[#550] Using lifecycle analysis to select remediation technologies for petroleum-impacted sites

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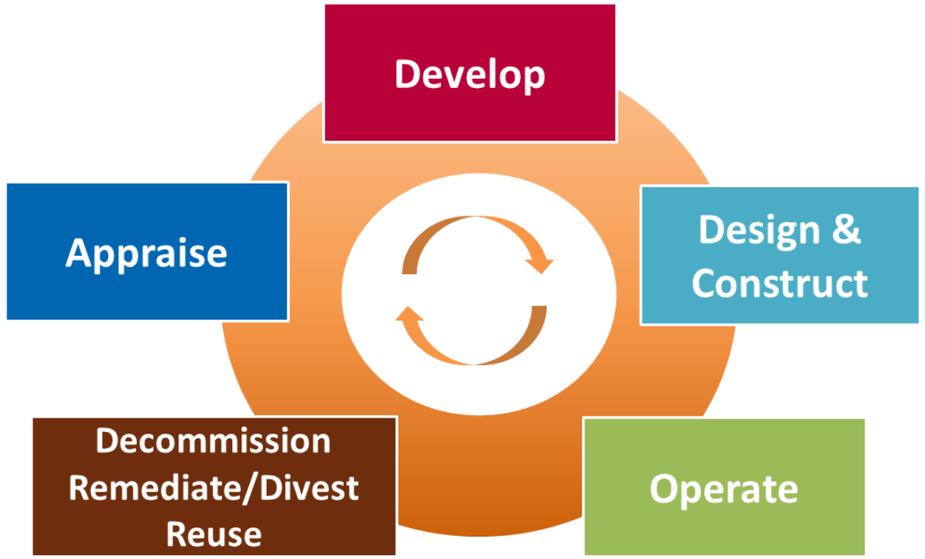
Presentation Outline

- Sustainable remediation concept and main drivers
- Life cycle assessment method
- Case study on soil remediation
- Lessons learned and good practices
- Summary



Asset lifecycle

Sustainable remediation concept and principles

EPA definition

- the process of examining the environmental footprint of site cleanup activities and taking steps to minimize the footprint.

