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Vapour Emissions from *Ex Situ* Remediation

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Introduction

- Onsite *ex situ* remediation of volatile hydrocarbons
- What are the effects?

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Potential Issues

- Hydrocarbon releases to the atmosphere
- Greenhouse gas emissions
- Particulate releases

- How do these compare to landfill disposal?

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2010/2011 Project

- Model development
- Life-cycle emissions of VOCs, criteria pollutants, greenhouse gasses, particulates
- Comparison of *ex situ* remediation and landfill disposal

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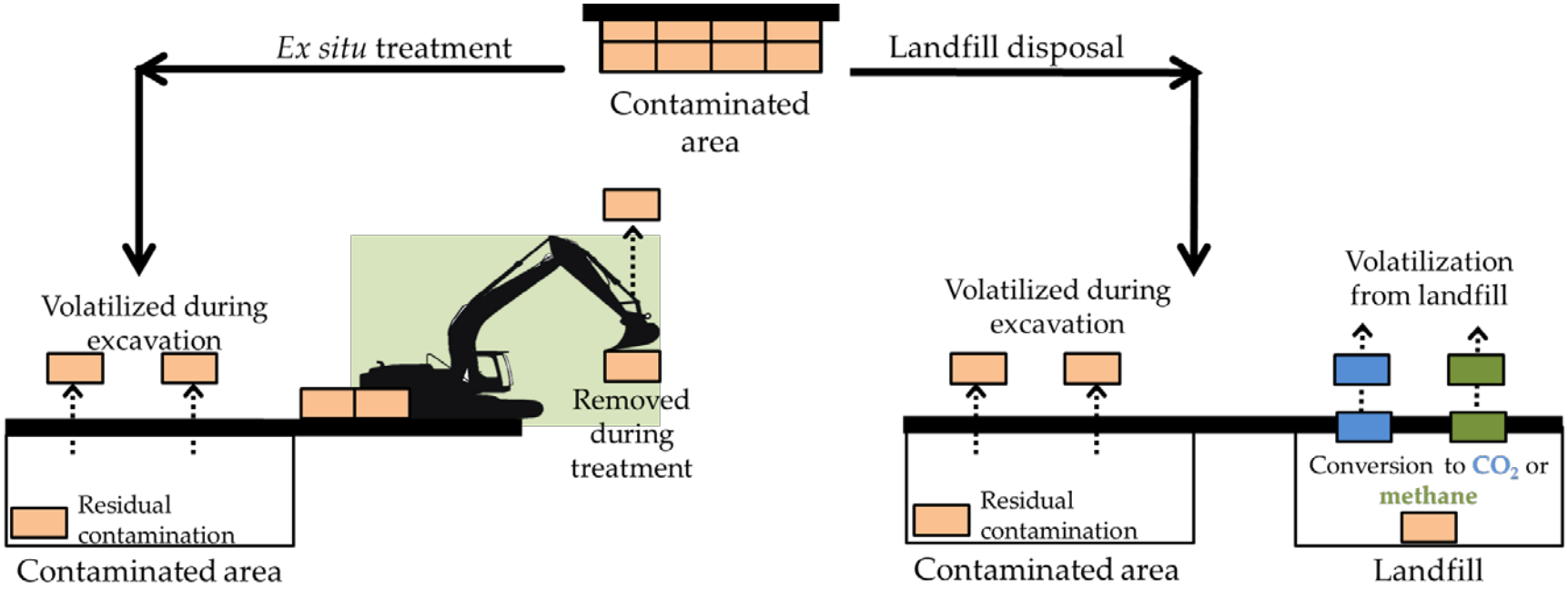
Contaminant Fate



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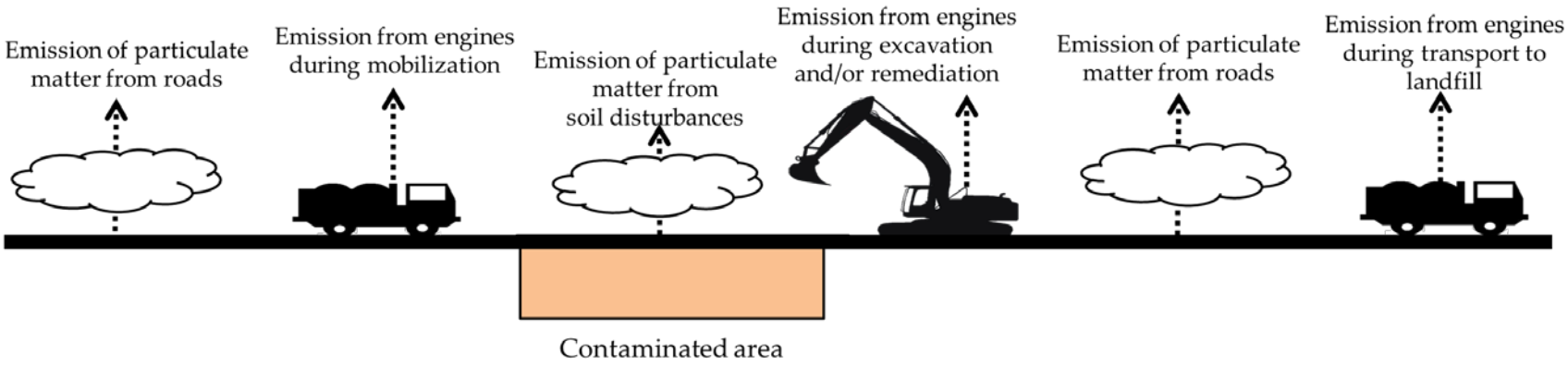
Other Emissions



