CONSOIL 2005 UK Country Session

A Coherent Vision for the Future Development of Brownfield Land..... the Ultimate Recycling Policy

FIRSTFARADAY

CL:AIRE

FIRSTFARADAY

The FIRSTFARADAY mission is to:

- **Develop world-class scientific methods, technologies and tools for the assessment, remediation and management of contaminated land**
- **Form a dedicated network of academic, industrial and other stakeholders and regulators committed to cost-effective research, technology transfer and training**
- **Enhance the position of the UK contaminated land and water sector in the global market place**

FIRSTFARADAY is a UK Centre of Excellence for the assessment and remediation of contaminated land and associated waters sponsored by the UK Government (Department of Trade and Industry and Research Councils). It brings together eight key academic institutions, four research technology organisations and the Environment Agency and facilitates the transfer of knowledge and technologies between industry and the knowledge base. FIRSTFARADAY interacts with a broad stakeholder community of over 250 member organisations to deliver solutions, knowledge and business opportunities.

The principle activities of FIRSTFARADAY are:

Research and Development

Delivering cost-effective, sustainable solutions with an emphasis on industrially-focused market-driven multidisciplinary projects

Knowledge Transfer

Enhancing staff and company performance and propagating state-of-the-art approaches and good practice

Technology Transfer

Developing business opportunities, contacts and collaborations through the effective translation of industries needs, solutions and aspirations

To find out more please visit **www.firstfaraday.com**

Contents

CL:AIRE's mission is to:

Deliver independently verified, cost-effective solutions for contaminated land clean up, and raise awareness of the benefits to the UK and beyond.

CL:AIRE is a public / private partnership established over 6 years ago sponsored by the Office of the Deputy Prime Minister (ODPM), English Partnerships, the Department of Environment Food and Rural Affairs (Defra), the Environment Agency and the Welsh Development Agency.

Our role is to accelerate the uptake of alternatives to dig and dump and raise the standards of the scientific understanding of remediation techniques.

Our unique contribution is to bring together site owners and technologists to run research and field scale demonstration projects under known conditions.

CL:AIRE's principal objectives are to;

- Disseminate information about contaminated land - bringing issues and solutions to the attention of the market place
- Provide a unique system of independent verification of technologies to give confidence to owners and developers
- Create dynamic relationships between problem holders and solution providers
- Be a constructive partner to policy makers and opinion formers, influencing the real agenda setters
- Provide relevant information to anyone seeking answers to contaminated land questions.

Over the past 3 years CL:AIRE has levered in over £14m for project work, delivered over 30 research and demonstration projects with 70 partner organisations and built our interactions to a membership of nearly 5,000 individuals and organisations.

Visit our website at **www.claire.co.uk** to view our products and project reports.

CL:AIRE has a prestigous Board and a verification body known as the Technology Research Group, which comprises 10 highly respected people in the world of contaminated land.

Our definition of success is when owners of contaminated land sites have the confidence to employ new technologies in a way which is good for the world economy and the environment.

UK Country Session
A Coherent Vision for the Future Development of Brownfield Land ..... the Ultimate Recycling Policy

UK Country Session Programme:

11-11.10 Introduction and Background
Simon Jackman, Director, FIRSTFARADAY / Jane Forshaw, Chief Executive, CL:AIRE

11.10-11.28 The National Brownfield Strategy for England
Paul Syms, Project Director of the National Brownfield Strategy, English Partnerships

This will be the first European presentation of the National Brownfield Strategy which sets out how England is planning to tackle this situation.

11.28- 11.45 CLEA-UK and other Technical Developments for Risk Assessment
Ian Martin, Principle Human Health Scientist, Environment Agency

The UK was the lead country for the development and application of risk-based land management approaches. CLEA (Contaminated Land Exposure Assessment Model) was developed in the late 90's and has been the principle tool applied for assessing and managing contaminated sites. Based on the probabilistic Monte Carlo model, the CLEA model enables practitioners to assess human health risks from contaminated sites for a number of scenarios using the source-pathway-receptor framework.

11.45 - 12.02 Innovative UK Technology Case Study: Development and Application of a PRB for Remediation of Carbon Disulphide Contaminated Groundwater.
Richard Thurgood, Technical Director, E&RS / Phil Morgan, Technical Director, ESI

This is one of the premier examples where effective collaboration between UK industry and the knowledge base has delivered a cost-effective solution for a complex and hazardous contaminant. The integration of value engineering, scientific vigour and industrial realism, has produced the world's first applied remediation approach for carbon disulphide contaminated groundwaters.

12.20 - 12.30 UK Industry Perspective of National and European Drivers, Barriers and Opportunities for Brownfield Redevelopment.
Colette Grundy, Nexia Solutions, BNFL Group, Contaminated Land Specialist, Chair of SAGTA

The Soil and Groundwater Technology Association (SAGTA) draws together a number of key UK stakeholders with keen business interests in contaminated land management. They are extremely well placed to provide the UK industry perspective and know full-well the recent factors that may affect the successful implementation of the UK's "ultimate recycling policy"

Biographical Notes - Simon Bell, Chairman

Martin J. Bell BSc (Hons) ARCS FIChemE

Martin Bell had 35 years experience with ICI in senior roles that included manufacturing, commissioning, and environmental management. Prior to leaving ICI at the beginning of 2004 he was Director of Sustainability in which role he provided leadership of environmental performance as well as engaging with regulators, NGO's, investment institutions, and other stakeholders.

For the past ten years, he has focused principally on the strategic management of environmental issues, and on developing management and research policies, standards and processes for ICI's global management of contaminated land and groundwater. He played a leading role in the formation of the SAGTA and NICOLE networks and was the first chairman of both these organizations. He also served as lead environmental member of ICI's corporate Mergers & Acquisitions team and gained experience of many global acquisitions and divestments during a period of significant restructuring.

He is currently Project Director of the DTI funded multinational SABRE research project, and runs his own consultancy focused on sustainable development and on environmental aspects of business transactions.

Biographical Notes - Simon Jackman, FIRSTFARADAY and Jane Forshaw, CL:AIRE

Dr Simon Jackman is the Director of FIRSTFARADAY, based in the Department of Earth Sciences, University of Oxford and a Senior Research Fellow at Linacre College.

He has a PhD in Biochemistry and worked for several years as an R&D manager in the pharmaceuticals industry, bringing new products to the market. Dr Jackman has developed engineered approaches for the remediation of recalcitrant contaminants whilst at the Universities of Kent and Oxford, working with European and industrial partners. His current research, funded by UK research councils, industry, and the EU, focussed on electrokinetics, depleted uranium, chlorinated solvents and mustard gas. Aside from publications, he has patented a novel biocatalysis process, leading to a spin-out company, EKB Technology Ltd., of which he is a non-Executive Director.

He has consulted for both Sauflon Pharmaceuticals and Rolls Royce, including their environmental and biotechnological strategic research reviews, and is currently the UK representative on EuroEnviron, the environmental umbrella for the Eureka funding mechanism to support businesses in near-market R&D.

Email: simon.jackman@earth.ox.ac.uk

Jane Forshaw is the Chief Executive for CL:AIRE. She joins the team having been the Chief Executive at Urban Mines, another environmental charity for over 4 years.

In terms of her academic background she completed her Environmental Health Degree with a First Class Honours from Salford University, and then held a number of different positions employed by Birmingham City Council over a period of ten years. She first worked as an Environmental Health Officer and was then promoted to be Head of the Sustainability Team. She also became the personal advisor to the Chief Executive on sustainability issues. She was also on the Government's working group which published the National Sustainability Indicators Report.

She has lead teams on a number of regeneration projects and is an accomplished networker. She sits on FIRSTFARADAYs Advisory Group and the English Partnerships Coalfields Project Board.

Jane holds three diplomas in Waste Management, Health and Safety and Management Development, and is a member of the Chartered Institute of Environmental Health and The Institute of Waste Management. She is currently a LEAD Associate, an international programme which creates Leaders for Environment and Development.

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Tel: 0207 340 0470 or 07974 366232

UK Session Introduction- Presentation

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FIRSTFARADAY

A UK Centre of Excellence for Remediation of the Polluted Environment

Dr Simon Jackman

www.firstfaraday.com

FIRSTFARADAY'S MISSION IS TO:

- develop world-class scientific methods, technologies and tools for the assessment, remediation and management of contaminated land
- form a dedicated network of academic, industrial and other stakeholders and regulators committed to cost-effective research, technology transfer and training
- enhance the position of the UK contaminated land and water sector in the global marketplace

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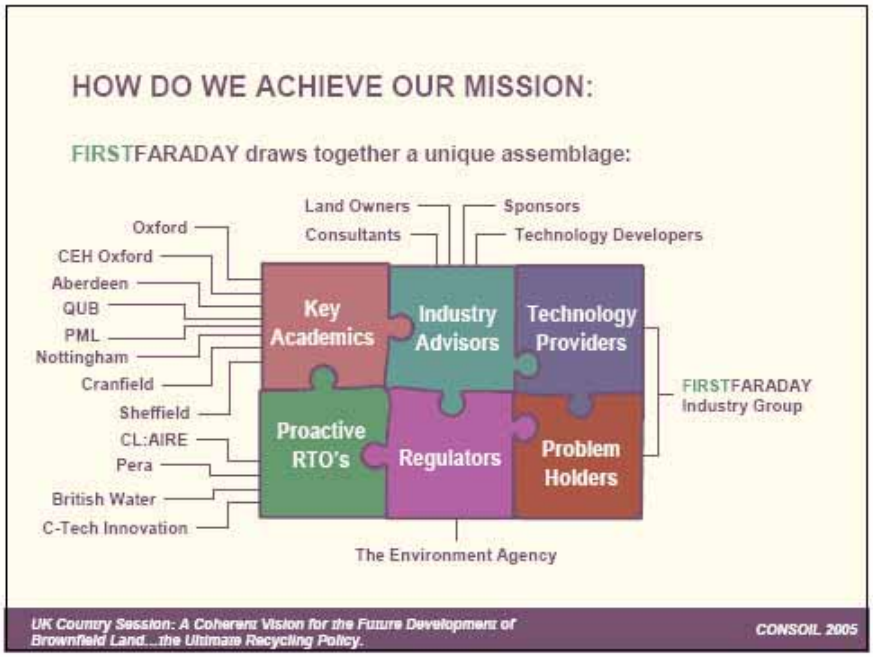

