



TECHNOLOGY AND RESEARCH GROUP

**ANNUAL REPORT
2010**

Introduction by the TRG Chairman

This year we welcomed Bob Barnes from the Environment Agency to the TRG and his appointment demonstrates that the Agency are still fully supportive of CL:AIRE's work. Bob brings with him a background in applied geology, hydrogeology and all aspects of the management of land contamination. Unfortunately, this year also saw the retirement of Professor Andy Moffat of Forest Research from the TRG, and I would like to thank him for his contribution during his time in the Group.

I am pleased to say that the TRG were kept very busy in 2010. The work programme included the review of 11 bulletins, one project application and one project report, together with the answering of many technical queries.

Since the TRG provides independent strategic peer review, support and technical steering functions in support of CL:AIRE's activities, a high workload indicates the continued success of CL:AIRE. Further, the TRG is fundamental to maintaining and enhancing CL:AIRE's reputation and supporting the development of the organisation.

I know that the CL:AIRE Board, Management Team and staff greatly appreciate the time and effort taken by the TRG members in ensuring the quality of CL:AIRE products and supporting future developments. I would also like to express my personal thanks to the TRG members and their employers for their contributions. We are united behind the mission to raise the scientific quality of contaminated land remediation.

This document is in two parts - the first gives background to the important role of the TRG within CL:AIRE, whilst the second details our activities during 2010.

Mike Pearl
February 2011

BACKGROUND TO THE TRG

INTRODUCTION

CL:AIRE was established as a public/private partnership in March 1999, to facilitate the field demonstration of remediation research and technology, including innovative methods for site characterisation and monitoring, on contaminated sites throughout the UK.

CL:AIRE'S Technology and Research Group (TRG) provide strategic review, support and steering functions for CL:AIRE's activities.

In 2009, changes were made to CL:AIRE's governance and the TRG became a sub-committee of the CL:AIRE Board. As a result, the TRG chairman is required to be a trustee of the Board and provide the link to the strategic direction of the company.

CONTEXT

CL:AIRE's reputation in the market place is for the dissemination of information and, in particular, the publication of high quality, peer reviewed, impartial and technically scientific robust reports. This is due in large part to two things:-

- the TRG process – which ensures consistency with UK policy and legislation, an appropriate scientific and technical quality of work, and transparency; and
- the TRG members – who are high calibre renowned experts in their field.

The TRG ensure the real added value to CL:AIRE.

THE TRG PROCESS

The TRG process works through a number of communication routes including meetings, conference calls and e-mail exchanges.

The process requires a detailed evaluation of CL:AIRE project submissions in terms of:-

- scientific validity of the application;
- robust nature of the methodology;
- contribution to the UK contaminated land marketplace;
- suitable assessment of site criteria; and
- competencies in forms of project management.

The process does allow for constructive feedback and resubmission, but not all applicants get through.

TRG MEMBERS AT END OF 2010

Chairman: Mr Mike Pearl – Babcock International Group

Deputy Chair: Mr Mike Summersgill – RSK Ltd

Mr Bob Barnes – Environment Agency

Dr Brian Bone – Independent consultant

Dr John Campbell – SAC Associates

Professor Max Coleman – Caltech

Mr Steve Edgar – Vertase FLI

Dr Theresa Kearney – Northern Ireland Environment Agency

Professor David Lerner – University of Sheffield

Professor Phil Morgan – The Sirius Group

Dr Mike Rivett – University of Birmingham

Professor Jonathan Smith – Shell Global Solutions

THE 2010 ANNUAL REPORT

1. TRG ACTIVITIES

1.1 TRG Meetings

During 2010, four TRG meetings were held.

1.2 Project Applications Reviewed

The TRG reviewed and approved one research project application and no technology demonstration applications during 2010.

The current status of CL:AIRE Technology Demonstration Projects (TDP) and Research Projects (RP) is provided in Appendix 1.

1.3 CL:AIRE Publications Reviewed

1.3.1 *Project Reports*

The TRG completed the review of one CL:AIRE Project Report in 2010 which was published in March.

