Selecting Gentle Remediation Approaches – the SUMATECS project

Professor Andy Cundy
University of Brighton, U.K.
and the SUMATECS team
Plan:

What is “gentle remediation”
What are the barriers to uptake?
The SUMATECS project
Developing decision support systems for selecting gentle remediation approaches
Conclusions
What is “gentle remediation”

Contaminated land remediation or stabilisation using \textit{in-situ} techniques that do not significantly impact soil function or structure, such as phytoremediation, \textit{in-situ} immobilisation, etc.

Subject of intense R&D for a number of years
Scope of SUMATECS study - “Gentle” remediation techniques for trace element contaminated sites (TECS).

<table>
<thead>
<tr>
<th>“Hand” remediation</th>
<th>Phytoextraction</th>
<th>Phytostabilization</th>
<th>Immobilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical soil wash</td>
<td>Plant cultivation dominated by contaminant removal</td>
<td>Plant cultivation not directly aimed at contaminant removal</td>
<td>Plant cultivation aimed at reduction of contaminant transfer into plants</td>
</tr>
<tr>
<td></td>
<td>Strong mobilisation</td>
<td>No mobilisation</td>
<td>Smart immobilisation</td>
</tr>
<tr>
<td></td>
<td>Soft/natural mobilisation</td>
<td>Soft/natural immobilisation</td>
<td>Strong immobilisation</td>
</tr>
</tbody>
</table>

Contaminant cementation

<table>
<thead>
<tr>
<th>Extreme</th>
<th>Very high</th>
<th>High to medium</th>
<th>Medium to low</th>
<th>Low</th>
<th>Very low</th>
</tr>
</thead>
</table>

Plant concentration and contaminant removal
What is “gentle remediation”

Great deal of progress achieved at laboratory or bench scale, plus field pilot scale, but application as practical site solutions still in relative infancy.

Considerable differences in the adoption and promotion of these technologies between different EU member states.
What are the barriers to uptake?

Include:
Timescales required for remediation
Need for long-term site monitoring
Uncertainties in what is bioavailable, and how to measure this

Industry confidence (generic issue for novel in-situ techniques)
What are the barriers to uptake?

A number of (gentle) *in-situ* remediation options are available, and thus some form of decision support is required to allow the user to make an informed decision on which is the most suitable technique(s) for the site requiring remediation or management.

Site management and/or remediation should also be affordable, feasible, effective & sustainable, factors which also need to be built in to the decision support process.
The SUMATECS project

SUMATECS – SUstainable MAnagement of Trace Element Contaminated Soils

The need to further develop decision support systems for selecting gentle remediation approaches, and assess

(a) the use of these technologies as more sustainable remediation tools,

and

(b) the current barriers to their adoption,

has been recognised by the funding of the SUMATECS project (SUstainable MAnagement of Trace Element Contaminated Soils).
The SUMATECS project

SUMATECS – SUsustainable MAnagement of Trace Element Contaminated Soils

Project launched in Oct 2007 under the umbrella of SNOWMAN*

Focussing initially on trace element contaminated sites, the project is undertaking a literature and project-based review (including a country-specific state of the art and current procedures review) to identify the current status of research and application of “gentle” remediation technologies across Europe

* one amongst more than 70 ERA-Nets (European Research Area – Networks) being funded by the European Commission’s 6th Framework programme for Research and Technological Development.
The SUMATECS project

SUMATECS – SUsustainable MAAnagement of Trace Element Contaminated Soils

General aims:

(i) To derive or recommend decision support systems and remediation scenarios (which include verification, and analysis of environmental, economic and social impacts); and

(ii) define further research needs and priorities
The SUMATECS project

Review of current gentle remediation techniques

Methods for assessing bioavailability

Environmental and socio-economic aspects

Sustainable management strategies

Development of decision-support systems

Summary of future research needs and priorities
Developing decision support systems for selecting gentle remediation approaches

Literature review and critical analysis of existing decision support systems, in terms of their application to “gentle” remediation technologies

Project questionnaire, to assess stakeholder opinions and needs

*Are current tools fit for purpose?*

*What input parameters / site knowledge (e.g. depth and type of contamination, local geology, depth to groundwater) do we need for a workable decision-making tool?*
Developing decision support systems for selecting gentle remediation approaches

e.g. in UK, CLR-11 (Model Procedures for the Management of Land contamination) provides a systematic decision support tool, with good cost-benefit analysis BUT little on selection criteria for gentle remediation techniques

<table>
<thead>
<tr>
<th>REMEDIATION OPTION APPLICABILITY MATRIX: INORGANIC SUBSTANCES AND EXPLOSIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remediation options</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td><strong>CIVIL ENGINEERING METHODS</strong></td>
</tr>
<tr>
<td>Containment - overpumps</td>
</tr>
<tr>
<td>Containment - hydraulic barriers</td>
</tr>
<tr>
<td>Containment - inground barriers</td>
</tr>
<tr>
<td>Excavation and disposal</td>
</tr>
<tr>
<td><strong>BIODIGESTIVE METHODS</strong></td>
</tr>
<tr>
<td>Natural attenuation</td>
</tr>
<tr>
<td>Bioremediation</td>
</tr>
</tbody>
</table>
Developing decision support systems for selecting gentle remediation approaches

Initial results from questionnaire survey indicates lack of stakeholder knowledge both on potential and application of gentle remediation methods, and of decision support tools that can be used to support gentle remediation approaches.

Tools need to be easy to use, incorporate sustainability measures, and consider potential use of gentle remediation technologies as part of integrated site solutions i.e. in combination with other methods, using zoned approach?

Longer-term work focussed on producing “bolt-on” tool to be run in conjunction with CLR-11 and existing national decision support tools / frameworks
Conclusions

Gentle remediation technologies can form part of sustainable, affordable and effective site clean-up, in combination with other more traditional methods.

Many current barriers to uptake are similar to other *in-situ* technologies.

Project results expected end October 2008 – disseminated via web portals, journal papers and trade articles…etc.

www.rhizo.at/Sumatecs
Acknowledgements

SNOWMAN-ERANET programme for project funding, and the U.K. Environment Agency (UK) for detailed discussions and advice

Project Consortium
BOKU - University of Natural Resources and Applied Life Sciences (AT)
Austrian Research Centers GmbH – ARC (AT)
Hasselt University (HAU) (BE)
Luleå University of Technology (SE)
Saxon State Agency for Environment and Geology (DE)
Ruhr-University Bochum (RUB) (DE)
INRA (Institut National de la Recherche Agronomique) (FR)
INERIS (Institut National de l’Environnement industriel et des RISques) (FR)
INERTEC (FR)
Université de Technologie de Compiègne (FR)
University of Brighton (UK)
Czech University of Life Sciences Prague (CZ)
UniFi (University of Florence) (IT)