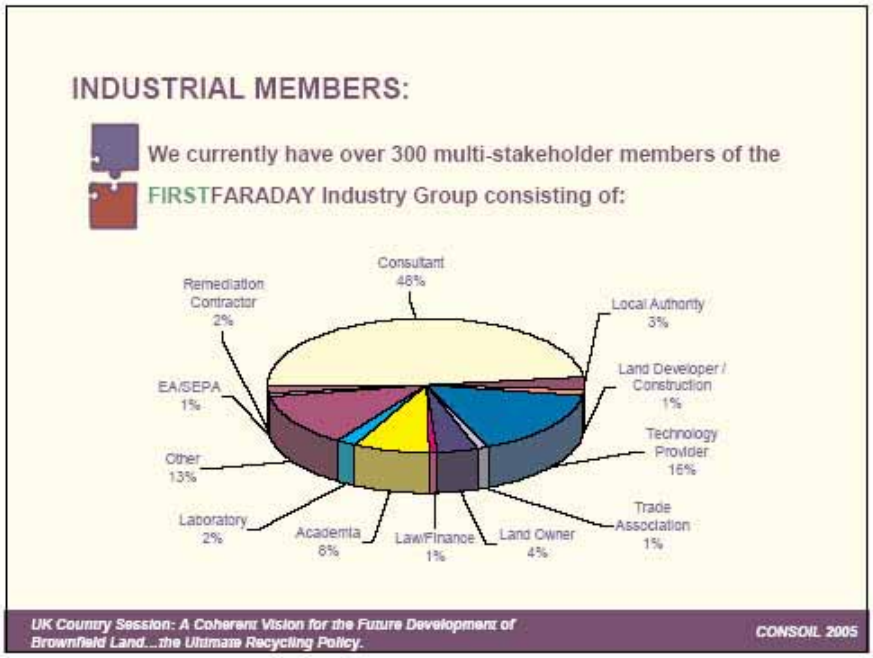

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CORE ACTIVITIES:

TECHNOLOGY TRANSFER

Developing business opportunities, contacts and collaborations

RESEARCH & TECHNOLOGY DEVELOPMENT

Delivering cost-effective, sustainable solutions

KNOWLEDGE TRANSFER

Enhancing staff and company performance and propagating state-of-the-art

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INDUSTRY SERVICES:

- Conferences
- Focus sessions/workshops
- Remediation technology training
- Bespoke training courses
- Personnel exchanges
- Web portal
- Newsletter
- Decision Support Tools
- Discussion forums
- Company profiling
- Technology brokering
- Development of collaborative consortia
- Assistance in accessing business support mechanisms
- Facilitated consultation for government agencies (EA, EIU, Defra...)
- Industrial studentships (21)
- Research collaborative projects (>£5M)

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EUROPEAN ACTIVITIES:

EuroEnviron

- near-market industrial research funding

PRODESTS

- development of Integrated Projects with SMEs
- road mapping and barrier identification

SNOWMAN

- ERA-Net for funders of contaminated land research

NITRABAR

- LIFE Environment demonstration project
- PRB for diffuse agricultural pollution

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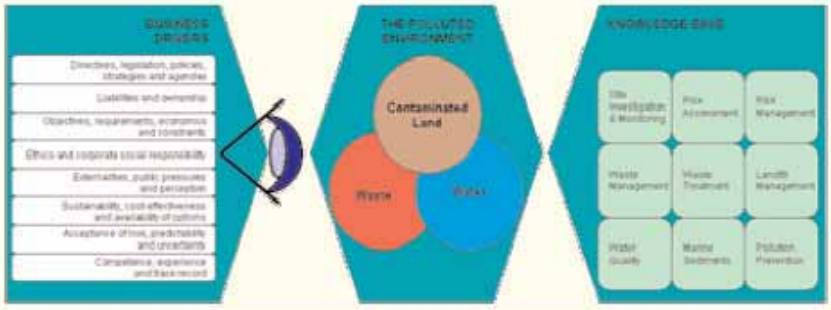
INTEGRATED POLLUTION MANAGEMENT NETWORK:

- Positioning contaminated land in the wider environmental context
- Broadening Knowledge and Technology transfer options
- Increasing innovation, uptake and competence



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UK Session Introduction- Presentation

UK Session Introduction - Presentation

Objectives

- To disseminate information about contaminated land problems and solutions
- To provide independent verification of technologies
- To create dynamic relationships between problem holders and solution providers
- To be a constructive partner to policy makers and opinion formers, influencing the real agenda setters
- To be the first port of call for anyone seeking information about contaminated land.

Technical Research Group

- 10 of the best brains in the world of contaminated land
- Independent verification of project rationale and methodologies
- We publish both good and poor results – we are interested in the learning
- This group adds real value to our work

UK Session Introduction- Presentation

Technology Demonstration Projects

- Low temperature thermal desorption (2)
- Soil washing (3)
- Permeable reactive barrier (4)
- Bioreactor
- Wetlands
- Static biopile (2)
- Aerated biopile
- Solidification/stabilisation (2)
- Air sparging
- Ex situ Soil Vapour Extraction
- Accelerated Natural Attenuation using HRC

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Other Projects

- Eurodemo – providing an information database of European projects and partners
- Cluster - how to set up a central soil treatment centre
- Low Grade Compost – use of composted materials to create fertile top soils

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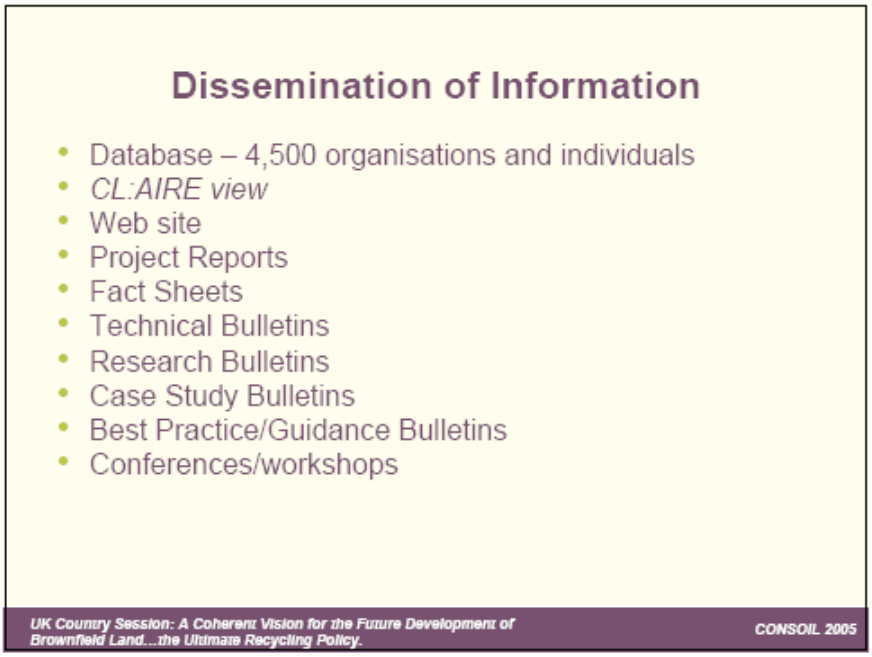

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Biographical Notes - Paul Syms, English Partnerships

Professor Paul Syms

Paul Syms is Director of the National Brownfield Team at English Partnerships. He leads a joint EP / Office of the Deputy Prime Minister team, charged with developing and delivering a comprehensive brownfield strategy for England. Prior to taking up his post in Autumn 2004 he was Professor of Urban Land Use at Sheffield Hallam University. Paul has more than 35 years property related practical experience, mostly as a development surveyor. He has acted for many internationally known development companies, for local authorities and other landowners, advising on the specialist aspects of re-using previously developed land.

He is a Fellow of the Royal Institution of Chartered Surveyors, a member of the boards of the Institution's Environment and Planning and Development faculties. His academic qualifications include MPhil (Economic Geography) from the University of Manchester and PhD in the development and valuation of contaminated land from Sheffield Hallam University. He represented the surveying profession on the working party set up under the auspices of the Urban Task Force to consider implementation of its recommendation on standardised Land Condition Statements. He has undertaken research for the Office of the Deputy Prime Minister into the transferability of lessons from the enterprise zones and, for ODPM and Inland Revenue, into the initial impacts of the Urban White Paper Fiscal Measures.

His publications include several books and major research reports. His books include Contaminated Land: the practice and economics of redevelopment (1997), Land, development and Design (2002) and Previously Developed Land: industrial activities and contamination (2004).

National Brownfield Strategy - Presentation

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A Strategic Approach to reusing Brownfield Land

Professor Paul Syms PhD
English Partnerships

Background

- English Partnerships is the National Regeneration Agency for England, sponsored by the Office of the Deputy Prime Minister
- *The Sustainable Communities Plan 2002* – a British Government publication – sets out the need for a strategic approach to the problems of previously developed (PDL) or 'brownfield' land
- The report *Towards a National Brownfield Strategy* was published in September 2003 and identified a number of issues, including:
  - The problem of long-term dereliction – vacant or derelict since 1993 or earlier;
  - That not all Previously Developed Land is suitable for redevelopment; and
  - An emerging shortfall in the supply of PDL 'suited for development'.

National Brownfield Strategy - Presentation

A few facts and figures – Long-term NLUD sites

Derelict or vacant since 1993 or earlier

- 2,063 sites
- 16,768 hectares
- Average size 8.128 hectares

Possibly a legacy of the widespread industrial closures of the 1980s?

An increasing number of derelict and vacant sites – post 1993 dereliction

- 4570 sites
- 8,460 hectares
- Average size 1.851 hectares

Continuing industrial decline affecting smaller businesses?