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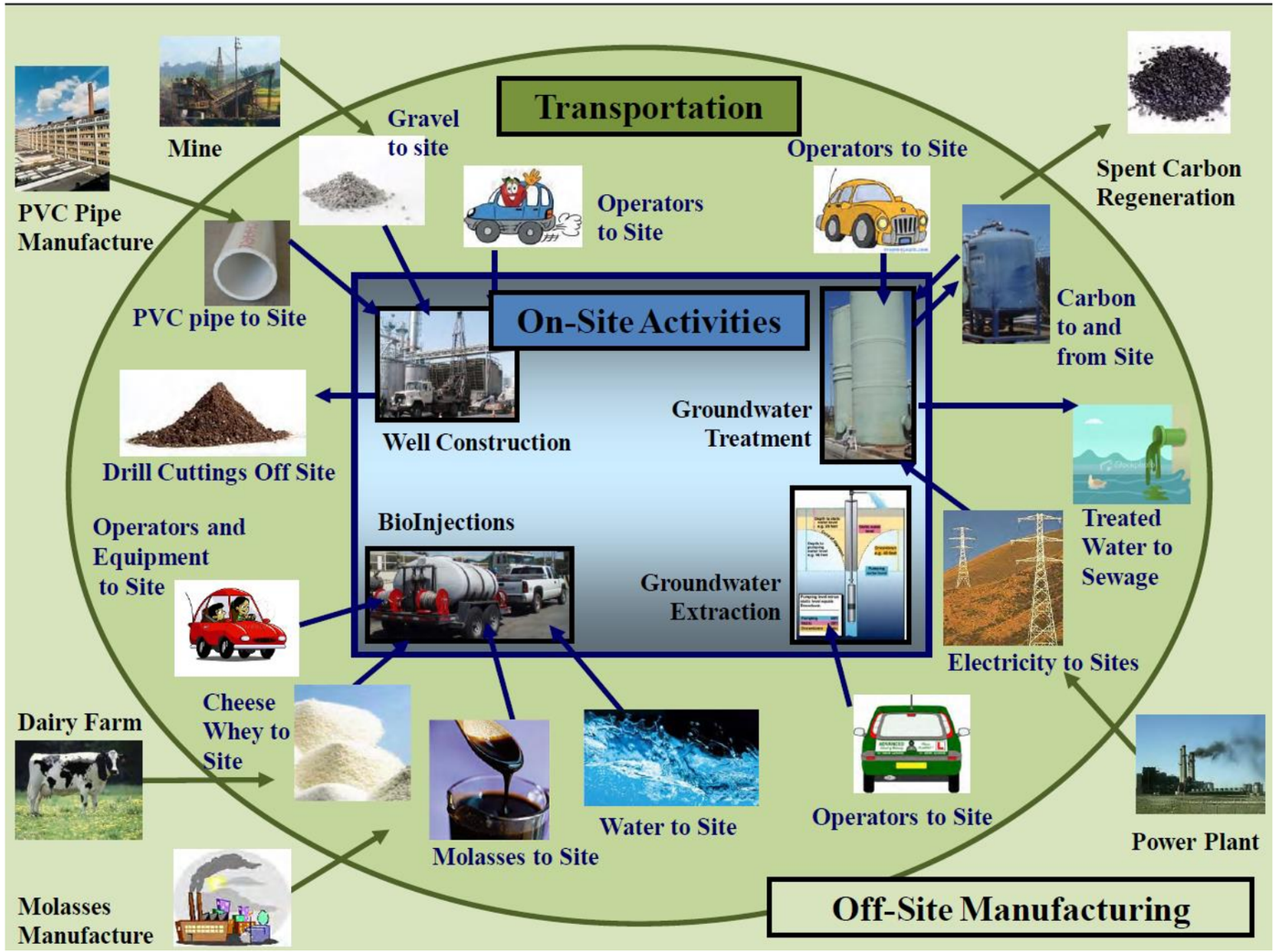
Core elements

- Minimize total energy use and increase the percentage of renewable energy
- Minimize emission of air pollutants and greenhouse
- Minimize water use and preserve water quality
- Conserve material resources and minimize waste
- Protect land and ecosystem services

Strategies and standards

- Whole-site approach used throughout the life of a cleanup project
  - from site investigation, remedy design, construction, operation, maintenance and long-term monitoring
- Follow ASTM Standard Guide for Greener Cleanups (E2893-16)

Driver: manage footprint from a system perspective ⇒ efficient and low impact remediation.