Project No.	Project Operator	Project Title
TDP24	Provectus Group, RSRL, Nuclear Decommissioning Authority	Application of thermally enhanced soil vapour extraction (TESVE) to remediate the unsaturated zone at the Western Storage Area (WSA), Harwell

1.3.2 *CL:AIRE Bulletins*

TRG members reviewed 11 bulletins during 2010, 8 of which were published and 3 of which are due to be published in 2011 (shown in *italics* below):

Bulletin Type	Bulletin No.	Bulletin Title
Research	RB10	Bioremediation of heavy hydrocarbons –reducing uncertainty in meeting risk-based targets: laboratory to field scale
Research	RB11	Streamtube project overview: longitudinal transect assessment of the SABRE site DNAPL source zone
Research	RB12	Modelling food-chain transfer of contaminants in soil to terrestrial ecological receptors
Research	SAB1	Project SABRE (Source Area BioRemediation) – an Overview
Research	SAB2	Site investigation techniques for DNAPL source and plume zone characterisation
Research	SAB3	Results of laboratory column studies to determine the potential for bioremediation of chlorinated solvent DNAPL source areas
Research	SAB4	Insights and modelling tools for designing and improving chlorinated solvent bioremediation applications
Research	SAB5	Overview of the SABRE field tests
<i>Research</i>	<i>SAB6</i>	<i>Source area DNAPL bioremediation: Performance monitoring and assessment</i>
<i>Research</i>	<i>RB13</i>	<i>The utility of continuous monitoring in detection and prediction of "worst case" ground-gas concentration</i>
<i>TDP</i>	<i>TDP28</i>	<i>In situ radio frequency heating (ISRFH) of hydrocarbon contaminated chalk at a former service station in Kent</i>

The current status of CL:AIRE Publications is provided in Appendix 2.

1.4 Other Activities

In addition to the above activities the TRG were asked to comment on, or contribute to, a number of issues, including the following:

- Input to Defra Research Project: Contaminated land remediation
- Review of Defra Research Project: Application of iron nanoparticles in remediation
- Review of a proposal for an industry data management system
- Input to the development of CL:AIRE's Contaminated Land Qualifications
- Review and test of the PARIS chemical oxidation selection tool
- Review of the SuRF-UK framework for assessing sustainable remediation document
- Delivery of CL:AIRE's remediation technology training
- Evaluation of TRG Member skills and gap analysis
- Identify potential for CL:AIRE working abroad
- Develop ideas for broadening CL:AIRE's work in the nuclear sector
- Review of a potential bulletin on application of the Cluster principle
- Review of a potential bulletin on contaminated land data management
- Review of a potential bulletin on groundwater / surface water interactions in contaminated land assessments

2. A LOOK AHEAD TO 2011

Building on the achievements of 2010, a new wave of CL:AIRE outputs is predicted for the forthcoming year. It is expected that the TRG will be called upon to review 3 new project applications and 8 TDP and RP reports or bulletins.

This document was prepared by Dr Rob Sweeney, Senior Project Manager, CL:AIRE on behalf of the TRG.

