CL:AIRE/Welsh Assembly Government Conference

Regenerating Contaminated Land in Wales through Partnership

13th March 2007
Wales Millennium Centre, Cardiff

Supported by Llywodraeth Cynulliad Cymru Welsh Assembly Government

In association with Integrated Pollution Management

Sponsored by

ACCORD ERM ESP GWL Health Protection Agency PB PARSONS BRINCKERHOFF WALTERS UK Ltd.

CL:AIRE
CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS

www.claire.co.uk

This conference has been generously sponsored by the following organisations:

- Accord
- ERM
- Earth Science Partnerships
- Geoscience Wales Ltd
- Health Protection Agency
- Parsons Brinckerhoff
- Walters UK Ltd

Contaminated Land: Applications in Real Environments (CL:AIRE) is a respected independent not-for-profit organisation established in 1999 to stimulate the regeneration of contaminated land in the UK by raising awareness of, and confidence in, practical and sustainable remediation technologies.

We are one of the leading organisations within contaminated land, fulfilling a need for objective, scientifically robust appraisals of remediation technologies and effective methods for monitoring and investigating sites. Our unique **Technology and Research Group (TRG)** draws on some of the foremost professionals and academics within the field to provide credible, third party appraisals of remediation technologies.

CL:AIRE is part-funded by key government stakeholders in recognition of the importance of our work:

o English Partnerships
o Defra (Department for Environment, Food and Rural Affairs)
o Department of the Environment Northern Ireland
o Environment Agency
o Welsh Assembly Government.

CL:AIRE's status as an independent organisation allows us to appraise and disseminate on innovation in remediation, increasing confidence across the entire industry and driving forward the effective remediation of contaminated land.

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CL:AIRE

conference

Regenerating Contaminated Land in Wales through Partnership

CL:AIRE (Contaminated Land: Applications in Real Environments) is being supported by the Welsh Assembly Government to host a one day conference at Wales Millennium Centre.

This one day conference will raise awareness of emerging issues, the regulatory framework, funding opportunities and risk assessment approaches in dealing with contaminated land in Wales. The event is aimed at the whole contaminated land community but especially at practitioners active in Wales.

13th March, 2007
Wales Millennium Centre, Cardiff, Wales

supported by Llywodraeth Cynulliad Cymru Welsh Assembly Government

In association with: Integrated Pollution Management

Programme

0900 - 0930	Registration and Coffee
Morning	Chairman - **John Harrison**, *Environment Agency Wales*
0930 - 0940	Introduction - **Jane Forshaw**, *Chief Executive, CL:AIRE*
0940 - 1005	European Structural Fund Programmes 2007-2013 - **Ian Watson**, *Welsh European Funding Office*
1005 - 1030	Regulatory and Policy Update - **Ceri Jones**, *Contaminated Land Policy Advisor, Environment Agency Wales*
1030 - 1055	Welsh Assembly Government Perspectives on Contaminated Land - **Steve Smith**, *Head of Land Reclamation, WAG*
1055 - 1115	Public Health Risk Assessments: Towards a National Model for Consistent, Standardised and Authoritative Advice and Support - **David Russell**, *Health Protection Agency*
1115 - 1140	**Tea/Coffee**
1140 - 1300	Contamination Issues in Wales - a series of short case studies on problem contaminants pertinent to Wales, including: • Implications of Abandoned Pb/Zn Mining for New Development in Flintshire - Risk Assessment and the Critical Receptor - **Keith Nicholls**, *Geotechnics* • Llanreath Oil Storage Depot - Managing a Wartime Legacy - **Gideon Jones**, *Parsons Brinckerhoff* • Acid Tar Remediation - A Holistic Approach - **Simon Talbot**, *GMGU* • Understanding the Complete Risk Transfer Process on Brownfield Sites: Case Studies - **David Williamson**, *ERM* • Treating Wastes for Restoring Land Sustainably (TWIRLS) - Approaches to Remediating Contaminated Land - **Julie Williamson**, *University of Wales, Bangor*
1300 - 1400	**Lunch & Exhibition Session**
Afternoon	Chairman - **Steve Matthews**, *ERM*
1400 - 1425	Assessing Risks from Land Contamination: Soil Guideline Values - **Judith Lowe**, *independent advisor to Defra*
1425 - 1545	**Parallel Workshops** **1: Funding** - What mechanisms are available? How could your project win funding approval? Workshop leaders: **TBC** and **PERA** **2: Delivering Solutions for Problem Contaminants** - Developing confidence in technology selection. What sources of information are available? Workshop leaders: **Hywel Thomas**, *Cardiff University* and **Kathryn Monk**, *Environment Agency Wales* **3: Communities, Public Health and Contaminated Land** - What has been done, where are we and where are we going? Workshop leaders: **David Russell**, *Health Protection Agency* and **Judith Lowe**, *independent advisor to Defra*
1545 - 1615	**Tea/Coffee**
1615 - 1635	Workshop Feedback
1635 - 1645	Concluding Remarks

Sponsored by: ACCORD, ERM, ESP, GWL, Health Protection Agency, PB Parsons Brinckerhoff, WALTERS UK Ltd.

CL:AIRE

Objectives

supported by

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Regenerating Contaminated Land in Wales through Partnership

A CL:AIRE conference supported by the Welsh Assembly Government
Wales Millennium Centre, 13th March, 2007

Wales is a country renowned for its natural beauty and rich wildlife. It also possesses a strong industrial past which has left a substantial legacy of land contamination. Although progress has been made in remediating sites identified as potentially contaminated, the residual land resource and challenges from these industries remains significant. The Environment Strategy for Wales and the Wales Spatial Plan have helped set the agenda for action to ensure such sites contribute to effective regeneration.

- Can this land be regenerated in a sustainable way without resorting to landfill?
- How can government, businesses, organisations and individuals work together to resolve the problem?
- Who can provide the funding?
- What are the latest sustainable remediation technologies currently being researched?
- What direction is Policy taking?

CL:AIRE (Contaminated Land: Applications in Real Environments), an independent not-for-profit organisation and environmental body, is being supported by the **Welsh Assembly Government** to host a one day conference at the Wales Millennium Centre to tackle these important questions and establish Wales as a global model of how a country can secure its environmental future through remediating its industrial past. We hope to raise awareness of emerging issues, the regulatory framework, funding opportunities and risk assessment approaches in dealing with contaminated land in Wales. The event is aimed at the whole contaminated land community and especially at practitioners active in Wales.

This event includes plenary sessions on funding mechanisms and strategic frameworks, as well as the latest regulatory and policy updates from the **Environment Agency Wales** and **Welsh Assembly Government** perspectives on contaminated land. A series of short case studies on problem contaminants will provide valuable practical analysis and debate for delegates.

Workshops will cover:
- Funding
- Solutions for Problem Contaminants
- Communities Public Health and Contaminated Land.

CL:AIRE

Integrated Pollution Management

Knowledge Transfer Network

Knowledge Transfer Networks
A DTI business support solution
Delivered through the Technology Programme

Integrated Pollution Management Network

IPM-Net

About us

The **Integrated Pollution Management Knowledge Transfer Network** (IPM-Net) is funded by DTI and Defra to improve the UK's innovation performance in the management and remediation of pollution by increasing the breadth and depth of knowledge transfer into UK-based businesses, and by accelerating the rate at which this process occurs.

IPM-Net brings together business professionals, the knowledge base and networks in the traditionally separate sectors of **land**, **water** and **waste** in an integrated manner and works with them to accelerate **cross-sectoral knowledge transfer.** This provides unique opportunities to optimise and broaden approaches adopted within the sub-sectors, to stimulate innovation that delivers solutions for cross-cutting needs and to produce skilled professionals that increase the UK's business capabilities.

How we can support you

Innovation

One of IPM-Net's main objectives is to stimulate and facilitate the innovation process. This is achieved by identifying and facilitating business opportunities; developing and implementing strategies with stakeholder communities; partnering organisations with relevant commercial or academic researchers; and influencing funders, government bodies and national/international strategies to deliver innovation opportunities and funding.

Networking and business opportunities

In addition to facilitating the creation of research opportunities to deliver innovation, an activity of equal importance to IPM-Net is to facilitate the transfer, commercialisation and uptake of technologies across the land, water and waste sectors. To achieve this, IPM-Net provides members with up to date information on potential funding streams, alongside guidance and assistance for proposal preparation, and operates tailored dissemination and technology brokering mechanisms.

Knowledge

The contaminated land, water and waste industries are evolving and fast moving, driven by government legislation, commercial pressures and the need to provide sustainable solutions. To ensure environmental professionals are kept up to date, IPM-Net, together with other networks and training providers, run and facilitate a wide range of workshops, training courses and events designed to equip industry with the appropriate skills and knowledge. In addition IPM-Net provides a directory of training providers and an up to date calendar of courses, workshops and events on its web portal (www.ipm-ktn.com).

How you can benefit

Becoming a member enables organisations to take full advantage of the activities and knowledge IPM-Net offers. Members gain full access to a state-of-the-art web portal which acts a central resource, providing relevant and timely information. The web portal is equipped with many state-of-the-art web tools including 'newsfeeds', on-line conferencing tools, discussion forums and collaboration functionality all designed to enhance knowledge transfer and business. Members also receive regular updates via e-bulletins and a quarterly newsletter.

Become a member www.ipm-ktn.com

Any organisation can become a member and there are no restrictions on the number of members per organisation. The IPM-Net website **www.ipm-ktn.com** contains further details and a simple on-line registration form, or alternatively contact us on: **(01865) 610500**.

Information from our Sponsors

PUBLIC SERVICE DELIVERY AND CONSULTANCY TO SUPPORT REGENERATION

Public Service Ethos

Public service ethos and local focus are central to our business model. We provide public services and consultancy support in a range of disciplines, including environmental management and solutions. Regeneration and renewal are designed into our offering. Across all our activities, a proactive approach in supporting our Clients to achieve their broader social, economic and environmental goals is paramount. Public private partnerships should and will focus increasingly on such outcome-oriented objectives, as councils and other authorities increasingly see their responsibilities in terms of leading sustainable communities.

We deliver a diverse range of services including: repair and refurbishment of social housing stock; environmental and street care services; highways management and maintenance at local and national levels and facilities management and building services. Our consultancy offering is diverse including: strategic support on leadership; partnering and procurement; management of major public consultation exercises transportation schemes to technical expertise in environmental management including the management of environmental risks. This enables us to use our considerable skills in packaging integrated, bespoke service delivery and consultancy offerings to meet distinct Client needs.

Two features of our business model are significant. Firstly, our promise to Clients is a local service partnership and not a take-over, incorporating skilled local leadership. Our business units are encouraged to grow locally, through organic expansion in existing partnerships and third party work with new Clients. This kind of expansion, alongside our commitment to developing a local supply chain and training local people, boosts and sustains the local economies where we operate. Secondly, our public service ethos includes excellent customer care and recognises the distinctive accountabilities that arise when being funded by public money to improve the quality of life of citizens and communities. Public services provision accounts for almost all of our approximate £300 million turnover. We were one of the first firms to describe itself as a public services company. Most of our workforce of over 3,000 employees transferred to us from the public sector.

We have invested in building up business in Wales and wish to expand

Our presence in Wales began in 2001. We won a highways term maintenance contract on the Isle of Anglesey that has been extended until 2009. This incorporated a TUPE transfer of employees from the local authority into Accord. All our transferred operatives have been trained in our North Wales training facility based in Anglesey and will have achieved NVQ level 2 and CSCS accreditation within the next three months. Over the period of the contract, a number of apprentiships have been created. In addition to the highways work, we also operate a highways materials waste recycling centre in North Wales, which was converted from a disused quarry.

More recently, 3-year surface dressing contracts in Caerphilly, Torfaen and Vale of Glamorgan have been added to the portfolio, together with additional surface dressing work in Bridgend, Cardiff and in Newport serviced from local office facilities. The expansion of the surface dressing business is being developed in working collaboratively with various other councils. The model entails us providing the high-tech equipment and staff trained to use it, while the councils provide their in-house surface dressing workforce. This integrated service arrangement is particularly attractive due to the seasonal nature of work.

Accord is keen to expand in Wales, both within our highways operations and beyond, to build up a broader portfolio of Welsh activities.

Best Practice and Customer Care

Our best practice typically helps to achieve our Clients' broader economic, social and environmental objectives. A distinctive contribution is made by customer care for service users. We bring a range of insights. Praise for the courtesy of our operatives proves to us the importance of doing the small things well. Designing work schedules sensibly, in partnership with Clients, local residents and businesses, is key to minimising the disruption caused by substantial works programmes. Our repair and disaster recovery work for insurance companies, such as our works programme after the Carlisle floods, brings experience of achieving high levels of customer care in pressured conditions.

Engaging with Communities

We engage with communities, giving them choices and managing their expectations. From experience, good service design and sensitive dialogue with communities are equally crucial. People's expectations rise once their public services or localities start to improve, so managing their expectations about what more they can expect is key to maintaining their satisfaction while keeping within budgetary constraints. A major benefit is our extensive experience of service user engagement and neighbourhood working across all areas of our public service delivery.

Equality & Diversity

We mainstream Equality & Diversity considerations into all of our activities, both because of the business benefits and because our services are only world class if they meet the needs of all the communities we serve. Our company was one of the first to volunteer to work with the Commission for Racial Equality (CRE) to identify how the private sector could best assume a voluntary responsibility, akin to the legal obligation on the public sector, to promote equality. The CRE is happy that the remit for our approach extends beyond racial equality to include all aspects of the equality agenda.

Health & Safety

Our approach to Health & Safety is world class. All our operational business units have British Safety Council 5-star accreditation and, in both 2005 and 2006 the BSC presented us with 5 of the 40 Swords of Honour they award annually to businesses world-wide, describing our record as 'a remarkable achievement and a shining example'. The focus is as much on the safety of our service users and tenants, as of our operatives.

Innovations

Our significant innovations, that tend to be adopted across industry, frequently achieve sustainability or Health and Safety goals and usually arise through supply chain collaboration.

For instance, our SADie (Specialist Asbestos Decontamination unit) vehicle was a first of its kind in the UK and provides a safer and environmentally friendly solution to asbestos decontamination for our operatives. Having pioneered various recycling techniques, we are developing a partnership with the social enterprise, Urban Mines, which finds innovative solutions for waste materials in a manner which values people and respects the earth.

Creating Jobs and Training Opportunities

Creating jobs and training opportunities. Our local focus includes a commitment to employing and training local people. We are developing a partnership across our business with Tomorrow's People, a charity with over 20 years experience of supporting long term unemployed and people facing other obstacles to find and keep jobs. Their specialist support enables us to create and sustain employment from within deprived communities within the context of our service provision. Tomorrow's People's record of supporting people once they have found a job is particularly impressive: 76% of the individuals they help are still in work after a year.

Support & Development of the Local Supply Chain

Through the support and development of the local supply chain, we have a track record of sustainability and growth. With the agreement of long term relationships, the confidence of local business enables investment. The support we offer includes integrated training initiatives to achieve shared loyalty, and shared values coupled with all aspects of Health, Safety and Environmental legislation.

Partnering

We have a strong track record in partnering with Clients, suppliers, joint venture and other delivery partners. The success reflects our culture and ability to form effective working relationships at all levels. Particular skill is in forming contractual structures, including payment mechanisms and performance management regime, that are built on a partnering approach. Increasingly, a major facet of our partnership working is joint planning with Clients to manage affordability constraints and budget fluctuations.

Our public service consultancy, Accord Consulting Services, has also built a 'Pathways to Partnership' toolkit. Its main purpose is to help public authorities to work together as partners in agreeing priorities and commissioning services. Its approach draws on our experience of supporting Local Area Agreements.

There are obvious applications in Wales, for instance within the Welsh Housing Quality Standard programme and related initiatives such as follow-up to Sir Jeremy Beecham's 'Beyond Boundaries' review and the Assembly Government's 'Making the Connections' strategy for improving public service delivery in Wales. At the service delivery level, we can integrate a wide range of local services to improve the public realm – which could be commissioned collectively by public authorities who come together to secure a cohesive solution. This toolkit is being used internally to support our own partnerships.

Accord has a strong track record of Participating in forums to improve public services and partnership working. We were the leading company to campaign for an end to compulsory competitive tendering and to work with local government and unions as the Local Government Social Partners to put good employment at the heart of council tendering.

Posts currently held by colleagues across Accord include: Member of the Northern Ireland Government Procurement Board; Chair of the CBI Local Government Panel; Chair of the National Highways Works Benchmarking Club; Member of Constructing Excellence and the Housing Forum; Founding Member of the Westminster Sustainable Business Forum; Board Member of the New Local Government Network and Members of various Health & Safety Executive panels.

Economic, Social & Environmental considerations within Public Procurement

We fully supporting the drive to ensure that Welsh investment in public services and infrastructure delivers broader benefits to regenerate localities, strengthen communities and improves sustainability. Clearly, this will require the procurement methodologies to be designed carefully. Our expertise has contributed within the UK and at European levels to policies on how to realise the broader ambitions while complying with European public procurement rules and national and devolved policies on value for money. This experience enables us to assist in how individual procurements and contract management arrangements can best be structured, so that the outcomes that really matter take priority during the procurement and over the lifetime of the relationship.

ACCORD

Why Partner with Accord?

- Public service is demanding. It goes beyond good customer care. We know this because public service provision is our core business.
- Our clients increasingly see their role as "place shapers" - helping to create distinctive local areas where people want to live and work.
- We are convinced that public private partnerships should help them to achieve these ambitious goals.
- Such partnerships are not only demanding: they are what motivate us to go the extra mile.

Maintaining, repairing and improving housing and public buildings…

Cleaning streets, refuse, recycling, maintaining parks and grounds…

Maintaining local roads, footpaths and national road networks…

Managing council facilities, back-office support, school transport…

Accord would like to thank the people of Islington, one of the communities we serve, for participating in our photoshoot. We gave a donation to Cancer Research UK, our charity of the year, in recognition of their help.

