



Groundwater remediation - where we are. And why.

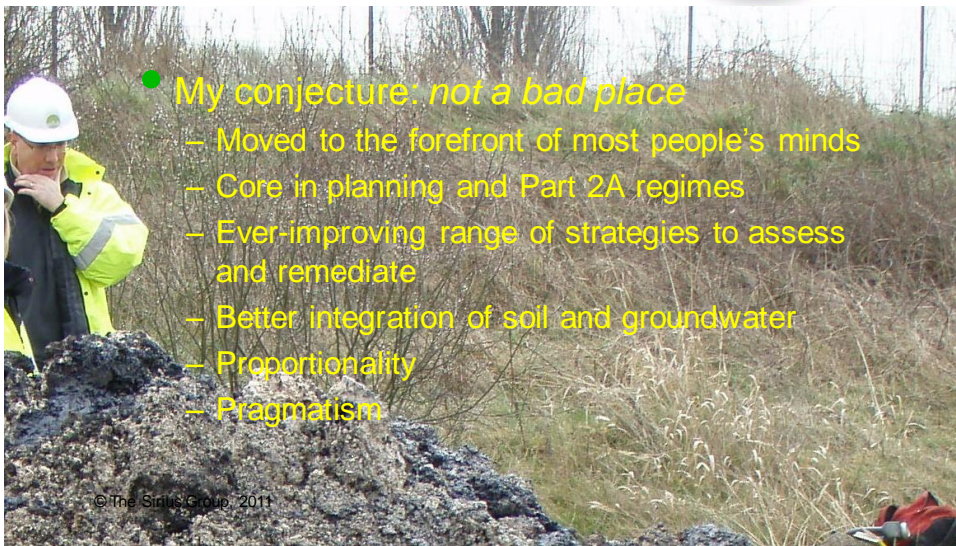
Prof. Phil Morgan

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So, where are we?





What has got us here?



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Some key legislative drivers – 1. EU Directives

Landfill Directive (99/31/EC) & Waste Framework Directive (2008/98/EC)	<ul style="list-style-type: none"> • Requirements start to drive remediation options and costs
Groundwater Directive (80/68/EEC)	<ul style="list-style-type: none"> • Protection of GW • To be repealed 2013
Water Framework Directive (2000/60/EC)	<ul style="list-style-type: none"> • Extends and supersedes prior directives
Environmental Liability Directive (2004/35/EC)	<ul style="list-style-type: none"> • New releases/permitted process • Limited relevance but may catch significant impact on chemical status of protected GW

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Some key requirements of the Water Framework Directive



- Prevent or limit input of pollutants and prevent deterioration of groundwater
- Protect, enhance and restore all GW bodies
- Reverse significant and sustained upward trends in anthropogenic contaminant concentrations
- Ensure compliance within 15 years for “Protected Areas” (includes groundwater bodies with abstraction for human consumption >10 m³/d or serving >50 people)

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Some key legislative drivers – 2. Selected national legislation



Town & Country Planning Act, 1990	• Includes contaminated land within framework for new development/change of use
Part 2A, Environmental Protection Act, 1990	• Ensures catching of “significant” sites not dealt with <i>via</i> planning or on another voluntary basis
Environmental Permitting Regulations, 2007, 2010	• Includes permitting of remediation activities
Environmental Damage (Prevention and Remediation) Regulations 2009	• Implements Environmental Liability Directive

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Changes on the way...



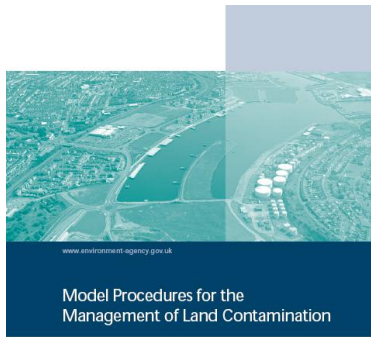
Building confidence

- Guidance
 - “Official”
 - Other authoritative sources
- Collaboration
 - Initiatives
 - R&D
- Experience
 - UK and wider

