

UK Approach to the Risk Assessment and Risk Management of Contaminated Sites

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UK Approach - outline of talk

- Background to legislation/regulation and scale of problem;
- General approaches taken;
- Tools available;
- Current situation;
- Future issues.



UK Legislative Framework

- water management legislation implemented from early 1960's and (ground)water protection, from the waste disposal angle, from 1970's,
- No legislation until 2000 on the remediation of historical pollution of land;
- Drivers have been: landfill gas; concerns over liability, and redevelopment pressures.
- The land-use planning system (since 1948) remains an important controlling mechanism:
 - the large majority of remediation schemes will still be undertaken on a **voluntary** basis, through the redevelopment of brownfield sites - planning conditions are the regulatory control mechanism.

Regulation and Incentives

- 300+ Local Authorities have the lead role;
 - identification of Contaminated Land and Local Planning Authority
- Environment Agency consultee of LAs and undertakes regulation of "special sites";
- Government target of 60% of new development to be on brownfield sites;
- £21 million/a Capital Programme for remediation of problem "orphan sites"
 - mostly undertaken by LAs (10% by Env Agency)
 - Agency vets bids from LAs for government

State of Contaminated Land

- Midlands and N-West England cradle of industrial revolution:
 - 250 years of historical pollution legacy as a result.
- There has been no national survey of contaminated land in the UK.
- Estimates vary widely for England and Wales:
 - from 50 000 to 300 000 hectares,
 - relating to 100 000 sites.
- Of these, between 5 to 20% may be considered to be problem sites, (i.e. they require some form of work to make sure that they don't pose an unacceptable risk to human health or the environment.)



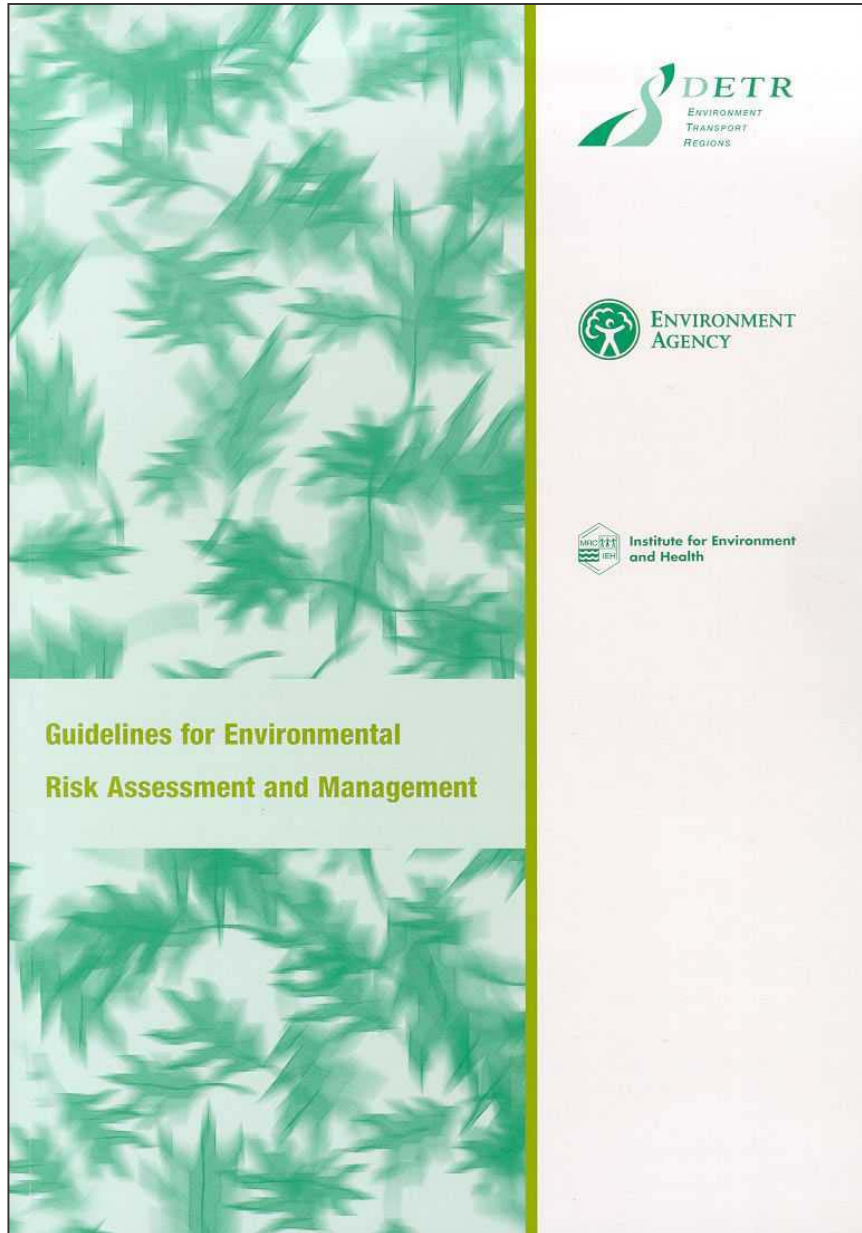
Soil & Groundwater Pollution

- We now know that most sites that manufacture, store, handle or use chemicals will have associated groundwater/soil contamination and;
- All sites that use organic liquid chemicals will have groundwater pollution under them - to a greater or lesser extent.
- But.... how serious is the threat?
- Does it justify high expenditure to protect from on-going pollution and to clean-up?
- Is a universal approach justified?



Risk-Based approaches are necessary because:

- It's a huge potential problem - very many activities have the potential to affect soil and groundwater and many places are already polluted;
- We do not have the resources (money or people) to deal with everything at once;
- There is huge technical and scientific uncertainty about the sub-surface environment;
- In addressing the need for, and scale of, action to be taken the text in UK legislation refers to:
 - "the significant possibility of significant harm";
 - "take account of sustainability and cost benefit".