For further information on Accord please contact:

Accord plc, Accord House, Albany Place, Welwyn Garden City, Herts AL7 1HX
Tel: 01707 367000 Fax: 01707 334176 Email: info@accordplc.com Web: www.accordplc.com

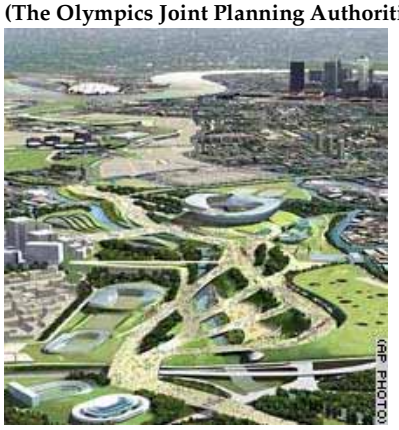
ERM is ranked as the World's No1 Environmental and Socio-economic consultancy by the Engineering News Record (ENR) survey published in July 2005. We have also been awarded the title of UK Environmental Advisor for 2005 and 2006.

About ERM

As the world's largest environmental consultancy, ERM has approximately 2500 staff and over 100 offices in 38 countries - including a local office in South Wales.

One of core areas of business is providing advice to government organisations and developers on large scale regeneration projects, both in the UK and globally.

London Olympic Bid
(The Olympics Joint Planning Authorities)



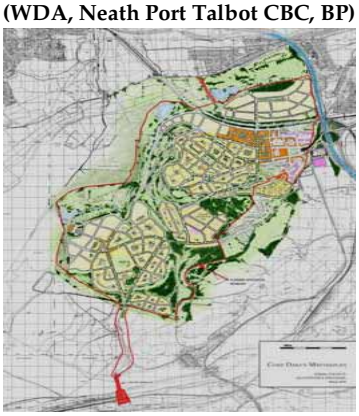
Services provided by ERM:

- *Planning strategy support*
- *Review of Planning Applications*
- *Quality assessment of supporting environmental information*
- *Financial advice on maximising regeneration and economic benefits*
- *Health Impact Assessment*

Sustainability in Urban Form

ERM's approach to sustainability addresses the social, economic and environmental elements of each project through a variety of measures ranging from the macro to the micro scale. Key to our understanding of what it means to create truly sustainable places is the ability to create a flexible framework that has the capacity to evolve and accommodate change over time.

Coed Darcy Urban Village
(WDA, Neath Port Talbot CBC, BP)



Services provided by ERM:

- *Sustainability Appraisal of Proposals*
- *Planning Team Core Member*
- *Proof of Evidence at UDP Inquiry*
- *Support on EIA for water resources, sustainability, remediation,*
- *Remediation Peer Review*
- *Preparation of public exhibition*
- *Communications group member*

Our approach applies to both individual buildings as much as larger urban extensions and strategic masterplans and we work with toolkits such as the BRE EcoHomes rating to evaluate proposals throughout the design process and following completion.

Cricklewood Redevelopment
(Multiplex, Hammerson,Bellhouse Joseph)

Services provided by ERM:

- *Sustainability Appraisal of Proposals*
- *Strategic Planning Advice*
- *Economic Advice*
- *Environmental Impact Assessment*
- *Support on Development Framework*
- *Public Exhibitions*

ERM has a major UK office in Swansea, West Wales.

The range of services offered from the Swansea Office include:

- Brownfield Regeneration and Environmental Planning
- Contamination Assessment and Remediation
- Environmental Impact Assessment
- Environmental Construction Management
- Strategic Environmental Assessment
- Regulatory Impact Assessment
- Environmental Management Systems
- Health Impact Assessment
- Health, Safety and Hazard Management
- Waste Management and Life Cycle Analyses
- Environmental Compliance and Permitting
- Renewable Energy

Sustainable Strategies for Wales

ERM assisted the National Assembly for Wales with its development of the National Sustainable Development Strategy. We have also completed a Sustainability Appraisal of the CCW Corporate Plan, and have produced Sustainable Development and Environmental Appraisal Guidance for the Objective 1 Programme in Wales.

In addition, our Sustainability team has evaluated the performance of the Welsh EGS sector for the former WDA.

Developing Best Practice on Strategic Urban Regeneration

ERM has recently developed a sustainability framework, for assessing the sustainability credentials of Strategic Urban Regeneration Projects in Wales. This was considered by the European PETUS project to be one the best tools available in Europe at present. We were recently invited to give a presentation on the Framework to European Delegates at their annual Conference in Cardiff University.

Ebbw Vale Regeneration

Blaenau Gwent CBC and WAG

ERM is the lead consultant for the regeneration of the former Steelworks in Ebbw Vale. Our roles

- Sustainability Advisor
- Environmental Impact Assessment
- Transport Assessment
- Health Impact Assessment
- Sustainability Assessment
- Race Equality Impact Assessment
- Listed Building Revitalisation
- Community Consultation
- Direction of Urban Masterplanning

Background
The former Steelworks site runs along the bottom of the Ebbw Valley to the south of Ebbw Vale town centre, which has a population of c. 18,000

At a higher level the site is bounded to the west by the A4046 Ton Centre approach, which links to the Head of the Valley Road to the north and the Cym Bypass to the south. To the east the site is bounded by the B4486 Steelworks Road.

Sustainable Design

The aspiration for the Ebbw Vale Project is to provide an exemplar of sustainable development. A comprehensive sustainability framework has been developed which is guiding the design process. An energy strategy is also being produced for the whole development area.

The sustainability framework is consistent with the Welsh Assembly Government's SD matrix for major plans and projects, and sets a number of core objectives for energy and resources. In the case of latter; people, materials, land, water and air are considered and one of the key targets is to have a green procurement code in place for the entire lifespan of the project.

The energy strategy for the site is still in development, although initial suggestions are that a carbon reduction target of -60% is proposed against a 2006 "business as usual" baseline, with an aspiration to work towards a carbon neutral position

Burry Port Docks

Several Confidential Developors

ERM is providing advice to several developers on projects in the vicinity of Burry Port Docks. Our roles include providing advice on contamination & remediation, sustainability and geotechnics.

We have also provided advice to a major industrial complex in the area, which is intended for divestiture and redevelopment.

Uskmouth Power Station

Newport Docks – Carron Energy

The Uskmouth Power Station Complex is situated alongside the Usk Estuary SSSI and the Severn Estuary SAC.

ERM currently has staff seconded to the site owner to provide environmental management support and to implement an Environmental Management System.

Other services that we have provided on this project include, pre-acquisition due diligence, IPC Improvement Notice Support, PPC Application Support, Site Investigations, Controlled Waters Risk Assessment, Waste Management advice and radioactive source removal.

EARTH SCIENCE PARTNERSHIP

Consulting Engineers, Geologists, & Environmental Scientists

RECENT PROJECT EXAMPLES:

Hydrogeological Impact Assessment: Yemen Desert

ESP recently won a contract to undertake a hydrogeological assessment of an area of desert in Yemen to assess potential impacts of proposed infrastructure associated with hydrocarbon prospecting. Matthew Eynon, an Associate of ESP, undertook the works over a fortnight which involved nearly two weeks of studies carried out in the desert under the protection of a Yemenese Army Escort.

Major Residential Development: Land Affected by Contamination

Working with a major UK developer, ESP designed a remedial solution that would allow redevelopment of this heavily contaminated site in South Wales. Historically, the site had been used as railway land and as a chemical plant, and was also raised using waste from a nearby Gasworks. Soil contamination posed a significant risk to end-users and site workers, and leachate and perched water contamination posed significant risks to the adjacent river and surrounding groundwater.

Coupled with extensive geotechnical considerations, the remedial solution involved localised soil stabilisation, an engineered capping layer and demonstration of natural attenuation.

ABOUT US:

Earth Science Partnership is a consultancy of engineers, geologists and applied environmental scientists. Trading for over 15 years, ESP has grown from the central office in Cardiff, and now has associated offices in Reading, Pembrokeshire and Westport Ireland.

We are experts in understanding ground processes and excel in providing effective solutions for a range of commercial and public clients.

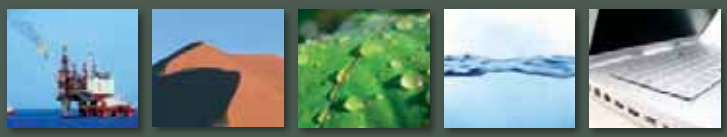
Through our fundamental understanding of technical principles and best-practice, we deliver excellence through consultancy, creating economic and time savings for a scheme. This is coupled with a good appreciation of stake holder, regulatory, and environmental context issues that can influence a scheme, and strive to deliver expertise that will best satisfy the project objectives.

ESP are always pleased to support CL:AIRE schemes as their innovative research and comprehensive presentation of findings are an invaluable resource to the remediation industry.

www.espwales.co.uk enquiries@espwales.co.uk

GWL
www.geoscience-wales.co.uk

a recognised centre of geoscience excellence



COMPANY PROFILE

Geoscience Wales Limited (GWL) supplies a diverse range of services and products in the petroleum, mineral and mining, information management, geotechnical and environmental sectors. The company was established in 1999, by people with natural resource exploration and development experience.

GWL's mission is to exploit its unique skills in these key areas by the provision of the highest quality services.

Operating from headquarters in the United Kingdom, GWL has professional, experienced and highly specialised people using advanced technologies to help its clients add value to their businesses. GWL's independence and broad skills set make the company an ideal partner.

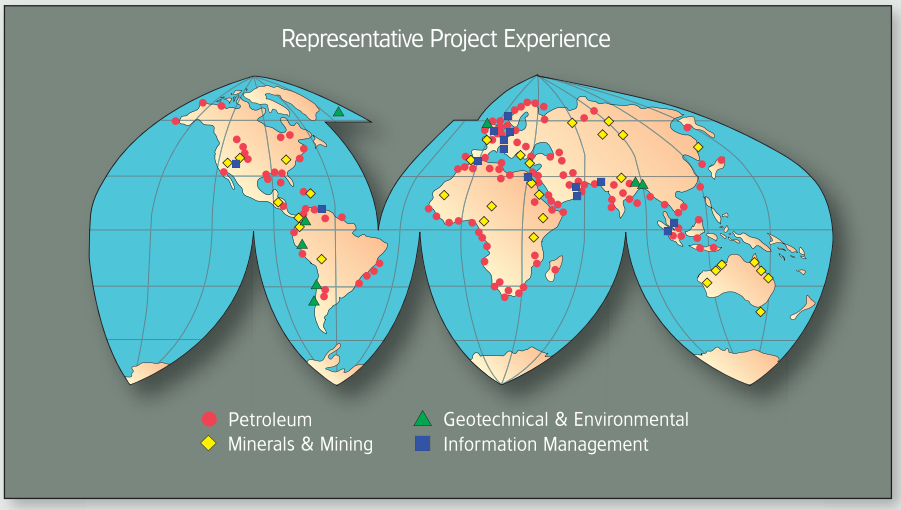
GWL has global experience with projects undertaken in over 50 countries. Our customers include major international oil and mining companies, national and local governments, energy contractors and financial institutions.

Geoscience Disciplines

- Geology
- Geophysics
- Geochemistry
- Geotechnical Engineering
- Data Management
- Traditional Cartography
- GIS
- Remote Sensing

Applications

- Petroleum exploration and production
- Minerals and mining exploration
- Information Management
- Environmental risk assessment
- Glacial hazard assessment and mitigation
- Earthquake disaster preparedness



Geoscience Wales Limited is a multi-disciplinary consultancy, supplying professional services to the petroleum, minerals and mining, information management, geotechnical and environmental sectors.

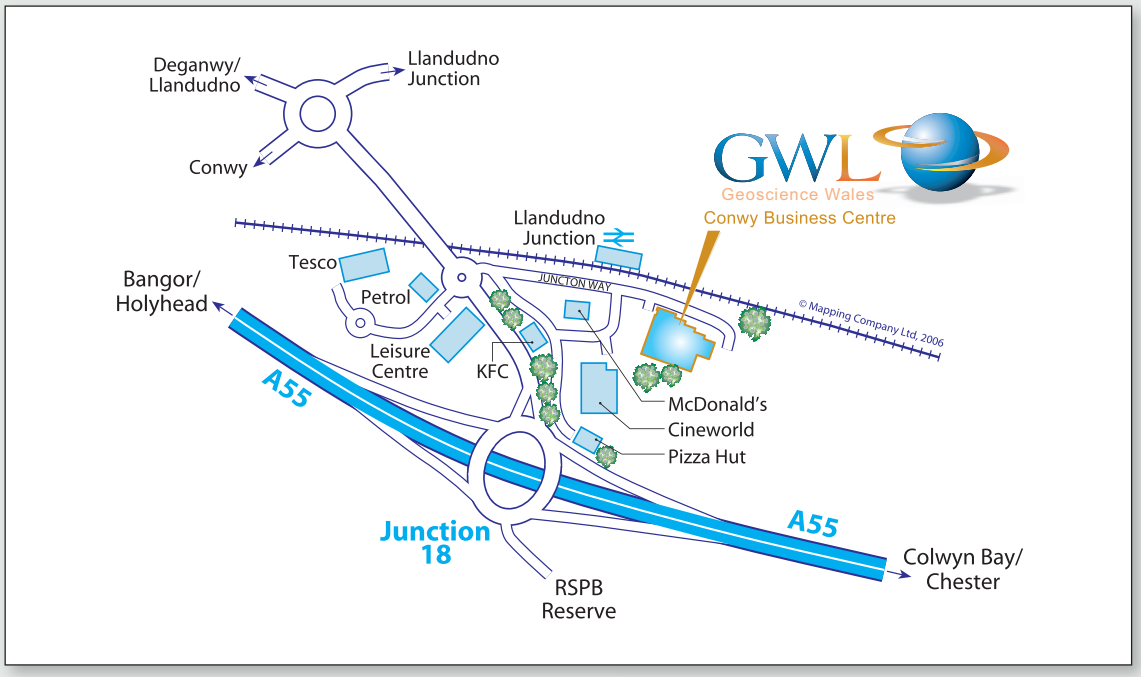
www.geoscience-wales.co.uk

Products and Services

- Petrog
- Stepper Stage
- Regional Studies
- Licence applications
- Regional and review studies
- Field mapping
- Laboratory analysis
- Process engineering
- Data clean-up and QC review
- Data processing and analysis
- Database analysis and design
- Web delivery solutions
- Project Management
- Training

Contact Details

GWL operates from the Conwy Business Centre, which is equipped with high quality conference and communication facilities. The Centre is conveniently located approximately one hour by road from Manchester International Airport on the A55 Euro-Route (at Exit 18) and adjacent to Llandudno Junction railway station on the main London – Holyhead – Dublin Inter-city rail line.



For high quality professional services contact:

Geoscience Wales Limited, No. 1 Conwy Business Centre, Junction Way, Llandudno Junction, Conwy, LL31 9XX, U.K.
Tel. +44 (0)1492 574563 . Fax +44 (0)1492 592425
Email. info@geoscience-wales.co.uk . Web. www.geoscience-wales.co.uk

THE HEALTH PROTECTION AGENCY

The Health Protection Agency (HPA) was established on the 1st. April, 2003, initially as a special health authority. It was established following the publication of the Chief Medical Officer's (England) document "*Getting Ahead of the Curve*", which provided a vision for a single agency to provide holistic and integrated advice on environmental hazards, whether chemical, biological, radiation or nuclear.

This visionary approach brought together health care, scientific and administrative professionals from the National Focus for Chemical, the Chemical Regional Service Provider Units, the Public Health Laboratory Service, the Centre for Communicable Disease Control, the Centre for Applied Microbiological Research and the National Radiation Protection Board. Established under the Health Protection Act (2004), the functions of the HPA are " *to protect the community against infectious disease and other dangers to health; to prevent the spread of infectious disease; assist…others who exercise these functions; undertake specific radiation protection duties*".

Within the aforementioned structure, the Chemical Hazards and Poisons Division (CHaPD) was established as part of the Centre for Radiation, Chemicals and Environmental Hazards. With a centre headquarters at Chilton, CHaPD has divisional units in Birmingham, Cardiff and London, whilst the Medical Toxicology Unit at Newcastle University undertakes research and development in the field of environmental and clinical toxicology. The division also commissions a service from the National Poisons Information Service (NPIS) based at Birmingham, Cardiff, Newcastle, Edinburgh and Belfast to provide expert and authoritative advice to health care professionals on issues pertaining to clinical poisonings.

CHaPD provides authoritative advice and support to government and the devolved administrations, other organisations and agencies as well as to the general public on the acute and chronic health effects of exposure to environmental chemicals. This remit includes advising upon the public health consequences of accidental and deliberate release associated with chemical incidents, air and water pollution, whilst the unit in Cardiff is the national HPA lead for contaminated land.

Other centres within the HPA include the Centre for Emergency Preparedness and Response, Local and Regional Services and the Centre for Infection. The Agency's headquarters resides at Holborn Gate, London.

For more information, please visit:
www.hpa.org.uk

CONTAMINATED LAND GROUP

PB's Contaminated Land group has a 20 year history in site assessment, land reclamation and remediation of old industrial sites, collieries, and former mineral workings. Within this period a broad range of experience has been built up covering all aspects of soil and groundwater investigation, decontamination and treatment for private developers and public authorities. In the UK PB has in excess of 40 contaminated land engineers operating out of offices in Bristol, Cardiff, Chester, Glasgow, London, Manchester and Newcastle.

PB has also gained experience in dealing with specialist remediation techniques in both the UK and overseas including state of the art multi-barrier containment cells and sustainable treatment of abandoned mine drainage systems.

The key to successful remediation is to understand the key risk issues and design the solutions accordingly. To achieve this cost-effectively requires a full understanding of technical issues, potential impacts and development needs. It also requires a full understanding of the legislative framework and principles of sustainable development.

http://www.pbworld.com/

Biographical Notes
(in order of appearance)

Jane Forshaw, CL:AIRE
Jane Forshaw is the Chief Executive for CL:AIRE. She joined the team in April 2005, having been the Chief Executive at Urban Mines, an environmental charity, for over four years. In terms of her academic background, she completed her Environmental Health Degree with First Class Honours from Salford University, and then held a number of different positions within Birmingham City Council over a period of ten years.
Jane first worked as an Environmental Health Officer and was then promoted to Head of the Sustainability Team where she became the personal advisor to the Chief Executive on sustainability issues. Jane was also on the Government's working group which published the National Sustainability Indicators Report.
As Chief Executive of CL:AIRE, Jane sits on the English Partnerships Coalfields Project Board, and Chaired DEFRA's Soil Guideline Value Task Force.
Jane holds various diplomas and is a member of the Chartered Institute of Environmental Health and the International Institute of Project Management. She is a Fellow of the RSA and a Fellow of LEAD (an international programme which creates Leaders for Environment and Development). She is also qualified as a Master Practitioner with skills in communication, learning and excellence.