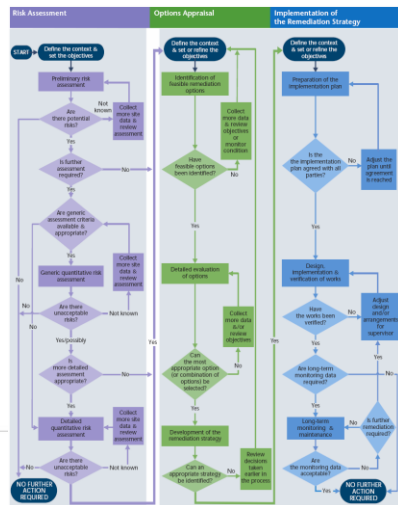
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The core guidance: CLR11 (2004)



Contaminated Land Report 11



A range of specific guidance on assessment and remediation



1996
2006

enhancing... improving... cleaning... restoring...
changing... tackling... protecting... reducing...
creating a better place... influencing...
inspiring... advising... managing... adapting...

Remedial Targets Methodology

Hydrogeological Risk Assessment for Land Contamination

Environment Agency

Guidance on the use of permeable reactive barriers for remediating contaminated groundwater

National Groundwater & Contaminated Land Centre report NC.01/51

M. A. Carey, B. A. Fretwell, N. G. Mosley & J. W. N. Smith*

1993 Publication 113

An illustrated handbook of DNAPL transport and fate in the subsurface

NRWCLC Report: NC/20/09

Review of ammonium attenuation in soil and groundwater

National Groundwater and Contaminated Land Centre

Collaboration



University research

CL:AIRE
CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS



Regional contaminated land groups



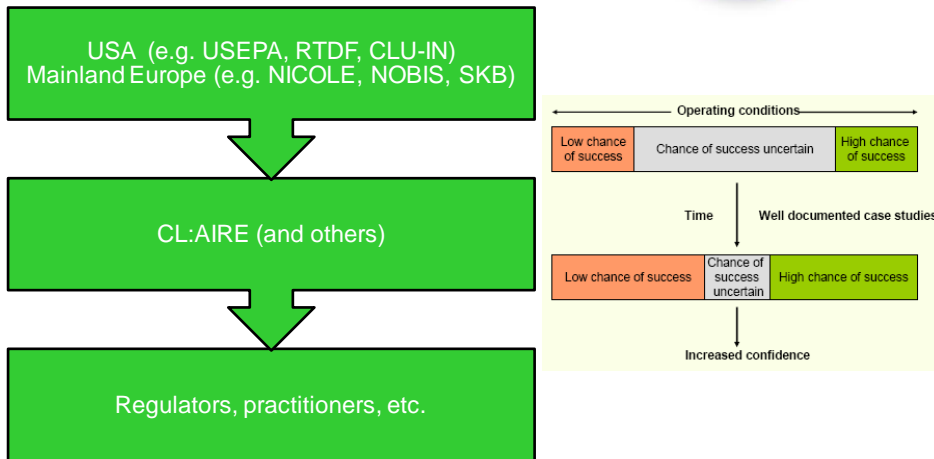
Environment Agency and SNIFER-supported projects



NNAGS
Network on Natural Attenuation in Groundwater and Soil



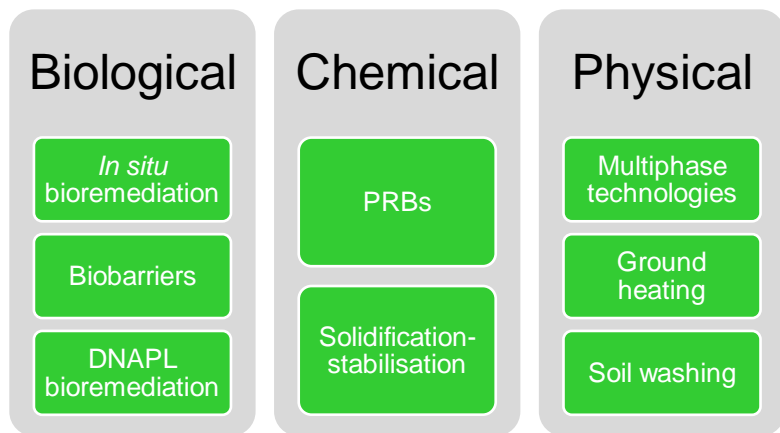
Learning from experience



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Some relevant CL:AIRE remediation demonstration projects