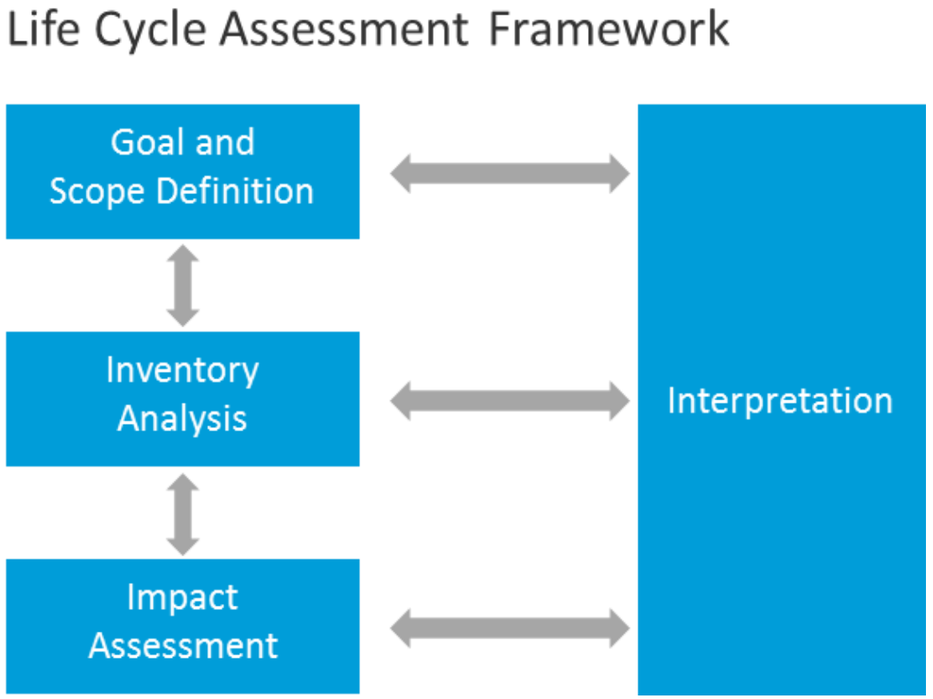


Source: Greener Clean-Ups: Estimating the Environmental Footprints of Clean-Up Remedies, Karen Scheuermann, EPA Region 9

- Remediation activities are getting more complicated and have wide-spread impact well beyond fence line.

Example – ground water remediation project at EPA Region 9

Methodology: life cycle assessment (LCA)



ISO 14040-14044 Series

life cycle inventory

Inputs:

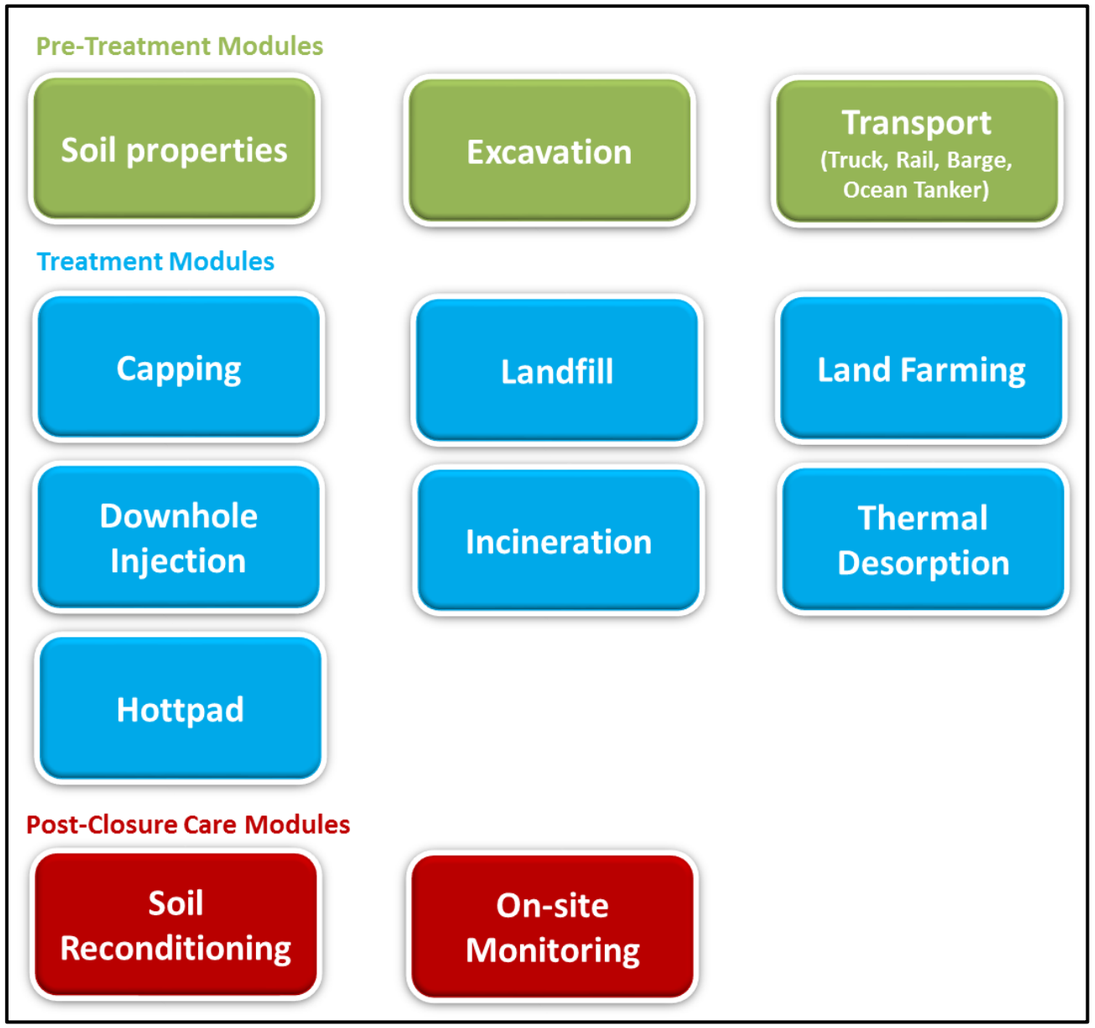
Material and energy flows, including natural resource consumptions, *i.e.*, fresh water, land