Ian Watson, Welsh European Funding Office
Ian has been employed by WEFO and involved in the Objective 1 Programme since 2001. He heads a unit with teams in Carmarthen and Colwyn Bay responsible for working with local partnerships and appraising a range of ERDF projects. He will lead on the Building Sustainable Communities Priority for the Convergence Programme.

Ceri Jones, Environment Agency Wales
Ceri Jones has worked for the Environment Agency in Wales since 1996. Trained as an Environmental Scientist, former experience has included private and public sector work involved with waste management and land contamination.
Having worked as an Area officer in SE Wales for 9 years Ceri has been involved with a number of local issues involving landfill, redevelopment of brownfield sites and minewaters. Now acting in a Policy role for the Environment Agency Wales, Ceri is in the Land Quality Team and working with the National Land Quality Team on Part 2A, land contamination and minewater issues for Wales

Steve Smith, Welsh Assembly Government
Steve is the Head of Land Reclamation in the Department for Enterprise, Innovation and Networks at the Welsh Assembly Government. He is a Chartered Civil Engineer with over 20 years' experience of land reclamation in Wales, initially working with engineering consultants before joining the Welsh Assembly Government (WDA) in 1987. The WDA merged the Welsh Assembly Government in April 2006.
Steve is a civil engineer and his principal duties relate to the management of the Land Reclamation Programme for the South East regional office. This programme has a current annual expenditure of around £9m, but includes projects with a gross value of up to £20m. In addition, he provides technical advice for reclamation projects being implemented across Wales and for development activity on brownfield land. His experience includes managing the preparation of the Welsh Development Agency's (WDA) Manual on the Management of Land Contamination, and he has represented the WDA on a number of national and international initiatives on contaminated land and brownfield development.
He is the immediate past Chairman of the British Land Reclamation Society and also acts as the Society's international representative for a network of five reclamation societies around the world.

David Russell, Health Protection Agency
Dr David Russell is Head of Unit at the Chemical Hazards and Poisons Division (Cardiff) of the Health Protection Agency, currently based at the University of Wales Institute Cardiff (UWIC). The unit is the HPA's national lead for contaminated land. Dr Russell initially trained as a physiologist at Leeds University before reading Medicine. He trained as a chemical pathologist, before becoming the Medical Director of the National Focus for Chemical Incidents in 2000. He is a Fellow of the Royal College of Pathologists and Deputy Director of the WHO collaborating centre, also based in Cardiff.

Keith Nicholls, Geotechnics
Keith holds degrees in Geology and Engineering Geology from University College Cardiff and the University of Leeds. He has more than 20 years experience in site investigation, civil and geotechnical engineering, and brownfield redevelopment, gained both here in the UK, and overseas (3 years with the Geotechnical Engineering Office, Hong Kong; and 2 years with Hollandsche Beton en Waterbouw, Netherlands).
Keith is a Chartered Engineer, a Member of the Institution of Civil Engineers, a Member of the Institute of Quarrying, and a Fellow of the Institution of Mining, Metallurgy and Materials.
For the last 8 years Keith has been responsible for the technical output from Geotechnics Ltd's North West Regional Office (current turnover £2 million pa).

Gideon Jones, Parsons Brinckerhoff
Gideon Jones leads the Contaminated Land team based in PB's Cardiff office, where he has worked for nearly ten years. After completing his undergraduate studies at Kingston University, Gideon went on to complete his MSc in Environmental and Engineering Geology at Cardiff University and now provides technical support and project management for contaminated land investigation teams working across much of south and west Wales.

Simon Talbot, GMGU
Simon Talbot has been director of the Greater Manchester Geological Unit (GMGU) since 1998, specialising in engineering & environmental geology, contaminated land, reclamation, minerals & waste planning, and project management. He has BSc in Geology from the University of Manchester, and an MSc in Engineering Geology, from the University of Leeds. He is a Chartered engineer and Fellow of the Geological Society, with extensive experience gained in the UK and overseas in mineral exploration, geotechnical and geo-environmental site investigations, foundation design, land reclamation, contaminated land remediation, ground stabilisation, minerals and waste planning. He is also has active interests in undergraduate, post-graduate, CPD training, and contaminated land remediation research.

David Williamson, ERM
David Williamson is a Partner within ERM's UK based Corporate Risk Team. He has been with ERM for 1 year having formerly been the Head of Environmental Risk Services for Europe for Marsh, the insurance and risk adviser. A geologist by background, David has worked in the provision of environmental risk advisory services to public and private sector clients for the past 15 years. He specialises in transactions and developments where brownfield issues play a major part; concentrating on the potential remedial, contractual and financial solutions to actual and potential liability.

Julie Williamson, University of Wales, Bangor
Julie Williamson is a senior researcher at the University of Wales, Bangor and currently manages a large EU LIFE-Environment funded project. Her experience in land restoration of brownfield sites spans some twenty years and she has worked in both the UK and New Zealand. Julie studied for her BSc and PhD at Bangor and her specialism is soil microbiology.

Welcome

Jane Forshaw

CL:AIRE

13th March 2007

Contaminated Land: Applications In Real Environments

CL:AIRE

Objectives

- **Build on 2005 event**
- **Funding opportunities**
- **Science and Technology**
- **Health impacts and risk assessments**
- **Networking**

Contaminated Land: Applications In Real Environments

CL:AIRE

The Integrated Pollution Management Network (IPM-Net)

- Part of the DTI's Technology Programme
- IPM-Net provides an overarching network for the integrated management and remediation of environmental pollutants in **land**, **water and waste**.

Contaminated Land: Applications In Real Environments

CL:AIRE

IPM-Net

- Assists Industry by:
  - Accelerating knowledge and technology transfer
  - Developing skilled personnel
  - Impacting government strategy
- **www.ipm-ktn.com**

Contaminated Land: Applications In Real Environments

CL:AIRE

CL:AIRE's purpose is to produce independent verification of effective solutions for contaminated land and to raise awareness of their benefits to the UK and beyond

Contaminated Land: Applications In Real Environments

CL:AIRE

CL:AIRE disseminates scientifically credible and practical information on remediation to interested parties

Contaminated Land: Applications In Real Environments

CL:AIRE

CL:AIRE Highlights

- **36 ground breaking projects with over 70 partners**
- **40 separate publications**
- **4,700 database members**
- **Brokered over £14m match funding**

Contaminated Land: Applications In Real Environments

CL:AIRE

Building confidence …
… *learning from mistakes*

When will we learn to honour error?

"Evolution can be thought of as systematic error management"
Kevin Kelly – Out of Control

The big goofs are the only way to *leap* forward

Contaminated Land: Applications In Real Environments

CL:AIRE

Building confidence …
… *nurturing partnerships*

"70% of lost customers hit the road not because of price or quality issues but because they didn't like the human side of doing business with the previous provider"
Forum Corporation

Contaminated Land: Applications In Real Environments

CL:AIRE

Building confidence …
… *removing barriers*

What exactly have you done today to remove obstacles from the success path of would be heroes working at the front line of remediation?

Contaminated Land: Applications In Real Environments

CL:AIRE

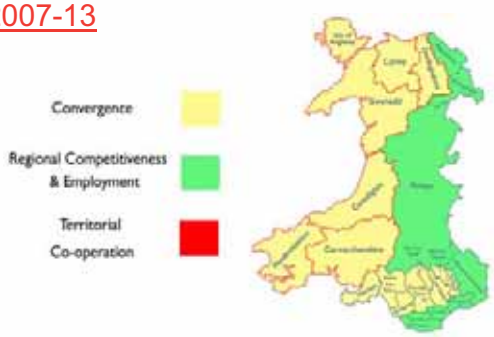
Swyddfa Cyllid Ewropeaidd Cymru
Welsh European Funding Office

European Structural Fund Programmes in Wales

2007-2013

Ian Watson
Head of Spatial Support and Regeneration Branch, WEFO

Wales European Structural Fund Programm 2007-13



www.wefo.cymru.gov.uk www.wefo.wales.gov.uk

"Health warning" on the information in this presentation!

- WEFO is not yet "open for business" - everything is subject to negotiation with the Commission
- This is a good time to be talking to prospective partners and interested parties, but don't expect definitive guidance from WEFO yet
- Keep watching the WEFO website for further information and Guidance

www.wefo.cymru.gov.uk www.wefo.wales.gov.uk

Post 2006: Operational Programmes

- Two Convergence Programmes for West Wales & the Valleys (ERDF and ESF)
- Two Regional Competitiveness Programmes for East Wales (ERDF and ESF)
- Cross - border Territorial Co-operation Programme with Ireland (ERDF)
- Also participate in North West Europe and Atlantic Area Transnational Programmes

Post 2006 Timetable

	WW & V Convergence	EW Reg. Comp.
Launch of public consultation	28 July 2006	1 Dec 2006
Submission to Commission	End Dec 2006	Early March 2007
Programmes Agreed	Spring 2007	May 2007

Post 2006: Structural Funds Policy – What's different?

- Strong focus on Lisbon and Gothenburg strategies – "sustainable growth and jobs";
- Stronger strategic context – alignment of Structural Funds with national/regional policies;
- Greater concentration of resources;
- Simplification - mono-fund programmes;priority level programming;10% ERDF/ESF flexibility
- Greater emphasis on indicators, targets and results;

Lisbon Strategy

- Aim: to make the *EU "the most competitive and dynamic, knowledge based economy by 2010" (European Council 2000)*
- Strategy renewed in 2005 - stronger emphasis on Growth and Jobs. *"All appropriate national and Community resources – including cohesion policy to be mobilised "(European Council 2005)*
- Integrated Guidelines for Growth and Jobs (2005 – 2008) - ambitious EU wide targets retained. Member State National Reform Programmes (NRPs) introduced.
- Sustainable Development – Lisbon closely aligned with Gothenburg strategy, emphasising need for economic, social and environmental policies to be mutually reinforcing.

Convergence Programme: Vision

Our vision for West Wales and the Valleys:

" A vibrant, entrepreneurial region at the cutting edge of sustainable economic development – with our people benefiting from increased prosperity, a better quality of life and an improving environment."

Convergence Programmes: Strategy

- Strong links to Welsh Assembly Government policies and strategies *(incl. Spatial Plan, W:AVE, SEAP 2005, Environment Strategy, Making the Connections etc)*
- Clear commitment to Lisbon Strategy *(65% of resources earmarked for key Lisbon related investments)*
- Stronger focus on employment and skills *(ESF share increases to 40%)*
- Spatial Plan Framework to inform targeting of resources
- More strategic approach to implementation, including introduction of Strategic Frameworks;
- Simplification of structures and processes *(e.g. single PMC; PPIMS – internet based application system)*

Convergence: Financial Allocations

- Increased focus on employment &skills – ESF share to rise to 40%
- 65% of resources linked to Lisbon earmarking criteria
- More investment in areas such as R&, innovation, entrepreneurship, skills, ICT, sustainable transport and environmental technologies
- Less investment in general urban, rural and community led regeneration and non-employment focused social inclusion measures

Priorities: ERDF Convergence Priorities (1)

1. **Building the knowledge based economy**
   - R&, innovation and technology
   - Information society for all &CT infrastructure
2. **Improving business competitiveness**
   - Entrepreneurship and business growth
   - Business finance
3. **Developing strategic infrastructure**
   - Sustainable transport
   - Strategic infrastructure (business &education)

Priorities: ERDF Convergence Priorities (2)

4. **Creating an attractive business environment**
   - Renewable energy
   - Environmental risk management
   - Environment for growth
5. **Building sustainable communities**
   - Physical regeneration
   - Community economic development

Priorities: ESF Convergence Priorities (1)

1. **Supplying young people with the skills needed for employment**
   - Tackling underachievement in schools
   - Integrating young people into the labour market
2. **Increasing employment and tackling economic inactivity**
   - Helping people into sustainable employment
   - Helping people to remain & progress in employment

Priorities: ESF Convergence Priorities (2)

3. **Improving skill levels and improving the adaptability of the workforce**
   - Raising the skills base and supporting progression
   - Improving systems for workforce development
   - Promoting gender equality in employment
4. **Making the connections - modernising our public services**
   - Building the capacity of public services to support economic development
   - Supporting collaborative working between public services

Competitiveness: Priorities

Priority 3 Theme 2 (ERDF)
Strategic Infrastructure

"supporting the implementation of site infrastructure … including, where necessary, site decontamination and reclamation for the development of high quality business accommodation."

Competitiveness: Priorities

Priority 5 Theme 1
Physical Regeneration

"landscape improvements for community benefit which may include site remediation"

Competitiveness Programmes: Vision

Our vision for East Wales:

" A thriving, vibrant, and entrepreneurial region at the cutting edge of sustainable economic development – with a highly skilled and innovative workforce, its citizens benefiting from increased prosperity, a better quality of life and an improving environment."

Competitiveness: Financial Allocations

- 80% of resources linked to Lisbon earmarking criteria
- Greater proportion of investment in areas such as R&D, innovation, entrepreneurship, skills, and environmental technologies
- Less investment in general urban, rural and community led regeneration and non-employment focused social inclusion measures

Competitiveness: Priorities

- ERDF – Knowledge and innovation for Growth
- ERDF – Business Competitiveness for Growth
- ERDF – Environment for Growth
- ERDF – Regeneration for Growth

- ESF – Increasing employment and tackling economic inactivity
- ESF – Improving skill levels and improving the adaptability of the workforce

Competitiveness: Priorities

Priority 4 (ERDF)
Regeneration for Growth

- Physical Regeneration

"environmental improvements of derelict buildings for economic use, with the possibility for associated limited site decontamination and reclamation"

Post 2006: Horizontal or Cross-cutting themes

- **Equal Opportunities for All**
- **Environmental Sustainability**

FRAMEWORKS & PROJECTS

An overview of implementation arrangements

STRATEGIC FRAMEWORKS – A DEFINITION

"A fully developed plan to achieve a particular strategic purpose by means of a number of project interventions that are strategically linked"

STRATEGIC FRAMEWORKS – PURPOSE

- To improve impact on growth and jobs
- To strengthen strategic alignment with WAG policies
- To encourage more Joined up' action
- To reduce the overall volume of projects
- To simplify access to funding
- To help shape and balance programme delivery

Strategic Frameworks

- Frameworks will be planning instruments only - WEFO will be responsible for project approval, payments & monitoring
- Each Framework will have a Co-ordinating Organisation' and will be developed / implemented in partnership
- Inclusion of a project in a Strategic Framework will not necessarily lead to its approval by WEFO
- Sustainable Regeneration Framework for each Spatial Plan area covering Strategic Infrastructure, Physical Regeneration and Environment for Growth
- 15 other thematic frameworks coordinated by DEIN/DELLS/SE

www.wefo.cymru.gov.uk www.wefo.wales.gov.uk

Strategic Frameworks will….

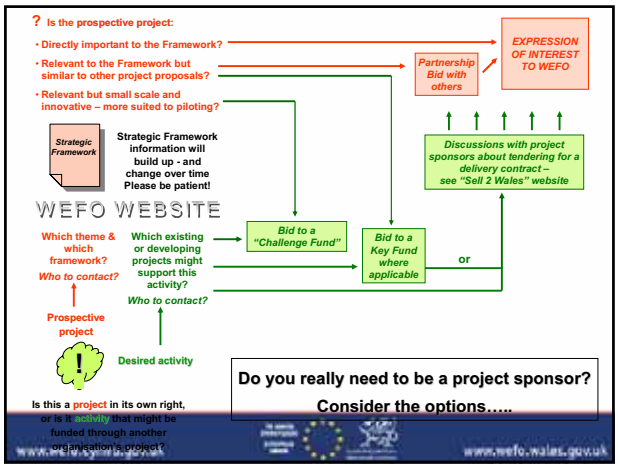
- describe the areas of intervent ion under their OP Theme that will deliver on the Priority aim and objectives;
- describe the partnership arrangements contributing to the Framework development;
- put a strong case for the choice of interventions and for the strategy that links them in support of the Theme – Thematic Frameworks taking account of Wales Spatial Plan Group input;
- describe in broad terms the " optimum" shape and content of a project portfolio to deliver the interventions – so far as is possible from discussions of emerging project ideas at a point in time – different approaches, different instruments;
- describe how the chosen interv ention strategy can be evaluated

www.wefo.cymru.gov.uk www.wefo.wales.gov.uk

Framework content

- OP – WAG Policy background
- The Operational Strategy:
  - *Strategic Aim*
  - *Strategic Objectives*
  - *The Plan – how interventions will link together*
  - *Indicators & evaluation approaches*
  - *The Interventions - in detail*
- Partnerships involved in the Framework
- The spatial context
- The financial context
- Key principles &egulations affecting Framework activities
- Framework communication and dissemination

www.wefo.cymru.gov.uk www.wefo.wales.gov.uk



Project Development

WEFO Project Development Officers (PDOs) will operate a "cradle to grave" model of support:

- helping sponsors in the refinement of project delivery plans;
- brokering links with potential partners and interested parties;
- identifying issues, risks and special conditions of grant early in the project development and helping to address them;
- co-ordinating a post-approval project review team (including Payments & Audit);
- monitoring progress, advising on risk management and making any necessary changes if project delivery conditions change;

Spatial European Teams (SETs)

brokering collaboration and helping Framework Co-ordinators to secure the involvement of existing partnerships at a local, sub-regional & national level

Spatial European Teams (SETs)

- Engaging partnerships at the national, sub-regional and local levels in Strategic Framework development and periodic review
- Encouraging and facilitating collaborative projects
- Assisting in the development of projects and providing aftercare services
- Ensuring that partnerships are fully informed about developments under the frameworks
- Providing a communications interface to promote Framework interventions
- Maintaining links and co-ordination with other programmes – Transnational, RDP etc

The WEFO Website – a shared resource

- Regular news updates
- Contact details - WEFO and Framework teams
- Partnerships involved in Framework development
- Draft Frameworks under development - for comment
- Completed Frameworks - agreed with WEFO
- A "register" of stakeholders with specified interests / expertise in particular Framework areas
- Key Fund &Challenge Fund projects under development/approved
- Lists of:
  - *emerging project ideas,*
  - *projects submitted as EOIs)*
  - *approved projects*

Conclusion

- Need to build on the success of the current programmes – not just more of the same;
- Recognise that policy context has changed – much stronger focus on growth and jobs;
- Need to align programmes with WAG policies
- Need to face up to challenge of concentrating resources on key priorities – Structural Funds can't do everything!
- Need to improve the impact of our interventions, including by being more joined up and making our systems and processes more efficient.