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Linking research and shared experience - MTBE as an example

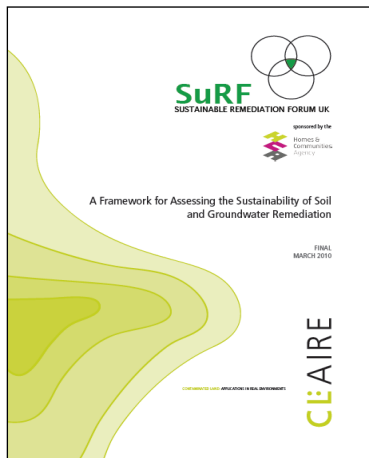


Pre-1980:	MTBE added to unleaded gasoline in USA. Reported in GW soon after and appears recalcitrant.
1994:	MTBE-degrading culture isolated from sludge bioreactor.
1997:	Review states: "MTBE generally resists biodegradation in groundwater".
1998:	Long-term field evidence for biodegradation in groundwater (Borden, Canada)
1998-2001:	Aerobic and anaerobic biodegradation reported in fresh water and sediments.
2000:	Review states: "good evidence that MTBE can be degraded under aerobic conditions" and "promising indications" for anaerobic conditions. First field evidence for MTBE biodegradation in UK Chalk.
2001:	Isotopic fractionation studies of MTBE biodegradation.
2002:	Long-term microcosm studies in Chalk establish acclimation and rates
2008:	Isotopic fractionation shows numerous mechanisms for MTBE biodegradation
2009:	MTBE generally found to biodegrade under most redox conditions in groundwater after acclimation, albeit more slowly than BTEX compounds

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With thanks to Prof. Jonathan Smith, Shell Global Solutions

Moving towards more sustainable remediation



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www.claire.co.uk/surfuk



Money

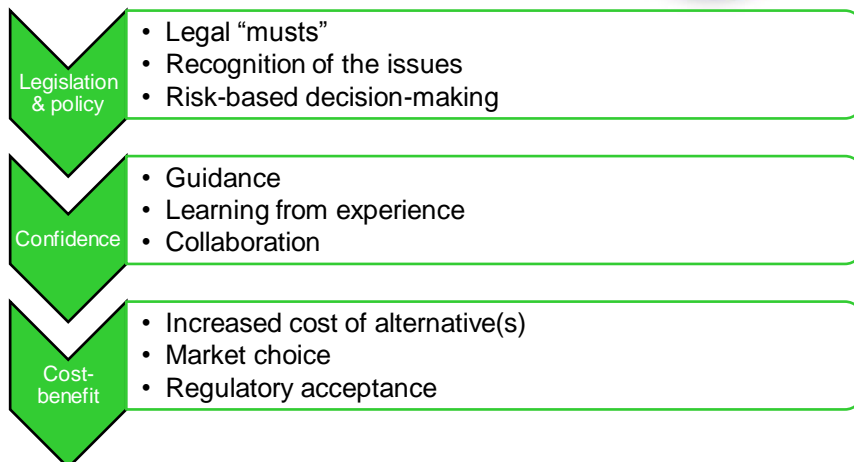
- Remediation = cost
 - Never underestimate the “must do” motivator
- The “good old days” are no longer economically viable
- Engineered groundwater remediation/MNA can be competitive
 - More choice
 - Track record
- Time = money



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Concluding thoughts – 1. Why we are here



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Concluding thoughts – 2. Where are we headed?



Legal & policy

- Changes to planning regime?
- Part 2A statutory guidance update
- Stronger emphasis on sustainability?
- EA/local authority roles?

Technical

- Technology improvements and better integration
- Dealing with rebound
- Interesting "new" contaminants
- Diffuse contamination

Financial

- Impact of policy changes?
- More choice of viable remediation options
- Capital v. operating cost balance
- Liability management?

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And by way of context...



“It is exciting to have a real crisis on your hands, when you have spent half your political life dealing with humdrum issues like the environment.”



Margaret Thatcher

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