Status of CL:AIRE Technology Demonstration Projects

Code	Project Title and Project Operator	Status
TDP 1:	Remediation Trial Using Low Temperature Thermal Desorption to Treat Hydrocarbon Contaminated Soil - British Aerospace Systems	Completed + Report Available
TDP 2:	Remediation of Basford Gasworks Using Soil Washing – National Grid Property/VHE	Completed + Report Available
TDP 3:	Design, Installation and Performance Assessment of a Zero Valent Iron Permeable Reactive Barrier in Monkstown, Northern Ireland- Nortel Networks/Golder Associates/Queen's University Belfast/Keller Ground Engineering Ltd	Completed + Report Available
TDP 4:	Slurry-Phase Bioreactor Trial - Parsons Brinckerhoff/National Grid Property	Completed + Report Available
TDP 5:	A Reducing and Alkalinity Producing System (RAPS) for Passive Treatment of Acidic, Aluminium Rich Leachates from Mine Spoils - University of Newcastle/Durham County Council	Completed + Report Available
TDP 6:	Bioremediation Trial at The Avenue - DEC NV/Jacobs/East Midlands Development Agency/Homes and Communities Agency	Completed + Report Available
TDP 8:	Field Demonstration of Accelerated Carbonation Technology (ACT) at The Avenue – Jacobs/East Midlands Development Agency/Homes and Communities Agency	Completed + Bulletin Available
TDP 9:	Use of an Air Sparge Treatment Curtain to Remediate Groundwater at a Former Gas Works – WorleyParsons Komex/National Grid Property	Completed + Report Available
TDP 10:	Thermal Remediation Trial at The Avenue - MEL Limited/Jacobs/East Midlands Development Agency/Homes and Communities Agency	Completed + Bulletin Available
TDP 11:	Soil Washing Remediation Trial at The Avenue - DEC NV/Jacobs/East Midlands Development Agency/Homes and Communities Agency	Completed + Bulletin Available
TDP 12:	Bioremediation of the Coke Works and Former Colliery at Askern, Doncaster - Ecologia Environmental Solutions Ltd/Carillion Civil Engineering/Yorkshire Forward	Completed + Report Available
TDP 13:	A Permeable Reactive Barrier for Remediation of Extremely Polluted Groundwater Associated with a Highly Pyritic Abandoned Colliery Spoil Heap - University of Newcastle upon Tyne and Northumberland County Council	Completed + Report Available
TDP 16:	Remediation of Chlorinated Hydrocarbon Contaminated Soils using <i>Ex Situ</i> Soil Vapour Extraction – RemedX and ABB	Completed + Report Available
TDP 17:	<i>In Situ</i> Bioremediation of Cyanide, PAHs and Heterocyclic Compounds using Engineered SEquenced REactive BARrier (SEREBAR) Techniques - Queen's University Belfast/National Grid Property/Parsons Brinckerhoff	Completed + Report Available

TDP 18:	Source Area <i>in situ</i> BioREmediation (SABRE) – Akzo Nobel/Archon Environmental/British Geological Survey/Celanese Acetate/Chevron/DuPont/ESI/ General Electric/Environment Agency/GeoSyntec/ Golder Associates/Honeywell/Scientifics/Strategic Environmental Research and Development Program (SERDP)/Shell Global Solutions/Terra Systems/University of Edinburgh/University of Sheffield/US Environmental Protection Agency	Completed + 5 Bulletins Available, 1 in Progress
TDP 20:	Design, Installation and Performance Assessment of a Permeable Reactive Barrier (PRB) to Treat Carbon Disulphide Contaminated Groundwater at a Former Chemicals Site in Manchester - CEL International Ltd, ESI, Akzo Nobel	Completed + Report Available
TDP 21:	Remediation of Agricultural Diffuse NITRAte Polluted Waters through the Implementation of a Permeable Reactive BARrier (NITRABAR) – University of Oxford/Queen's University Belfast/Environment Agency/Ecomesh Ltd (N. Ireland)/PGRW (Poland)/Zenenzo (Belgium)/APCO Ltd (Malta)/CL:AIRE	Completed + Bulletin in Progress
TDP 22:	Improved Ground Gas Risk Prediction by Continuous In-borehole Gas Monitoring (IRP-IGM) - Salamander; Urban Vision; The University of Manchester	Completed + Bulletin in Progress
TDP 23:	<i>Ex situ</i> Treatment of Coal Tar Impacted Soil Using Low Temperature Thermal Desorption at the Former Gasworks, East Dock Street, Dundee - National Grid Property Holdings Ltd; White Young Green; Bilfinger Berger; I & H Brown	Completed + Report in Progress
TDP 24:	Application of Thermally Enhanced Soil Vapour Extraction (TESVE) to remediate the unsaturated zone at the Western Storage Area (WSA), Harwell - UK AEA; Provectus Group; Nuclear Decommissioning Authority	Completed + Report Available
TDP 25:	Decision Support Tool for Innovative In-Situ Multi-Contaminant Groundwater Remediation - WorleyParsons Komex, National Grid Property, Environment Agency, Bradford City Council and Imperial College	Completed + Bulletin in Progress
TDP 26:	<i>In situ</i> Soil and Groundwater Decontamination using Electric Resistive Heating Technology (Six-Phase Heating®) - Terra Vac (UK) Ltd; Taylor Wimpey Ltd	Completed + Bulletin Available
TDP 28:	<i>In situ</i> Heating using Radiofrequency (RF) Coupled with Soil Vapour Extraction/High Vacuum Dual Phase Extraction for the Remediation of Contaminated Soil in the Unsaturated Zone - Ecologia Environmental Solutions Ltd; Total UK Ltd	Completed + Bulletin in Progress
TDP 29:	Low-cost Rapid On-Site Quantification of Oil-based Contamination (ROSQUO) - National Grid, Cranfield University and WSP Remediation	Completed + Bulletin in Progress
TDP 30:	Remediation Field Trials for the Chromium-Contaminated Area at Shawfield, Glasgow - Clyde Gateway Urban Regeneration Company and URS Corporation Ltd)	Completed + Bulletin in Progress
TDP 31:	Demonstration of the Arvia® Process of Adsorption Coupled with Electrochemical Regeneration for the On-site Destruction of Organic Contaminants in Groundwater - Arvia Technology Ltd and VertaseFLI.	Completed + Bulletin in Progress