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Model Predictions

- "Typical" hypothetical sites run for *ex situ* remediation and landfill disposal
- Predicted benzene concentrations onsite below occupational limits
- Offsite concentrations below AAQO

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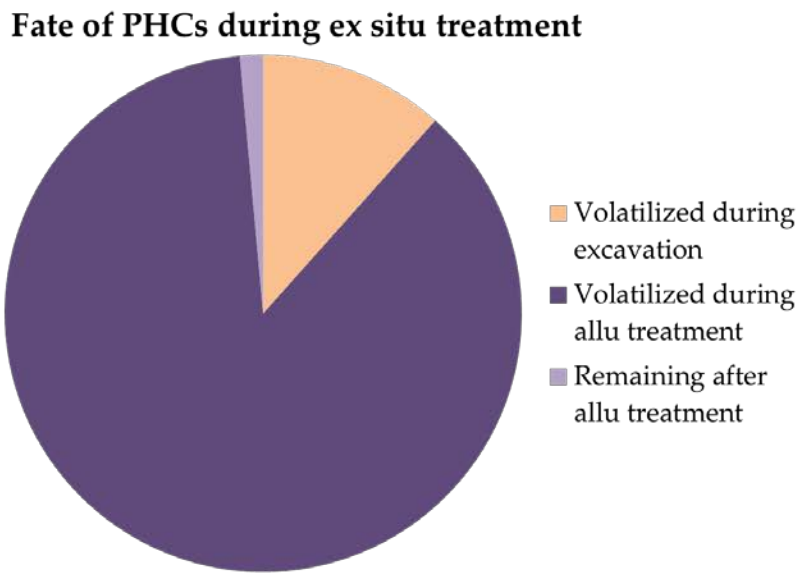
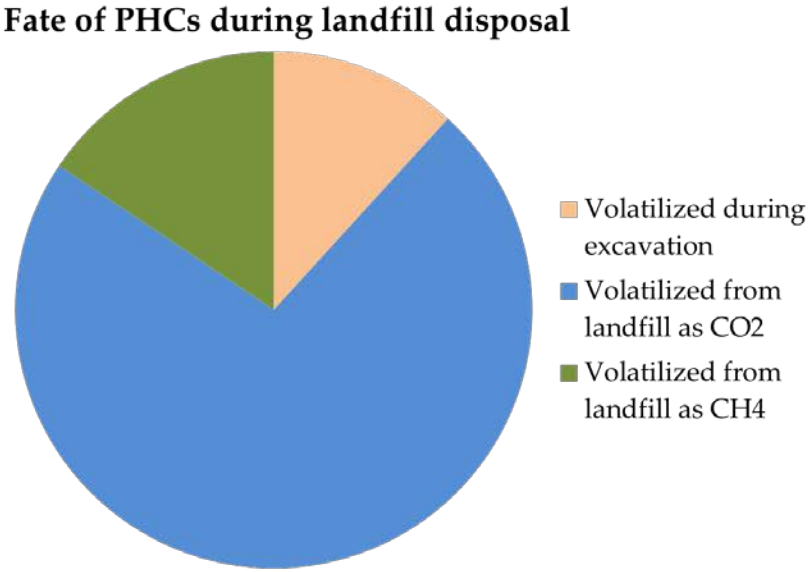
Model Predictions





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Model Predictions

- How does the model compare to reality?

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Follow-up

- 2012 Work
  - Development of spreadsheet model
  - Evaluation of biofilters
  - Pilot trial of field validation
- 2013 Work
  - Additional field validation
  - Challenges finding appropriate sites

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Field Validation

- Soil sampling
  - Hydrocarbon concentrations before treatment
  - Hydrocarbon concentrations after treatment
  - Soil properties (texture, organic carbon content)

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Field Validation

- Air sampling (hydrocarbons) – 1 hour
  - Next to soil treatment
  - 10 m down-wind
  - Up-wind (background/control)

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Site #1

- Wellsite remediation (drill sumps)
- Concentrations of BTEX, F1, F2 above guidelines
- Soils stockpiled onsite then passed through an Allu® bucket and trommel screen.
- Validation conducted when expected worst-case soils were being treated