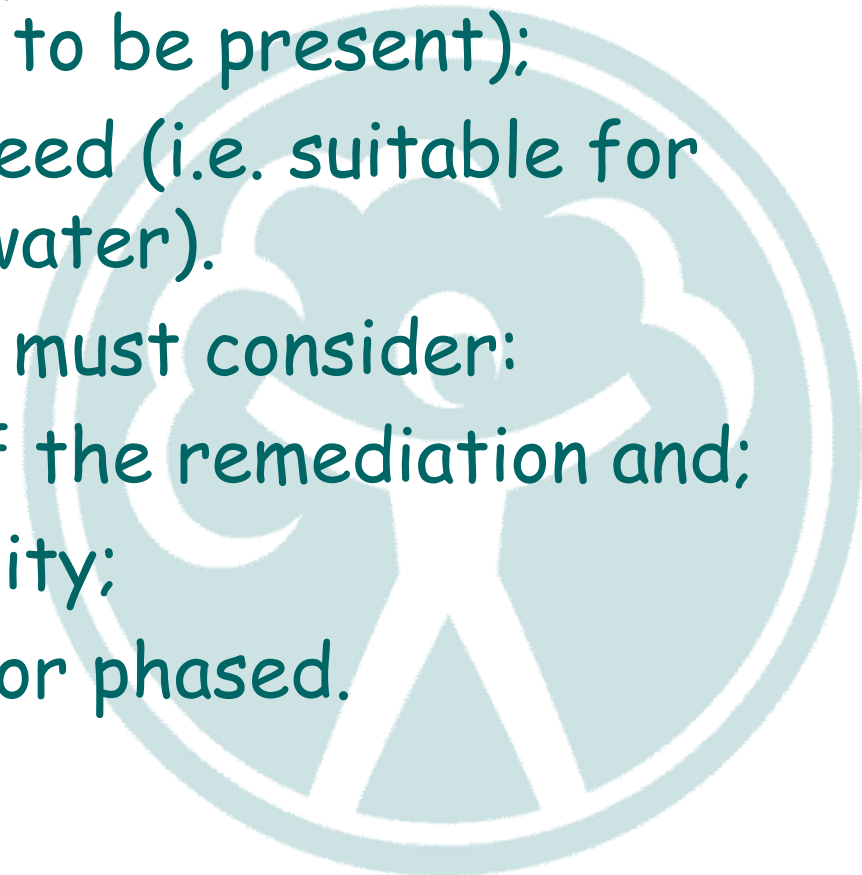
**Guidelines for Environmental
Risk Assessment and Management**

**Generic Guidelines
for Environmental
Risk Assessment and
Management are set
out in joint
Environment
Agency/Government
document -
"Green Leaves 2"**

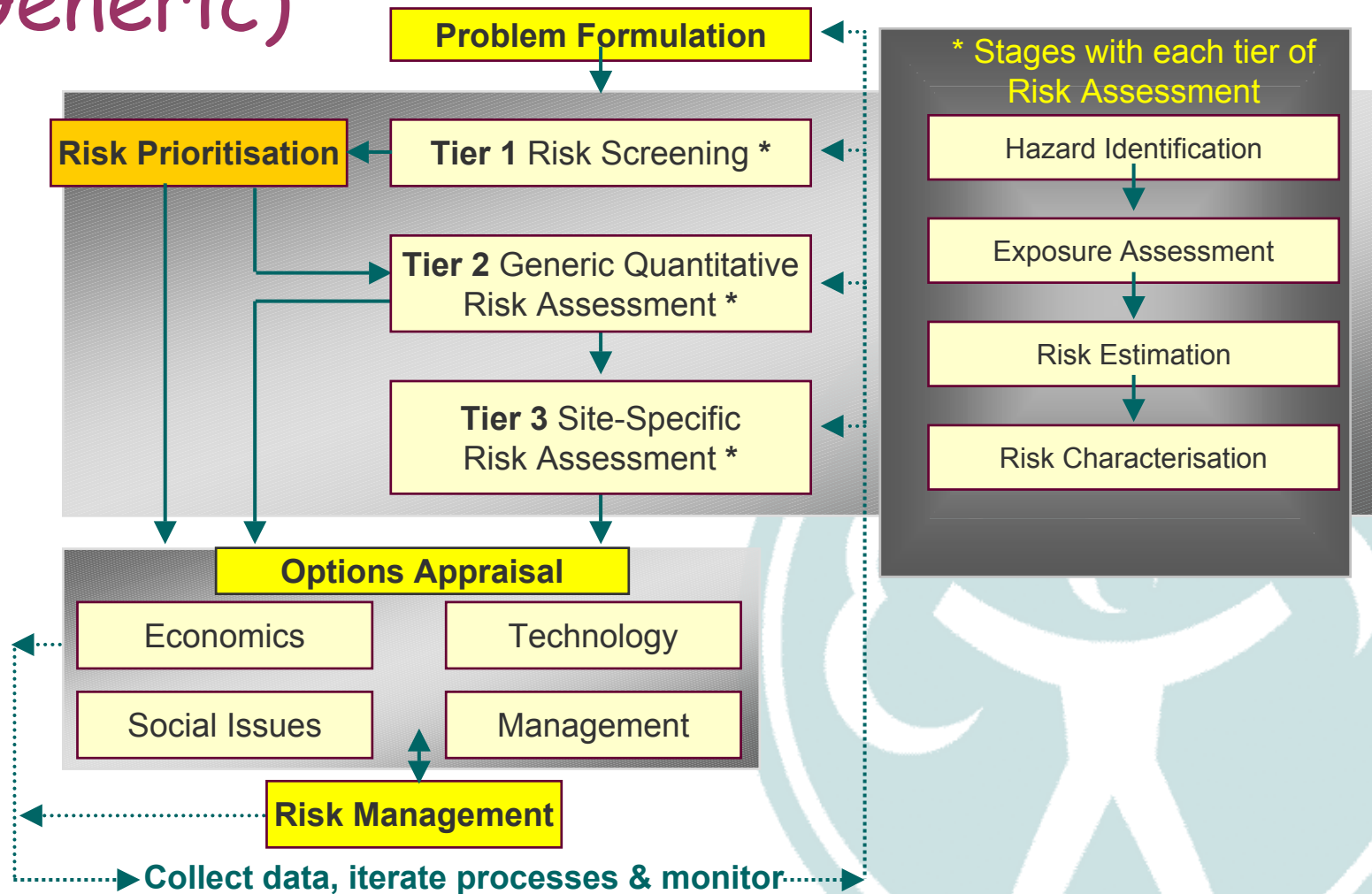


Outline UK Approach to Remediation of Soils & Groundwater

- Risk-based approach centred on:
 - **source-pathway-receptor** (a **significant pollutant linkage** has to be present);
 - remediation fit for need (i.e. suitable for **current** use of land/water).
- Remediation objectives must consider:
 - costs and benefits of the remediation and;
 - the technical feasibility;
- The approach is tiered or phased.



Environment Agency Tiered Approach (Generic)



Risk Assessment should be Phased



Phase 1a

Hazard identification

Phase 1b

Hazard assessment

what's the problem?

