Future In-Situ Groundwater Remediation Trends in EMEA

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GQ 19
Groundwater Quality 2019

The business of sustainability

ERM

Agenda Slide

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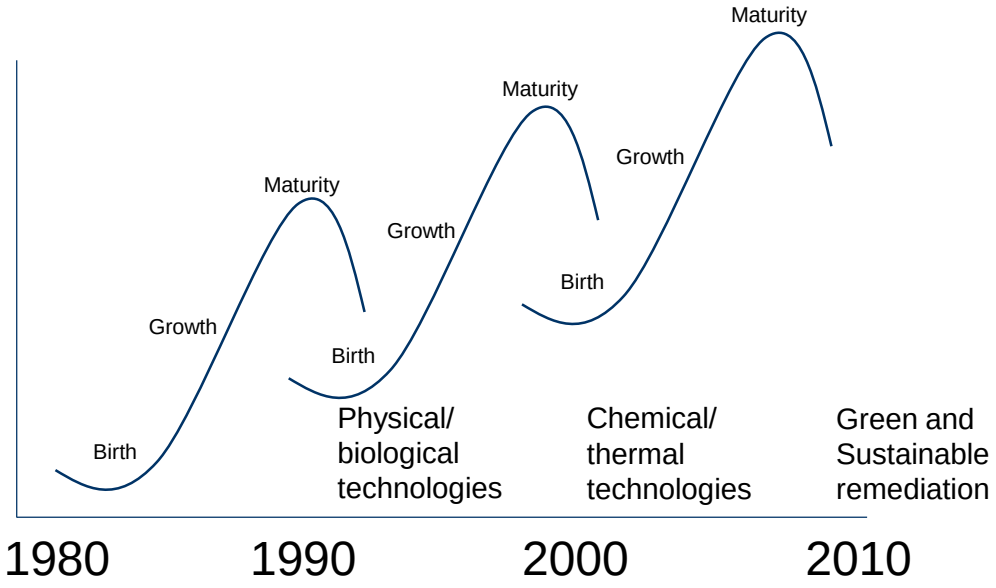
Background