European Structural Fund Programmes 2007-2013

Ian Watson
Welsh European Funding Office
Rhydycar
Merthyr Tydfil
CF48 1UZ

Email: Ian.Watson@wales.gsi.gov.uk

Aim

As a constituent part of the Welsh Assembly Government within the Department of Enterprise, Innovation and Networks, the aim of the Welsh European Funding Office (WEFO) is to make European Structural Funds work efficiently and effectively in Wales.

Policy context

WEFO works to support the delivery of the Assembly Government's key strategic policies as stated in Wales a Better Country a key commitment of which is to boost economic development and employment opportunities throughout Wales by:

- promoting sustainable economic growth
- increasing prosperity in all parts of Wales
- tackling inequality, inactivity and the resulting social exclusion

The policy framework within which WEFO operates is set by the Welsh Assembly Government. Further details of the main policies and strategies including Wales: A Vibrant Economy & Wales Spatial Plan can be found on the Assembly's website at **www.wales.gov.uk**.

Structure

WEFO is split into three Divisions and located in 4 offices across Wales at Merthyr Tydfil, Machynlleth, Carmarthen and Colwyn Bay.

Programme Management Division

Responsible for the effective management of the seven current Structural Fund Programmes; Objective 1, 2 & 3, Leader+, Urban 2, Equal and Interreg 3a.

Planning and Strategy Division

Responsible for Planning and Strategy, Research, Monitoring and Evaluation & Corporate Business and Communication

Finance and Corporate Services

Responsible for Payments, Finance, Article 4 verification visits and IT. (Article 10 Financial Control Team reports directly to the Chief Executive).

All three Divisions are involved in the preparations for the next round of Structural Fund Programmes.

Current Programmes

Wales has been allocated a total of over £1.5 billion by the European Union for the period 2000-2006. With match funding from a variety of public, private and voluntary sources the Structural Funds are worth around £3.2 billion in Wales. Challenging spend targets have

been met every year and WEFO continues to manage the funds in such a way that will ensure optimum draw down of the money available for each Programme. Approved projects will continue to run and claim funding until mid 2008. At the end of January 2007 nearly 3000 projects had been granted funding forecasting over 77,000 new jobs with a further 94,000 safeguarded. A small number of land remediation projects have been supported including: the Ebbw Vale Tin Plate Works Reclamation (total cost £8.2m E RDF grant £3.3m), New D'Arcy Business Centre Remediation Works (total cost £830k ERDF grant £300k) and Old Castle Works Remediation (total cost £1.4m ERDF grant £565k).

Next round of Structural Fund Programmes

The detailed preparation of the 2007-13 Structural Funds Programmes and their implementation arrangements involves a major programme of work. This will build on the lessons learned from past experience and identify the best practice and innovative ideas that can be incorporated into any new programmes, in order to make them more effective and efficient.

External Stakeholder Group (ESG)

To this end the ESG was established in September 2005 and has been meeting on a regular basis since then. The purpose of the Group is to represent the main external interests and to provide input into the development of the new Programmes. The Group also considers and provides feedback on the key deliverables produced by the expert workstreams (see below) and act as a sounding board to test and consider emerging ideas. Membership of the Group includes representatives from Local Government, Voluntary Sector, Further, Higher and Adult Education the Private and Youth Sectors and the Welsh Language Board.

Workstreams

In addition to the External Stakeholders Group, WEFO has also been working closely with partners through five expert Workstreams. Each workstream is responsible for considering a specific set of key issues on a range of key deliverables. The 5 workstreams listed below have been meeting since December 2005 and members were selected on the basis of the knowledge and experience they could bring to the work.

Operational Programmes
Programme Management
Evaluation & Monitoring
Governance and Compliance
Territorial Co-operation

Further information on both the current and next round of Structural Fund Programmes can be accessed via the WEFO website **www.wefo.wales.gov.uk**.

1996 2006 Environment Agency

LAND CONTAMINATION IN ENGLAND AND WALES 2007

Where are we and what does the future hold?

Ceri Jones
Land Contamination Policy Adviser
Environment Agency Wales

1996 2006 Environment Agency

Leave today

- Role and Impact of Part 2A including how Part 2A influences other approaches
- Related Regimes to deliver Land Quality

1996 2006 Environment Agency

Role of Part 2A

- Retrospective Regime to deal with historic contamination
- Polluter Pays principle
- Protection of human health and the environment
- Encourages land contamination to be dealt with ahead of regulatory intervention
- Where action has not been taken or was inadequate to address the risks then action can be taken

Impact of Part 2A

- Introduced in 2000 England, 2001 Wales
- Number of sites identified to date
- England: 533 sites
- Wales: 121 sites
- 2007 - Extended to include radioactively contaminated land

Extent of problem

- No absolute numbers
- Each Local Authority has developed a strategy to identify and assess potential contaminated land
- No central database of suspected sites or areas of land

Lessons learned from Part 2A

- Prevention is better than cure
- Opportunities to address contamination are most effective ahead of regulatory intervention
- Act proactively - together...
- Investment in understanding is critical
- Wide range of multidisciplinary skills need to be developed and used
- Recognise that communication is essential
- Recognise that liabilities can remain after you have left a site

How Part 2A influences other approaches to clean up contaminated land

- Understanding objectives for protection and clean up
- Incentive to ensure adequate pollution prevention is adopted to prevent new contamination and new liabilities
- Increased recognition of potential liabilities:
  - causers and knowing permitters
- Encourages contamination to be dealt with through opportunities such as proactive voluntary action or through redevelopment

Influences Continued

- Risks considered for current and planned use.
- Development of wide range of skills for Part 2A that are complimentary for those needed to consider risks at development sites.
- Costs can be addressed as part of project plans

Key Related Regimes for Land Quality

- Environmental permits such as PPC, WML
- Planning
- WAG - Environment Strategy for Wales
- Metal Mine Strategy for Wales
- Coal Authority Priority List

Key Related Regimes for Land Quality

- Environmental Liability Directive
- Soil Framework Directive
- Water Framework Directive
- Mine Waste Directive

Avoid This

- 1

Promote this….

1996 2006 Environment Agency

Achieve this...

1996 2006 Environment Agency

Ceri Jones

- Information and guidance on land contamination can be found at:

www.environment-agency.gov.uk/landcontamination

Welsh Assembly Government Perspectives on Contaminated Land

Steve L Smith
Head of Land Reclamation
Department for Enterprise Innovation and Networks
South East Wales

Policy and Operational Areas

- Environment Planning and Countryside
  - Waste Policy
  - Planning
  - Environment Strategy
- Public Health Protection
- Sustainable Futures
- Enterprise Innovation and Networks
  - Infrastructure
  - Wales European Funding Office
  - Science Policy

Contaminated Land Regime

- 1990 Act proposals
- Part 2a in Wales July 2001
- Local Authorities and Environment Agency
- Inspection Strategies
- Designation if pollutant linkage proven

EPC Waste Policy

- Contaminated Land Capital Projects Programme
  - £5m over 3 years
  - Competitive bidding process
  - Approvals to date mainly for site investigation
- Environmental Liability Directive

Planning

- Expectation that legacy would be dealt with through planning
- Without risk to human health and the environment
- Detailed investigation and risk assessment prior to determination
- Link to Health through draft MIPPS

Planning Policy Wales

- Aims to ensure that development is suitable
- Understand risks
- Effectiveness of remedial measures
- Important to be transparent in addressing local concerns/anxieties
- Discussion on providing further detailed guidance

Environment Strategy

- Consultation captured wide range of themes, including contaminated land/soils
- Strategy published May 2006 does not have major focus on contaminated land
- Actions to bring despoiled land back into beneficial use

Health Protection

- Incidents at former industrial sites can have direct impact on public
- Redevelopment has potential for long term concerns
- Perception can be worse than reality

Castle Gate- a personal experience

Health Risk Assessment

- Health professionals skills increasing
- Engagement as part of the site appraisal team
- Trusted professionals able to communicate actual risks
- Local Public Health Board has responsibility for health of population

Regeneration

- Physical transformation of former industrial land led by WDA from 1976 to 2006
- Community led regeneration initiatives - e.g. Communities First and Groundwork
- Transfer of functions to Welsh Assembly Government from April 2006
- Land reclamation and property development remain as key functions

Wales Spatial Plan

- Economic context guided by Wales: A Vibrant Economy
- Spatial focus within 6 areas of Wales
- Recognises the different characteristics
- Sub regional initiatives
- For example Heads of the Valleys Partnership in south east Wales

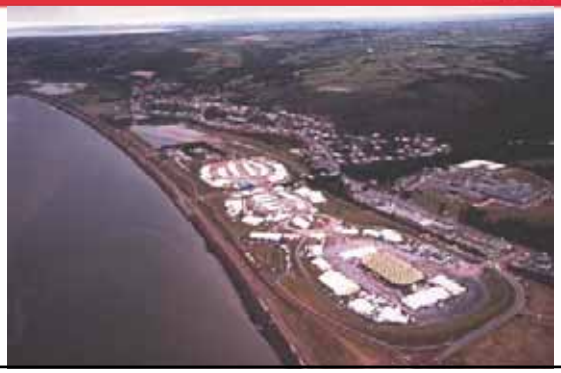
Major Projects

- Docks -SA1 and Barry Waterfront
- Collieries - Oakdale and Coed Ely
- Coal Processing - Phurnacite
- Petrochemical - Llandarcy
- Millennium Coastal Park, Llanelli
- Cardiff Bay International Sports Village
- Steelworks – Brymbo and Ebbw Vale

Millennium Coastal Park, Llanelli

Millennium Coastal Park, Llanelli

Millennium Coastal Park, Llanelli



Cokeworks tars

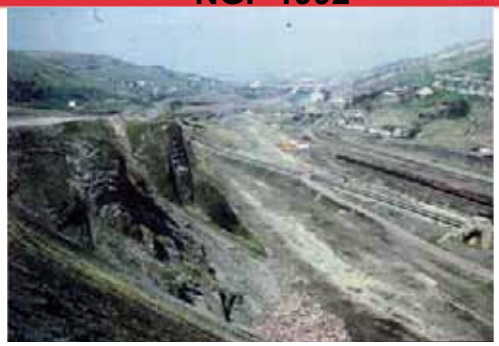
Aberaman Phurnacite Works

Aberaman Phurnacite Works

Aberaman Phurnacite Works

Aberaman Phurnacite Works

Ebbw Vale Steelworks NGF 1992

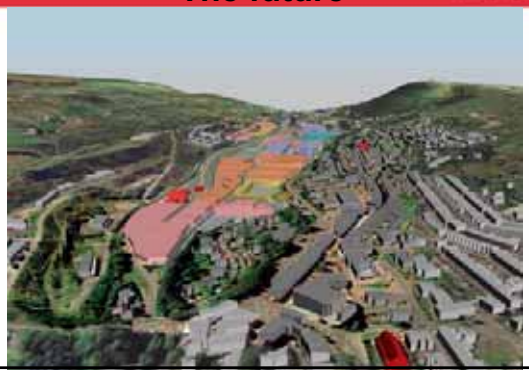


Ebbw Vale Steelworks NGF 1992

Ebbw Vale Steelworks post 2003

Ebbw Vale Steelworks post 2003

Ebbw Vale Steelworks
The future



Local impacts from contamination

- Lead Mines
- Gas works
- Foundries
- Acid Tar wastes
- Petrochemical

Y Fan Lead Mine

Y Fan Lead Mine

Manual on the Management of Land Contamination

- Developed in early 1990's
- Objective to give confidence to investors and site users
- Provides procedural guidance for recipients of grant
- Reviewed in 2003 and republished
- Emphasis on project planning
- Rebranding for DEIN underway

Creating Sustainable Places

- National Assembly of Wales duty on sustainable development
- WDA developed practical tools to ensure integration
- Working Differently, Design Guide and Creating Sustainable Places
- Delivering sustainable outcomes and design quality aspirations

Science Policy

- Led by DEIN Business Policy to focus on strengths in science and technology
- Consultation identified 3 areas
  - Health
  - Low carbon
  - Sustained social and economic renewal
- Direction of travel to encourage better links between business and science base

Summary

- Welsh Assembly Government focus on outcomes from investment
- Investment requires a sound evidence base and a clear understanding of objectives
- Support for contaminated land has a number of strands
- CL:AIRE role in demonstrating technologies is unique in UK

Thank you

email: steve.smith@wales.gsi.gov.uk

Risk Communication

Dr David Russell
Chemical Hazards and Poisons Division(Cardiff)

Risks to humans posed by contaminants on land:

- **Increased levels of illness have not been observed in people living on contaminated land**
- **However ill effects, which may be undetectable using current epidemiological and analytical methods, may occur**
- **Impact from contaminated soil can be difficult to separate from other types of pollution**
- **Possible health effects of the contaminants are difficult to establish because there are many confounding factors**

Most common contaminants

- Inorganic substances

- Cadmium
- Chromium
- Lead
- Mercury
- Nickel

(metals)

- Arsenic (semi metal)
- Cyanides
- Nitrates
- Asbestos

(other)

- Organic substances

- Dioxins
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Benzene

- Chemical mixtures

3

Evidence Based Public Health

4.1.6 Public Health Implications

Cadmium is a significant contaminant of soils and can be often found at toxic concentrations.

A cohort study of the impact of high cadmium concentrations in soil on human health was conducted in Shipham (Somerset) by Elliott *et al.* in 2000; they concluded that there was no clear evidence of health effects from possible exposure to cadmium despite the extremely high concentrations of cadmium in the soil. This was probably because most residents of Shipham would have been only marginally exposed to cadmium, because of its low bioavailability.

Food and cigarette smoke are the greatest sources of cadmium exposure for people in the general population. People are much more likely to be exposed to cadmium from cigarettes than from the soil in their gardens.

4

Precautions

Contaminated gardens

E.g. Vegetables should washed or grown in raised beds with clean soil

Special precautions with children

Children are especially vulnerable to contaminants, because of increased exposure when playing in the garden

Public Awareness

Risk communication

- Uncertainty **is an important factor that complicates risk communication in contaminated land issues**
- **Is an interactive process of exchange of information**
- **People's fears should be taken seriously**

7

- **Contaminated land management requires more than technical expertise. Social issues such as** house prices, house ownership **or** stigma of the neighbourhood **are also important**
- Risk Comparisons. **Often, an involuntary risk is compared with a voluntary one (e.g. the risk from nearby incinerator is compared with smoking or dietary habits). If such a comparison is done in the spirit of minimising the importance of the involuntary risk, it will generate anger**

Risks are generally more worrying if perceived:

- –To be involuntary
- –As inequitably distributed, some benefit while others suffer
- –As inescapable by taking personal precautions
- –To arise from an unfamiliar or novel source
- –To result from man-made, rather than natural sources
- –To cause hidden and irreversible damage with onset many years later
- –To pose particular danger to small children or pregnant women or more generally future generations
- –To threaten a form of death (or illness/injury) arousing particular dread
- –To damage identifiable rather than anonymous victims
- –To be poorly understood by science
- –As subject to contradictory statements from responsible sources (or even worse, from the same source), or from untrustworthy source.
- –Invisible or undetectable, catastrophic, memorable, uncertain, uncontrollable or unethical risk.

All apply to contaminated Land !

–Involuntary
–Inequitably distributed
–Inescapable
–Arise from an unfamiliar or novel source
–Result from man-made, rather than natural sources
–Cause hidden and irreversible damage with onset many years later
–Pose particular danger to small children or pregnant women
–Threaten a form of death arousing particular dread: CANCER
–Damage identifiable rather than anonymous
–Poorly understood by science
–Is subject to contradictory statements from responsible sources
–Invisible or undetectable, catastrophic, memorable, uncertain

Some problems….

LHBs, HPA, NPHS: Very late engagement with unrealistic expectation to respond

Lack of consultation can result in

➢inaccurate health messages
➢raised expectation
➢unnecessary community concern

Some solutions ….

Openness and transparency

✓Trust should be based on mutual respect
✓Communication should be open and honest
✓The language used should be understandable for the general public

Engage early with LHBs, LAs, HPA!


Acknowledgments: Dr Josep Vidal-Alaball
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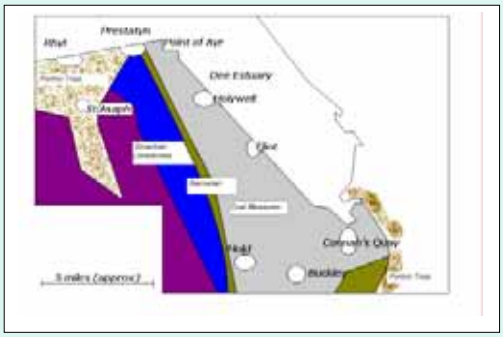
13

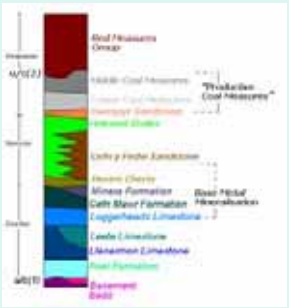
The legacy of coal and non-ferrous metal mining in Flintshire: a perspective for brownfield development in the 21st Century

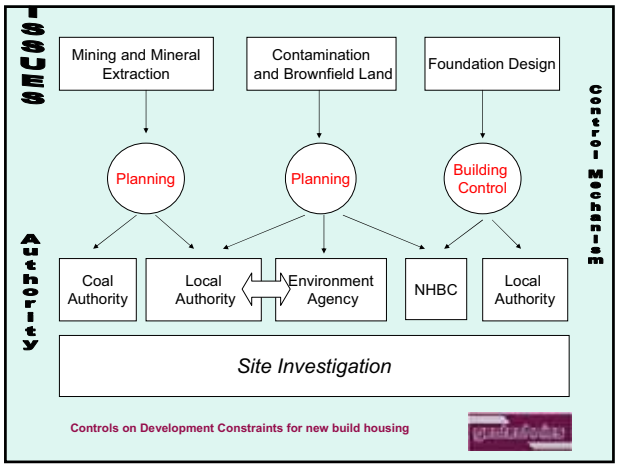
Keith Nicholls -
Geotechnics Ltd

Simplified Geological Map of the Area



Basic Geological Profile





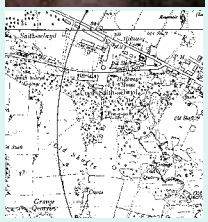
Legislative Tools

- Mines and Quarries (Tips) Act
- Mines and Quarries (Tips) Regulations
- Planning Legislation (and Associated PPGs and MPGs)
- Building Regulations
- ENVIRONMENT ACT and associated legislation (CLR regime)

Evidence everywhere……..