Phase 2

Risk estimation &
risk evaluation

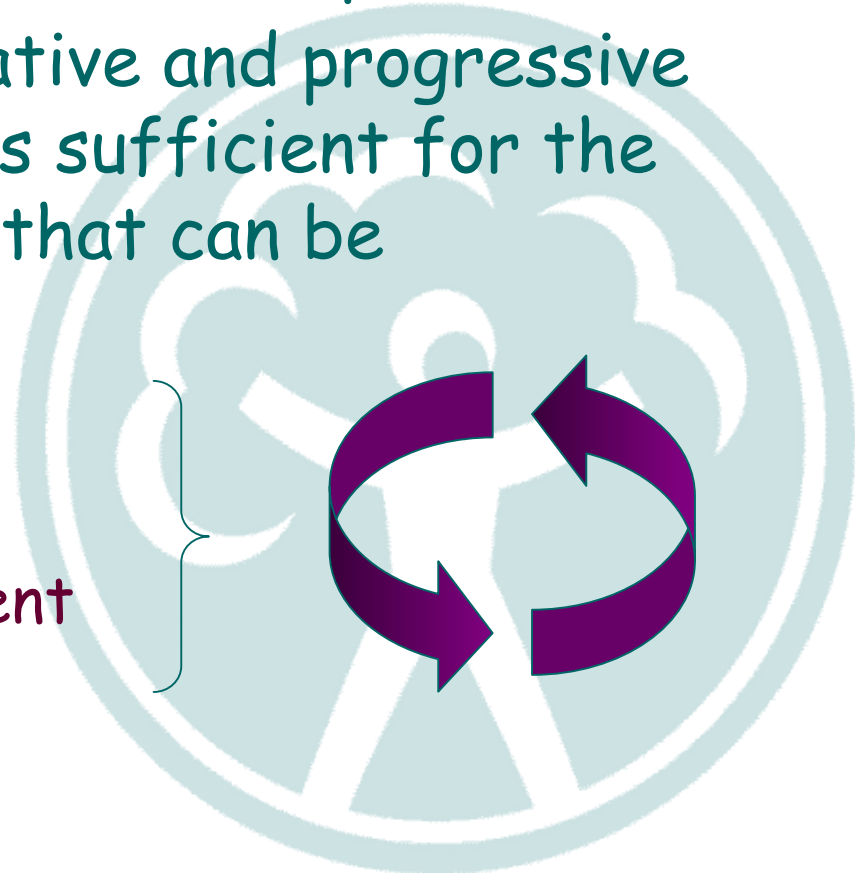
so what?