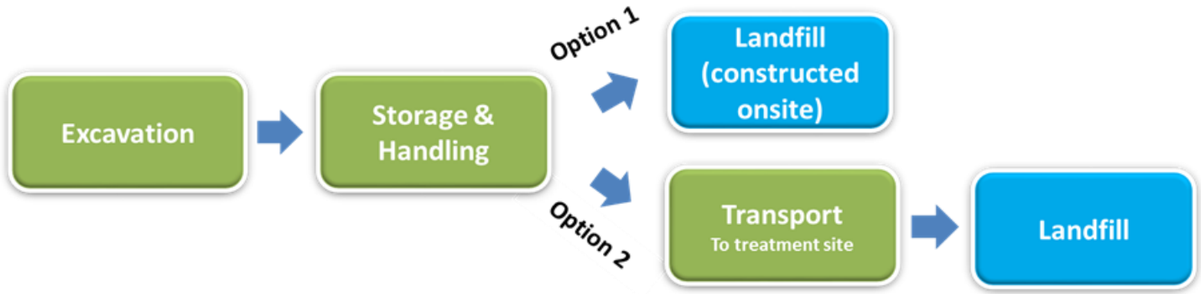
Outputs:

Products, byproducts, and pollutants including discharges to air (GHG, NOx, SOx, PM, VOC), water (wastewater), and solid wastes

Quantitative information to feed into further analysis to inform designs and decisions