Geographic distribution – long-term dereliction

National Brownfield Strategy - Presentation

Geographic distribution – medium-term dereliction

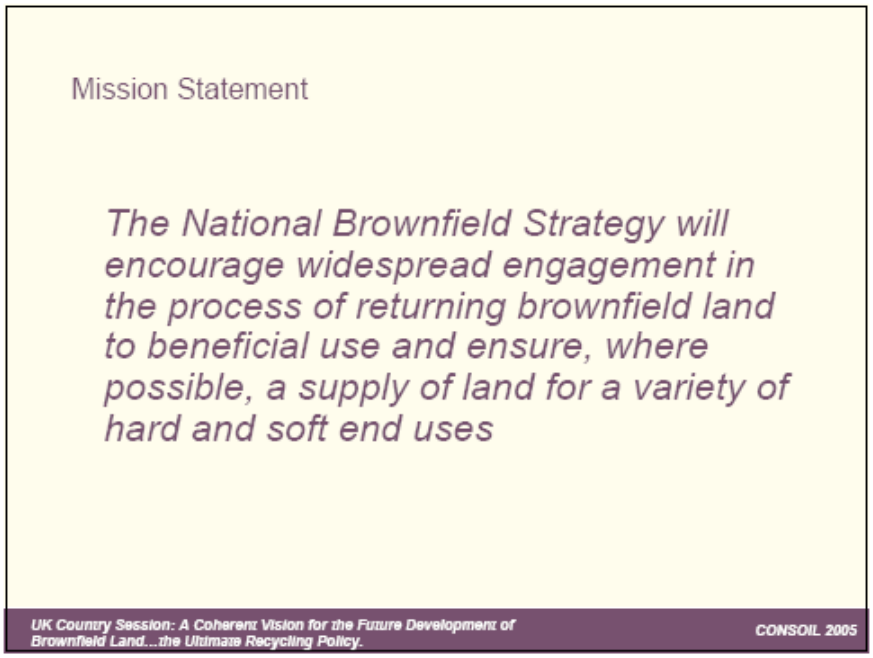
Research and workshops

In order to gain a better understanding of these figures, English Partnerships commissioned two pieces of research

1. To update the long-term dereliction study that was carried out in 2002 and examine the flows through into the development market of the occupied sites; and
2. A detailed, site by site, examination of the Long-term and Medium-term vacant and derelict sites in a small number of local authority areas

Three workshops were held in order to identify the issues perceived by brownfield specialists to be of greatest concern

National Brownfield Strategy - Presentation



National Brownfield Strategy - Presentation

Objectives

- **Nationally**
  - To bring more brownfield land into beneficial use
  - Develop policies and targets to: -
    - Increase supply and demand, making brownfield reuse a key element supporting regeneration and growth
- **Regionally**
  - To support Regional Brownfield Land Action Plans
  - Focus on hardcore and imminent hardcore PDL
- **Locally**
  - Help to address the re-use of PDL at site-specific level
  - To develop techniques, and a good practice guide, signposting to 'expert sources'

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Bringing land back into use through

- The creation of strategic partnerships, with private and public sector organisations and with local communities – Local Brownfield Partnerships
- Encouraging 'lifecycle' and recycling approaches to land use, taking account of environmental as well as economic factors
- Development and application of the 'toolkit' required to bring land back into use, site assembly, infrastructure provision, gap funding
- Skills development, at all levels in the regeneration process
- Publicity and Research.

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National Brownfield Strategy - Presentation

The Pilot Project authorities

- Barrow-in-Furness
- Manchester
- Dudley
- Bristol
- Kerrier
- Barking & Dagenham
- Tower Hamlets
- Easington
- Sheffield
- Mansfield
- Milton Keynes
- Ipswich
- Bradford
- Portsmouth

Pilot Projects

- To identify and assess the 'hurdles' that inhibit or prevent the re-use of brownfield land
- To identify the 'spurs' that encourage the re-use of brownfield land
- To examine the feasibility of different hard and soft end uses, including mixes of uses
- To develop and test innovative appraisal techniques
- To create strategic partnerships involving all sectors of the community
- Where possible to facilitate actual brownfield regeneration projects

National Brownfield Strategy - Presentation

A New Regulatory Approach: Ecological Risk Assessment

Abstract CLEA UK:

The publication of the CLEA 2002 software and its associated documentation (R&D Publication CLR7 - 10) was a key step in the Environment Agency's programme to develop a consistent, scientifically based framework for assessing risks to human health from land contamination.

The CLEA 2002 software was primarily designed to allow interested parties to understand how the Soil Guideline Values (SGVs) were derived. In addition it was intended to allow practitioners to conduct generic risk assessment, for a limited number of contaminants, (particularly those for which SGVs had been derived) where human activity patterns and contaminant characteristics conform to a set of broadly drawn general scenarios.

The Environment Agency recognised that there was a need to provide practitioners with a more powerful tool able to derive site-specific assessment criteria for those cases where the conceptual model for a site does not fit that of the generic scenarios. In addition, the approach to deriving Soil Guideline Values had been updated since the release of CLEA 2002 according to CLEA Briefing Notes 1, 2 3 and 4. There was therefore a requirement for a publicly available version of the CLEA software that incorporates these updates.

In response to these needs a new version of the CLEA software, 'CLEA UK' has been developed. This software can be used to:

- Derive generic assessment criteria;
- Derive site-specific assessment criteria; and
- Calculate average daily exposure/ health criteria ratios

Its methodology is consistent with current government policy on contaminated land. Additionally, criteria can be derived for contaminants for which no government approved Health Criteria Values or Soil Guideline Values are available.

'CLEA UK' Beta Version 1.0 will be available in October / November 2005 as a Microsoft Excel based workbook for user evaluation. The final version of 'CLEA UK' based on comments received by the user community will be available from about six months after release and will be dependent on feedback received and changes that are undertaken.

Biographical Notes - Ian Martin, Environment Agency

Ian Martin

Ian is a Principal Scientist in the Human Health Science Team at the Environment Agency for England and Wales. With a background in environmental geochemistry, Ian has been working in the contaminated land field for more than 14 years and involved with the development of the Contaminated Land Exposure Assessment model since 1994. In 2002, he was Exposure Assessment Manager at the Agency leading the technical team behind the publication of R&D Reports CLR7 - 10, and the first series of the Soil Guideline Values (SGV) and TOX reports. After a two-year "sabbatical" in consultancy, Ian rejoined the Agency in July 2005 to continue development of the exposure science and modelling tools that underpin the CLEA work and the publication of Soil Guideline Values and supporting technical reports.

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CLEA UK - Presentation

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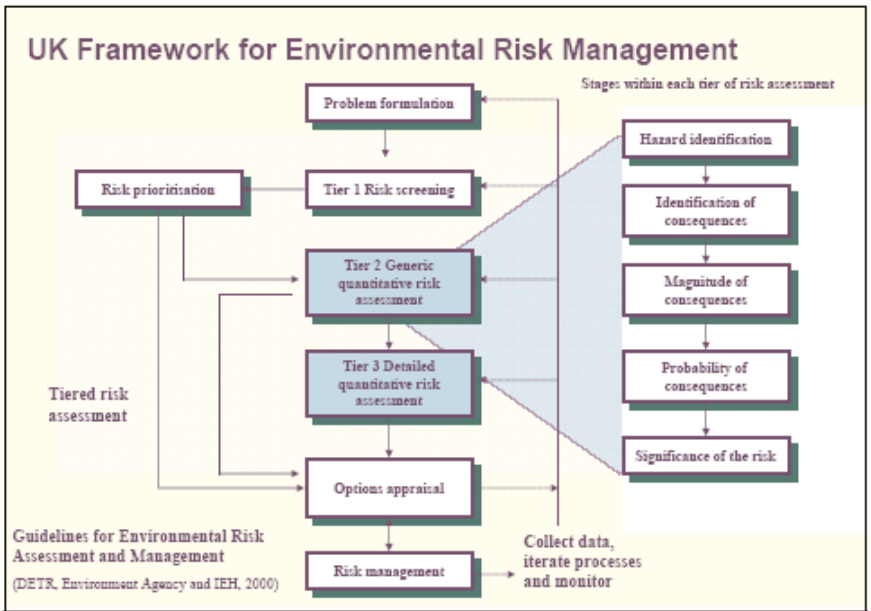
CLEA UK

Ian Martin

Environment Agency for England and Wales

UK Framework for Environmental Risk Management



CLEA UK - Presentation

Assessing Risks to Health from Soil Contamination

- In the context of evaluating the risk posed by soil contamination, assessors need guidance on addressing two key questions:
  - for a given contaminant, at what level is human intake (from soil) unacceptable?
  - for a given land-use, what might be the typical contaminant intake for adults and children exposed to soil contamination

CLEA Science Programme

- Framework reports - R&D Publications CLR7 - 10
- Chemical specific daughter reports in the TOX and SGV series
- Technical updates - Fate and Transport Review, Briefing Notes, FAQ
- Communication - CLEA Update, Web Site
- Software - CLEA 2002 and CLEA UK

CLEA UK - Presentation

History of the CLEA Model (1990 - 2005)

1993

Development of the CLEA model was commissioned by the then Department of Environment in 1992.

Work carried out by Professor Ferguson and his team at the Centre for Research into the Built Environment (CRBE) until 1997.

1997

CLEA 2002 was developed by Defra, Environment Agency, and SEPA in consultation with LQM and ERM from 1999 - 2002. It was the first CLEA software release.

2002

CLEA UK was developed by the Human Health Science Team from 2004 - 2005, learning lessons from CLEA 2002 including vastly improved functionality and portability

2005

Over the past ten years, the CLEA model and its supporting documents have been subject to national and international peer review. The Department of Health, the Food Standards Agency, and industry have commented on and contributed to the development of the model.