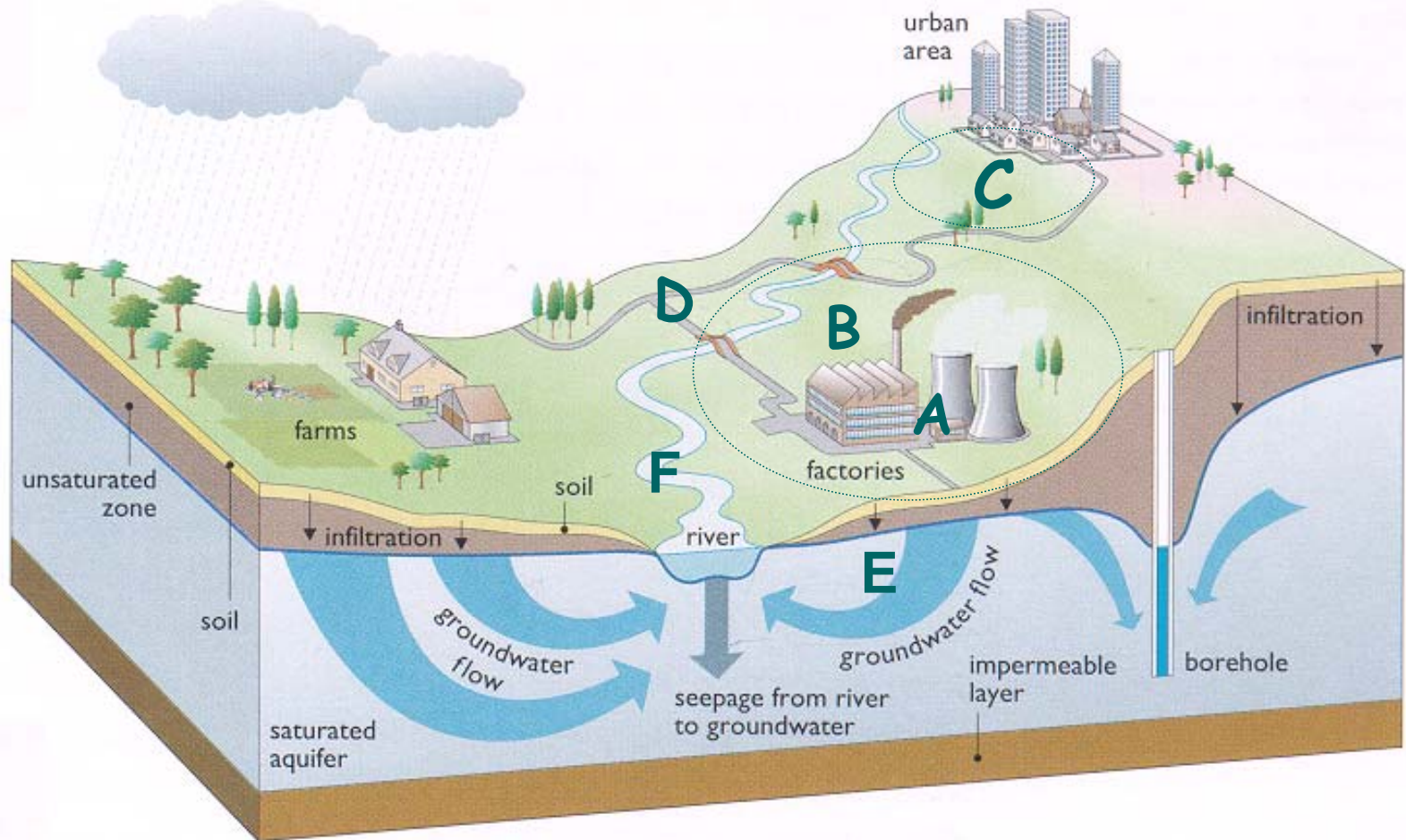
Hazard Identification & Assessment

e.g. site characterisation

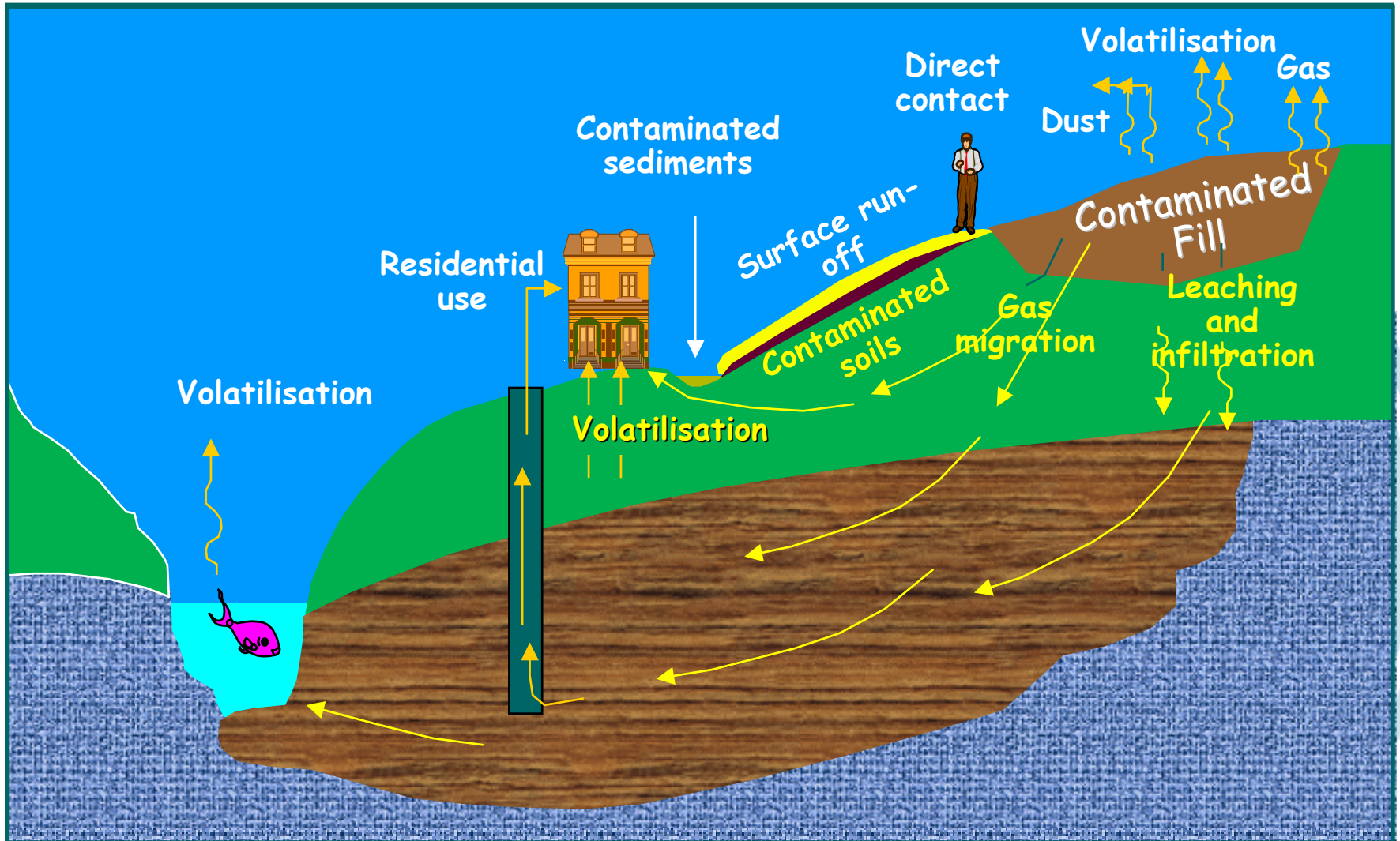
- An holistic and integrated approach will help reduce uncertainty to acceptable levels and allow the next stage of risk assessment to proceed;
- The process should be iterative and progressive until the conceptual model is sufficient for the next stage (often the best that can be afforded). It involves:
 - Objective setting
 - Information gathering
 - Conceptual Model development
 - Model testing/validation



