What next for Hydrocarbons?

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Scottish Contaminated Land Forum

Release the Value of Your Land

Specialist Site Investigation and Remediation Contractor

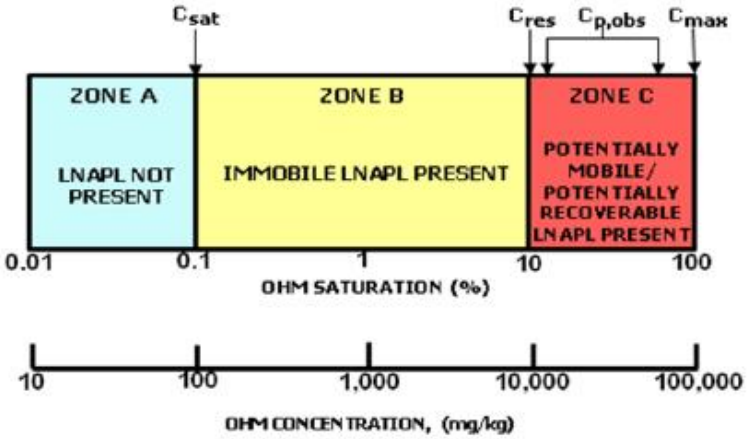
Context

- **Csat - soil saturation limit**

the maximum soil concentration for hydrocarbon sorbed on the soil particles, in dissolved pore water or present in the air-filled porosity

- **Cres - soil residual NAPL saturation**

the minimum concentration for NAPL to be “mobile”



From Massachusetts Department of Environmental Protection LNAPL Guidance , 2016

Context – Petroleum Hydrocarbons

- Very common group of contaminants on brownfield sites
- Scotland heavy industry, shipping
- Diesel used for so many things…
- Heating oil

- Not just on the “big” sites

- More and more we see the Water Environment as the key risk driver in their assessment

Guidance

A lot of technical guidance /tools:

- An Illustrated Handbook of LNAPL Transport and Fate in the Subsurface (2014)
- Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies (2017)
- Guidance on MNA and NSZD (2024)

Regulatory guidance:

- SEPA WAT-PS-10-01

The challenges

- NAPL removal and residual NAPL risk assessment
- Low soil and gw “remedial targets”… sometimes not achievable

- Development time and budget
- Small sites: less data availability

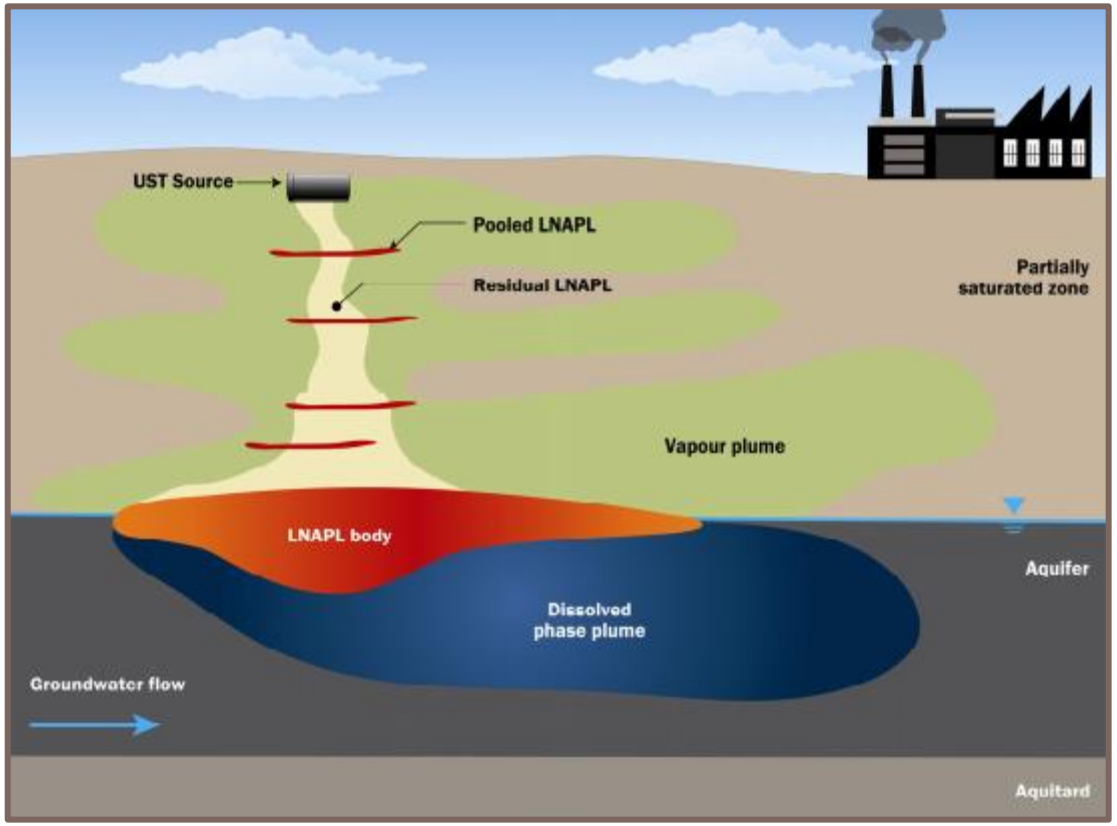
- “Lack of” DWS standard for TPH CWG in water
- The *“prevent”* requirements of the GWDD
- Framework for assessing excessive/disproportionate costs(cost benefit analysis)