Layout of the environmental screening tool for remediation technologies



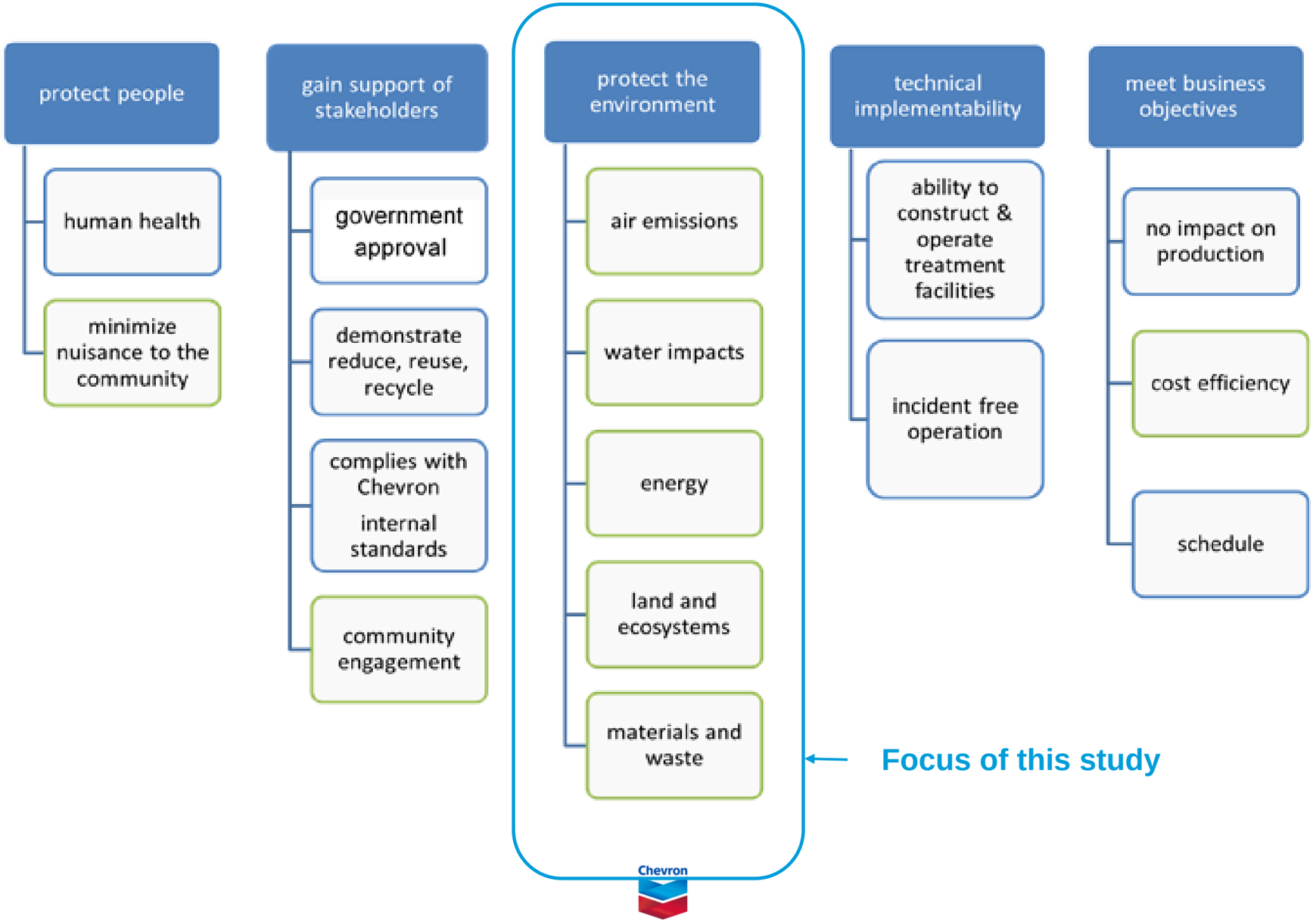


Option 1: On-site landfill
Option 2: Off-site landfill

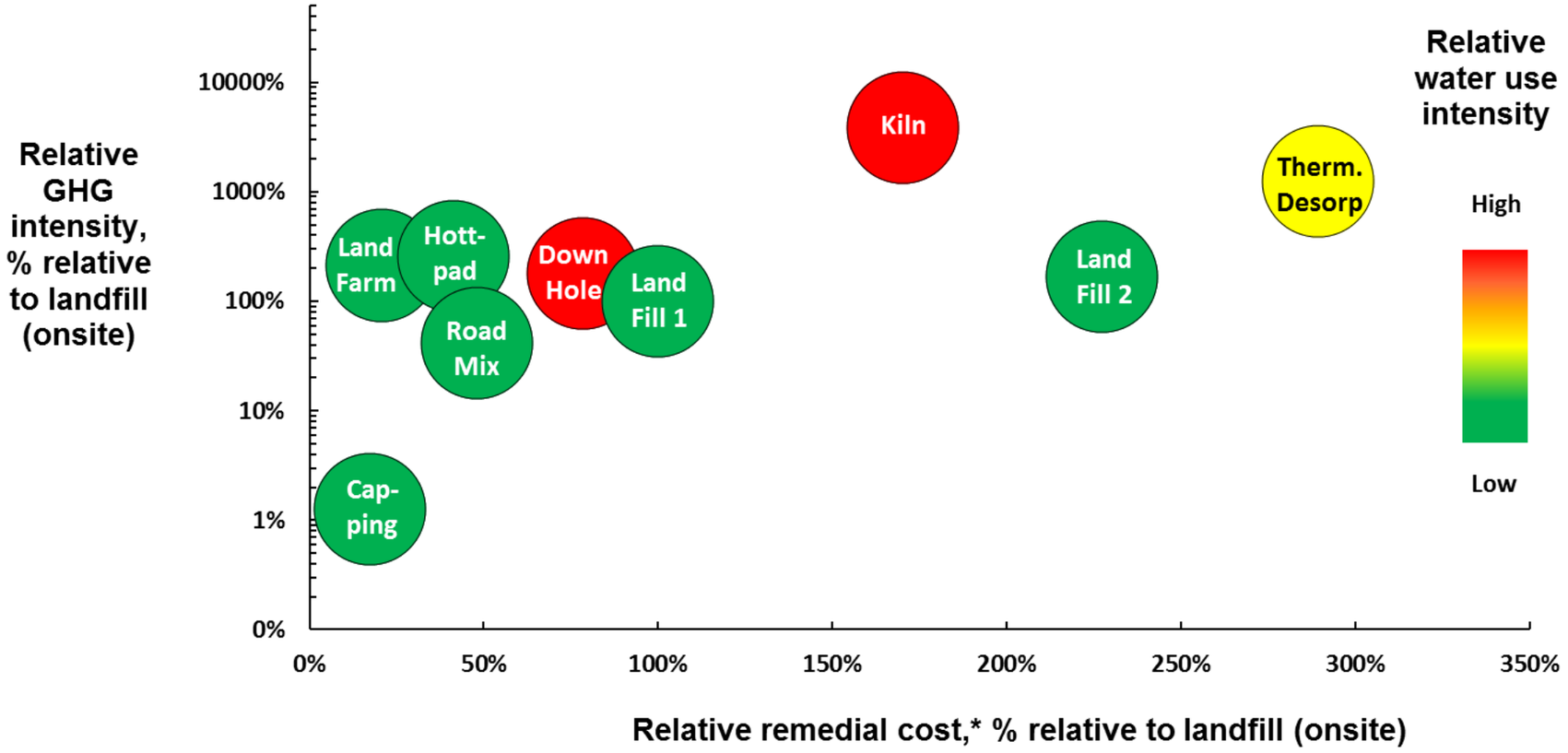
Goals and scope of the case study

- Conduct LCA to screen remedial alternatives. Apply ASTM standard.
  - What does the overall footprint look like?
  - How do alternative compare? tradeoffs? major contributors?
  - How will transportation influence decision on siting?
- Does LCA yield the same results as traditional methods?