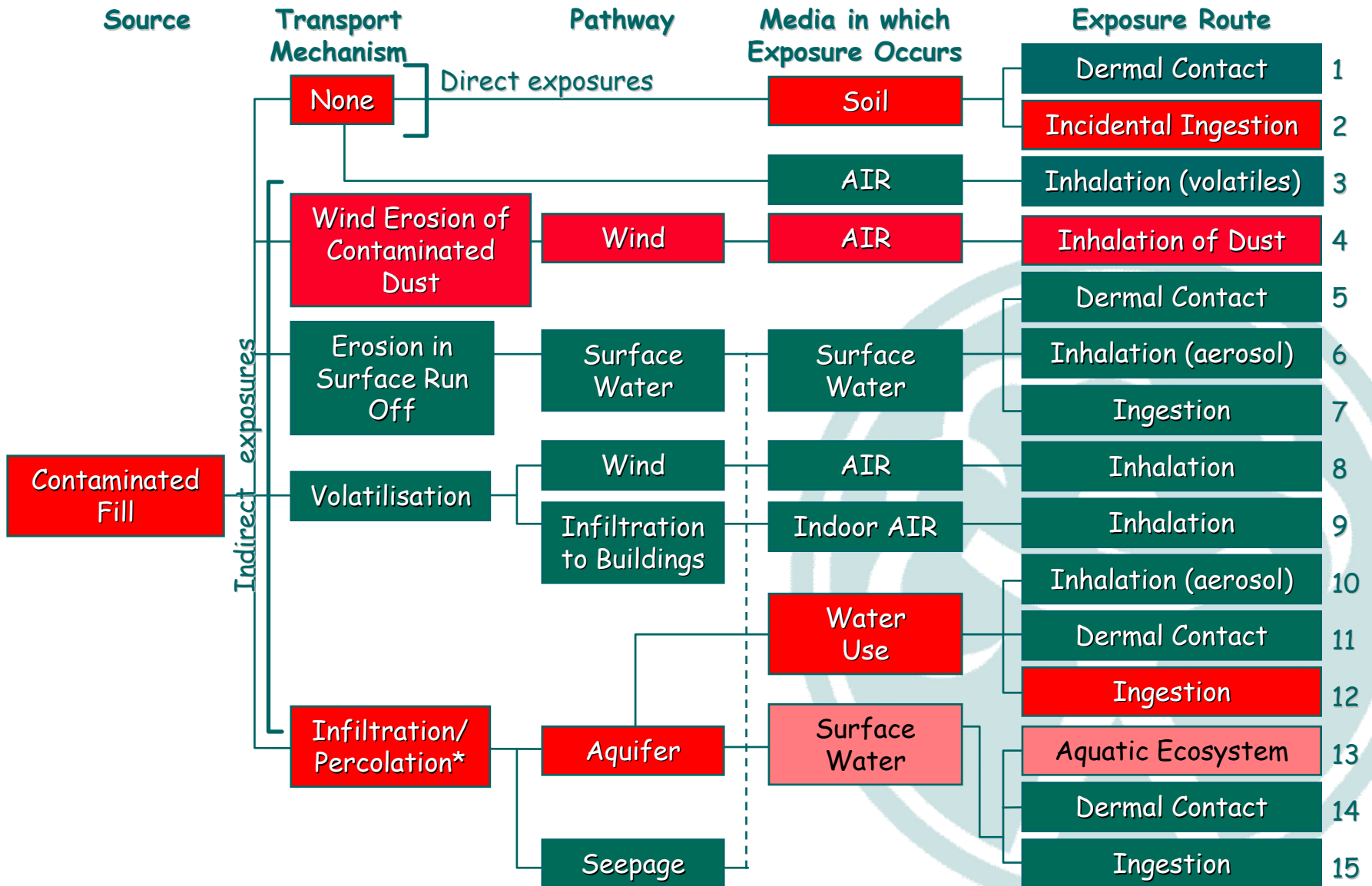
Contextual Conceptual Model



Conceptual Model: sources, pathways and receptors

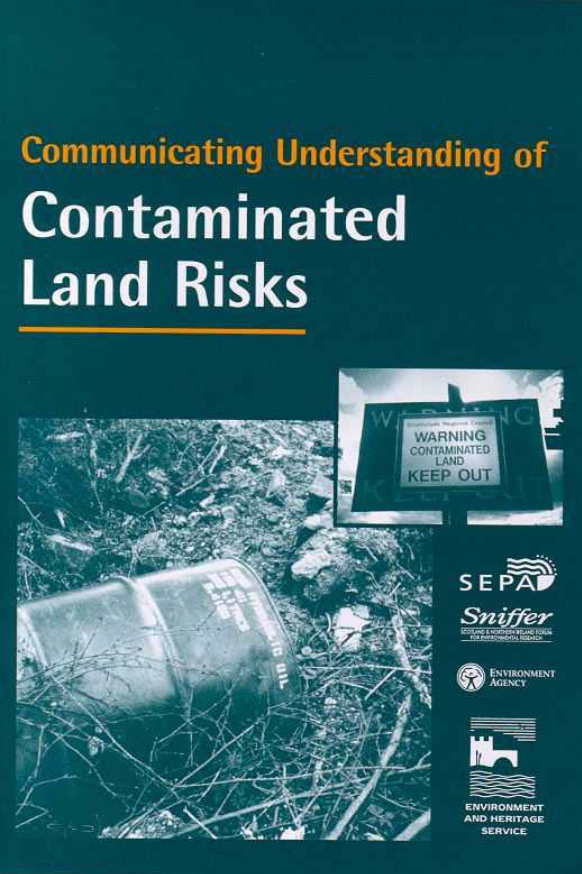


Formalised Conceptual Model - what are the possible significant pollutant linkages?



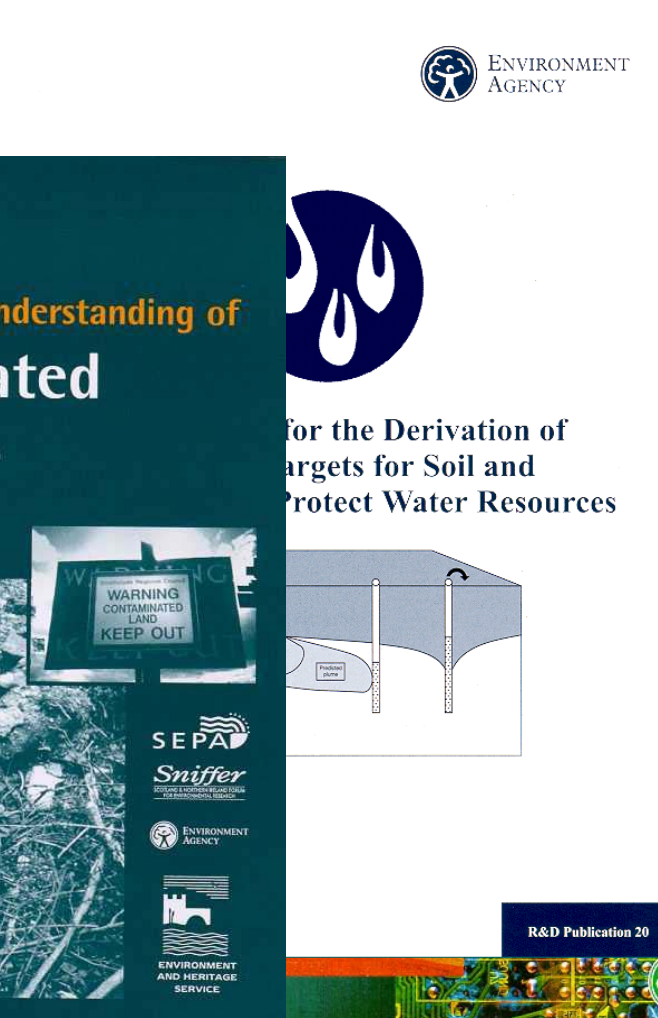
Using tools to access risks for each pollutant linkage

Communicating Understanding of Contaminated Land Risks



SEPA
Sniffer
Soil & Groundwater Data Measurement Network
ENVIRONMENT AGENCY
ENVIRONMENT AND HERITAGE SERVICE

ENVIRONMENT AGENCY



Guidance for the Derivation of Targets for Soil and Protect Water Resources

ENVIRONMENT AGENCY
SEPA
Sniffer
Soil & Groundwater Data Measurement Network
ENVIRONMENT AGENCY
ENVIRONMENT AND HERITAGE SERVICE

R&D Publication 20

DEFRA
Department for Environment, Food & Rural Affairs

ENVIRONMENT AGENCY

Land Exposure Assessment
Technical basis and algorithms

Golder Associates



nsim

CLR 10

ENVIRONMENT AGENCY

Deriving Site-Specific Remedial Objectives

Desk Study & Site Investigation

Identify Source-Pathway-Receptor linkages and develop Conceptual Model

Human Health exposure assessment

Environmental Impact Assessment (Water Resources)

Impact Assessment on Air Quality, Buildings, Ecology

Human toxicology data

Environmental Standard

Relevant standard?

Site-specific assessment

CLEA Guideline Values and site-specific model

Site-specific assessment

Integrated Methodology for the Derivation of Remedial targets for Soil and Groundwater to Protect Water Resources & ConSim