CLEA UK - Design Specification

- Accessibility
  - Free to the end-user
  - Easy to install and use (based on Microsoft Excel)
  - Layered access based on user experience
- Flexible
  - Usable as part of GQRA and DQRA
  - Most parameters can be tweaked
  - New chemicals, land-uses, building and soil types can be added
  - Data can be shared by users using import / export functions
  - Comprehensive results output and file save options

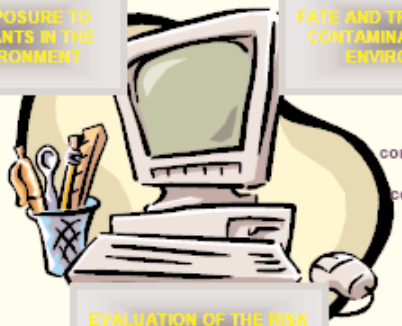
CLEA UK - Presentation

Key components of the CLEA model

HUMAN EXPOSURE TO CONTAMINANTS IN THE SOIL ENVIRONMENT

FATE AND TRANSPORT OF CONTAMINANTS IN SOIL ENVIRONMENT

Predicting how we behave on a contaminated site according to land-use and the extent to which this may lead to exposure to soil contamination for critical receptors (e.g. small children)

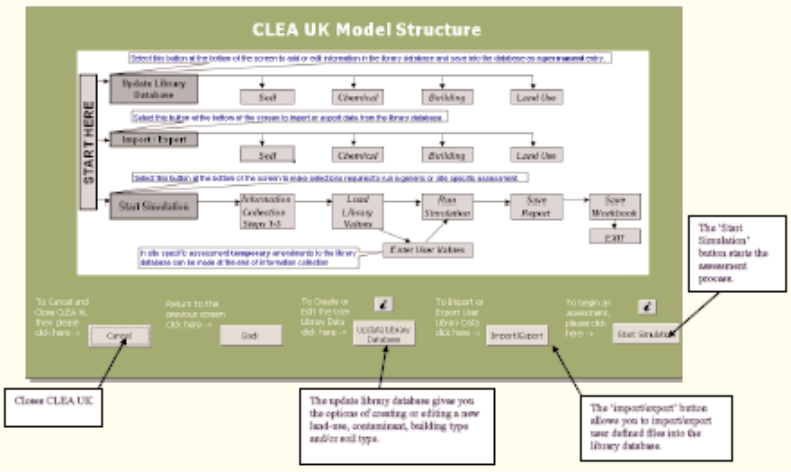


Understanding and predicting how contaminants move within each environmental compartment - air, water, and soil

EVALUATION OF THE RISK TO HUMAN HEALTH ARISING FROM EXPOSURE

Judging the potential risks to health from exposure to contaminants in soil and setting an appropriate level for regulatory "intervention"

CLEA UK - Main Screen



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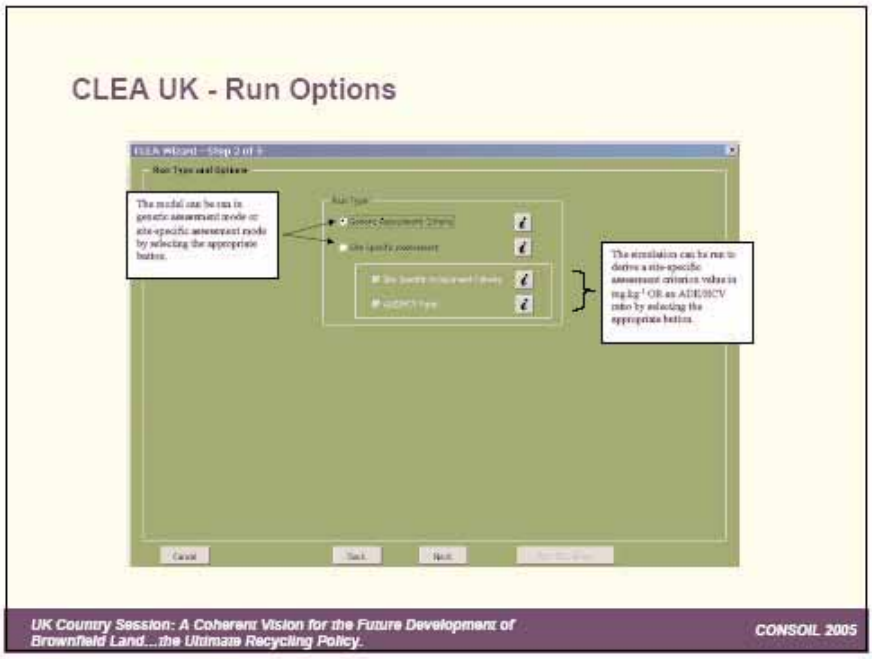

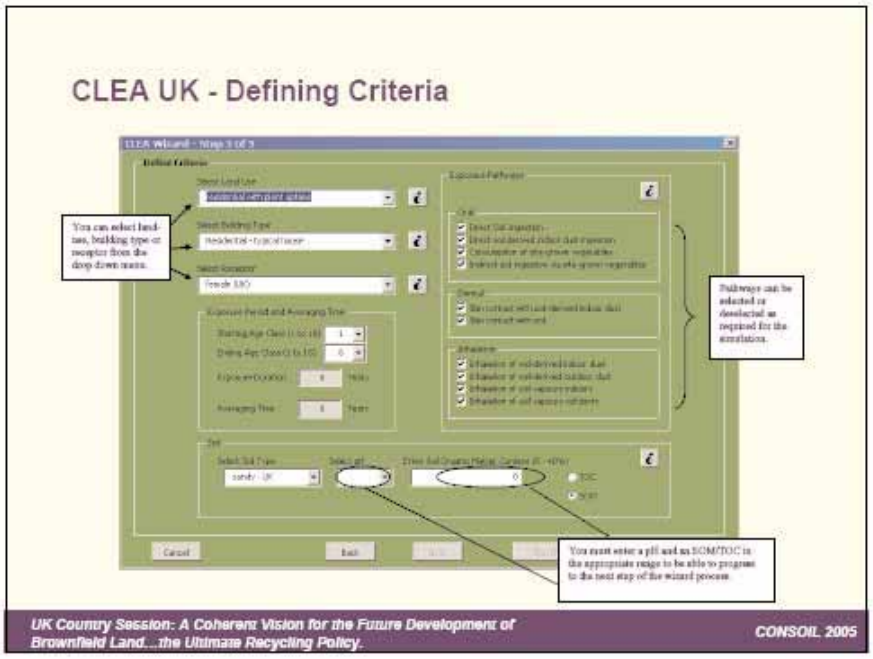

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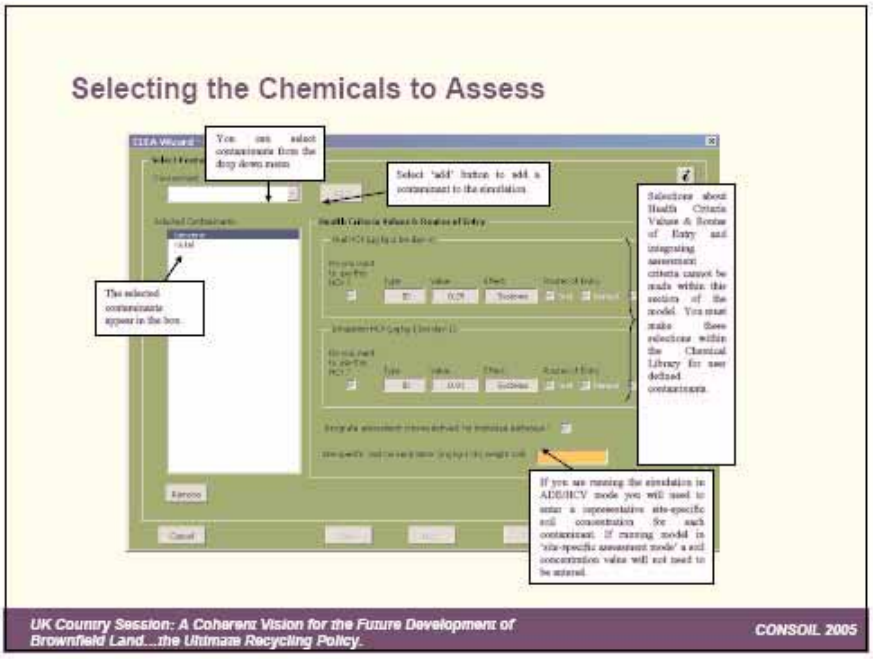