Maturity
Maturity
Maturity
Growth
Growth
Growth
Birth
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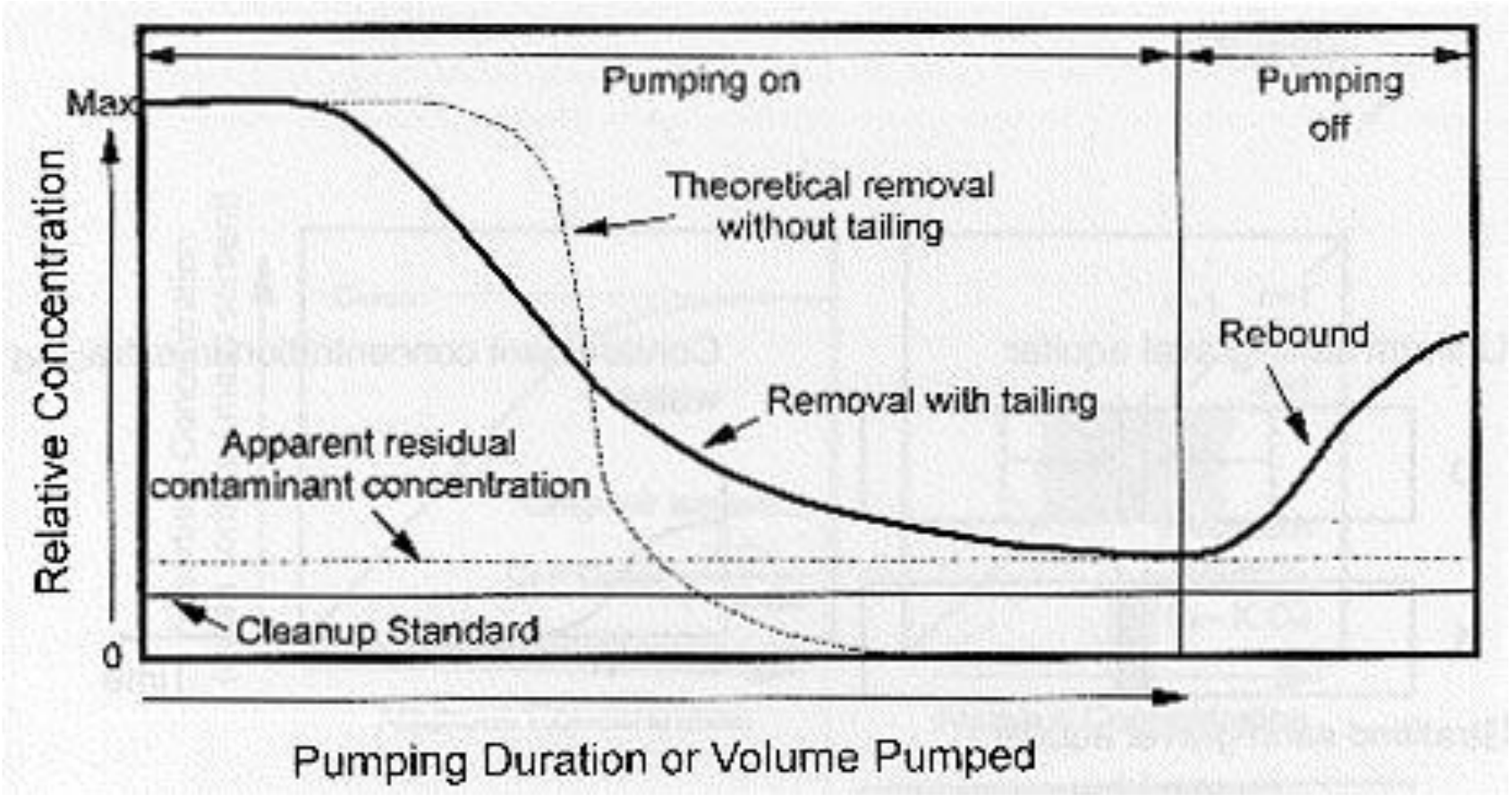
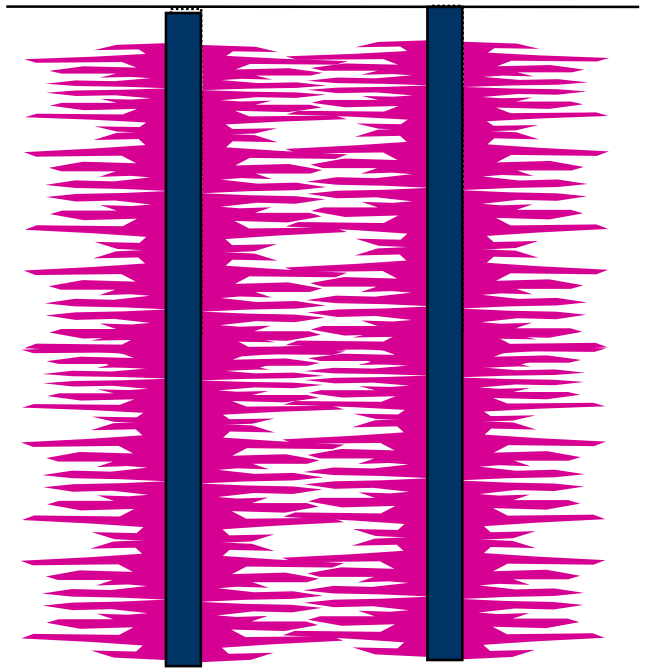
Birth
Physical/ biological technologies
Chemical/ thermal technologies
Green and Sustainable remediation
1980
1990
2000
2010