Status of CL:AIRE Research Projects

Project Code	Project Title and Principal Project Operator	Status
RP 2:	Hydro-biological Controls on Transport and Remediation of Organic Pollutants for Contaminated Land - Professor Howard Wheater, Imperial College of Science, Technology and Medicine; Professor Jeremy Mason, Kings College, London; and National Grid Property	Completed
RP 3:	Processes Controlling the Natural Attenuation of Fuel Hydrocarbons and MTBE in Chalk - Dr Steve Thornton, University of Sheffield	Completed + Report Available
RP 4:	The Development of a Statistical Model to Optimise Investigation to Characterise Contaminated Land - Professor Mike Ramsey, University of Sussex	Completed + Report Available
RP 5:	The Use of Bonemeal Phosphates to Stabilise Metal Contamination - Dr Eva Valsami-Jones, The Natural History Museum	Completed + Bulletin Available
RP 6:	Phytoextraction of Metals: Investigation of Hyperaccumulation and Field Testing - Professor Steve McGrath - Rothamsted Research	Completed + Report Available
RP 9:	The Development of an Indicator Methodology to Determine the Plant Availability of Potentially Toxic Elements - Tony Hutchings, Forest Research/Martina Juvara – Arup	Completed + Bulletin Available
RP 10:	Comparative Assessment of Approaches for Predicting the Fate and Transport of Dissolved Phase Hydrocarbons in Chalk Aquifers - Natalyn Ala, Atkins Environment	Completed + Bulletin Available
RP 12:	Development of an <i>In Situ</i> Aquifer Assessment Tool with Risk Management Calculator for Natural Attenuation - Professor Steve Banwart, University of Sheffield	Completed + Bulletin in Progress
RP 13:	<i>In situ</i> Source Treatment for Enhanced Bioremediation Processes (IN-STEP) - Professor Bob Kalin, Queen's University Belfast	Completed + Report Available
RP 14:	Use of Longitudinal STREAMTUBE-Based Monitoring Approaches to Determine Contaminant Fate Within the SABRE Intra-Source/Plume Test Cell.- Dr Mike Rivett, University of Birmingham	Completed + Bulletin Available
RP 15:	Ferric Iron Remediation and Stabilisation (FIRS): electrokinetic remediation of heavy metal-contaminated back garden sites - Dr Andrew Cundy, University of Sussex, Dr Laurence Hopkinson, University of Brighton	Completed + Bulletin Available
RP 16:	Performance Assessment of Stabilised/Solidified Waste Forms (PASSiFy) – Dr Colin Hills, University of Greenwich	Completed + Bulletin in Progress
RP 17:	The Use of Recycled Construction/Demolition and Industrial Waste as a Substrate in a Novel Manganese Removal Passive Treatment System - Dr Selina Bamforth, University of Newcastle upon Tyne and Dr Karen Johnson, University of Durham	Completed

RP 18:	Optimising Biopile Processes for Weathered Hydrocarbons within a Risk Management Framework - Professor Simon Pollard, Cranfield University	Completed + Bulletin Available
RP 19:	Process Envelopes for Cement-based Stabilisation/Solidification (ProCeSS) - Dr Julia Stegemann, University College London	Completed + Bulletin in Progress
RP 20:	Increased Acceptability of On-Site Measurement by Estimation and Reduction of Uncertainty – Severn Trent Laboratory, University of Sussex, National Grid Property Holdings, Corus UK,	Completed
RP 21:	The Use of Biologically Enhanced Charcoal for In Situ Remediation of Contaminated Land - Aspire Defence Ltd, Forest Research, University of Surrey, University of Sheffield	Completed + Bulletin in Progress
RP 22:	Contaminal – the use of Supercritical Carbon Dioxide (SC-CO ₂) for the In Situ Sampling and Analysis Contaminants - PJH Partnership Limited, University of Birmingham, Pera Innovation, Lankelma	Completed + Bulletin in Progress