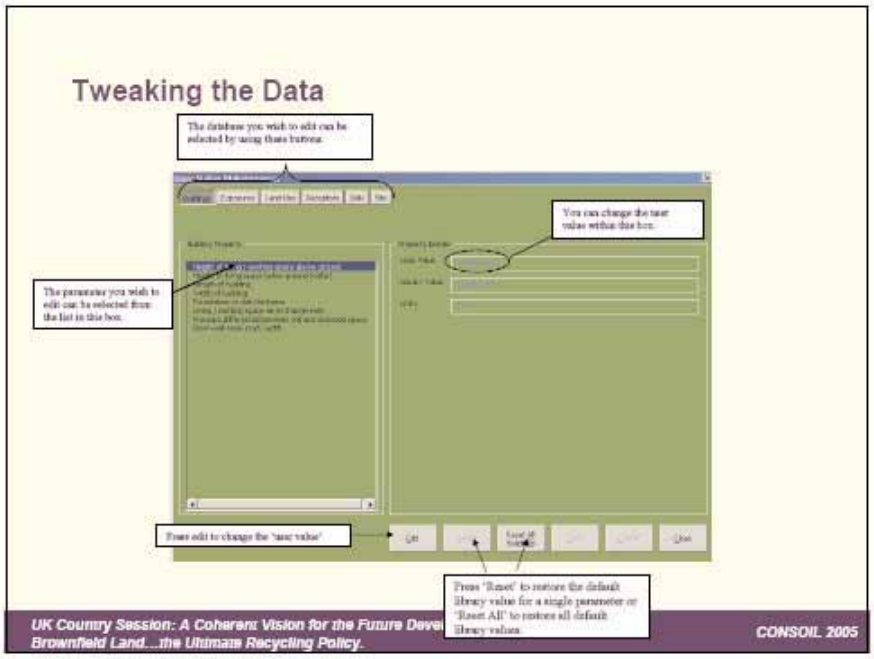

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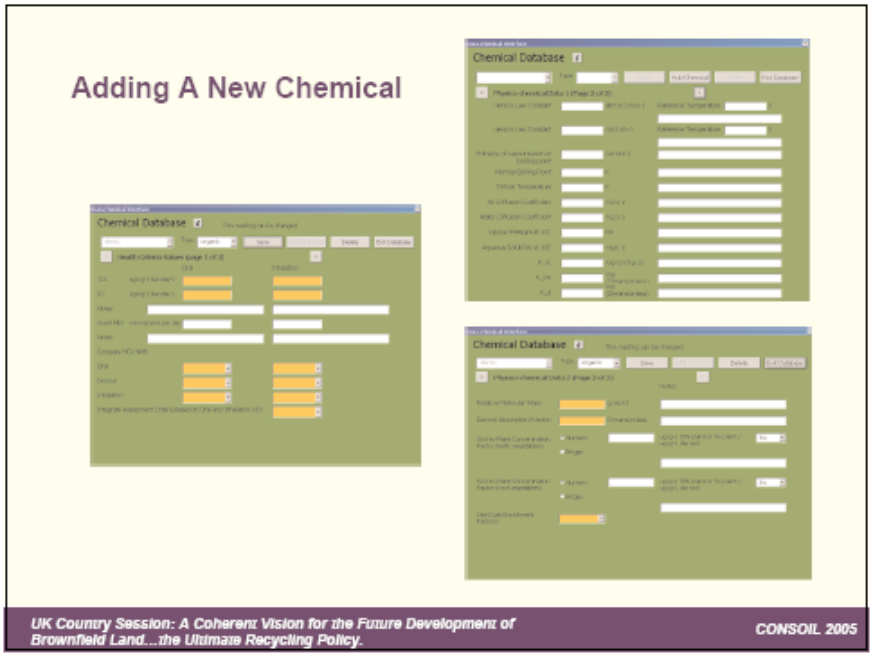

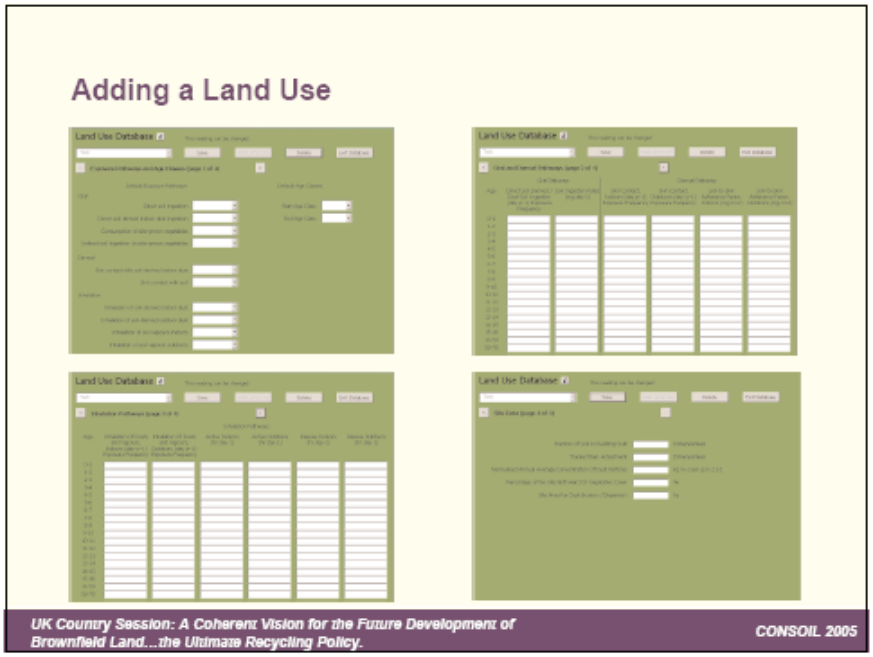

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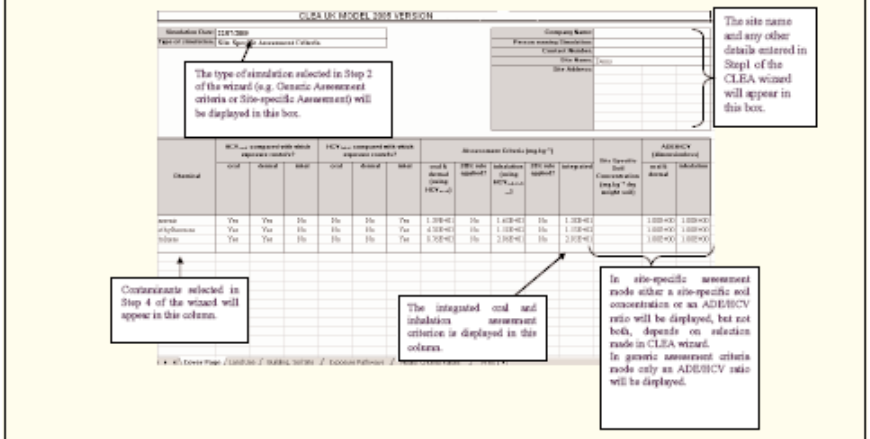
Reporting



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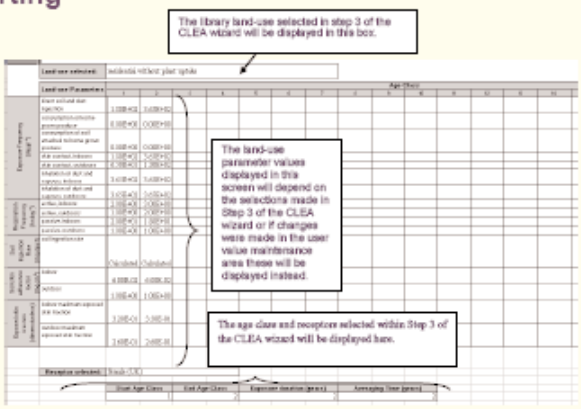

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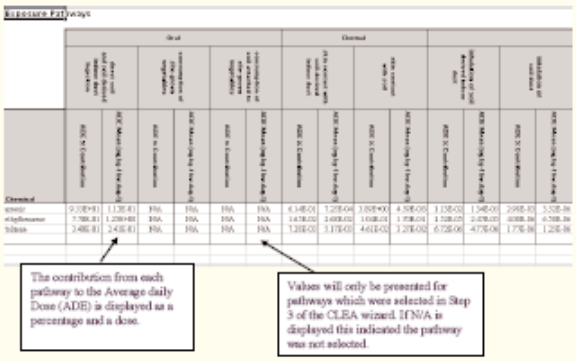

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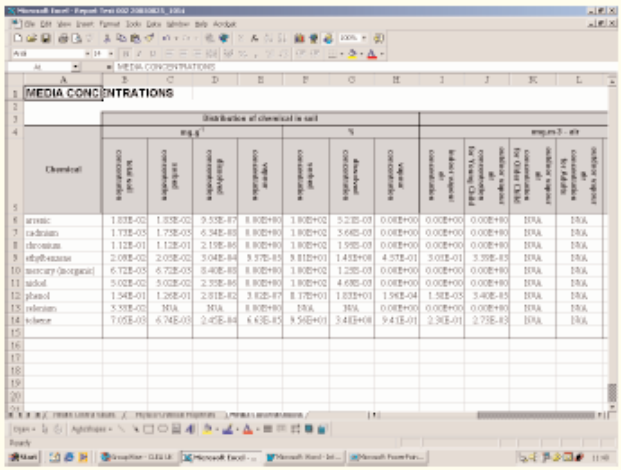

CLEA UK - Presentation

Next Steps

- CLEA UK will be launched on October / November 2005
- Software and manual available from www.environment-agency.gov.uk
- Technical support by e-mail at clea@environment-agency.gov.uk
- Software released as *beta* version (use with caution in decision-making)
- Experience and feedback from *beta* version will be incorporated into final version released spring 2006.

Acknowledgments

CLEA UK has been developed for the Environment Agency by CODA SciSys, and the software manual by consultants at Atkins Environment as part of the Environment Agency's Science Programme.

The project has been managed by Jo Jeffries at the Environment Agency with support of colleagues including Bridget Butler, Albania Grosso, and Sarah Hadley.

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Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater

Abstract

The former Akzo Nobel site in Stretford, Greater Manchester, UK, had been used by its previous owners, Courtaulds Chemicals, as a manufacturing facility, principally for the production of carbon disulphide (CS_2). With a production history of over 50 years, CS_2 contamination was present in the shallow soil and groundwater at the site.

An intensive programme of site investigation and risk assessment was performed to determine the suitability of the site for redevelopment for light industrial use. A remediation strategy was developed for this land use and agreed with the regulatory authorities, which included the installation of a "funnel and gate" design permeable reactive barrier (PRB) with zero-valent iron (ZVI) as the reactive medium to treat residual dissolved CS_2 in shallow groundwater.

The remediation programme was designed to allow the fastest possible development of the site for light industrial (and similar) end-use and the PRB system had to fit with the proposed development plans. Key technical performance criteria defined for the PRB included the capture of the contaminated groundwater originating from the site, the destruction of >90% of the captured CS_2, no detrimental effect on local groundwater levels and a process design that was easy and safe to install, monitor, maintain and, ultimately, decommission.

The evaluation and design of the PRB was undertaken in accordance with the Environment Agency's guidance on PRBs and included a laboratory test programme (undertaken by Prof. Bob Kalin's group at Queen's University Belfast), hydrogeological design and process design. The initial design was subjected to a rigorous value engineering programme that sought the greatest savings from the least changes (Pareto rule) - as a consequence, the cost of the gates was reduced by around £250,000 and significant constructability and health and safety improvements were achieved.

Laboratory testing demonstrated that the degradation of CS_2 by ZVI was first order over the range of CS_2 design concentrations (1-100 mg/l) and a half-life was in the order of 4 hours was likely under in situ conditions. The basic degradation reaction can be summarised as:

$$CS_2 + 5Fe \rightarrow 2FeS + Fe_3C$$

and no significant dissolved-phase intermediates were detected.