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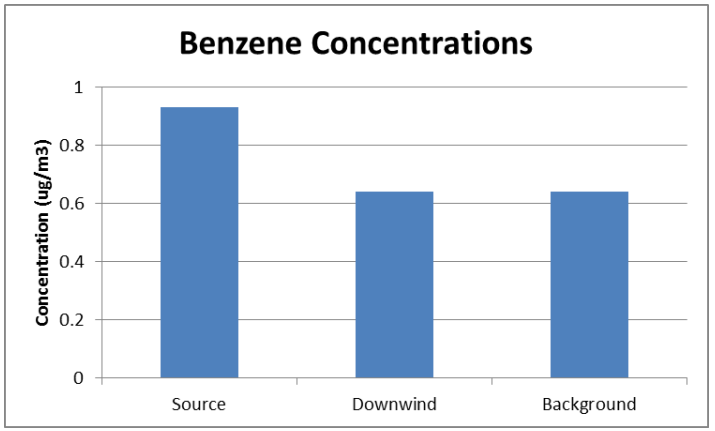
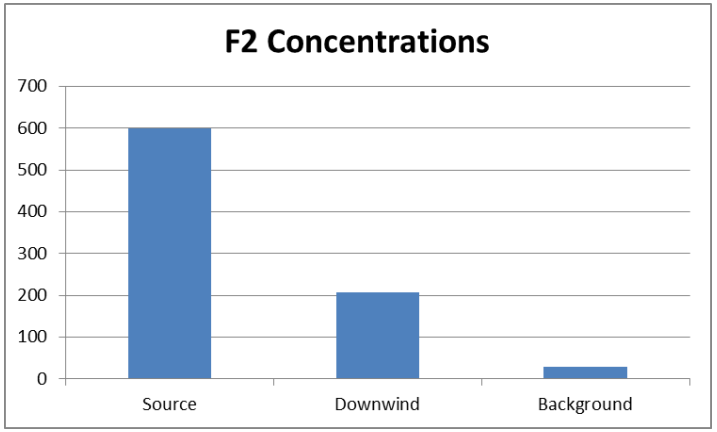
Site #1 - Results

- Pre-treatment soil samples met Tier 1
- No observable decrease in concentrations
- Hydrocarbons in air close to or below detection limits
  - Except F2





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Site #2

- Former gas plant
- Soils stockpiled after excavation then treated with Allu® bucket

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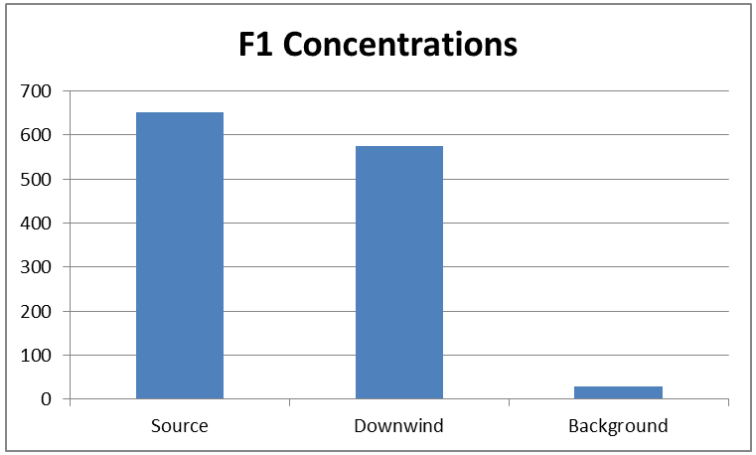
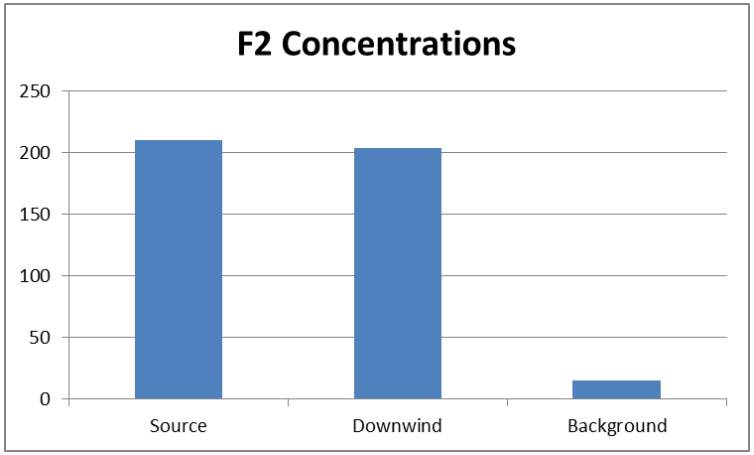
Site #2 - Results

- Pre-treatment soil samples had F1 ranging from 80 to 900 mg/kg; no BTEX
- Post-treatment soil had F1 60 to 600 mg/kg
- F1 and F2 measured in air (less than residential air targets and ~50 times lower than predictions)





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Conclusions

- Model appears to over-predict ambient air concentrations
  - Limited data
- Significant amount of volatile hydrocarbon loss occurs before *ex situ* treatment

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What's Next?

- Collection of additional data by industry would be valuable
  - Hydrocarbons in soil before and after treatment
  - Hydrocarbons in ambient air

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