The original source

- Do we know what it is?
- Is it still there? Is it still leaking?
- Is it where expected?
- Is there another one?
- What about pipework, chambers, OWS etc?

Is there NAPL?

- Has a huge effect on the mass of contaminant in the ground
- Effectively acts as a “secondary” source of contamination
- Can be a “mobile” source.
- Mobility depends on NAPL type (thickness/viscosity/density), saturation and soil porosity
- Residual LNAPL smear zone

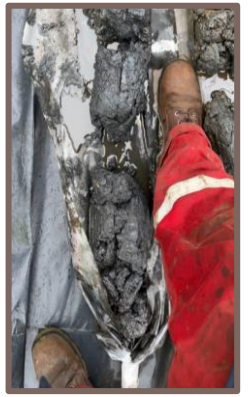


From CL:AIRE, 2014

Is there NAPL?

- Usually visible in water … not always!
- Less visible in soil – water test, centrifuge?

- Soil concentrations



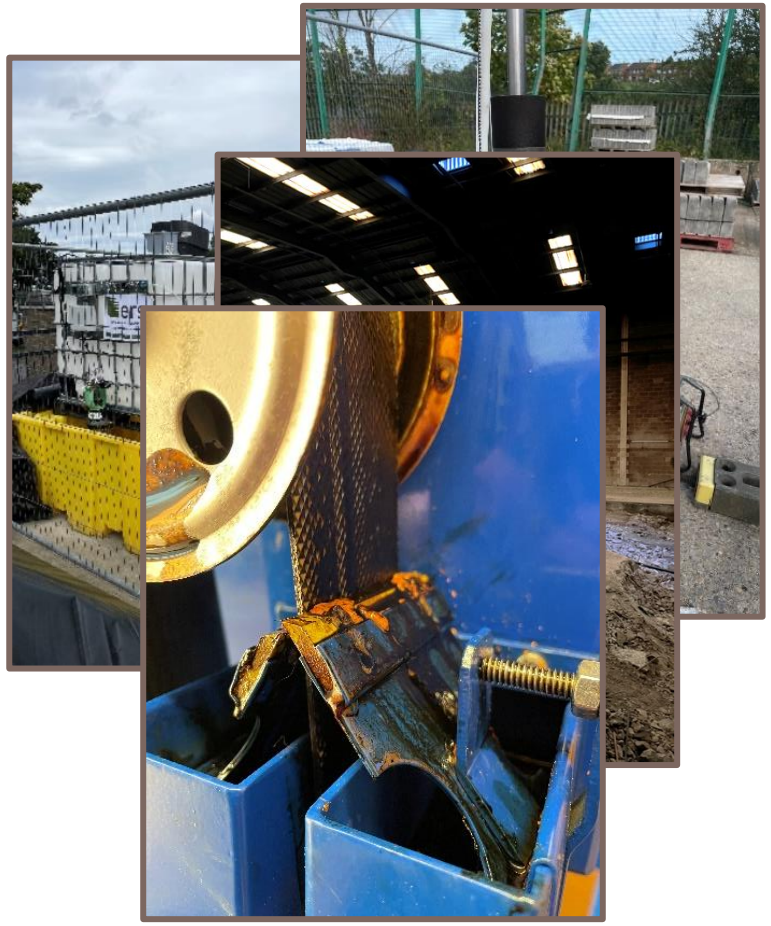
- Proxy data – e.g. “10% rule” for gw concentrations
- Delineation is important