……you look (coal mining)

…you look (lead / zinc)



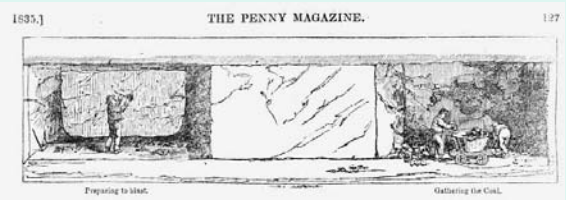
Photographs courtesy of Clwyd – Powys Archaeological Trust

CPAT

geotechnics

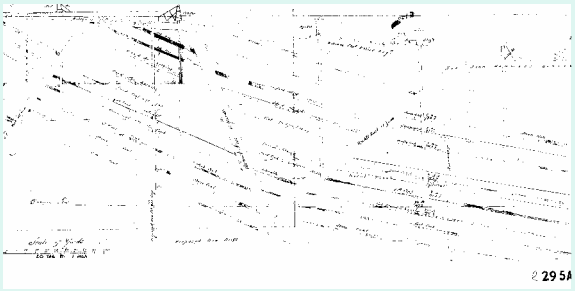
Mining – the Shaft

Coal Mining – Room and Pillar Workings

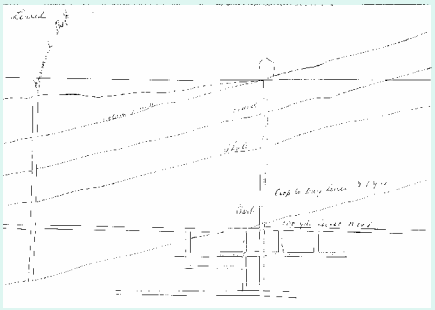


"Overhand stoping"

Mine Plans – Coal Authority



Section of workings near Holywell, Flintshire



If this happens in your garden …..Who you gonna call????

If it's a coal mine – the Coal Authority Historic Liabilities Section

Capped coal shaft – Bagillt, Coal Authority approval required

Problems arise when the shaft is here…..!

If it's a lead / zinc mine who's responsible…….?

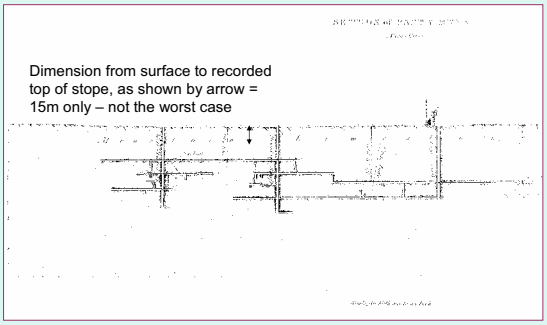
How often? What sort of scale?

Powys – February 2007!

April 30th 1945 – Mr Ludovic Berry was shunting 13 wagons with "Dolly" at Mains Colliery, Wigan.

Mr Berry, Dolly and the wagons remain at the bottom of shaft No 7 – Brookside Colliery – to this day

Mine Plans – County Archive – formerly HSE (Bootle)



Stope entrances……transition from open excavation to underground workings

In this case the ore body forms a stable wedge

How close to surface…..?....

In this case however the ore body widens upwards….

Old Pb / Zn mine buildings and shaft – near Holywell

Buckley Common Reclamation scheme - 1973

Buckley Common, 2007

Berth – ddu (Pre-reclamation in 1973)

Berth-ddu,Halkyn Mountain - 2007

In our rush to “clean up….and green up” let’s not forget where the real killers in our environment are hiding!

Painful lessons learned once shouldn’t be forgotten!

The risks associated with tips, shafts and shallow workings are real and present – and are increasingly being sidelined in the investigation process – as a new generation of legislators, engineers and administrators take their places in society…..without first hand experience of the mining industry.

Paper Presented to the Regenerating Contaminated Land in Wales through Partnership Conference, 2007

The legacy of coal and non-ferrous metal mining in Flintshire: a perspective for brownfield development in the 21st Century.

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Explanatory Notes:

1. Throughout this paper the term “colliery” is reserved for a mine site associated with coal workings, whereas a “mine” is restricted to workings for metalliferous ores.
2. For the purposes of keeping this paper to a manageable size potential affects relating to acid mine drainage and mine gas emissions have been excluded.

Introduction:
This paper gives a very basic introduction to the geology and mining history of an area of Wales much less well known than the South Wales Coalfield, and offers some comment with respect to the appropriate use of Risk Assessment procedures in mining areas.

Local Geology:
The Local Geology comprises predominantly Carboniferous strata, with base metal mineralization associated with limestones, cherts, shales and sandstones in the older (lower) part of the sequence as illustrated in Figure 1.

The general dip in the area is towards the east, with the older (deeper) base metal sequence outcropping to the west of the main urban areas. The majority of the larger urban centres (Flint, Mold, Buckley) lie on Coal Measures, with much of the base metal sequence associated with areas of upland scenery on the eastern flank of the Clwydian range (Figure 2).

Mining History: Base Metals
The North East Wales Orefield, comprising this area, and the adjoining Minera area, near Wrexham, has a long history of exploitation, dating at least as far back as Roman times.

The earliest mining was generally poorly planned and of local scale, based on open excavation at the surface, and bell pit mining.

The 18th and 19th Centuries in particular saw widespread mining activity, with substantial developments associated with driving of major drainage adits constructed to take water from the ore fields to the Dee Estuary near Holywell. The early 20th Century saw a substantial reduction (or more accurately a collapse) of the industry, with historical mapping frequently displaying evidence of mine closures. Mining ceased in the 1920s, although the Halkyn District United Mines Co restarted works in 1928. Mining operations in this case also involved extraction of limestone for agricultural and industrial purposes, in conjunction with the lead/zinc operations. These operations continued in a generally deteriorating economic environment until final closure in 1978. The later mines used "open" or "overhand" stoping techniques from sub level drivages. The current surface expression of many older mines confirms that this method of mining has been used for many years.

Following closure mine sites were generally left in a derelict condition, but in the intervening years have been subject to a combination of active reclamation, or a slower process of natural assimilation (or "greening") into the (predominantly rural) landscape.

Beyond the actual mining site mineral processing activity was also widespread. Smelting sites were generally located to the east of the principal ore locations along the Dee Estuary where the favourable combination of the following elements all came together:

- Clean fresh water for power and processing
- Coal for power, sintering and smelting activity
- Port and harbour facilities

It is evident that with much of the reclamation and greening of the mine and processing sites having been undertaken during the 1970s and 1980s, much of the direct local knowledge associated with the industry itself, and any reclamation works undertaken is now being lost.

Unlike the situation for the Coal Industry, there is no central repository for records relating to lead zinc mining activity. Records are held in a number of locations including the County Archives (in Flintshire - at Hawarden), within Engineering and Planning Departments of County Councils, and in private collections. The County Archives include records, formerly held centrally by the Health and Safety Executive at Bootle, but returned to County Archives in recent years.

Mining History: Coal

Coal is known to have been worked in the area from medieval times, with historical records dating back to 1322. In a similar manner to the lead/zinc mining initial activity was carried out by open excavation at outcrop, extending into bell pit excavations and adit drivages. The coal seams are relatively flat lying, sedimentologically controlled, bedded structures. Whilst tectonism has produced dipping strata (as mentioned earlier generally eastwards) of up to 30 degrees, the coal seams are planar features, generally lying at low, or near horizontal, angles. Mining technology prior to the late 19th century dictated that mine workings, were for the most part, relatively shallow operations, undertaken in the "pillar and stall" method of extraction, where a patchwork of intact pillars and open stalls are excavated, allowing up to 70% extraction (but generally far less – of the order of 30-40% typical).

As and when a pit reaches the end of its working life the activity known as "pillar robbing" would frequently have been carried out. This involved the backwards retreat toward the shaft, mining the intact pillars to the point of collapse. With some experience of this pillar robbing the next logical progression is the development of "longwall retreat" methods, which allow 100% extraction of the coal seam, coupled with controlled subsidence of the overlying rock strata.

Increases in pumping efficiency and development of the longwall methods, together with an associated increase in mechanisation, allowed a significant increase in the depth of mining activity in the late 19th and early 20th Century. By the early years of the 20th Century however the industry was in decline. Mining did continue however until the late 1980s at Tan Llan and Coed Talon.

It should be noted that mining records held by the Coal Authority are known to be both incomplete, and in some cases, inaccurate. It was only in 1872 that lodging of records became compulsory, and as with all records they are only as accurate as the techniques of the day, and the capabilities of the surveyors, allow.

THE LEGACIES

Shafts and Mine Entries:
Published estimates suggest that there are 5000 charted mine shafts in the Holywell area alone, suggesting that on a county wide basis the total number of shafts is likely to be counted in the tens of thousands.

Shaft construction methods vary considerably, however some general rules can be deduced from a review of historical necessity. Superficial deposits are not self supporting and all shafts which were required to remain open would have required some form of lining. In lead - zinc mines lining would have most probably been with dressed limestone masonry. In coal workings linings were generally constructed from a number of courses (or skins) of brickwork. The shaft would have penetrated a short distance into the underlying solid rock, sufficient to ensure local stability, and preferably sealing off any water in the superficial strata above. Where stability allowed, the remaining shaft section (in rock) would have been unlined. Timber staging decks would have occurred at ladder height intervals in the shallower mines. Some of the late 19th Century Coal shafts were built to considerable (many hundreds of metres) depth.

The risks arise primarily as a consequence of:

- Exploration of open shafts by over inquisitive children, and
- Potential collapse beneath existing structures (particularly housing) or transport arteries (highways and railways).

To the author's knowledge, no deaths have occurred in the area as a result of any such occurrence in recent years although there have been a number of near misses. The risks of future death and / or serious injury as a result of such collapses are very real however. For example, Nichol records an incident in 1996 when a child fell into an open shaft near Holywell, and three subsidence events affecting the local highway network between 1982 and 1993.

Other Shallow Workings: Lead / zinc workings
Where the workings associated with the steeply dipping "stopes" approach ground surface, existing developments can be severely compromised, and safe development potential of new buildings restricted. It is remarkable how close to surface the original mining operations were pursued.

Tip Instability
Unlike in South Wales the Coal Measures bedrock is not generally deeply dissected, and colliery spoil tips (coal) are therefore generally sited in areas of relatively flat topography. As a consequence of this, tips are far less likely to be at risk of failure in the general case.

Contaminated Land
Both colliery and mine sites can represent a significant environmental hazard, depending on the nature of the processing operations associated with the history of the site. At colliery sites the majority of discarded material from longwall mining operations is "coarse discard". This consists predominantly of inert rock material and varying proportions of coal. Its' chemical composition reflects the nature of the ground being mined, and the processing operations. A particular problem associated with poor processing operations (ie poor recovery of coal by volume) is the propensity for loose tipped coal bearing waste to suffer from spontaneous combustion.

In addition coal measures strata (in particular the mudstones and shales) are frequently pyrite bearing, and can give rise to significant problems associated with aggressive ground conditions in relation to foundation concrete. Colliery spoil materials are therefore a particular design case under current concrete design procedures.

Older mine sites, predating the late 19th Century and early 20th Century mechanisation however have a very different make up. At this time the cost of hauling waste rock from coal face to surface was prohibitively expensive. Substantial effort was made to sort poor quality material underground and a relatively small proportion of waste rock was "picked" for tipping at the surface. The mining process however required significant input in winding cages at shafts, and in particular in raising water. These processes were driven by steam engines powered by coal, in winding and pumping houses. Tips therefore included considerable quantities of boiler ash, potentially considerably enriched in heavy metals and hydro-carbon combustion products, such as benzo-a-pyrene, coal tars etc.

Further potential contamination arises from the geography of the colliery sites in the Flint / Bagillt area along the Dee Estuary. Ground raising was undertaken at the colliery sites themselves, with construction of quay walls, railways, roads etc evident on historical 19th Century maps. The source of the fill material used reflected all the industrial activity ongoing at the time. Consequently the colliery sites themselves were built on land already potentially contaminated with waste materials from the smelting of copper, lead and zinc, town gas plants, limestone quarrying etc, all of which were common in the immediate area.

There are a wide range of potential contaminants associated with former mine sites, but it is worth considering three of these in some detail, these are lead, zinc and cadmium being particularly problematic.

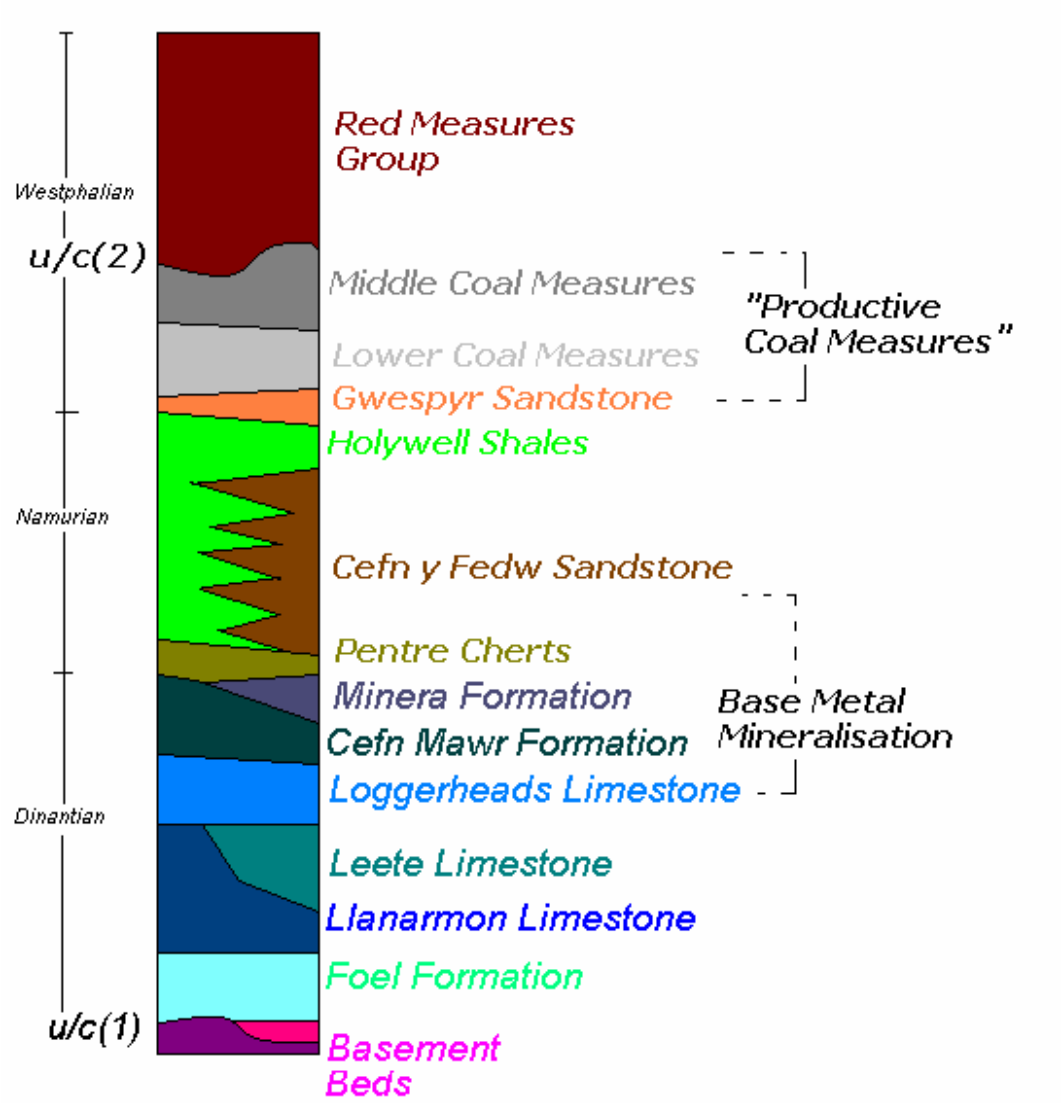


Figure 1 – Illustrative geological section – Flintshire region

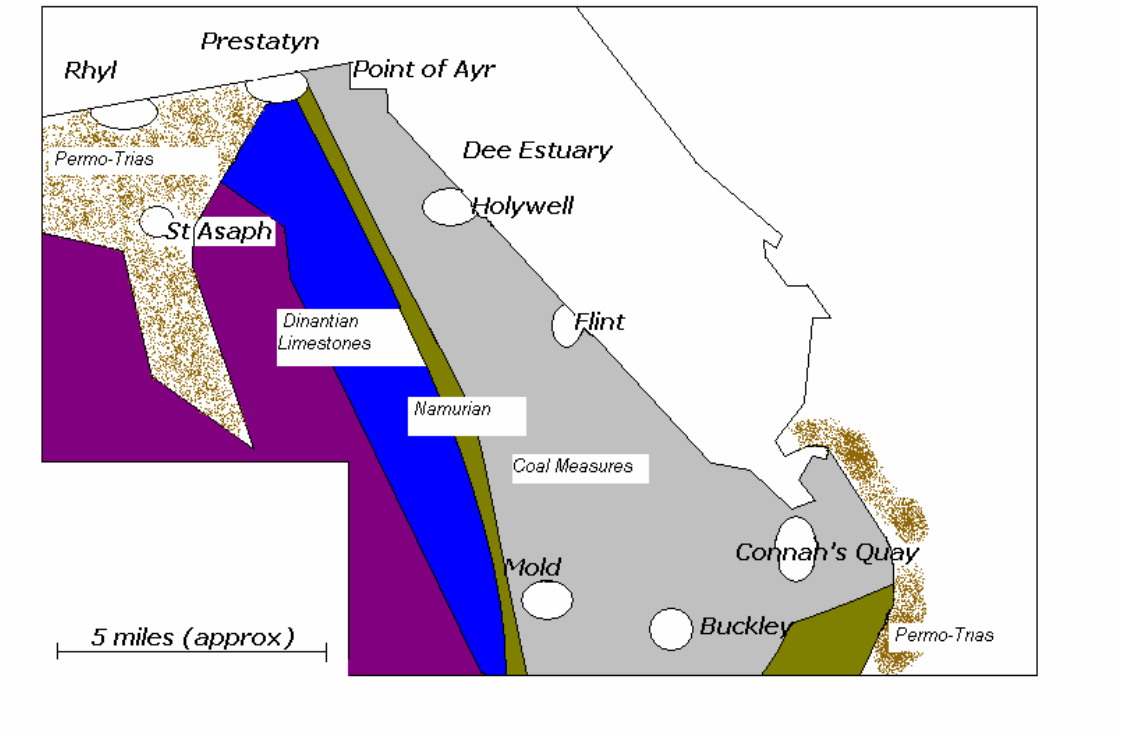
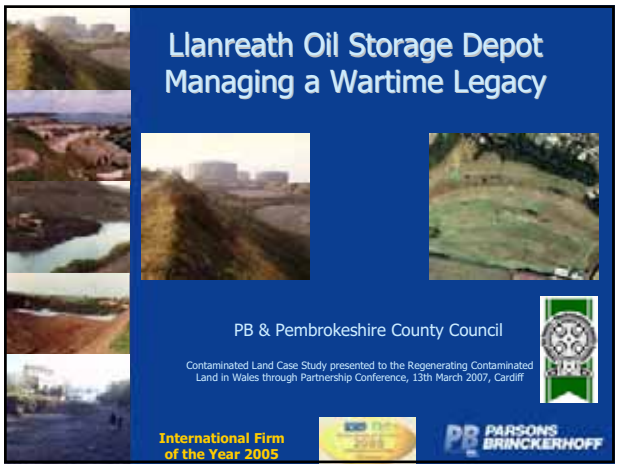
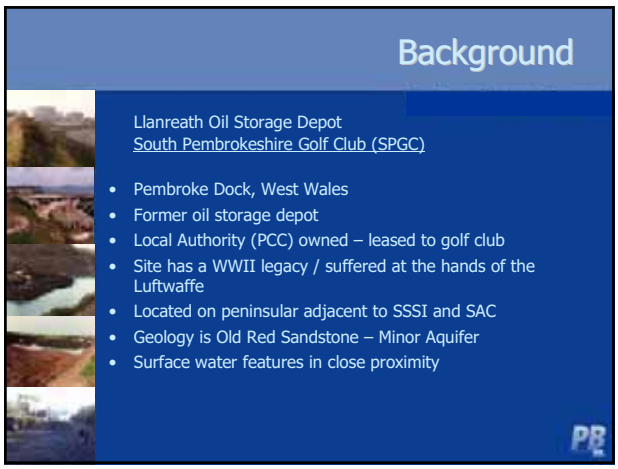