Site-specific assessment

Remedial Target

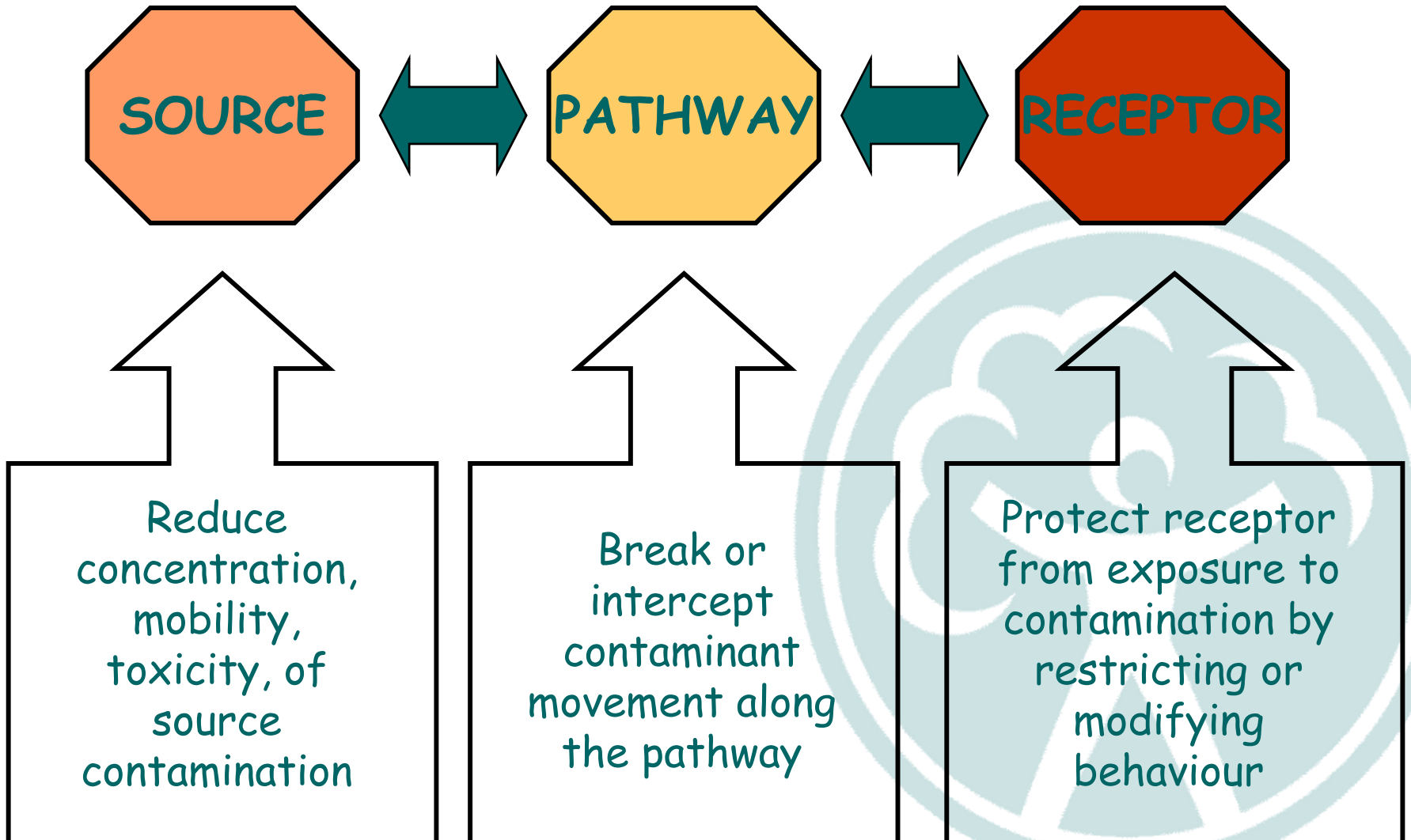
Remedial Target

Other Remedial Targets based on risk to air quality, plants, buildings etc

Decision making based on risk to individual receptors (comparison of Remedial Target for each S-P-R linkage), and taking into account likely costs and benefits, sustainability, technological limitations and mitigating factors (Options Appraisal)

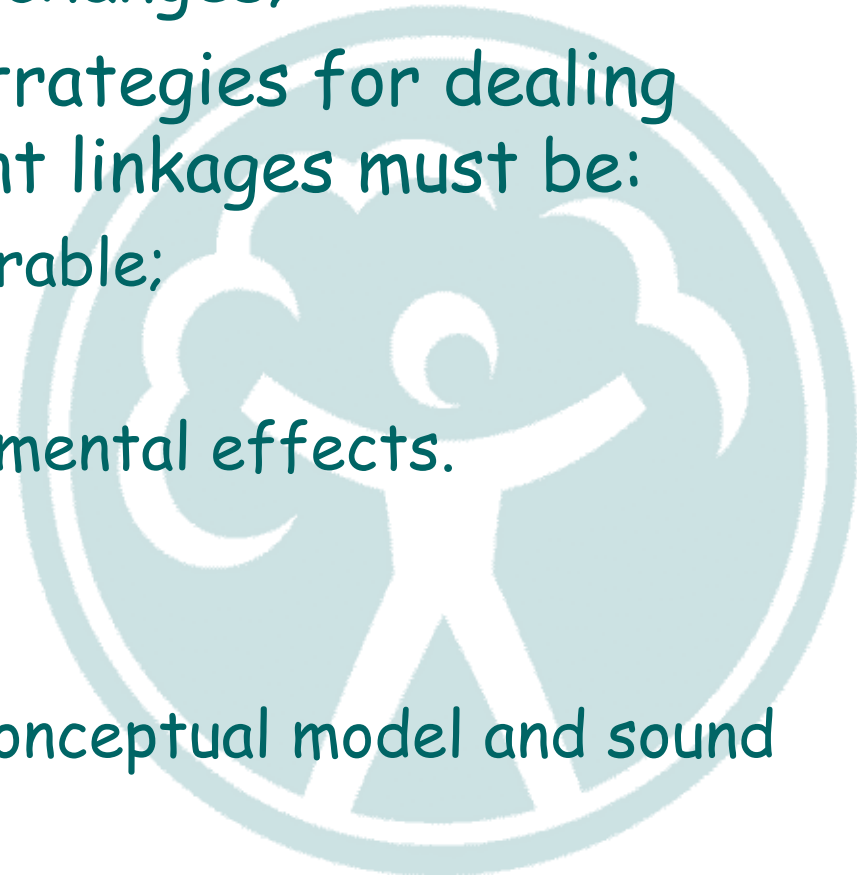
Remedial Objective(s)