So there is NAPL…

- Sample it! Type, main constituents, “fingerprinting”, also density, viscosity
- Does it accumulate in wells? Thickness?
- Does it “recover” in wells? Baildown tests / NAPL transmissivity.
- It probably will require some management

NAPL Recovery

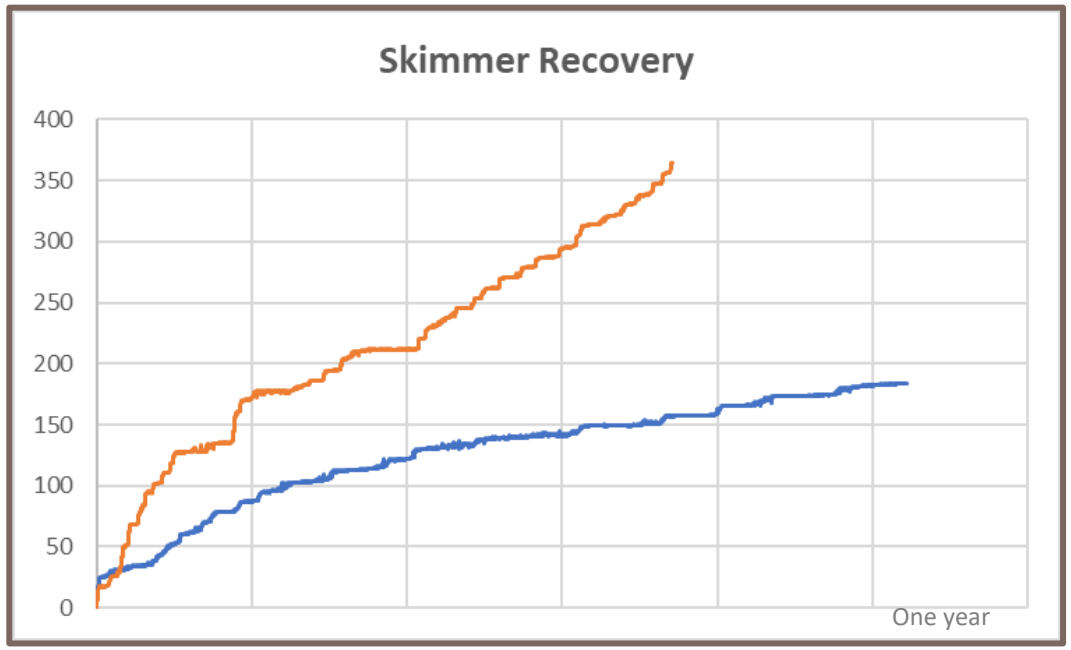
- A number of techniques recovering NAPL, possibly together with vapour/water



NAPL recovery end point

Agreement on end point:

- Fixed/measurable? <1cm? <1mm?
- Asymptote? (diminishing returns)
- Money? *"Disproportionality Costly? "*



- Not all NAPL will be recovered!!!
- There will still be some *"entry"* of hazardous substances by dissolution
- Need a WERA that recognises this: residual NAPL risk assessment
- (Also consider HH/vapour risk)

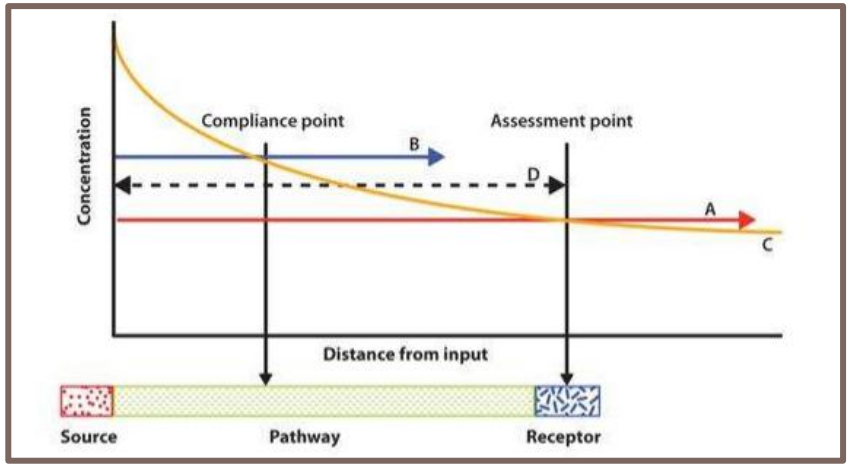
Water Environment Risk Assessment

- What will happen to the plume downgradient of the NAPL source which has been treated?