Figure 2: Sketch map illustrating much simplified Geology of the District


Llanreath Oil Storage Depot
Managing a Wartime Legacy
PB & Pembrokeshire County Council
Contaminated Land Case Study presented to the Regenerating Contaminated Land in Wales through Partnership Conference, 13th March 2007, Cardiff
International Firm of the Year 2005
PARSONS BRINCKERHOFF


Background
Llanreath Oil Storage Depot
South Pembrokeshire Golf Club (SPGC)
• Pembroke Dock, West Wales
• Former oil storage depot
• Local Authority (PCC) owned – leased to golf club
• Site has a WWII legacy / suffered at the hands of the Luftwaffe
• Located on peninsular adjacent to SSSI and SAC
• Geology is Old Red Sandstone – Minor Aquifer
• Surface water features in close proximity


Site Location
Site Centre
This map is reproduced from Ordnance Survey material by Parsons Brinckerhoff on behalf of Pembrokeshire County Council with the permission of the Controller of Her Majesty's Stationery office © Crown Copyright reserved.
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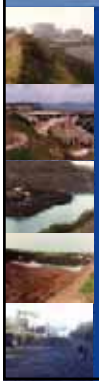
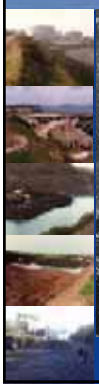
Site History Summary

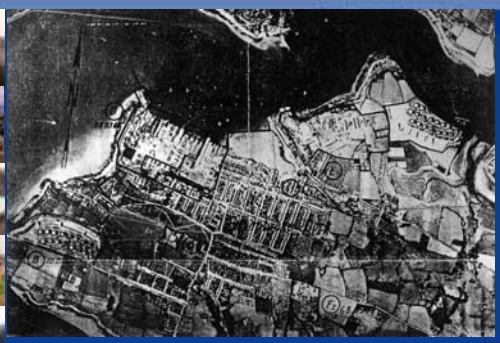


Llanreath Oil Storage Depot

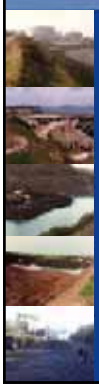
- Developed by the Admiralty during WWII to supply atlantic convoys with marine oil
- Situated on Pennar headland - east of Milford Haven
- Depot comprised 16 large tanks, each with an estimated capacity of 10,000 m^3
- 4 deep moats excavated into bedrock down gradient of tanks, designed to intercept oil in the event of a breach
- Single bombing raid in 1940 destroyed 8 tanks
- Fires burned for approximately 2 weeks
- Estimated 80,000 m^3 of oil lost
- Large proportion intercepted by the moats

Site History (1940 - 1980)





Site History (1940 - 1980)



31st August 1940

North


Site History (1940 - 1980)


Site History (1940 - 1980)
15th April 1946
North


Site History (1940 - 1980)

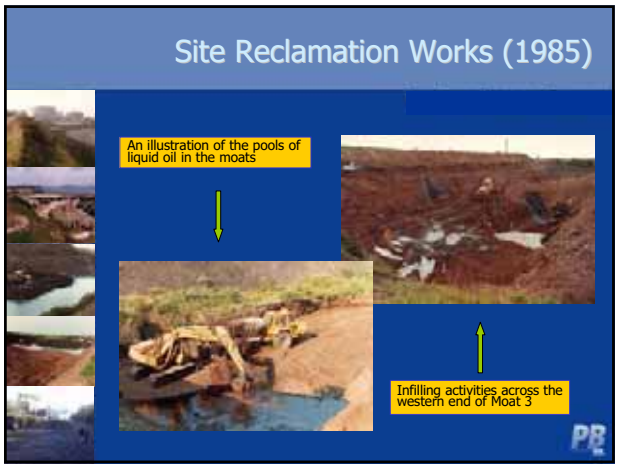
Site History Summary (1940 - 1980)

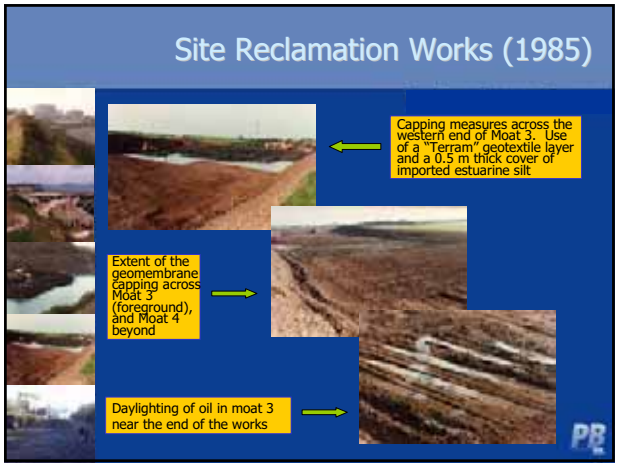
Site Reclamation Works (1985)

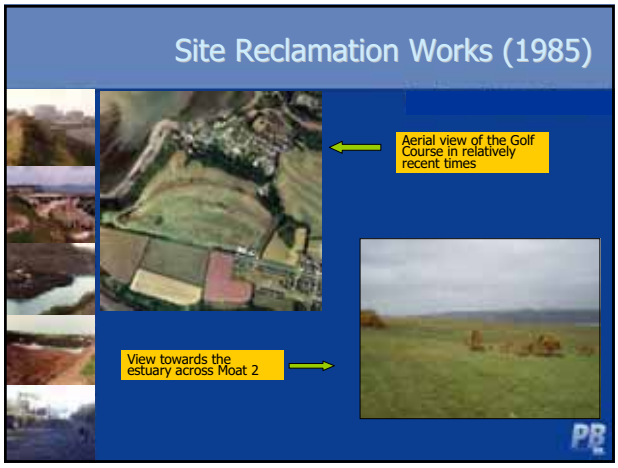
Standing tanks dismantled & ground re-levelled

View over site pre-demolition- Remaining oil tanks, concrete foundations.

Moat Construction


Site Reclamation Works (1985)
An illustration of the pools of liquid oil in the moats
Infilling activities across the western end of Moat 3


Site Reclamation Works (1985)
Capping measures across the western end of Moat 3. Use of a "Terram" geotextile layer and a 0.5 m thick cover of imported estuarine silt
Extent of the geomembrane capping across Moat 3 (foreground), and Moat 4 beyond
Daylighting of oil in moat 3 near the end of the works


Site Reclamation Works (1985)
Aerial view of the Golf Course in relatively recent times
View towards the estuary across Moat 2

Current Situation

Oil movement through site drainage system, collection within site interceptor and discharge to stream

Current Situation

Fairway oil seepage. Sand applied to oil patches by green-keeper staff. Note subsequent oil breakthrough

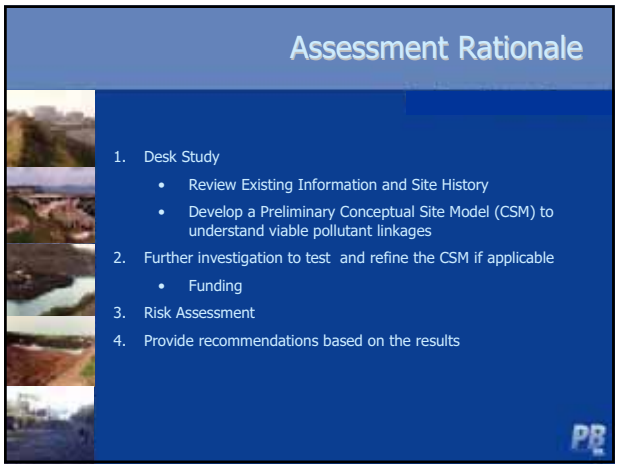
Driver for assessment

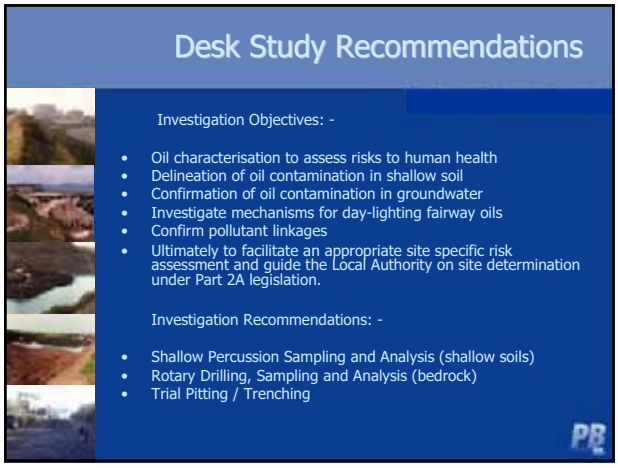
For the purposes of Part 2A (EPA, 1990), the statutory definition of contaminated land is:

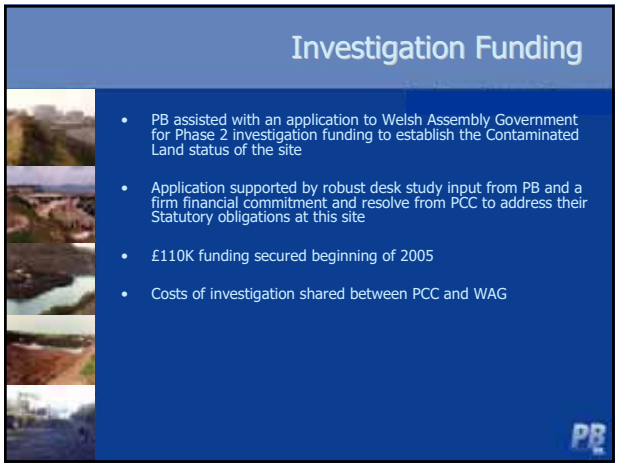
"land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that:

- ***significant harm is being caused or there is a significant possibility of such harm being caused; or***
- ***pollution of controlled waters is being, or is likely to be, caused."***

PB objective was to assess "Contaminated Land" status of the site

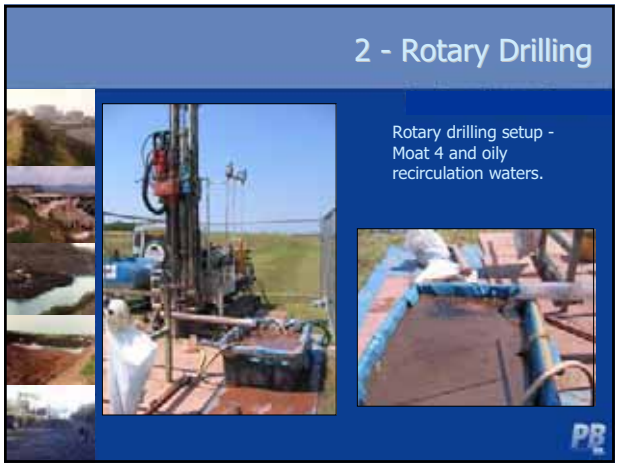

Assessment Rationale
1. Desk Study
• Review Existing Information and Site History
• Develop a Preliminary Conceptual Site Model (CSM) to understand viable pollutant linkages
2. Further investigation to test and refine the CSM if applicable
• Funding
3. Risk Assessment
4. Provide recommendations based on the results
PB


Desk Study Recommendations
Investigation Objectives: -
• Oil characterisation to assess risks to human health
• Delineation of oil contamination in shallow soil
• Confirmation of oil contamination in groundwater
• Investigate mechanisms for day-lighting fairway oils
• Confirm pollutant linkages
• Ultimately to facilitate an appropriate site specific risk assessment and guide the Local Authority on site determination under Part 2A legislation.
Investigation Recommendations: -
• Shallow Percussion Sampling and Analysis (shallow soils)
• Rotary Drilling, Sampling and Analysis (bedrock)
• Trial Pitting / Trenching
PB


Investigation Funding
• PB assisted with an application to Welsh Assembly Government for Phase 2 investigation funding to establish the Contaminated Land status of the site
• Application supported by robust desk study input from PB and a firm financial commitment and resolve from PCC to address their Statutory obligations at this site
• £110K funding secured beginning of 2005
• Costs of investigation shared between PCC and WAG
PB


Site Investigation
Summer 2005
PB PARSONS BRINCKERHOFF


1 – Shallow Soil Sampling
Window Sampling
Sonic-bore
Percussion
sampling
PB


2 - Rotary Drilling
Rotary drilling setup -
Moat 4 and oily
recirculation waters.
PB

2 - Rotary Drilling

Oily contamination along rock fractures.

Evidence of oily contamination in underlying bedrock.

Trial Trenching – Moat 4 (TT1)

Oil stringer – vertical pathway exposure

Oil exposed along clay vertical discontinuity

Trial Trenching – Moat 3 (TT2)

Influence of geo-textile on oil movement

Oil stringer

Trial Trenching – Moat 3 (TT2)

Sporadic reservoirs / pools of oils in granular lenses through soil profile.

Trial Trenching – Moat 3 (TT3)

Oil concentration along discontinuities in lower layers

Clean cover soils overlying darker, oily soil horizons

Oil Characteristics

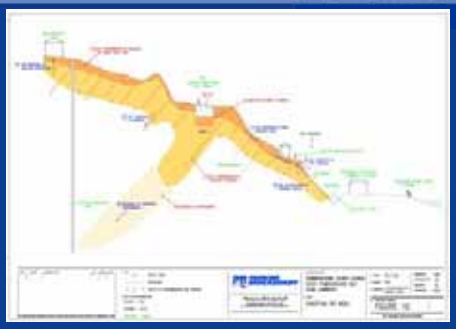
- **Physical Properties**

- Neutral density (LNAPL & DNAPL components)
- Confirmed marine oil origin
- Over 20 years old & subject to combustion
- Highly viscous, bitumen-like consistency
- Forms a dry, brown skin on contact with air
- Mobile

- **Chemical Properties**

- 50 – 60% mineral oil; 18 – 30% aromatics; PAH's
- Some metals e.g. lead, chromium & zinc
- Sulphate, iron and manganese
- Variable compositions across the site
- Very low solubility

Conceptual Site Model (CSM)



Conceptual Site Model (CSM) detailing key Source-Pathway-Receptor relationships

HHRA Conclusions

- Low incremental carcinogenic risk to Child Residents from contact with day-lighting hydrocarbons on course or at outfalls
- Low incremental carcinogenic risk to Adult Residents from contact with day-lighting hydrocarbons on course or at outfalls on more than 100 occasions per year
- Gas risks identified for site maintenance workers in confined space areas (manhole/interceptor chambers)
- Primary issue is perception of risk and nuisance factor associated with oil patches

CWRA Conclusions

- **Streams and Springs**

  Impact to stream confirmed on basis of visible contamination of free-phase hydrocarbon within the stream. Dissolved phase hydrocarbon not detected.

- **Minor Aquifer**

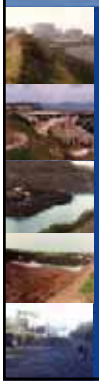
  Impact confirmed by presence of free-phase hydrocarbon in bedrock of the aquifer and dissolved phase concentrations in groundwater samples collected

- **Abstraction Well**

  Risk to abstraction well considered to be low given its' use is for irrigation purposes only and water samples of good quality with exception of minor trace phthalates

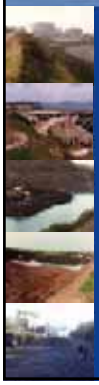
  Risk rating may change in future

What Next?



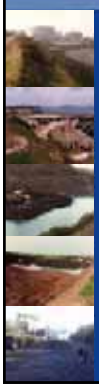
- Formal site 'determination' by PCC on the basis of pollution being caused to controlled waters
  - Environment Agency in agreement with PB conclusions
- **Solutions?**
  - Active remediation of the entire source area?
    - Financial costs (up to £100M) disproportionate to likely benefit attained
    - Priority to minimise ongoing pollution to the stream and develop an approach to managing residual environmental risks
  - Implementation of a long term management strategy that addesses the residual risks proportionate to their significance

What Next?