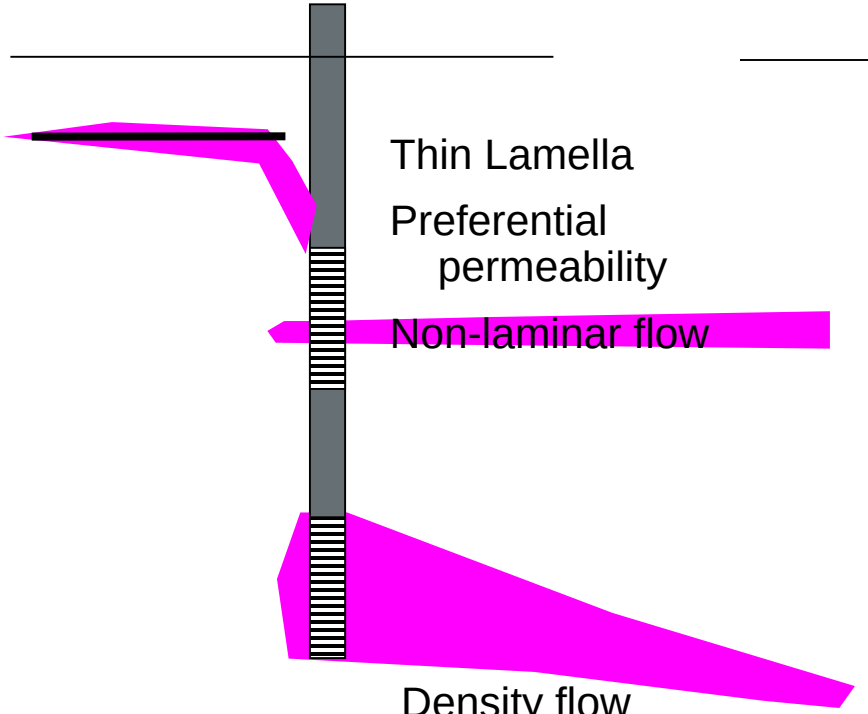
Physical Technology Limitations

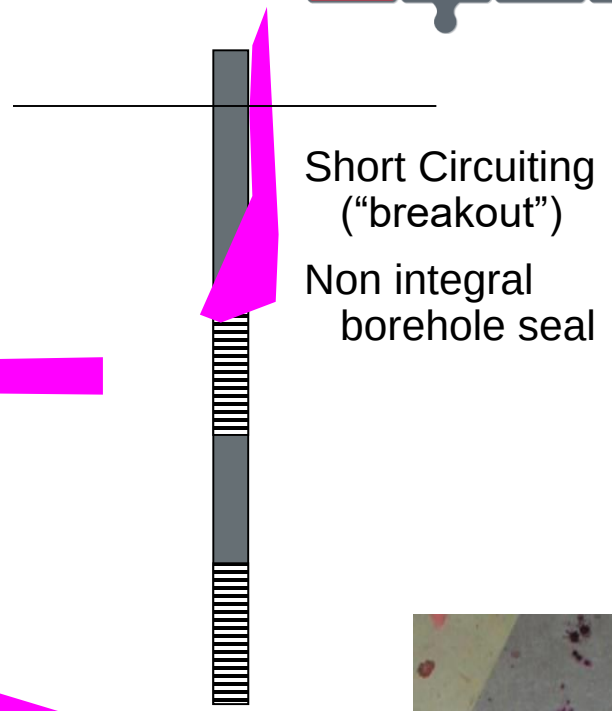


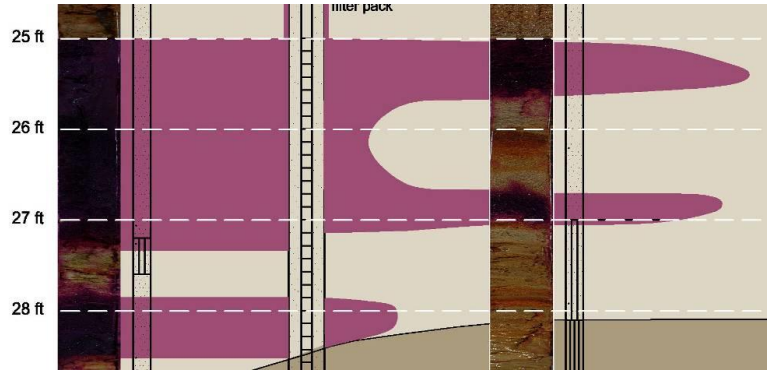
Methods for Monitoring Pump and Treat Performance, Cohen et al, 1994

