An Industry Perspective: Enabling Effective Contaminated Land Management

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Effective Contaminated Land Management (CLM) – Lessons Learned

• **Protective** - human health & environment, but fit for purpose & sustainable
• **Supported** – scientifically sound, stakeholder buy in = expanded participation
• **Practical** – flexibility to provide management options to contain costs & timelines
• **Predictable** – understand the expectations – clear objectives
• **Timely** – regulatory pace can support business objectives
• **Certain** – there is a definite end to the process

Collaboration

What we have learned
Global CLM Challenge → Sound Science Leads to Better Decisions, Practical Approaches Foster Compliance

National:
- Australia – CRC Care
- UK – National Brownfield Forum
- US - Interstate Technology & Regulatory Council

Local:
- California- UST Program Review, Low-Threat UST Case Closure Policy, Vapor Intrusion Workgroup
- Texas - Texas Risk Reduction Program Steering Committee
- Kansas – TPH & LNAPL
- Michigan – UST Program Review

People tend to support what they help build.

Setting the Stage: Petroleum Fuel Hydrocarbon Releases
What have we learned?
Solution Paradigm: Research & Big Empirical Data Studies, Collaborative Guidance, Collaborative Outreach & Training

Groundwater Petroleum Remediation due to "...significant reductions in benzene concentrations can occur, even without active Remediation."

We found no difference in plume between different remediation sites and sites with no Remedial action.

Survey of natural attenuation of petroleum hydrocarbon plumes in groundwater in Europe

Report

Fuel PHC LNAPLs distribute quickly, stabilize, then deplete naturally
Dissolved PHC plumes are typically small and biodegrade
PHC vapors biodegrade
Bulk LNAPL recovery does not decrease dissolved-plume longevity
LNAPL thickness is not a good metric of LNAPL recoverability

NSZD Rates can be Significant!

<table>
<thead>
<tr>
<th>NSZD Study</th>
<th>Site-wide NSZD Rate (gallons/acre/year)</th>
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</thead>
<tbody>
<tr>
<td>Six refinery &amp; terminal sites</td>
<td>2,100 – 7,700</td>
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<tr>
<td>(McCoy et al., 2012)</td>
<td></td>
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<tr>
<td>1979 Crude Oil Spill (Bemidji)</td>
<td>1,600</td>
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<tr>
<td>(Sihota et al., 2011)</td>
<td></td>
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<tr>
<td>Two Refinery/Terminal Sites</td>
<td>1,100 – 1,700</td>
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<tr>
<td>(LA LNAPL Wkgrp, 2015)</td>
<td></td>
</tr>
<tr>
<td>Five Fuel/Diesel/Gasoline Sites</td>
<td>300 - 3,100</td>
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<tr>
<td>(Piontek, 2014)</td>
<td></td>
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<tr>
<td>Eleven Sites, 550 measurements</td>
<td>300 – 5,600</td>
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<tr>
<td>(Palaia, 2016)</td>
<td></td>
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</tbody>
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Locations where carbon traps have been used to measure NSZD rates (E-Flux, 2015).

NSZD rates are in the range of 100s to 1000s of gallons/acre/year
Effective Contaminated Land Management

Innovative Ideas to Increase Closures of Low Risk Sites

Huge US CLM Challenge → Better Approach Required

- 87% of confirmed LUST sites (453,000 of 520,000) have received regulatory closure
- Fewer releases
- Risk Based Decision Making
- Difficult sites still open
Petroleum Plumes Degrade Screen Out Low Risk Sites

- **Texas Exit Criteria – 1997**
  - A series of flow charts with site conditions relative to plume concentrations and trends, and receptor distances, if meet qualify for immediate closure
  - Learnings from the 1997 Texas plumeathon

- **California Low-Threat UST Case Closure Policy – 2012**
  - Series of soil, groundwater and vapor scenarios that if match site conditions, or other condition determined low threat, qualify as low risk and thus for closure
  - Learnings from the 1995 California plumeathon and program reviews
  - [https://www.waterboards.ca.gov/ust/lt_cls_pcly.html](https://www.waterboards.ca.gov/ust/lt_cls_pcly.html)

California Low-Threat UST Case Closure Policy (Background)