- **Implementation of long term management strategy: -**
  - To review overall site surface water drainage and to design and install a product recovery system within the site interceptor.
  - Review risks associated with confined space working / modification of routine maintenance practices
  - Regular environmental monitoring (visual inspection, sampling, recording etc.)
  - Further assessment of the deep site abstraction borehole
  - Delineation of shallow soil contamination at eastern site boundary
  - Develop environmental management document / Stakeholder actions and responsibilities

What Next?



- **Research Opportunities: -**
  - Potential for Industrial / Academic collaboration for research at the site.
  - Cardiff University carrying out a research options study with PB at present.
  - Field and/or Laboratory scale research into aspects such as oil flow mechanisms, microbial processes etc.
  - Research into contaminant transport in groundwater.
- **Points in Favour: -**
  - Oil composition is relatively benign, but presents a challenge for remediation due to its physical properties.
  - The site will require long-term site management – long-term research potential.

Llanreath Oil Storage Depot - Managing a Wartime Legacy

Gideon Jones

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Site History and Background to Investigations

The Llanreath oil storage depot was developed by the Admiralty during World War II, principally to supply the Atlantic conveys with marine fuel. It consisted of 16 No. large tanks, each with an estimated capacity of 10,000 m^3, which were situated on Pennar headland, to the east of Milford Haven. Four deep moats were excavated into the bedrock, down-gradient of the tanks, in order to intercept oil in the event of a breach. During a single bombing raid in WWII, eight of the tanks were destroyed by enemy action and it is reported that the ensuing fire burned out of control for two weeks. At that time, approximately 30 million gallons of fuel was reported as being lost (~140,000 m^3), a proportion of which was received by moat numbers 3 and 4.

The first attempts to address the contamination problems at the now derelict site were made during a land reclamation scheme in the mid 1980's. It was originally proposed to fill the moats to above the level of the oil with coarse concrete debris from the demolished tank bases and blast walls, placing restoration soils above the hardcore. During the restoration work however, it became apparent that there was insufficient hardcore material to achieve this and parts of the site were therefore 'stabilised' by mixing the residual free oil with imported soils. Following completion of the work, the site was turned into a municipal golf course, which has been operated since by Pembrokeshire County Council (PCC).

Following the reclamation work, and particularly in the more recent past, there has been an on-going issue with the day-lighting of highly viscous oil on golf course fairways above moat numbers 3 and 4. In addition, there has been reported flushing of oil collecting in the site drainage system into an adjacent stream to the north of the site during periods of heavy rainfall. The stream eventually flows into Milford Haven, which is designated as a Special Area for Conservation (SAC).

These on-going problems prompted PCC, as landowner, to commission PB to undertake a review of the situation in late 2004. The review was undertaken in accordance with current government guidance on contaminated land and was reported in February 2005. It presented several tentative pollutant linkages but concluded that there was insufficient information on which to determine the site as Contaminated Land under Part 2A of the Environmental Protection Act 1990. Recommendations were therefore made to confirm various aspects of the prospective pollutant linkages by further investigation, particularly the 'source' and 'pathway' terms.

Investigations Undertaken

The investigations were undertaken in three phases between February and November 2005, as follows:

1. Sediment and water samples were obtained from the stream and springs located to the north of the site for chemical analysis. In addition, samples of oil were obtained from the oil interceptor along the site drainage system and from oil patches on the golf course fairways for product typing.
2. Investigations targeting the four moats down-gradient of the former oil tank storage areas and the area directly to the north, between the moats and the stream have been undertaken. This phase of work comprised 7 No. rotary drilled boreholes to a maximum depth of 15 m used to assess the vertical profile and depth of the moats,

and the condition of the bedrock below the moat bases. An additional array of 34 No. shallow 'window-sample' boreholes was also drilled to assess the lateral distribution of shallow oily contamination directly to the north of the moats.

3. Further probing and trial trenching was undertaken across the moat areas and the former oil tank storage areas to the south of the site. This programme of work was designed to understand the spatial distribution of contamination up-gradient of the moats and the mechanism for vertical oil migration through the soil profile. Measurements of gas flows were taken from selected boreholes with gas samples taken for composition analysis.

Human Heath Risk Assessment

A quantitative human health risk assessment has been carried out following the intrusive programme of work and the following conclusions have been drawn:

1. Maintenance workers are primarily at risk from acute health risks from elevated air concentrations of carbon dioxide, methane and hydrogen sulphide, accumulating in on-site chambers (man-holes and the oil interceptor) and boreholes. These acute health risks are similar to those encountered in other industrial maintenance activities where confined space entry management procedures are routinely used to mitigate the risks.
2. Child residents (members of the public aged 6 years or younger) and adult residents (members of the general public and golf course users) have either a very low or low incremental carcinogenic risk when coming into repeated contact with day-lighting hydrocarbons on the golf course or at the site / beach outfall. Whilst the overall health risk to child and adult residents is considered to be generally low, it would be further reduced by appropriate on-site mitigation measures.
3. Although human health modelling results indicate that the hydrocarbons have low incremental risk to human receptors it has been noted that a perceived risk may remain in the eyes of the public and the site operator. Further, it is likely that ongoing maintenance of the day-lighting oil (currently by covering each oil seep with sand) will be required in the long term in order to maintain usable golf course fairways in the vicinity of Moats 3 and 4.

Controlled Waters Risk Assessment

It has been confirmed that free phase hydrocarbons are periodically flushed from the oil interceptor within the site drainage system into the stream that flows to the north of the site. This is attributed to there being insufficient capacity within the interceptor to cope with the volumes of water generated within the area drained by the system during high intensity rainfall events. Field inspections undertaken in February 2005 confirmed the presence of hydrocarbon 'sheens' on the surface of the stream and hydrocarbon coatings on its vegetation for about 100 m downstream of the interceptor outfall. Subsequent analysis of the stream bed sediments confirmed elevated concentrations of diesel range organics (DRO) and PAH in the samples obtained.

It has also been confirmed that free phase hydrocarbon is present within the fractured Old Red Sandstone bedrock below the water table.

Recommendations, Partnership and Research Opportunities

The main recommendation arising from the work undertaken to date has been that the site should be determined as Contaminated Land as defined under Part 2A of the Environmental Protection Act 1990, on the basis of pollution being caused to controlled waters.

Active remediation of the source material at the site is considered disproportionate to any real benefit, considering the likely costs involved and the level of risk identified to site receptors. However, certain mitigation measures would benefit in reducing risks further to specific receptor groups.

Fundamentally, the site requires long term management for many years to come. It has therefore been recommended that a Long Term Management Strategy be implemented to address ongoing long term residual environmental risk. The long term strategy as it evolves is likely to include measures such as regular environmental monitoring of the water environment across the site, soil gases and appropriate maintenance of affected fairways and the oil interceptor point.

More immediate action has been recommended to prevent further discharges of oil to the stream. To break this particular pollutant linkage and to address the potential for further breaches of relevant surface water regulations, physical control measures to augment the existing surface water drainage system at the interceptor point have been recommended as a matter of priority.

Miscellaneous (lower priority) additional site works have also been recommended to fully delineate the lateral and vertical extent of contamination.

Looking further into the future, the opportunity for research at this site through academic/industrial collaboration could prove feasible. The physical properties and problematic nature of the oily contamination being dealt with at this site on a day to day basis at present, coupled with a reasonably favourable and relatively controlled site setting could lend itself well to research into applications for new remedial technologies through field and laboratory scale trials.

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CL:AIRE **Conference**

13 March, 2007

ACID TAR REMEDIATION

- A HOLISTIC APPROACH

Simon Talbot – Director GMGU

Presentation

- SUBR:IM research
- Acid tars in Wales
- Examples of problem sites
- Science research
- Social science research
- Elements of a 'remediation decision making tool-kit'
- Acknowledgements

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SUBR:IM Research

- **SUSTAINABLE URBAN BROWNFIELD REGENERATION: INTEGRATED MANAGEMENT**
- **Project H - Restoration of acid tar lagoons**
- **Multidisciplinary research split into:**
  - **Science research**
  - **Social science research**

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Project H - Research Team

- **Sheffield University**:
  - Dr Colin Smith
  - Xu Hao
- **Manchester University**
  - Nigel Lawson
- **MG**
  - Simon Talbot
  - Sally Shaw
  - Monica Palaseanu-Lovejoy
- **SUBR:IM Collaborators**
  - **Building Research Establishment**
- **Funders**
  - Engineering & Physical Science Research Council
  - Environment Agency
- **Various Acid Tar Site Owners**

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Acid Tars in Wales

Acid tars originally produced from:

- benzole refining plants
- white oil refining plants
- lubricating oil re-refining plants

Production generally ceased in the 1960's to 1980's

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Acid Tars in Wales

Historical disposal options:

- off-site to landfills and co-disposed, as minor constituent, with other industrial wastes, or
- tipped in worked out quarries, clay or gravel pits

(UK acid tars generally not present in purpose built 'engineered' lagoons)

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Current remediation challenges (physical and chemical):

- Highly acidic and complex mixture of hydrocarbons, sulphuric acid and water
- Range of toxic contaminants
- Variable physical properties and mobility
- Present in a variety of phases
- Presence of co-disposed materials
- Inadequate containment

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Current remediation challenges (social):

- Ownership
- Sources of funding
- Timescales of impacts
- Effected stakeholders
- Legislative framework
- Resources & experience of regulators

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Examples of Acid Tars Problem' Sites

- Benzole refining from coal tars (Site A)
- Re-refining of waste oils (Sites B & C)
- White Oil manufacture from petroleum (Site D)

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Science research – University of Sheffield

- Natural weathering properties
- Leaching behaviour

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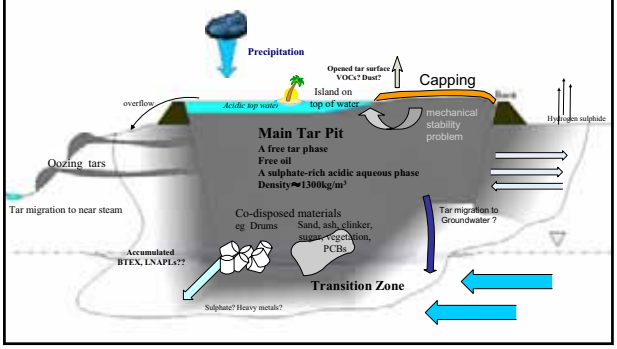
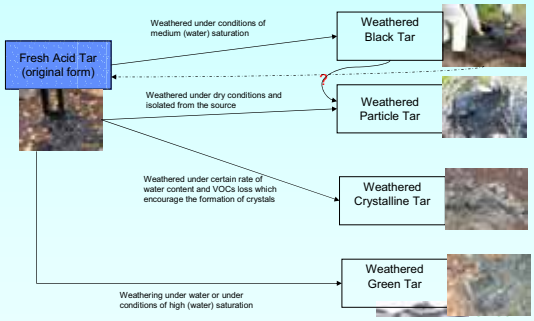
Site D Conceptual Model

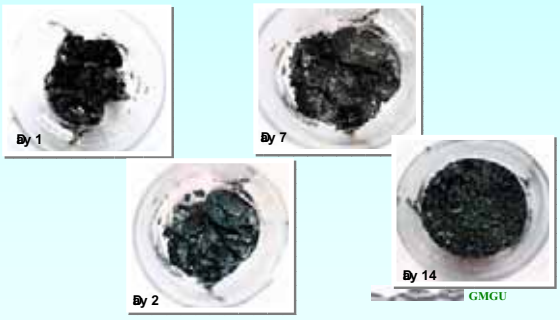


Weathering – Conceptual Model



Weathering

Weathering trial (fresh tar, 2 weeks, weight loss 54.5%)



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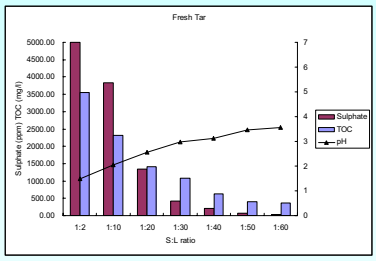
Leaching Tests

Cascade tests -up to cumulative liquid to solid ratio 1:60

Fresh Tar



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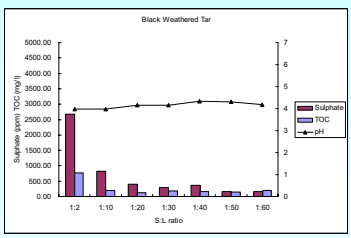
Leaching Tests

Cascade tests -up to cumulative liquid to solid ratio 1:60

Weathered Black Tar



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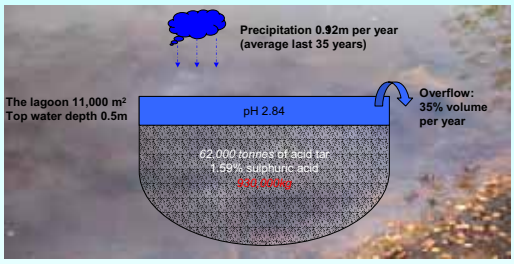
Simple calculation of leaching time scale



Total acidity lost during past 35 years is approximately *17,700kg* (as sulphuric acid), 1.9% of total acidity

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Additional Work - containment materials

Building Research Establishment research into the durability of:

- cement based systems
- geotextile systems

Also assess relevance of permeable re-active barriers

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Social science research - University of Manchester

- Regulatory framework
- Remediation stakeholders
- Risk communication issues and stakeholder involvement

- Additional SUBR:IM work: psychological factors motivating local community stakeholders

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Stakeholders- internal

In the know but divorced from full effects

- Site owner/s
- Local Authority.
- Environment Agency
- Health Protection Agency/Primary Care Trust
- Health and safety officers
- Restoration consultants
- Restoration contractors
- Researchers

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Stakeholder- external

Subjected to effects but invariably not fully informed and with reduced influence

- Local community
- Local politicians
- Wider community
- Media

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Acid Tar Lagoons - Remediation Options

Options include:

- Engineered cap
- Stabilization/solidification
- Removal and treatment for use as fuel
- Do nothing ('Monitored Natural Attenuation')
- Full containment/partial containment ('Permeable Reactive Barriers')
- Restrict access to site

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Issues affecting local residents:

1) Removal based techniques: release of volatiles, odour, transportation issues.

2) On-site treatment: treatment plant, emissions, transportation issues.

3) Stabilization/solidification: transportation issues, import of material and significant volume increase in the final lagoon site.

4) Simple fencing off: loss of amenity for residents, does not lower the risk of dust blow off and vapours.

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Working towards an acid tar remediation decision making tool-kit

Factors to take into account:

- **Legislation**
- **Local politics**
- **Financing**
- **Technical**
- **Timing**

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Acknowledgements

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- **Funders**
  - Engineering & Physical Science Research Council
  - Environment Agency
- **Various Acid Tar Site Owners Including:**
  - **Baufeld Umwelt-Engineering**
  - **BC NV**

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Understanding the Risk Transfer Process on Brownfield Sites

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The first task involved in understanding the risk transfer process associated with brownfield sites is to understand the risks themselves. This may sound straightforward but a detailed environmental risk mapping exercise is vital to ensure that any solution captures as wide a spectrum of risk as possible; to ensure that each risk is evaluated and appropriate solutions applied; and should any residual risk remain then these are understood and that no 'surprises' hit the parties involved down the line. Remedial and redevelopment works have risks attached which are not solely limited to spills or missing contaminated areas. Consider the following:

- During site remedial works
    - On-site clean-up
    - Third party property and health damage – potentially business interruption
    - Off-site clean-up of existing contamination
    - Off-site clean-up of newly generated contamination
    - Technology performance risk
    - Contractor performance and actions
    - Risks in transporting contamination materials
    - Changes in legislation/regulatory opinion
    - Reputational risk
- Post remedial works
    - All of the above – again
    - Contamination from materials disposed of inappropriately

Once you understand the risks, the next task is to understand the range of solutions. There is a vast range of tools available to brownfields practitioners, however they can all be grouped under common themes:

- Technical – the actual assessment and remedial effort to remove contaminated materials which, when considering the development purpose and design, are required to be treated or removed from site
- Legal – there are numerous legal tools available to help manage aspects of risk including assuming or assigning liability for particular risk in contracts, agreements or memoranda; warranties or indemnities related to performance or issues; and a large number of other routes.
- Financial – there is a wide spectrum of financial solutions to the potential risks from manipulating costs/prices to accommodate risk, through insurance, to constructing financial vehicles designed to house risk.

On most brownfield projects, the final 'solution' combines aspects from all three types listed above; there is no 'magic bullet'. Another important point to note at the outset is that there is never a complete solution – there will always be quantum of residual risk – the key is to design a solution where the residual risk is either negligible or is at a level where the parties involved are comfortable with the management of the risk and the potential for loss.

There is no standard process of designing the solution but some common rules should apply:

- Only apply the technical solutions to those areas where it is required to undertake remedial or mitigation works. Such works are 'required' if that is the opinion of the regulatory authorities or if there is some internal driver. Remedial works are almost always the most expensive option and to some extent the legal and financial solutions have been designed as less expensive options.
- For non-technical tranches of the solution, take the line of least resistance until an impasse is reached
    - There is a hierarchy of risk solutions based on the typical time and cost involved – where one strand fails, then a more complex option may provide a close;
    - Simplest fix is around contract or asset price to take the risk into account. This may be unacceptable to one or more parties so the next line of attack is;
    - A contractual solution looking to an equitable allocation of risk. If one or more parties views the proposed split as inequitable then the next route is;
    - Insurance or some other form of risk transfer to a third party. If this fails then the final port of call is;
    - A form of funded vehicle to accommodate liabilities.

There is one fundamental question to be asked is the design of any solution which will guide the process and enable advisers to focus their efforts appropriately, namely:

- What are the risk objectives of the parties involved – mitigate risk below catastrophic levels; minimise risk involving expenses less than a specified target; minimise risk down to a negligible residual level; or a 'walk-away' position (which will almost never happen).

From consideration of the above, a bespoke solution can be crafted which best matches the requirements of all parties. What is required then is close co-operation from all sides and all advisers.

TWIRLS

Treating Wastes for Restoring Land Sustainability

Approaches to the remediation of contaminated land

Dr Julie Williamson

University of Wales, Bangor

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www.bangor.ac.uk/ies/TWIRLS/TWIRLS_home.htm

TWIRLS

LIFE -Environment funded project

Aim: to demonstrate effective re-use of industry and municipal wastes to produce soil-forming materials for restoring degraded land.