Injection Technology Limitations









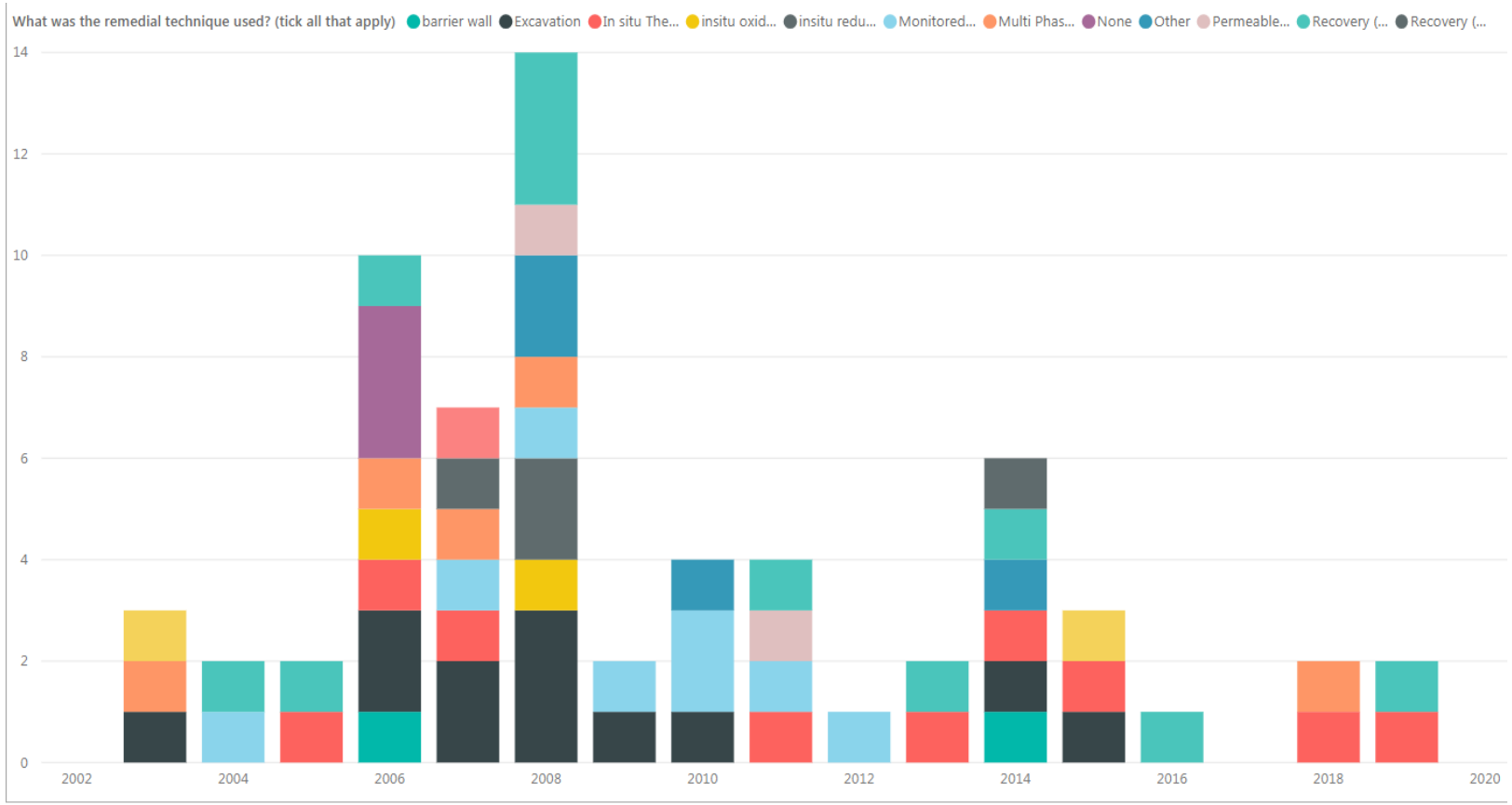
Growth of Thermal

- **Technologies: Increasing Thermal Application – why?**
  - **Technology Basis:** Unlike any fluid or physical based injection/extraction technique, the suite of heating technologies available does not rely on direct contact
  - **Application:** Applied correctly, rebound at thermal sites has been not been shown to be significant where evaluated
  - Rapid and predictable performance

Methodology to Predict Future Trends

- Internal discussions
- Client outreach
- Business drivers and changing regulatory frameworks have also been considered
- Review of remedial technologies used at multiple ERM sites over the last two decades in Europe
- Examine historical data to help predict future trends

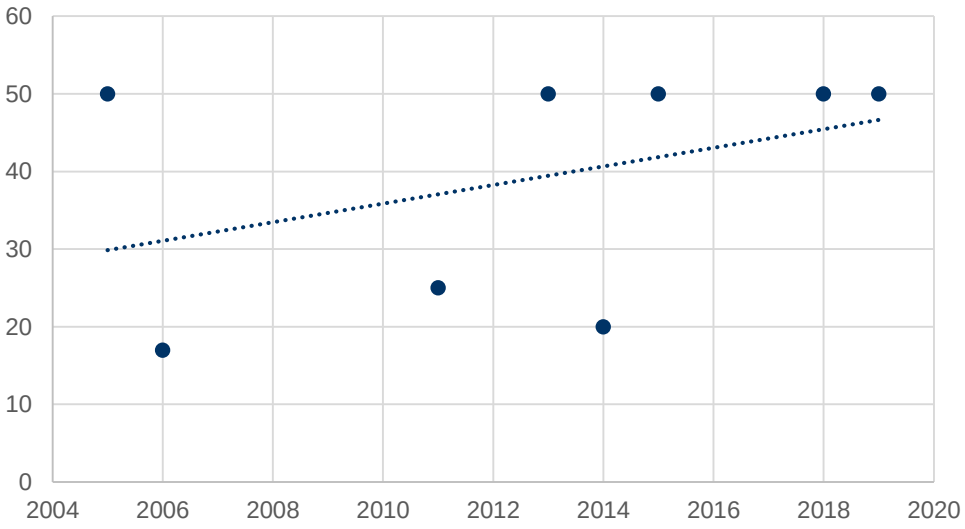
In-Situ Remedial Technologies Trends



- UK examples (for NAPL)
- Smaller number of sites, but typically larger more complex issues
- Range of technologies used declining but combinations more frequently used
- More aggressive technologies applied in recent years reflects this complexity and business drivers

Changes in Remediation Drivers

Technology selection influenced by technical characteristics, but also business drivers. Two categories:



Site Closure

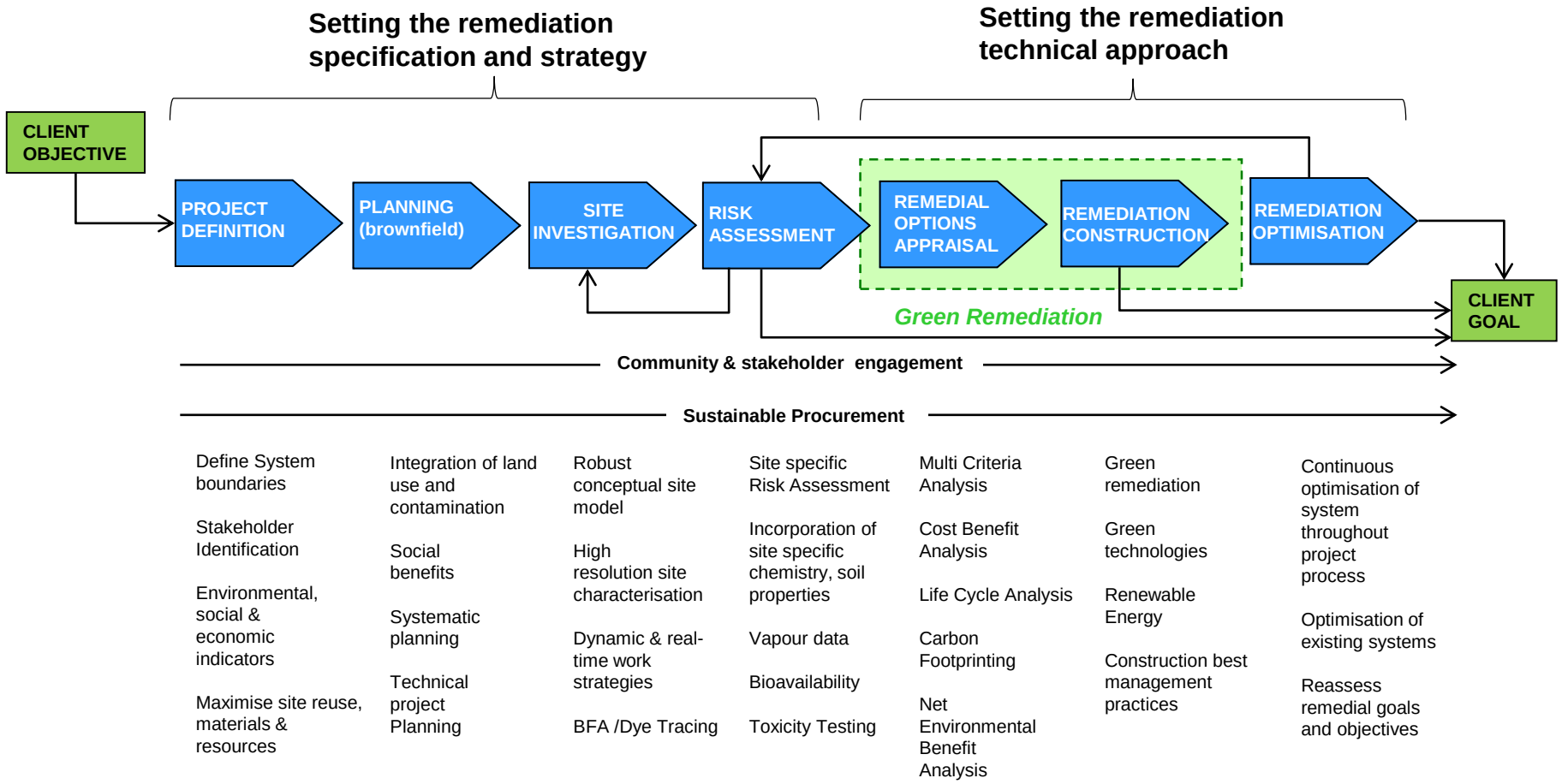
- **Rapid Site Closure:** Site divestiture
- **Permit Surrender:** Does baseline data exist? If not, remedial end goals therefore tend to be stringent

On-going operational sites

- Remediation has traditionally meant deployment of low annual cost, long term approaches
- Still the case at some sites, at others a change towards one off source treatment programmes versus continued annual spend over several decades (reduction in long term reserves)

Future Trends?