Risk Based Remediation



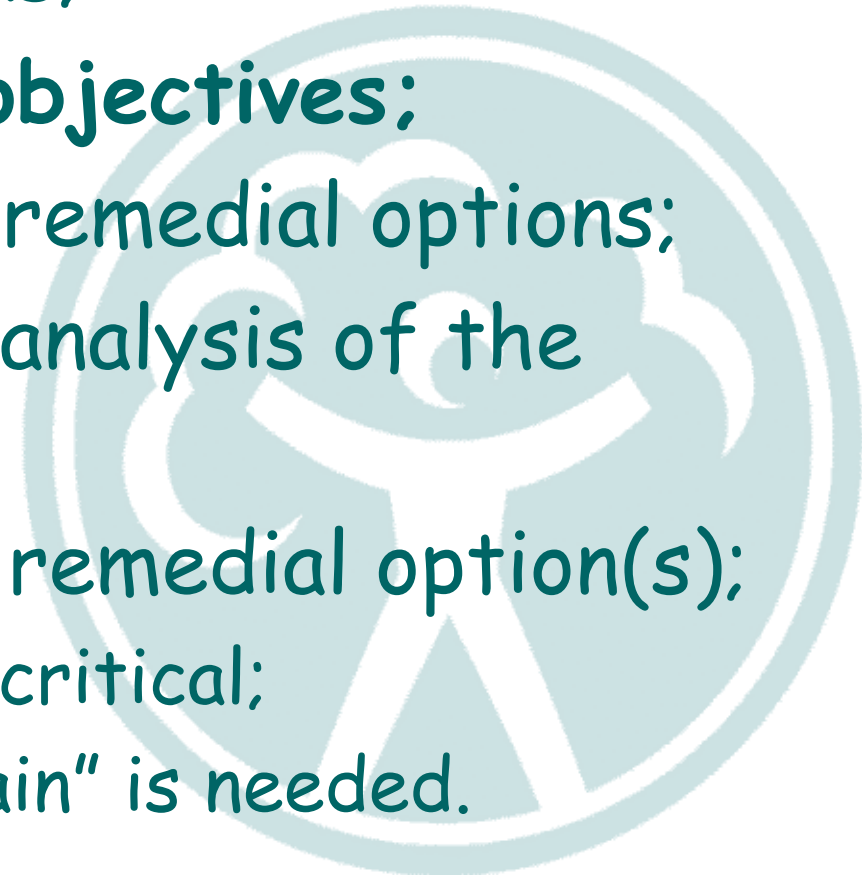
Risk-Based Remediation

- 90% of clean-up still dealt with by “dig & dump”, “cover & contain” or “pump & treat” in UK at present.
- The new legislation brings changes;
- Risk-based site-specific strategies for dealing with all significant pollutant linkages must be:
 - Effective, practical and durable;
 - Cost effective and;
 - Consider the wider environmental effects.
- Decisions must be:
 - clearly documented and
 - based on good data, best conceptual model and sound science.



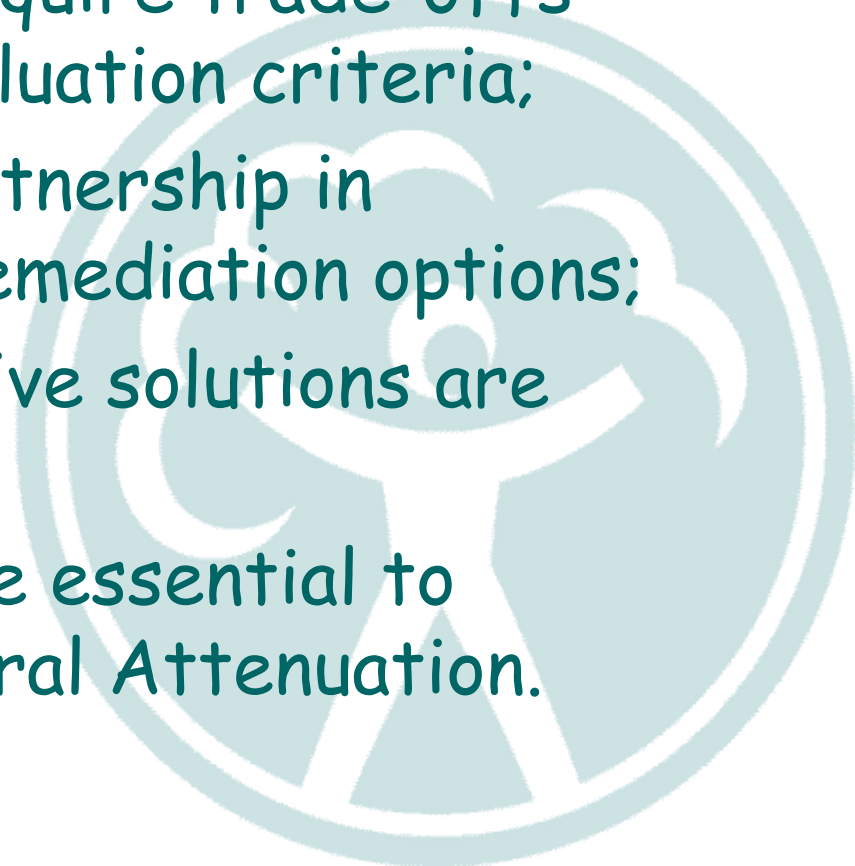
Evaluation and Selection of Risk Management Options

- Agree the data, the conceptual model and the evaluated risks;
- **Agree the remedial objectives;**
- Screen and short list remedial options;
- Undertake a detailed analysis of the short-listed options;
- Select the preferred remedial option(s);
 - source management is critical;
 - often a "treatment train" is needed.



Risk Management Summary

- Remedial strategies are developed on a site specific basis;
- Selection process may require trade-offs between a number of evaluation criteria;
- Stakeholders work in partnership in developing appropriate remediation options;
- Sustainable; cost-effective solutions are considered best;
- For groundwater it will be essential to promote Monitored Natural Attenuation.



Monitored **N**atural **A**ttenuation is at one end of a spectrum of related remedial options and should be seen as simply part of a continuum in a range of options, not the "ultimate solution".



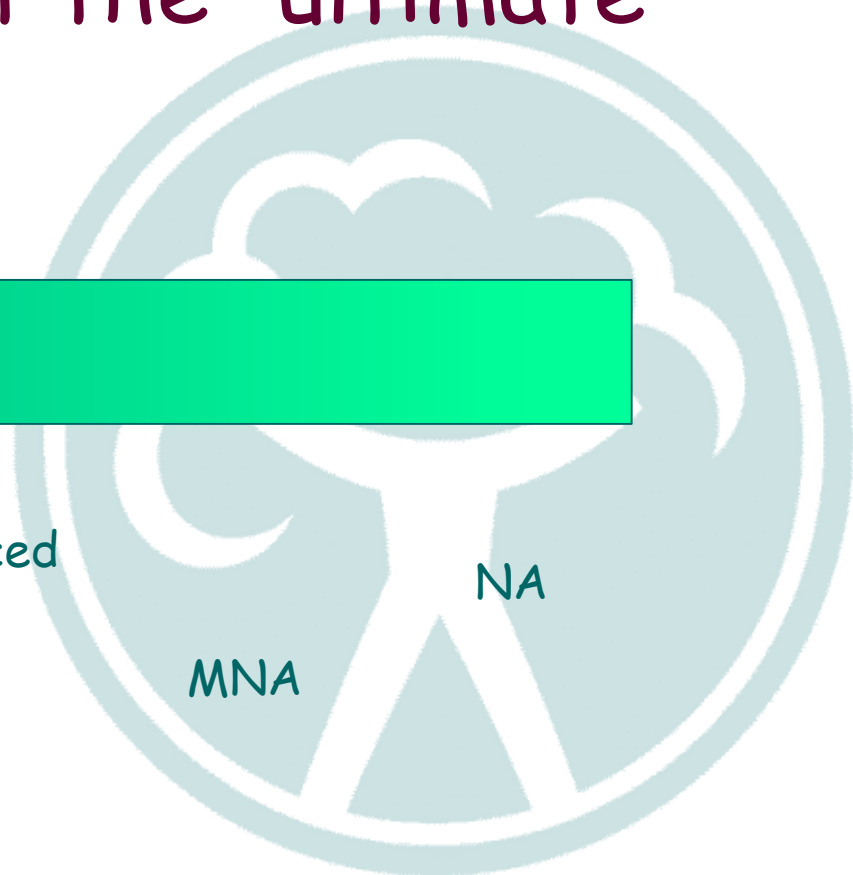
ex-situ
bioremediation
(& sewage
treatment)