CL:AIRE PUBLICATIONS

Technology Demonstration Project (TDP) Reports and Bulletins

- TDP1 - *Remediation trial using low temperature thermal desorption to treat hydrocarbon-contaminated soil (2004)*
 TDP2 - *Remediation of Basford Gasworks using soil washing (2003)*
 TDP3 - *Design, installation and performance assessment of a zero valent iron permeable reactive barrier in Monkstown, Northern Ireland (2001)*
 TDP4 - *Slurry-phase bioreactor trial (2004)*
 TDP5 - *A Reducing and Alkalinity Producing System (RAPS) for passive treatment of acidic, aluminium rich mine waters (2005)*
 TDP6 - *Biopile field demonstration at the Avenue Coking Works (2004)*
 TDP9 - *Design, installation and performance assessment of an air sparge curtain system (2004)*
 TDP12 - *Bioremediation of the Coke Works and Former Colliery at Askern, Doncaster (2005)*
 TDP13 - *A permeable reactive barrier for remediation of extremely polluted groundwater associated with a highly pyritic abandoned colliery spoil heap (2006)*
 TDP16 - *Ex situ soil vapour extraction to remediate chlorinated hydrocarbons (2007)*
 TDP17 - *A biological sequential reactive barrier (SEREBAR): design, installation and performance at a former manufactured gas plant site in south west England (2008)*
 TDP20 - *Design and installation of a permeable reactive barrier to treat carbon disulphide contaminated groundwater (2009)*
 TDP24 - *Application of thermally enhanced soil vapour extraction (TESVE) to remediate the unsaturated zone at the Western Storage Area, Harwell (2010)*
 TDP26 - *In situ soil and groundwater decontamination using electric resistive heating technology (2008)*

Research Project (RP) Reports

- RP3 - *Processes controlling the natural attenuation of fuel hydrocarbons and MTBE in the UK Chalk aquifer (2006)*
 RP4 - *Cost-effective investigation of contaminated land (2007)*
 RP6 - *Phytoextraction of Metals: Investigation of hyperaccumulation and field testing (2005)*

Other CL:AIRE Bulletins

Technical Bulletins (TB)

- TB1 - *Introduction to an integrated approach to the investigation of fractured rock aquifers contaminated with non-aqueous phase liquids (2002)*
 TB2 - *Multilevel sampling systems (2002)*
 TB3 - *Principles and practice for the collection of representative groundwater samples (2008)*
 TB4 - *Parameterisation of aquifer hydraulic properties: A contaminant hydrogeology perspective (2009)*
 TB5 - *The use of geophysical investigation techniques in the assessment of contaminated land and groundwater (2007)*
 TB7 - *Improving the reliability of contaminated land assessment using statistical methods : Part 1 (2004)*
 TB9 - *Stabilisation/Solidification Treatment and Remediation: Part 1: Summary of the State of Practice Reports I-IV STARNET (2004)*
 TB11 - *A practical guide to investigating DNAPL releases in the subsurface (2004)*
 TB12 - *Statistical assessment of contaminated land: Some implications of the 'Mean Value Test' (2006)*
 TB13 - *Understanding soil washing (2007)*
 TB14 - *Treatment of chromium contamination and chromium ore processing residue (2007)*

Case Study Bulletins (CSB)

- CSB1 - *Site characterisation in support of monitored natural attenuation of fuel hydrocarbons and MTBE in a chalk aquifer in Southern England (2002)*
 CSB2 - *A constructed wetland to treat acid mine drainage from colliery spoils at Quaking Houses, County Durham (2002)*
 CSB3 - *Portadown biological reactive barrier (2005)*
 CSB4 - *Mine water treatment at Wheal Jane Tin Mine, Cornwall (2004)*

CSB5 - *Remediation trial at The Avenue using stabilisation/solidification and accelerated carbonation technology (2006)*