  (or soils if no NAPL remediation phase)

- DQRA modelling, requires:
  - choice of CoC and assessment limits
  - significant data: permeability, gradient, foc, etc…
  - upgradient concentrations?
  - (Any evidence of biodegradation downgradient?)

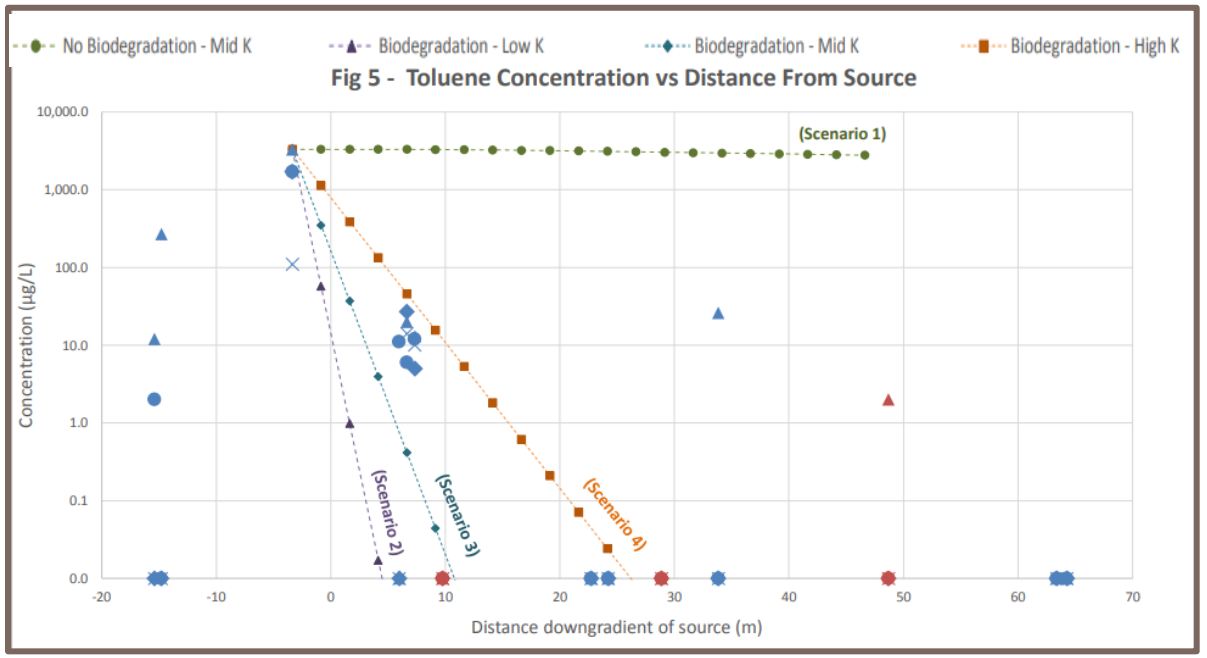
- (Any soil assessment will benefit from leachate data)



From SEPA WAT-PS-10-01, 2014

Water Environment Risk Assessment

- Biodegradation: lines of evidence
  - Decrease in concentrations
  - Right conditions: DO, redox, indicator species
  - Right processes



- Is there still a risk to the Water Environment?
- Money: *"Disproportionaly Costly? "*

Example of follow-up GW remediation

- Active manufacturing site
- Hydrocarbons discovered in soils during civil works
- Shallow soils excavated and removed off site
- Some NAPL and elevated hydrocarbons in bedrock groundwater
- NAPL skimming from wells

- Plume management: ISCO via injection wells to treat dissolved phase hydrocarbons
- (Pathway management: sorption agent for offsite risks)
- GW monitoring programme for verification

Conclusions / Questions

- Hydrocarbons are the most common contaminant on our brownfield sites
- We have plenty of knowledge and technical guidance on their investigation, assessment and remediation

- Development timescales and budget constrain investigation/assessment… but the data is needed for a detailed assessment of hydrocarbons.
- A detailed assessment requires time as well, so getting this data should be factored in early in a project to accrue a useful dataset.

- Regulatory guidance:
  - do we really need to assess TPH against a LOD?
  - what about the "*prevent*" requirement of the GWDD?

Questions?

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