Sustainable/Green Remedial Design

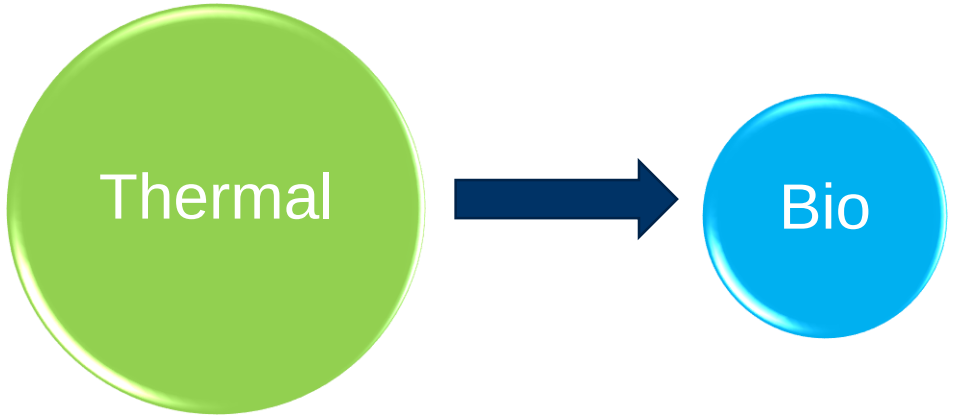


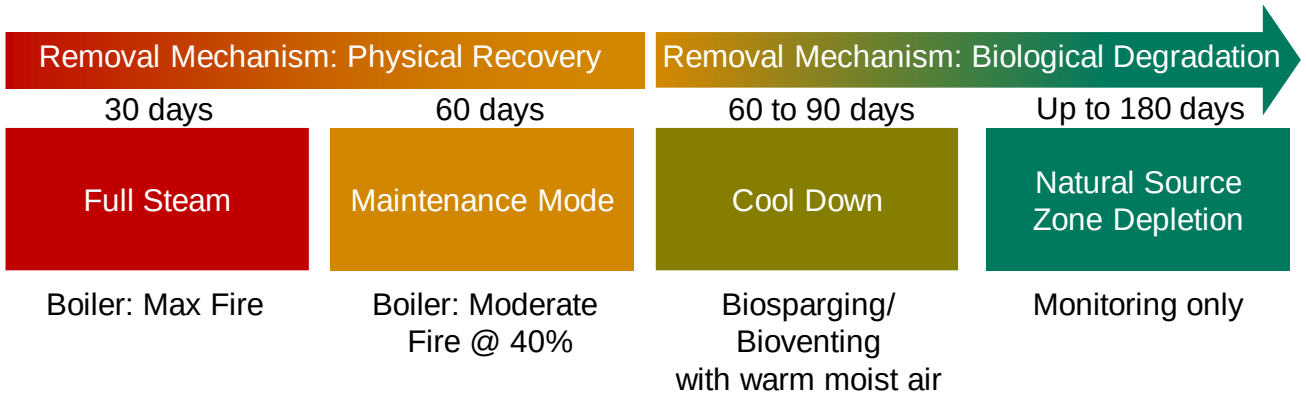
Examples of activities that can help deliver a sustainable solution

Technology Advances

- Brand new technologies not being developed
- High cost/risk of innovation
- Low cost, low risk incremental improvements
- Same technologies – different contaminants
- Combinations:

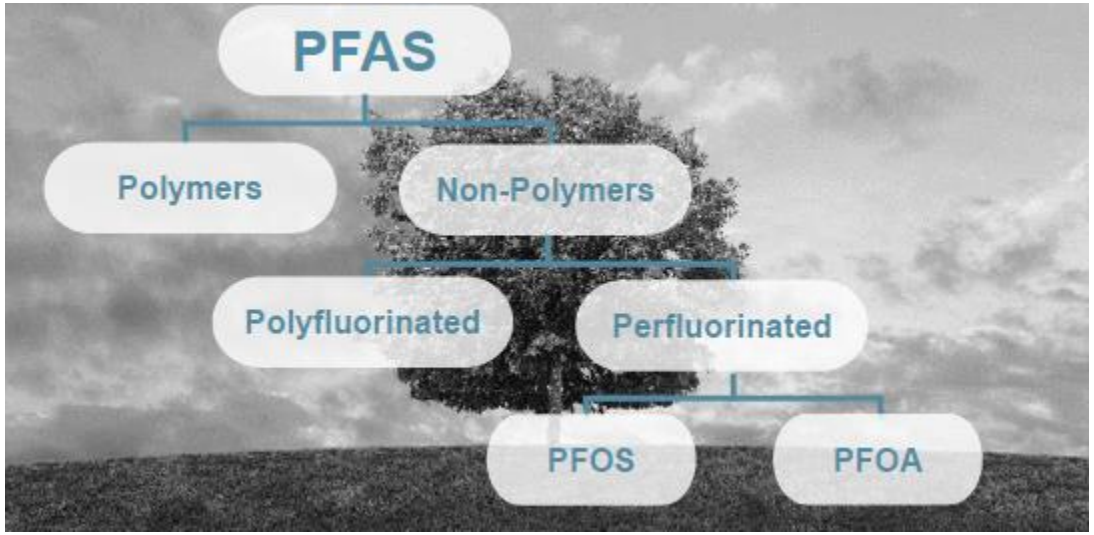
Combinations





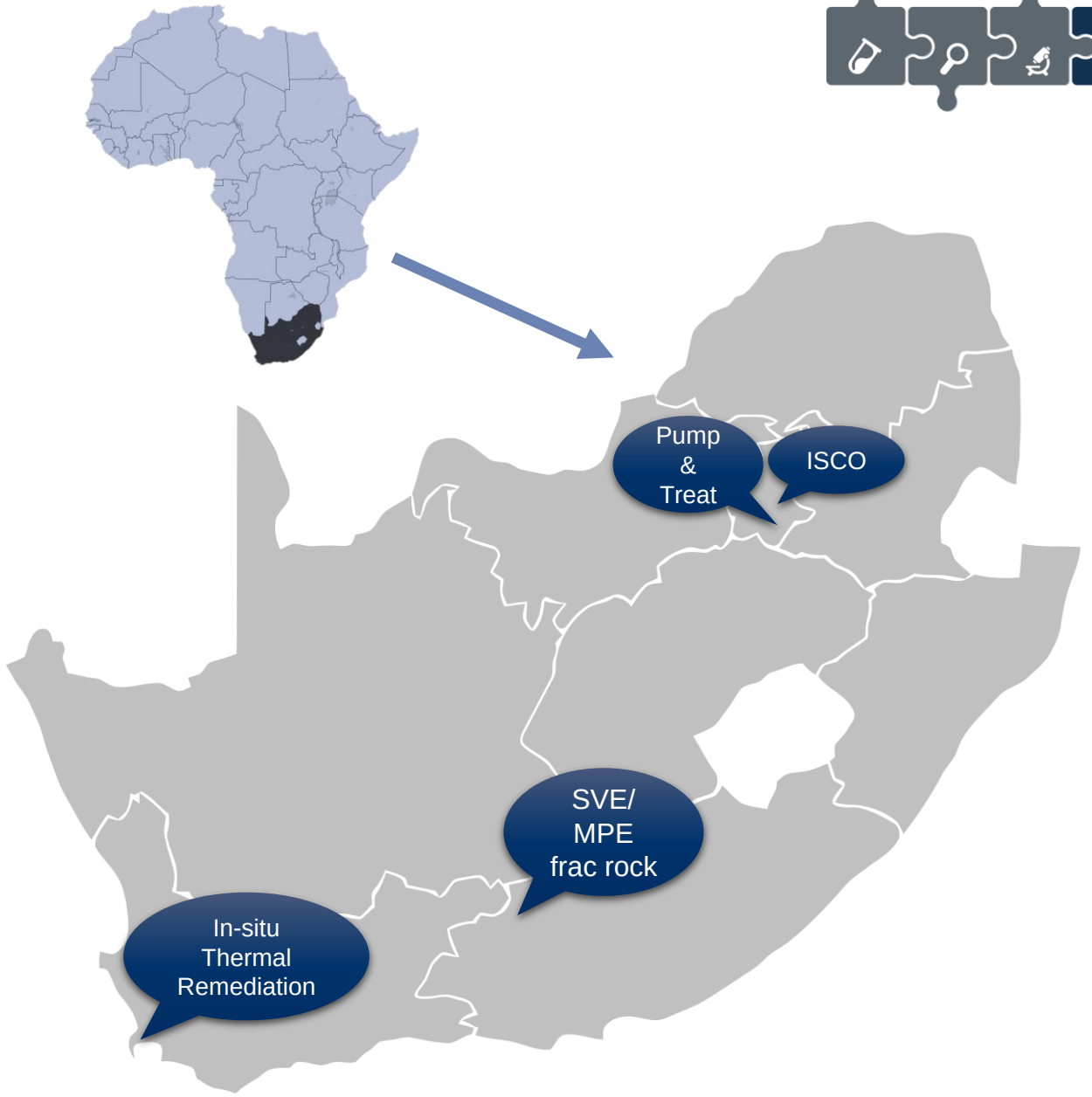
‘Emerging Contaminants’ Focus

- PFAS were developed to be resistant to biological, chemical and thermal destruction, so how do we remove them?
- Could be the reverse of what we seen elsewhere and a return to physical based or immobilisation technologies?
- Innovation certainly needed here!
- Other emerging contaminants?