CSB6 - *Remediation trial at The Avenue using thermal treatment (2006)*

CSB7 - *Remediation trial at The Avenue using soil washing (2008)*

CSB8 - *Public affairs and communications on contaminated land projects (2007)*

Research Bulletins (RB)

RB1 - *Enhanced in situ bioremediation technique for manganese removal from mine waters (2003)*

RB2 - *FIRS Ferric Iron Remediation and Stabilisation: a novel electrokinetic technique for soil remediation and engineering (2003)*

RB3 - *Project SIREN: Research Projects (2006)*

RB4 - *Project SIREN – Future Research Needs (2006)*

RB5 - *Remediation of heavy metal pollution via bone meal amendments to soil: Field and laboratory trials (2007)*

RB6 - *Results of a laboratory microcosm study to determine the potential for bioremediation of chlorinated solvent DNAPL source areas (2006)*

RB7 - *Field Portable X-ray Fluorescence (FPXRF): A rapid and low cost alternative for measuring metals and metalloids in soils (2008)*

RB8 - *Modelling approaches for assessing risks associated with petroleum hydrocarbon spills in the UK Chalk aquifer (2009)*

RB9 - *Electrokinetic Ferric Iron Remediation and Stabilisation (FIRS) of hexavalent chromium contaminated soils: An ex situ field scale demonstration (2009)*

RB10 - *Bioremediation of heavy hydrocarbons – reducing uncertainty in meeting risk-based targets: laboratory to field scale (2010)*

RB11 - *Streamtube project overview: longitudinal transect assessment of the SABRE site DNAPL source zone (2010)*

RB12 - *Modelling food-chain transfer of contaminants in soil to terrestrial ecological receptors (2010)*

Site Bulletins (SB)

SB1 - *MNA Bulletin (2005)*

SB2 - *SIREN (MNA) overview and description of projects (2005)*

SB3 - *Coal Mine Sites for Targeted Remediation Research:- The CoSTaR Initiative (2006)*

Guidance Bulletins (GB)

GB1 - *Stabilisation/Solidification for the treatment of contaminated soil (2005)*

GB2 - *Managing Japanese Knotweed on Development Sites: Code of Practice (2008)*

SABRE Bulletins (SAB)

SAB1 - *Project SABRE (Source Area BioRemediation) – an Overview (2010)*

SAB2 - *Site investigation techniques for DNAPL source and plume zone characterisation (2010)*

SAB3 - *Results of laboratory column studies to determine the potential for bioremediation of chlorinated solvent DNAPL source areas*

SAB4 - *Insights and modelling tools for designing and improving chlorinated solvent bioremediation applications (2010)*

SAB5 - *Overview of the SABRE field tests (2010)*

SUBR:IM Bulletins (SUB)

SUB1 - *The role of the development industry in brownfield regeneration (2006)*

SUB2 - *Uncovering the true impacts of remediation (2007)*

SUB3 - *Climate change, pollutant linkage and brownfield regeneration (2007)*

SUB4 - *Measuring sustainability: What's in a number? (2007)*

SUB5 - *Avoiding future brownfield sites through design for deconstruction and the reuse of building components (2007)*

SUB6 - *Communicating risk on contaminated sites: How best to engage with local residents (2007)*

SUB7 - *Acid Tar Lagoons (2008)*

SUB8 - *Community Engagement, Urban Regeneration, and Sustainability (2008)*

SUB9 - *Quality in Land Remediation: Indicators and Protocols for Brownfield Land (2008)*

SUB10 - *The Use of Compost in the Regeneration of Brownfield Land (2008)*

SUB11 - *Integrated remediation, reclamation and greenspace creation on brownfield land (2009)*

SUB12 - *SUBR:IM (Sustainable Urban Brownfield Regeneration: Integrated Management) - An overview (2009)*

All of the Bulletins can be downloaded from the CL:AIRE website.

Other publications

- UK Trade & Investment/EISU & CL:AIRE Trade Guide (2006)
- Guidance on Comparing Soil Contamination Data with a Critical Concentration (2008)
- The Definition of Waste: Development Industry Code of Practice (2008)
- SuRF-UK: A Review of Published Sustainability Indicator Sets: How applicable are they to contaminated land remediation indicator-set development? (2009)
- SuRF-UK: A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010).