in-situ
bioremediation
(& landfill)

enhanced
MNA

MNA

NA



However, MNA as a single option for the remediation of groundwater and soil may not suit for many reasons:

- long timescale;
- political/public acceptability (education issue);
- immediate risks (receptor being impacted);
- logistics (inability to monitor);
- inapplicability/uncertainty (recalcitrant pollutants);
- etc



It should be considered in the overall context of RBLM - "risk-based land management". Adopting it as a whole or part remedial solution has attractions because of:

- economic/cost benefit reasons;
- sustainability reasons;
- minimal disruption and;
- reducing on-going pollution.

Continuing pollution from existing/new land use is inevitable - use the concept of existing natural biotreatment systems to help locate polluting industries/activities? - i.e. keep brownfield sites for brownfield industries.

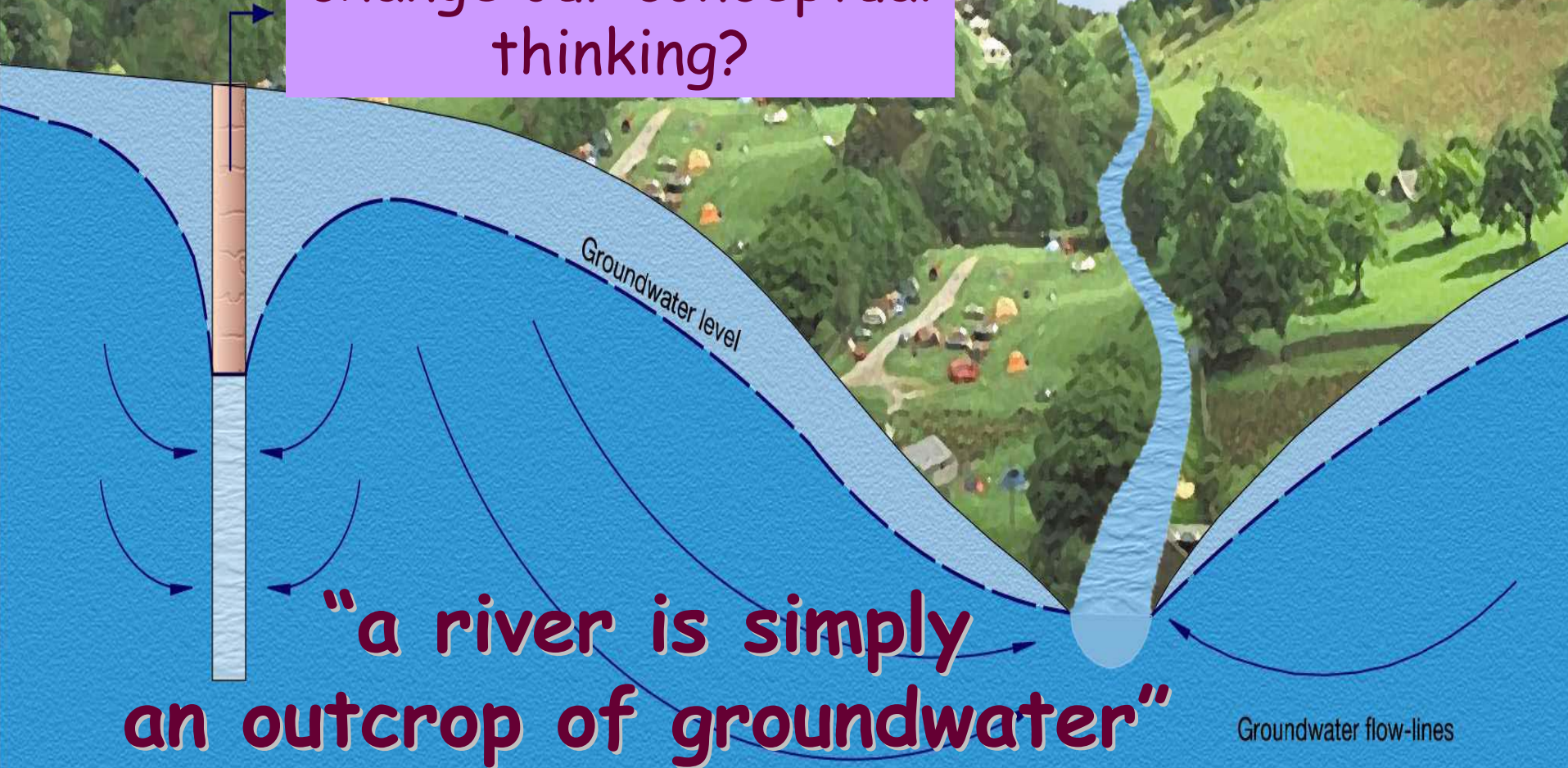


Water Framework Directive

- Modern **risk-based** Directive that requires Member States to achieve good status for surface & groundwater;
- the overall driver is "good ecological status" for rivers;
- we therefore have to understand how river basins work in a more holistic way - changing our conceptual models?;



.....do we need to
change our conceptual
thinking?



**"a river is simply
an outcrop of groundwater"**

Water Framework Directive

- Modern risk-based Directive that requires Member States to achieve good status for surface & groundwater;
- the overall driver is "good ecological status" for rivers;
- we therefore have to understand how river basins work in a more holistic way - changing our conceptual models?;
- needs to be considered within the context of the whole river basin (i.e. land, groundwater, wetlands, lakes and rivers);
- May act as a driver for contaminated land remediation



In Conclusion -the UK approach is:

- A tiered/staged approach to risk assessment based on "fit for current use";
- Focus on critical issues; conceptual models are key;
- Encourages the appropriate use of quantitative risk assessment; no generic clean-up standards.
- Requires justification of approach & content; assessments should be auditable and accessible to other audiences;
- We've been doing "clean-up" for a long time but are just at the beginning of the "professional" approach - it will be a long road!