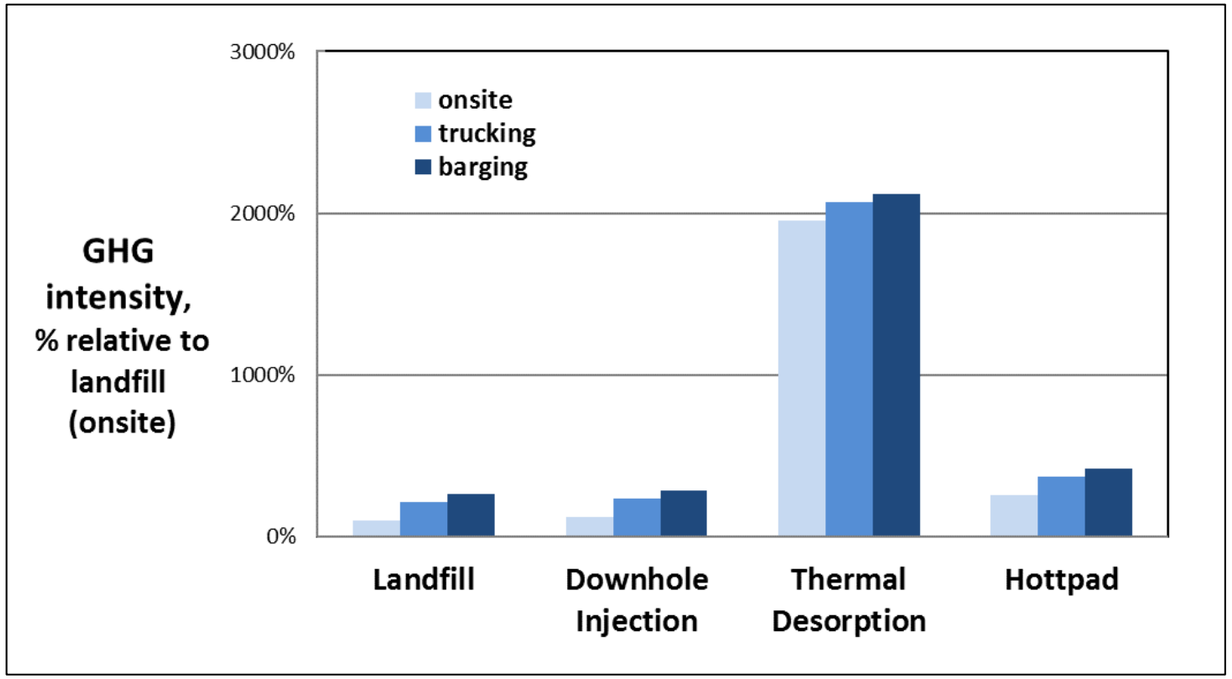
Decision criteria for alternative assessment

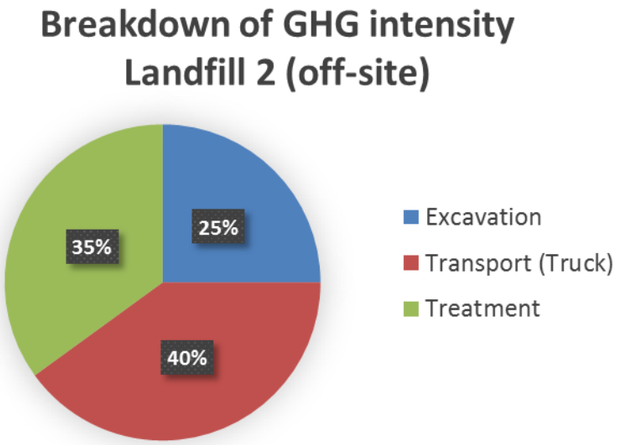


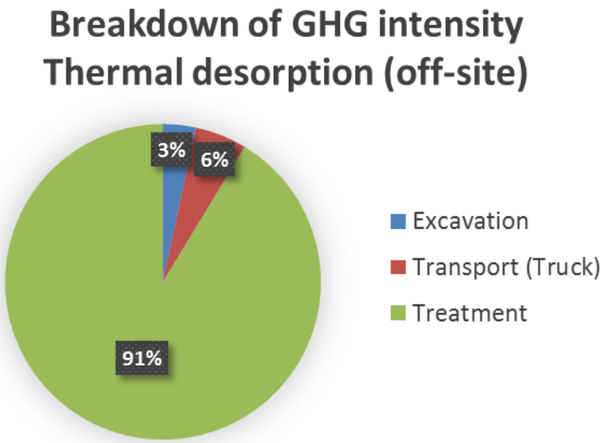
Key learnings:
Footprint analysis provides additional insights and highlights potential environmental issues. It's critical to evaluate footprint comprehensively.



Key learnings:
Transportation plays a more important role when GHG emissions from treatment processes are moderate







Summary

- Applying environmental footprint analysis in remediation decisions offers unique advantages.
- There are trade-offs between the thermal treatment and containment technologies, as well GHG and water footprints.
- Siting may play a critical role in selecting preferred remedial alternatives.
- Footprint analysis results should be interpreted in a broader context.

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Thank you!

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