The PRB was commissioned in late-2004 and a programme of post-commissioning monitoring was implemented from January to July 2005. Results from this period indicate that all aspects of design performance are being achieved and confirmed the conclusions reached in the laboratory testing and hydrogeological design phases. Consequently, a lower intensity, long-term programme has been implemented to monitor routine performance into the future. Development of the site has continued during this period, returning a brownfield resource back into beneficial use.

Biographical Notes - Richard Thurgood, E&RS and Phil Morgan, ESI

Richard Thurgood

Richard Thurgood is Technical Director of E&RS (part of the CEL International group of companies), and is a chemical engineer with over 25 years of experience in environmental, process and project engineering, commissioning and safety. He has extensive experience of leadership of all aspects of contaminated land investigation, risk assessment and remediation.

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Professor Phil Morgan

Phil Morgan is a Director of the specialist soil & groundwater consultancy ESI and has 20 years experience in the practical application of environmental science and technology. He specialises in the assessment of the fate and impact of contaminants in soil and groundwater, and in the practical application of monitored natural attenuation (MNA) and remediation technologies, both biological and physical-chemical. He also has experience in waste and effluent treatment technologies and has worked in multi-disciplinary teams world-wide.

Phil is Visiting Professor of Environmental Biotechnology in the Groundwater Protection and Restoration Group, Dept. of Civil & Structural Engineering, University of Sheffield. He also works with a number of other research groups, is Chairman of the Programme Management Committee of the UK Dept. of Trade and Industry (DTI) Bioremediation LINK programme and a member of the CL:AIRE Technology and Research Group (TRG).

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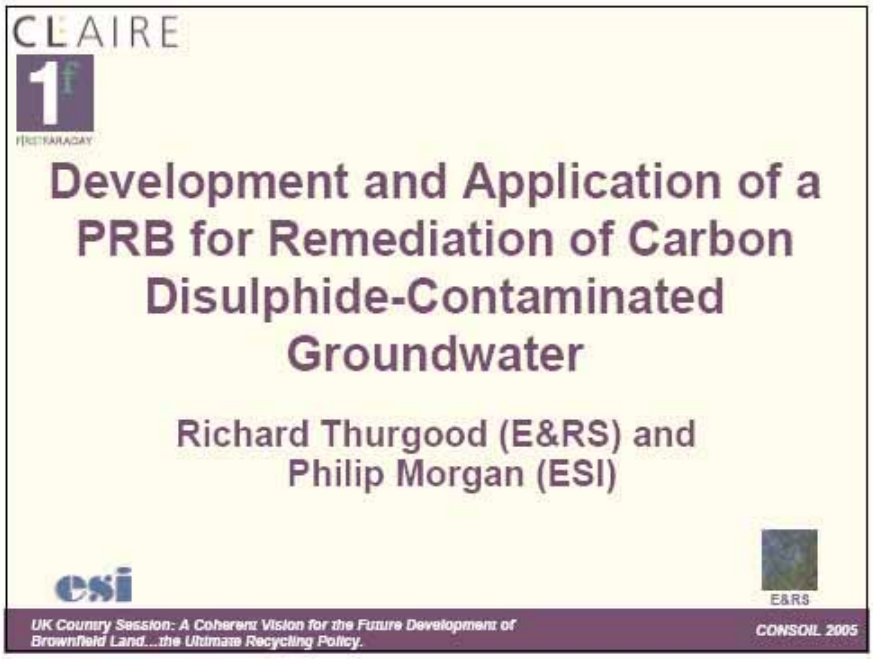

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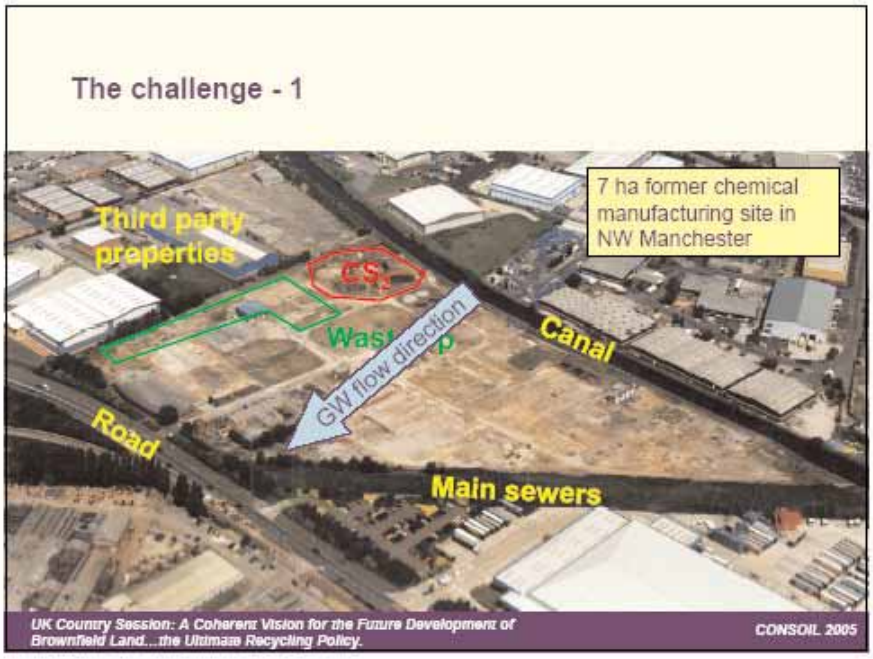

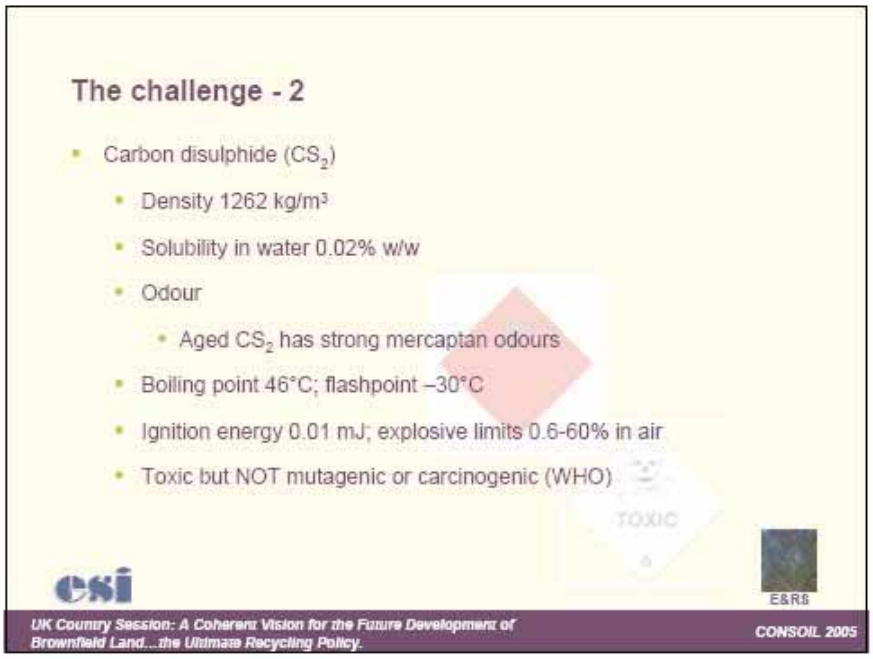

Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater - Presentation

The solution

Barriers to success

- Operational constraints
  - A future multi-occupant site in depressed area
  - Low maintenance and ability to decommission easily
- Layout constraints
  - Easement
  - Site access road
- Technical constraints
  - Treatment of a fundamentally "unknown" chemical with "bad" reputation
  - Need to meet best-practice guidance

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Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater - Presentation

Barriers for success - 1. The chemistry

- First-order kinetics for field-relevant CS_2 concentrations (1-100 mg/l)
  - Maximum CS_2 half-life of <4 hours under field conditions
- Degradation intermediates and products
  - No generation of persistent intermediates
  - Complete degradation (put simply): $CS_2 + 5Fe \rightarrow 2FeS + Fe_3C$
- Evaluation of iron types – performance, longevity, cost
- Passivation and fouling
  - Passivation rate was estimated but no major interference from geochemical or trace contaminant components
- Potential for H_2 and odour (mercaptan) generation

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Barriers for success - 2. Design and engineering

- Cost-effective
- Achieve design performance
- Safe for use and maintenance
- Constructable
- Design life
  - Structure 20 years
  - Iron 10 years
- Durable and robust
- Minimum maintenance
- Adaptable to site redevelopment and easement issues
- Low environmental and visual impact
- Monitoring must be easy
- Warrantable!

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Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater - Presentation

Barriers for success - 3. Design and engineering, too

- The right team!
  - Involving all parties
- Hydrogeological parameters
  - Plume capture
  - Regional groundwater flow
  - On-site groundwater levels
- Gas management
- Groundwater monitoring
- Value engineering
  - Stripping out conservatism
  - Innovative materials and construction

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Barriers for success - 4. Implementation

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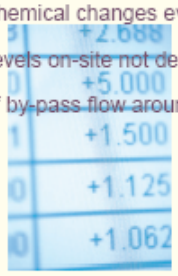
Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater - Presentation

Performance (the first 6 months)

- CS_2 concentrations
  - Upgradient groundwater locally 10-100 mg/l but uneven distribution
  - PRB exit: <0.001 to 0.008 mg/l
- No significant effect of gates on wider hydrochemistry
  - Although chemical changes evident within the gates themselves
- Groundwater levels on-site not detrimentally affected by the PRB
- No evidence of by-pass flow around barrier



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Lessons learned

Positives

- ✓ PRBs can work well in the development context
- ✓ Effective remediation performance
- ✓ Engaging with the regulators
- ✓ Project team dynamics
- ✓ It's a chemical engineering process!
- ✓ Value engineering does work
- ✓ Opportunities for improved performance next time

Negatives

- x Project team dynamics (too many cooks…)
- x Laboratory results never fulfil every requirement
- x Uncertainty rules
- x Development resource shortage
- x *Tempus fugit*
- x Hiding behind warranties

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Don't be first!