SLATE ALFRED McALPINE — Slate Alfred McAlpine Blaenau Ffestiniog Quarry, N. Wales

UPM — UPM Kymmene UK, former Shotton Steelworks, N.Wales

Welsh Assembly Government, colliery spoil and restored sites

NAGREF — NAGREF, SSIA; TITAN Cement Co. S.A., schist quarry, Greece.

TITAN

TWIRLS DEMONSTRATION SITES

Schist quarry, Kamariza, Athens

Former steelworks, Wales

Slate quarry, Wales

Former colliery, England

Shotton - former steelworks brownfield site

2005

2006

Problem

- Low soil organic matter
- Low water-holding capacity.
- Contaminated (VOCs & PAHs).

Action

- Add organic matter as composted wastes.
- Co-compost soil to remove contaminants.
- Seed with biodiverse grassland mix.

Co-composting experiment

Biopile (= contaminated) soil, only, composted.

Biopile soil, green waste + biosolids composted.

Biopile soil, biosolids + paper fibre composted.

Biopile soil, green waste + biosolids + paper fibre composted.

In-vessel composting with 80 d aeration, then 120 d maturation

Spread directly back on contaminated land.

Samples analysed prior to composting, at end of maturation and after landspreading (then after 9 mo and 16 mo).

In-Vessel Composting: EcoPOD® system

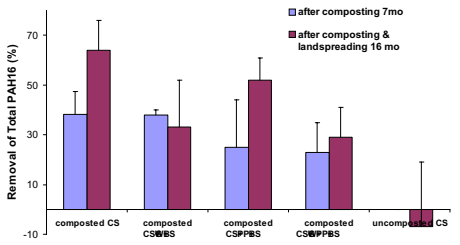
Mixing feedstocks

Filling pods

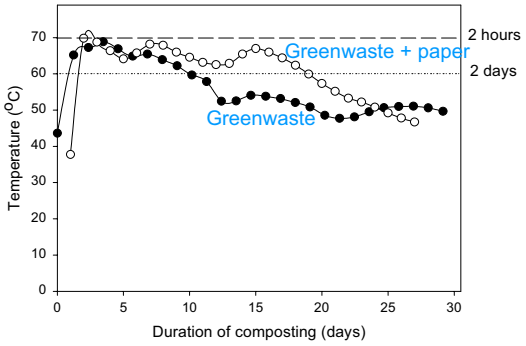
Aeration ducting

Temperature probes for process control

Concentrations of PAH (USEPA 16) removed after composting and landspreading contaminated soil. Values represent means ± SEM (*n* = 6).

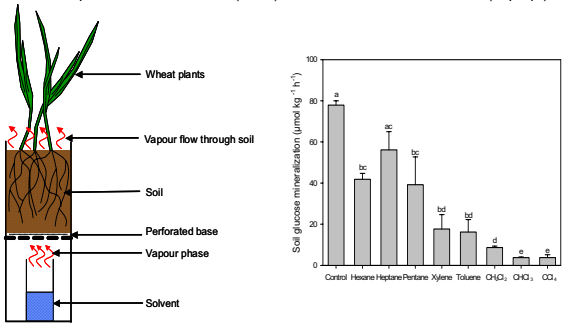


Adding paper fibre (high in labile carbon) to greenwaste results in better composting because it stimulates microbial activity.

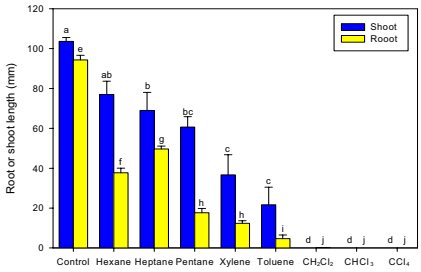


Effect of vapour phase solvent flow through soil on glucose mineralization by the soil microbial biomass.

Values represent means ± SEM (*n* = 3). Akinola, Williamson & Jones, (in prep.)



Effect of vapour phase solvent flow through soil on glucose mineralization by the soil microbial biomass.
Values represent means ± SEM (*n* = 3).



Conclusions

- ❑ covering land polluted with volatile organic compounds may not be sufficient to block the source-receptor pathway;
- ❑ Vertical migration of vapour phase solvents through the soil profile is harmful to soil microbial and plant biomass;
- ❑ Composting and landspreading processes both resulted in dissipation of PAHs;
- ❑ Co-composting contaminated soil with organic material may initially occlude PAHs from dissipation;
- ❑ Microbial mineralization studies will evaluate whether organic material will facilitate PAH biodegradation in the medium-term.

TWIRLS – Treating Wastes for Re storing Land Sustainability: approaches to the remediation of contaminated land

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Abstract
The restoration of historic, contaminated brownfield sites is an important part of the regeneration strategy for urban areas where undeveloped land is scarce. Orphaned sites are problematic because the polluter is no longer responsible and it falls to government agencies to render these sites safe and to block source-receptor pathways. Commonly, contaminated land is covered with inert material as this is an inexpensive option compared with remediation. In the case of volatile pollutants, however, vapour phase movement may limit its effectiveness.

This paper describes field-scale and greenhouse experiments that demonstrate the remediation of a former steelworks site in N. Wales polluted with volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). In the greenhouse, soil columns were exposed to a range of solvents from beneath. Solvent vapour reduced shoot and root growth and microbial mineralization potential, with aromatic and chlorinated solvents showing greatest effect.

In the field, compost was produced from organic wastes co-composted with contaminated soil and the fate of PAHs followed over time. The reduction in PAH concentrations varied with the presence of organic material during composting and compost constituents after landspreading.

1 Introduction

The main objective of the TWIRLS project is to demonstrate the effective re-use of industry and municipal wastes to produce soil-forming materials for restoring degraded land. Work tasks include the *in situ* remediation of polluted brownfield sites, re-creation of acid heathland on slate quarry waste, native pine forest establishment at an opencast schist quarry, soil organic matter improvement of degraded arable land and the restoration of colliery shale to pasture. Success has been achieved through the close working partnerships we developed with land owners and statutory authorities.

This paper reports on the potential for compost or composting to enhance the dissipation of pollutants from PAH-contaminated soil at the former Shotton steelworks site at Deeside, North Wales and examines the vertical flow of VOCs through soil and the effect this had on plants and soil microbial activity. PAHs are common organic pollutants and occur naturally in fossil fuels e.g. coal and oil, or as a result of incomplete combustion of organic material. PAHs are classified as

carcinogenic compounds. The concept of treating PAH-contaminated soil by composting or with compost has been well reviewed by Semple et al. (2001).

Organic solvents are also common contaminants in soil and groundwater at post-industrial sites. Frequently the contamination is located below the rooting zone in soil possibly indicating that surface contamination may not be an issue.

2 Methods

2.1 Dissipation of PAHs during composting

Parts of the Shotton site (OS SJ 305 728) was considered highly contaminated and hazardous prior to the decision to cap it with an inert sand cover taken from the Deeside Estuary during the mid 1990s (Smith Grant LLP, 2002). The cover was reported to be 4 m deep (anecdotal) but our rapid site assessment found it to be variable and less than 0.5 m in places. The TWIRLS demonstration trial was located in Zone 2 where we found elevated levels of VOCs (max. BTEX sum 500 µg kg^{-1}) and PAHs (max. 16PAH sum 34,000 µg kg^{-1}). Soil arisings from the construction of a bentonite wall in year 2000 had been formed into static biopiles on the surface of Zone 2 and provided us with a source of moderately contaminated soil to use in the composting trial.

Soil was either composted on its own or with organic wastes (Table 1). Compost was produced using EcoPOD® in-vessel aerobic composting vessels (Ag-Bag International Ltd, Warrenton, OR, USA) which are ideal for in situ work as all components of the system are mobile and suitable for up to 1000m^3 compost production on an 80-day cycle. Wastes were weighed and thoroughly mixed using a vertical auger cattle feed mixer wagon (Biga Twin Eco, Peecon, Etten-Leur, The Netherlands) and loaded into the EcoPOD® vessel (LDPE; 1.5 m diameter) by hydraulic ram, along with perforated plastic aeration pipe to deliver forced aeration. The aeration regime was controlled by means of a timed fan running at a flow rate of approximately 140 dm^3 min^{-1} for two months. Radio-linked temperature probes (Tinytag, Gemini Data Loggers UK Ltd., Chichester, Portsmouth) were inserted into each pod to log temperature data to an on-site computer.

Table 1. Feedstock composition of co-composting trial.

Code	Composition	% by dry wt
CS	Contaminated soil	100
GW+BS	Greenwaste + biosolids	80+20
PP+BS	Paper fibre + biosolids	40+60
CS+GW+BS	Contaminated soil+Greenwaste+biosolids	20+64+16
CS+PP+BS	Contaminated soil+Paper fibre+biosolids	20+32+48
CS+GW+PP+BS	Contaminatedsoil+Greenwaste+Paper fibre+biosolids	20+28+28+24

The Ecopod contents received forced aeration for 80 days then the immature compost underwent a maturation phase (no forced aeration) of four months in the Ecopods. At this point, composts were removed from the Ecopods and spread immediately onto a designated area in a fully replicated, randomised split plot design. In addition to the six composts in Table 1, untreated contaminated soil was also spread and a control plot with no additions made up the eighth treatment. Treatments were spread to a depth of 7.5 cm over an approximate total area of 6000 m^2. Composts were then incorporated into top 7.5 cm sand of Zone 2, to give 50:50 sand-compost mixes, to a depth of 15 cm, using a power harrow with 4 m spread. Activities were carried out under Exemptions to Paragraphs 12 and 9 of the Waste Management License Act (1994) and in addition, planning consent was required.

Three levels of vegetation establishment treatment were superimposed randomly at the split plot level. Poplar trees were planted immediately after landspreading (2/06) followed by the seeding of mesotrophic grassland seeds (4/06). The third split plot was unseeded and would allow us to take account of natural plant regeneration.

PAHs were measured in contaminated soil taken from the biopiles and prior to mixing with organic feedstocks (6/05), immediately after mixing and placement in the Ecopods (6/05), at pod opening after compost maturation (1/06), at landspreading with incorporation (2/06) and 9 months after landspreading (11/06). PAHs in soil were analysed by Hewlett Packard 6890 Gas Chromatograph system using a Hewlett Packard 5973 Mass Selective Detector after soxhlet extraction (ALcontrol Geochem Analytical Services, Chester). Analysis was conducted under MCERTS (European and International Standard BS EN ISO/IEC 17025:2000) accreditation.

2.2 Solvent vapour flow through soil

To simulate a highly contaminated subsoil environment (e.g. free-phase benzene at Shotton) we placed a reservoir of organic solvent (hexane, heptane, pentane, xylene, toluene, dichloroethane, chloroform, carbon tetrachloride) under soil columns and monitored vapour flow through the soil over a 14 day period. Simultaneously, we measured plant germination and growth and soil microbial activity.

3 Results

3.1 Dissipation of PAHs during composting

The thermophilic phase of composting attained the requisite temperature of 65°C (data not shown) for at least 7 days (British Standard for compost, PAS 100: 2005), even with the inclusion of 20% by dry weight mineral, contaminated soil. Contaminated soil that was composted alone reached an average max. of 40 ^{0}C.

All composted treatments resulted in some dissipation of Total PAH16. Composted contaminated soil (CS) and CS+GW+BS exhibited the highest percentage removal of PAHs of 38% (Fig.1). The cumulative effect of composting and landspreading increased the dissipation of PAHs in composted CS and CS+PP+BS, with the greatest removal of 64% exhibited by composted CS. CS+PP+BS showed the greatest dissipation in absolute PAH16 concentration of 49,000 µg kg^{-1} soil. Finally, there was little change in PAH concentration evidenced in uncomposted contaminated soil spread directly to land.

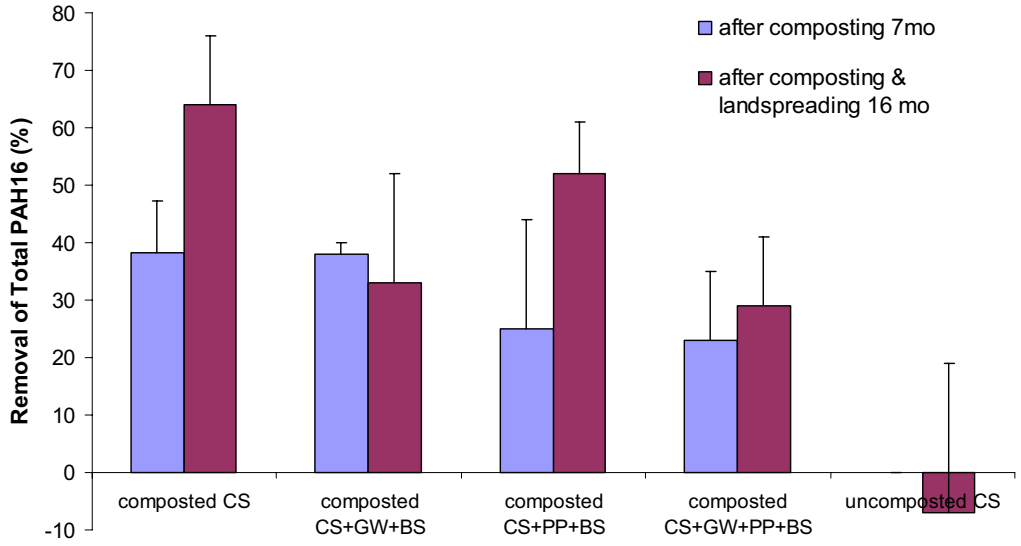

Figure 1. Effect of composting and of cumulative composting and landspreading on the percentage removal of Total PAH16 in contaminated soil (CS) undergoing different treatments. Values represent means ± SEM (n = 6). Abbreviations as in Table 1.

3.2 Solvent vapour flow through soil

Solvent vapour phase flow through the soil significantly affected seed germination and plant growth in all treatments in comparison to the control (Fig. 2). Root growth tended to be more affected than shoot growth. Soil microbial activity was similarly affected. The toxicity of the solvents to both plants and microbes followed the series: heptane < hexane< pentane < xylene < toluene < dichloromethane < chloroform = carbon tetrachloride. Toxicity was inversely related to the octanol-water partition coefficient of the solvent (r^2 = 0.90) and its Henry's Law constant (r^2 = 0.95).

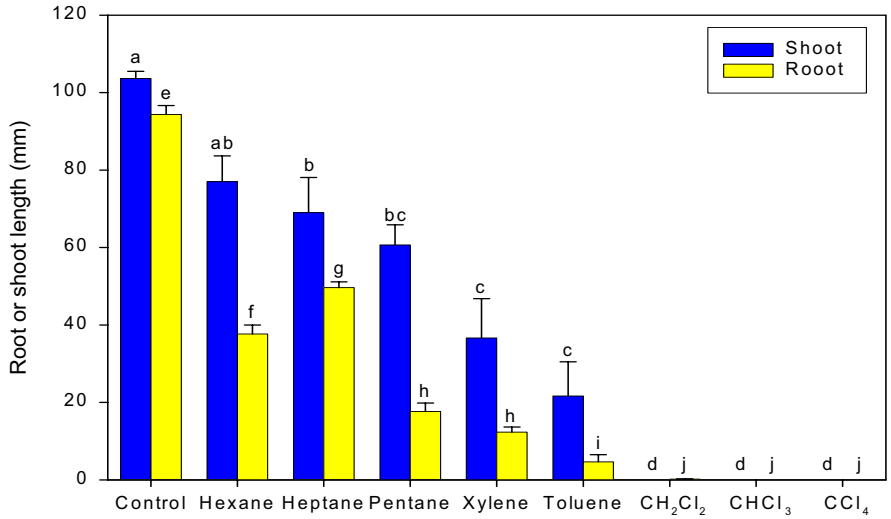

Figure 2. Effect of vapour phase solvent flow through soil on plant shoot and root length. Values represent means ± SEM (n = 3). Different letters indicate statistically significant differences between treatments at the P < 0.05 level.

4 Discussion and Conclusions

4.1 Dissipation of PAHs during composting

The addition of the organic mixes PP+BS and GW+PP+BS to contaminated soil appeared to reduce the dissipation of PAHs compared with contaminated soil alone or mixed with GW+BS (Fig. 1). This suggests paper fibre may have been responsible for the occlusion of PAHs. Once landspread, however, the CS+PP+BS exhibited continued dissipation of PAHs, unlike the other two organic mixes. We had previously found that paper fibre has greater carbon (C) availability than greenwaste (Williamson et al., 2006) which results in a longer thermophilic phase during composting. We hypothesise that only after available C is depleted do specialist microbial communities capable of mineralising PAHs develop.

Where the PAHs in contaminated soil were not occluded by organic matter during composting, forced aeration appeared to be effective as a means of dissipation. We postulate that these losses were largely through volatilisation and that microbial mineralization will play an increasingly important role with time. If so, organic amendments may be expected to directly influence mineralization through nutrient input and indirectly, through plant rhizosphere development. The next phase of work will be to demonstrate mineralization capability by enumerating phenanthrene (a

prevalent PAH in this soil) degrader colony forming units using agar overlay plates and respirometry using ^{14}C-phenanthrene. In addition, a pot experiment is running concurrently which mirrors the landspreading treatments in the field study.

4.2 Solvent vapour flow through soil

We hypothesise that organic solvent vapour flow through the soil inhibits plant growth by, (a) displacing oxygen from the soil so inducing hypoxia, and (b) by dissolving in the soil solution and disrupting biological membrane functioning.

In conclusion, our work has shown that the simple act of covering land or groundwater contaminated with VOCs may not be sufficient to interrupt the source-receptor pathway and that vapour phase solvent flow can be harmful to both soil microbial and plant biomass. The dissipation of aged PAHs in soil, as opposed to PAH-spiked soil, remains a poorly understood process. We have shown that on-site remediation can be partly achieved by subjecting contaminated soil to forced aeration and that the Ecopod in-vessel system is ideal for delivering this. The benefits after the landspreading of co-composted contaminated soil plus organic materials depended on the feedstocks used and further work will evaluate how the feedstocks influence microbial PAH-mineralization capability.

5. Acknowledgements

Co-authors: Olatunde Akinola and Davey Jones
Funding: European Commission LIFE-Environment Programme
Partners: Alfred McAlpine Slate; UPM Kymmene UK; Welsh Assembly Government.

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