**Evolution:**

- **issues (low UST case closure rate - average case open 17 yrs)**
  - cleanup to background, irrespective of site risk
  - limited consideration of probable future groundwater use
  - residual LNAPL difficult to remediate; natural attenuation occurring, but slow; VI sites not effectively screened
  - lots of data collection/reg negotiation/remedy selection

- **Few petroleum UST cases w/ impacts**
  - domestic wells: 32/6423 sites (< 0.5%) or 54/250,000 to 600,000 = < 0.02%
  - municipal wells: 42/6423 sites (< 0.7%)

- **Stakeholder group initiated to:**
  - review existing regs (adopted over 25 yrs), industry practice, science
  - recommend improvements to UST Cleanup program
  - risk-based (focus on low-risk sites)
Benefits of Screening Out Low Risk Sites
Texas and California Example

COC concentrations are attenuating, conditions are improving!

Low-Risk Groundwater Plume Management Options – Plume Scale

Site-specific plume scale – covered by institutional control to prohibit particular use.
Endpoint state, not an interim safeguard – final remedy
May require long-term monitoring – situational, should serve a purpose

Victoria, Aus and other states: Groundwater Quality Restricted Use Zones – recommended by the regulator or the environmental auditor after remediation attempt, reinforce with institutional control and registry https://www.epa.vic.gov.au/your-environment/land-and-groundwater/groundwater-pollution


**Effective Contaminated Land Management**

**Innovative Ideas to Increase Brownfield Participation**
**Voluntary Programs and “Innocent” Programs**

Now in many US states (google “Voluntary Cleanup Program”) to encourage Brownfield development

- Streamlined regulatory scheme
- Formal concurrence of remediation – e.g., “Certificates of Completion”, “Conditional Certificate of Completion,” “No Further Action”
- Some with releases of liability from regulator
- “Cleanup” not limited to numeric standard compliance, but includes risk-based management
- Pay to play – pay for regulatory oversight

**Texas:** Innocent Owner/Operator Certificate, **Colorado:** No Action Determination

- Statement of “innocence” and regulatory liability release for soil and groundwater pollution if property affected by an off-site source, and did not cause or contribute to
- Encourages off-site landowner support for regulatory flexibility at on-site source property
- On-site source property owner can pursue for innocent off-site property

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**Prohibited Groundwater Use Ordinance – City or Sector-Scale**

Municipal ordinance (i.e., bylaw) as an institutional control within City limit or portion of City limit

- Eliminate only groundwater ingestion exposure pathway
- Publicly provided potable water source, and not that groundwater
- To spark urban Brownfield redevelopment
- Legislation, but local government decides

- **Ohio** – Urban Setting Designation ([http://codes.ohio.gov/oac/3745-300-10](http://codes.ohio.gov/oac/3745-300-10), [https://epa.ohio.gov/portals/30/vap/docs/fact8.pdf](https://epa.ohio.gov/portals/30/vap/docs/fact8.pdf))
- **Texas** – Municipal Setting Designation ([https://www.tceq.texas.gov/remediation/msd.html](https://www.tceq.texas.gov/remediation/msd.html))
**Timely Regulatory Review & Closure Documentation**

Extending the regulatory base to the private sector to fill capacity and skill gaps.

- Licensed environmental professionals certify regulatory compliance
- US use for lower risk sites, Australia typically use for the higher risk, more complex sites
- Professionals subject to competency audits which tends to drive to regulatory conservatism
  - UK National Quality Mark Scheme - industry initiative [https://www.claire.co.uk/projects-and-initiatives/nqms](https://www.claire.co.uk/projects-and-initiatives/nqms)
  - BC Contaminated Sites Approved Professionals [https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/approved-professionals](https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/approved-professionals)

**Sustainable Soils Re-Use**


- Industry developed, regulatory endorsed
- Self implementing environmental standards for property developers to work with local planning authority to define suitable approaches
- To determine if soils can be suitably reused for a designated purpose, to bypass “waste or contaminated” designations and thus remain outside a regulatory process. Developed to encourage investors to redevelop Brownfields
- More sustainable by not filling landfill space and limits soil use from green fields by re-use of recovered materials
- Projects are overseen by Qualified Professionals, and subject to audits to verify compliance