Development and Application of a PRB for Remediation of Carbon Disulphide-Contaminated Groundwater - Presentation

CLAIRE

Acknowledgments

- Akzo Nobel
- EDS
- Prof. Bob Kalin and his team at Queen's University Belfast
- Project partners, including:
  - Arup
  - KGE
  - ETI
  - Connolly-GPM
- The constructive support of the Environment Agency and Trafford MBC

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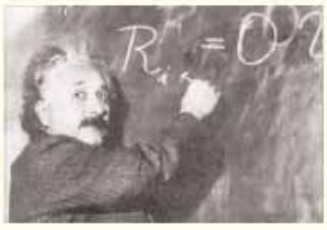

"Concern for Man and his fate must always form the chief interest of technical endeavour...

Never forget this in the midst of your diagrams and equations."

Albert Einstein

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UK Industry Perspective of National and European Drivers, Barriers and Opportunities for Brownfield Redevelopment

In June 1995, a group of companies representing a significant proportion of the UK's industry landholding held its first meeting as The Soil and Groundwater Technology Association - SAGTA.

Formed in 1994 with the support of the Contaminated Land and Liabilities Division of the then DoE, SAGTA represents many of the major industrial sector landholders. Our Members share a common culture of active management of their own landholdings and, crucially, all possessing in-depth and extensive knowledge of the issues. By bringing together this expertise, SAGTA's objective has been to share the best of techniques and experience from our various sectors to address the often complex and emerging technical issues of managing land contamination as effectively as possible. As such, we aim to assist the process of developing policy and national good practice.

Now entering its second decade, SAGTA's aims have remained remarkably consistent. Whilst we have pursued a programme that welcomes wide input from the broadest spectrum of the contaminated land community - regulators, policy makers, practitioners and problem holders, SAGTA has not sought to display a high public profile. However, a glance at the breadth of coverage of our 18 Members who represent chemicals, petrochemicals, defence, power, nuclear, water, minerals, waste and regeneration sectors, with access to international expertise will reinforce our key aim of acting as a respected and informed contributor from industry as a whole.

Our first 10 years have seen many significant and enduring contributions:

- We were one of the original drivers and funders behind the development and formation of CLAIRE, now firmly in place as a key component of UK practice. CL:AIRE's Chairman as well as two Members of its Board are drawn from our Membership.
- We have been an active respondent to consultations on a large array of national initiatives lead by Defra and Environment Agency that have embraced many of the facets of management of land contamination. These we continue to support.
- Productive links have been developed with many national bodies. These include Defra, DoH, Environment Agency, SEPA, ODPM, NII and more recently the Cabinet Office's Better Regulation Team. We have now convened over 40 key Workshops that have acted as a regular framework at quarterly intervals throughout the year. These help to contribute by bringing together these bodies, together with industry specialists and members of professional bodies to identify gaps, technical viewpoints and areas where the land management community, and SAGTA in particular, can contribute to advancing good practice and policy.
- Local authority links have also been developed over recent years. These now number some 30 contacts through specific links with representatives at our various Workshops. In addition, we have regular participation with both the NSCA's Contaminated Land Working Group and CIEH and we remain keen to further consolidate and develop these local authority contacts in the future.
- SAGTA has also driven specific research initiatives via our Member organisations which our work on PPC baseline studies and management of small sites via the current CLUSTER initiative are indicative of our contributions.

As we move forward, our aim is to retain our role as a measured voice from industry that is respected for its authoritative, high level contributions both in terms of technical rigour and in the context of measured views on impacts on business.

Our future challenges must include the encouragement and acceleration of the use of sustainable remediation technologies. We will also be aiming to consolidate and stimulate our current involvement in the practical integration of legislation relating to water and land contamination and waste whilst maintaining our regular dialogues with policy makers and regulatory authorities at both national and local level.

Biographical Notes - Colette Grundy, SAGTA

Dr Colette Grundy

Colette has worked for BNFL for the past 5 years and has over 15 years experience in the industry. She is a Fellow of the Royal Society of Chemistry, with a first degree, masters and doctorate in Physical Chemistry. She is Vice Chairman of the Royal Society of Chemistry Environment, Health and Safety Committee.

Colette is a contaminated land specialist and was the technical manager for the production of the first contaminated land safety case for BNFL in the UK. This was for the Sellafield site which is recognised as the most complex nuclear site in the UK by the Environment Agency. She is currently managing a programme of work on Site End Point Management for the 20 Nuclear Decomissioning Authority sites in the UK.

She is a member of the UK Inter-Industry Group (IIG) for Contaminated Land and Site Closure issues. This group acts on behalf of the Safety Directors Forum to act as the means by which the Nuclear Industry shares practical experience, information and understanding in the management of contaminated land, site restoration and site closure.

Colette is Chairman of the UK Soil and Groundwater Technology Association, SAGTA. The Soil and Groundwater Technology Association (SAGTA). Its members actively address technical challenges associated with the management of landholdings which are potentially contaminated. A key component of the Association's activities is regular dialogue with representatives from the policy makers, regulatory agencies and local authorities to facilitate a common understanding of the issues.

Colette is also a Director of CL:AIRE.

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UK Soil and Groundwater Technology Association - SAGTA

Dr Colette Grundy
SAGTA Chairman
(Nexia Solutions, BNFL Group.)

Background

- SAGTA was formed in 1995 with support from UK DoE's Contaminated Land & Liabilities Division
  - Criterion for membership :To own and actively manage land holdings
  - Members are drawn from
    - Chemicals/Petrochemicals, Waste, Regeneration - ICI, BP, Shell, English Partnerships, Land Restoration Trust, Westbury Homes, Shanks, SecondSite Property Holdings, Corus
    - Also Nuclear, Energy and Defence - UKAEA, AWE, BNFL, DLO, E ON, National Grid Transco, BAE Systems, RWE NPower

UK Industry Perspective of National and European Drivers, Barriers and Opportunites for Brownfield Redevelopment - Presentation

Aims and Objectives

- SAGTA aims to share experience and develop best practice and achieve its aims of :
  - Stimulating and accelerating the development of the most cost-effective technologies and methodologies
  - Actively contributing to translating policy into practice
  - Providing feedback through case studies and members experiences

Structure and Membership

- SAGTA currently has 18 corporate members in the UK. Its structure involves :
  - Memorandum of Agreement
  - Elected Chair and Deputy Chair- 1 year tenure
  - Steering Group (open membership)
  - Members Meetings
  - Workshops

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SAGTA Members and Brownfield Issues

- SAGTA members in managing their landholdings recognise the importance of Brownfield Issues :
  - Members are involved in acquisition of divestment of land that has been previously developed - Brownfield
  - Not all Brownfield sites are contaminated or located in urban areas
  - Organisations such as English Partnerships have been involved in bringing brownfield sites back to a condition where they can be redeveloped
  - Hence the need to develop remediation technologies
  - Workshops- Sustainable development of Brownfield Land, Financial Risk Management

How does SAGTA operate?

- SAGTA provides feedback and develops best practice via
  - Sharing knowledge and disseminating best practice via meetings, workshops, shared projects
  - Assessing and promoting awareness of emerging policy, legislation and technologies via workshops and meetings
  - Dissemination of research and reports via members network and contact with other organisations
  - Responses to Consultations, providing test sites for new methodologies e.g. EA Ecological Risk Assessment test sites

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Workshop Structure

- Workshops are held quarterly. Recent workshops include Environmental Forensics, In Situ Measurement, Non-Chemical Perceived Risks
  - Attendees- Government, Regulators, Research Councils/Organisations, Local Authorities, Members
  - Case Studies from Members and others
  - Open Debate and Breakout Sessions on Issues arising e.g. Regulatory position
  - Output Position Papers - State of the Art, identifying Gaps and Priorities
  - Provides a means for real testing of guidance and methodologies

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Current and Future Challenges

- Forthcoming Policy and Legislation
  - EU Directives - Water Framework Directive, Environmental Liability Directive
  - Part IIA extension to Radioactively Contaminated Land
  - Work towards practical integration of legislation relating to Land (inc. Brownfield) and Water Contamination and Waste
  - Continue our dialogue with Policy Makers and Regulators including Local Authorities

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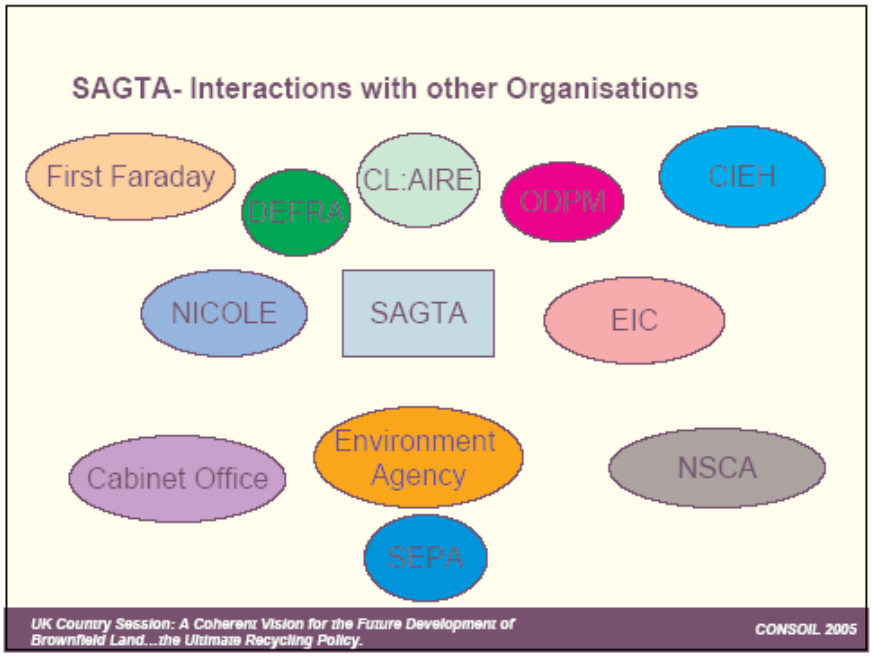

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Example of SAGTA's Achievements

- Over the past 10 years SAGTA has made significant contributions through
  - CL:AIRE - Its instigation
  - Response to Consultations & Specific Projects :
    - IPPC Baseline Study - tested draft EA Guidance
    - Cluster - reducing the barriers to sustainable remediation of small sites
    - DTI/DEFRA Environmental Industries: Consultation on Technology Priorities, Scottish Executive Consultation on Part IIA

Lessons Learned

- During the past 10 years we have found
  - Stakeholders are willing to involve in constructive debate
  - Benefits include learning from member experience, cost sharing to fund specific research areas

  But
  - Engaging Local Authorities is difficult- individuals attend on a regular basis but roll out to over 400 regulators is problematic
  - EA National staff appreciate the value of SAGTA workshops but attendance is resource constrained

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The Department for Environment, Food and Rural Affairs (Defra) works for the essentials of life - food, air, land, water, people, animals and plants. Our remit is the pursuit of sustainable development - weaving together economic, social and environmental concerns. Defra therefore:

- brings all aspects of the environment, rural matters, farming and food production together;
- is a focal point for all rural policy, relating to people, the economy and the environment;
- has roles in both European Union and global policy making, so that its work has a strong international dimension.