Technology Transfer

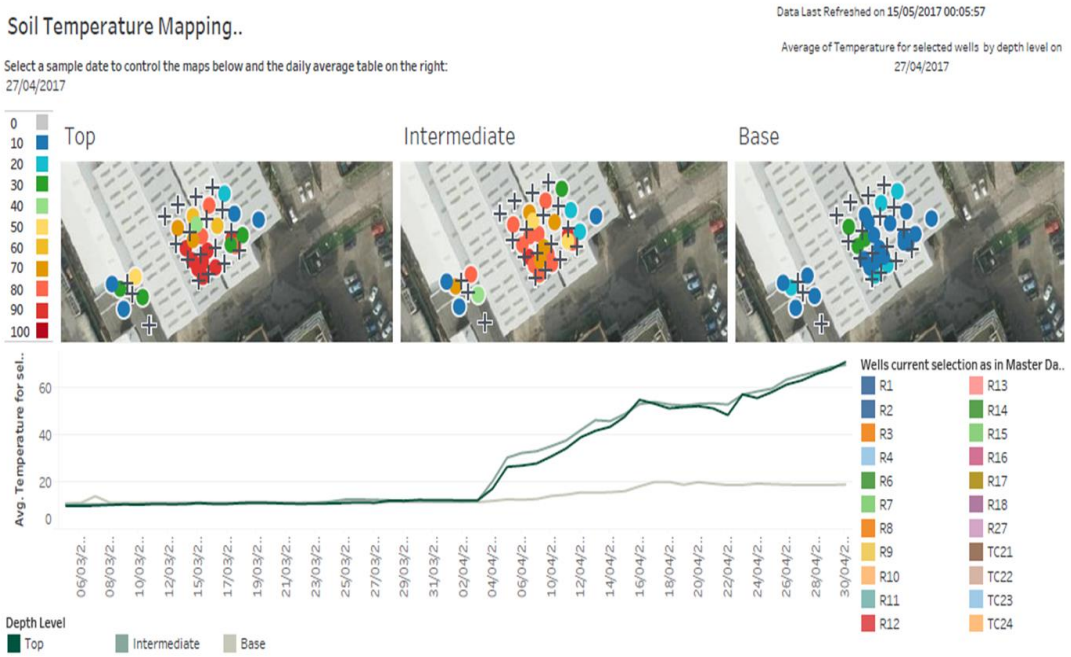
- Most remedial technologies started in the US and then became applied in Europe – we are catching up!
- Technology application broadening in geographical extent across EMEA
- Promote training to quickly move up learning curve – don't repeat any mistakes

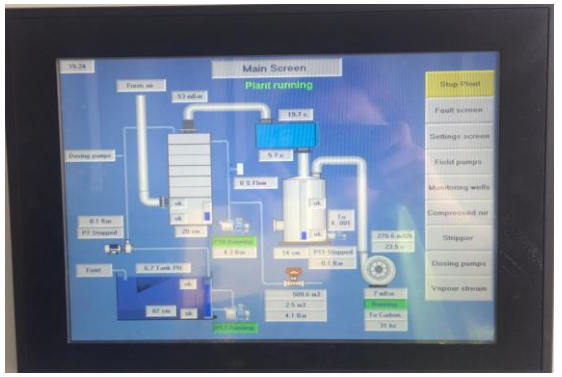


Data Management

Key benefits:

- Health and Safety
- Cost reduction
- Quality Assurance
- Greater opportunities for remedial optimisation



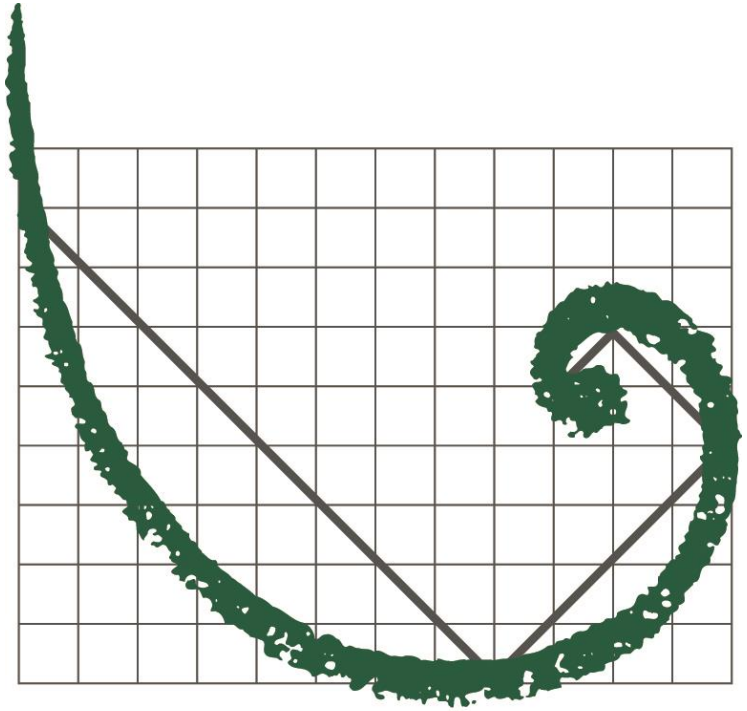


Conclusions

- Two main trends:
  - At sites with the right commercial drivers, aggressive remediation technology application will continue to expand in terms of number of applications and geographies
  - Sustainable remediation expected to continue where there are not the same drivers

- In both cases effective data management and technology transfer are key to optimising technical performance and costs
- Regulatory drivers still there in some countries

Questions???



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