Defra is led by the Secretary of State, the Right Honourable Margaret Beckett, MP, supported by her Ministers, a Permanent Secretary and other officials. Mrs Beckett represents the UK at the EU Agriculture and Fisheries Council and at the EU Environment Council, chairing both Councils during the UK Presidency. Mrs Beckett leads for the UK in other international negotiations.

Defra's work in England is delivered through policy development, legislation, guidance, funding mechanisms and many other means. The "devolved administrations" take forward a similar agenda in Scotland, Northern Ireland and Wales.

Full details of Defra activity can be found on our webpages at **http://www.defra.gov.uk/**

Contaminated land in England is dealt with by the Local Environment Quality division of Defra, which is responsible for the overall policy, and for the main legislation, concerning historic land contamination. Full details can be found at:

http://www.defra.gov.uk/environment/land/contaminated/index.htm

Those pages also contain links to other relevant websites, including the Environment Agency website which features a large range of technical and scientific material relevant to land contamination, especially on risk assessment.

For further information about Defra please contact:

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The Environmental Industries Sector Unit (EISU) is a government unit, operating within **UK Trade & Investment,** with responsibility for promoting the UK environmental industry overseas. The UK environmental industry is diverse in terms of the expertise and experience available.

EISU - Gateway to environmental solutions from the UK
The EISU maintains contact with a wide range of UK environmental companies and organisations, including:

- Leading environmental consultancies and technology providers
- Younger firms specialising in innovative technologies or approaches to environmental problems
- Leading UK industry trade associations and professional bodies.
- Research organisations in UK universities and other centres of excellence
- Links with organisations which promote cleaner technology and can put potential customers in touch with a range of firms

EISU is therefore well placed to introduce industrialists, government organisations, and others with environmental problems to UK suppliers of appropriate technologies and services who can provide solutions across the broad environmental spectrum.

UK credibility
The UK has a comprehensive legislative framework combined with effective monitoring and enforcement, leading to very high environmental standards. Our approach in setting an effective policy framework is based on the principles of Best Practicable Environmental Option and Best Available Technology Not Entailing Excessive Costs. UK environment suppliers are used to meeting these requirements and are capable of providing equipment, technologies or services that meet the high standards of national and international legislation at competitive prices.

Website
The EISU website (www.eisu.org.uk) is the most convenient way to access up to date information regarding events and news affecting the Environmental Goods & Services sector. The UK suppliers database can be accessed directly from the site along with a list of current EISU publications.

For further information about EISU please contact:

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THE SOIL AND GROUNDWATER TECHNOLOGY ASSOCIATION

Sharing Experience aids Policy to Practice

The Soil and Groundwater Technology Association (SAGTA) is a non-profit making association of member organisations drawn from leading UK companies representing many of the major industry sectors and landholders. Formed in 1995, its Members have addressed many of the technical challenges associated with landholdings that are potentially contaminated.

Key to SAGTA's activities is the opportunity for regular dialogue with policy makers, and representatives of the regulatory agencies and local authorities to facilitate common understanding of the issues. It pays particular attention to good practice to prevent land contamination in the future as well as dealing with contamination from past activities.

By being able to share know-how and experience between its members and leading UK and international experts, specialists from regulators and local authorities, the Association's primary aims are to:

- Actively contribute to helping translate UK policy into practice
- Stimulate and accelerate the development of the most cost-effective technologies and methodologies in assessing and dealing with land contamination.

SAGTA was instrumental in supporting the formation of CL:AIRE and its Members actively participate in management and direction, furnishing its Chairman and other members its Board, as well as financial and in-kind support.

For further information, view SAGTA's website: www.sagta.org.uk or contact SAGTA's Secretary:

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English Partnerships
The National Regeneration Agency

English Partnerships is the government's national regeneration agency. Our aim is to deliver high quality sustainable growth in England and we do this through our five core business areas:

- Developing our own portfolio of strategic projects
- Acting as the government's specialist advisor on brownfield land
- Ensuring the at surplus public sector land is used to support wider Government objectives, especially the implementation of the Sustainable Communities Plan
- Helping to create communities where people can afford to live and want to live
- Supporting the Urban Renaissance by improving the quality of our towns and cities

Through our National Land Use Database (NLUD) we have identified more than 64,000 ha of previously developed or brownfield land, and one of our core objectives is to develop and implement strategies to bring this land back into productive use.

In partnership with the ODPM (Office of the Deputy Prime Minister), English Partnerships is drawing up a *National Brownfield Strategy* that aims to find solutions and devise methods of helping to deal with England's legacy of brownfield land, especially long-term dereliction that often blights our towns and cities.

As part of a wide-ranging consultation programme that will feed into the long-term strategy English Partnerships is working with fourteen local authorities across the country on a pilot programme to tackle some of the worst 'eyesores'. New uses could include homes, offices, shops, recreation areas or natural open space.

The *National Brownfield Strategy* is expected to be published in mid 2006.

For further information on our projects and programmes see www.englishpartnerships.co.uk or contact

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Fax: 01925 411493
E-mail: enquiries@brownfieldstrategy.info

UK Approach to Contaminated Land

Like most other industrialised countries, the UK's long industrial history has left us with an extensive legacy of land contamination. Industrial practices, ranging from gasworks and landfilling of waste, to making hats, have led to harmful substances being present in, on or under land. Examples include oils and tars, heavy metals, organic compounds, mining materials, and gas and leachate from older closed landfills.

The contaminated condition of land can sometimes present unacceptable risk to human health, ecosystems, property, and water resources.

An estimated 5,000 to 20,000 sites in England may present unacceptable risk to human health or the environment, and require remediation (Environment Agency estimate).

Current licensing controls implementing EU law tackle new contamination, and also help prevent it. Several regimes help tackle the existing legacy, as follows:

Environmental protection rules (the "Part 2A" regime)

From 1st April 2000 in England, local authorities (LAs) must inspect their areas to identify contaminated land (as defined), following a strategic prioritised approach, and secure its remediation in each case. This is a huge, long-term task, now well under way.

LAs are assembling and organising data, in order to prioritise detailed inspection of individual sites, and these detailed inspections are also taking place. Defra support LAs and the Environment Agency in this task with capital (£20m pa) and also revenue funding. This regime is contained in Part 2A of the Environmental Protection Act 1990.

Remediation can be by voluntary action. If necessary, a remediation notice is served on the "polluter", or in some cases the landowner. This is enforced by LAs, or by the Environment Agency in some cases. The regulators may carry out remediation if no-one else can be found to pay.

The approach to intervention, and to remediation, is risk-based. Land is "contaminated land" as defined where the presence of any substances gives rise to significant harm, or a significant possibility of it, or actual or likely pollution of groundwater, rivers etc. All land and all substances (including naturally present ones) are covered. Risk is assessed with regard to the current use of the land, and its environmental circumstances.

Remediation is to a standard which deals with the risk and ensures the land is suitable for its existing or permitted use, subject to considerations like cost/benefits & hardship.

In England, Defra is responsible for overall policy and legislation, and the Environment Agency lead on the production of extensive technical advice and information to help support decision-making, particularly risk assessment.

Planning and building control regimes

Whenever land is being developed, eg new housing on former industrial sites, land contamination is a "material planning consideration". Where necessary, sites must be investigated as to their condition by the developer, and development must include appropriate remediation to ensure the site is "suitable for use", especially to remove or prevent any unacceptable risk. In effect, development profits pay for the remediation.

UK Approach to Contaminated Land

Building controls deal with matters such as the safety of new construction, and impose requirements concerning land contamination. These two regimes, which in England are led by the Office of the Deputy Prime Minister, deal with much historic contamination in practice. Part 2A deals with situations where development does not provide the answer.

Damaged land and derelict land is often tackled by using public funds to reclaim sites. This work is led by English Partnerships, by regional development agencies, and by LAs, in compliance with the rules on state aids. Such land isn't always contaminated of course, but "hardcore" derelict land, that may have been unused for a decade or more, is often contaminated, as well as having other problems.

Land transactions and other areas of commercial life increasingly take account of the condition of land, and indirectly help drive both investigation and improvement.

It is estimated that perhaps £1billion pa is being spent on investigation and improving land condition.

More information on the UK approach

Full details including access to the full range of legal, policy and technical material as well as background facts can be found on two key Governmental websites:

1.
www.defra.gov.uk/environment/land/index.htm

This includes the material about, or links to;

- Part 2A of the Environmental Protection Act 1990
- the Government Circular containing Part 2A statutory guidance and overall policy
- Government Planning Policy Statement PPS 23 (which deals with land contamination in relation to development control, in England)

2.
www.environment-agency.gov.uk/subjects/landquality/113813/?version=1&lang=_e

This is the main location for technical guidance and information

- on risk assessment: see CLR 11 "Model Procedures" part 3 for an extensive list of publications covering human health, ecosystems, property, and water resources
- on human health risk assessment: see CLEA, SGVs, Tox reports, CLR 7-10
- on procedures for deciding remediation and considering waste: see CLR 11

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