Sustainable Remediation in Site Revitalization

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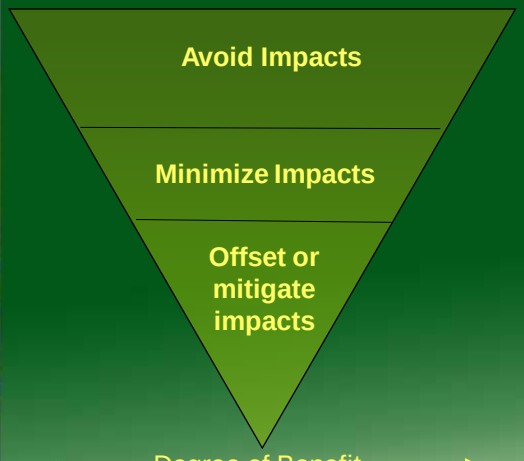
What is Sustainable Remediation?

Continues to evolve, but includes these basic concepts:

- Environmental impact of implementation is less than the impact of leaving site untreated
- Non-renewable energy consumption is minimized or eliminated
- Releases to the environment, especially the air, are reduced or eliminated
- Redevelopment capitalizes on existing infrastructure and resources/opportunities

Integrating Sustainable Remediation into Your Project



Examples

Select passive groundwater treatment

Design remedy to have lower carbon emissions

Restore or improve habitat to mitigate for natural resource debits

Challenges to Integrating Sustainability into Remediation and Redevelopment

- Integrating sustainability into remedy selection is more resource intensive
- Managing perception that sustainability will be used by problem owners to avoid taking responsibility
- Incorporating view of sustainability that considers collateral risks to workers and society on par with cancer incidence risks of contamination
- Infrastructure or building reuse can constrain flexibility in site revitalization

Opportunities to Integrate Sustainability

- Incorporate in remedy selection
- Optimize existing remedial operations
- Look for opportunities to address "lingering tail"
- Include sustainable principles in site demolition/redevelopment

Case Example: Remediation of parcel at former industrial site

- Plant manufactured phenol and various resins from 1950 until 1980
- Landfill received wastes from 1952 until 1972
- Landfill is capped, but organic compounds are present in an underlying sand and gravel aquifer

Alternatives retained for sustainability evaluation

Evaluated:

- Expanded Pump & Treat
- North-South Air Sparge/Biosparge
- South Air Sparge*
- South Air Sparge/Biosparge
- South Air Sparge/Biosparge*

** adding vapor extraction and treatment*

Groundwater Remedy Alternative Energies Evaluation

- Evaluated alternative energy sources for incorporation into system operation:
  - Solar
  - Wind
  - Biofuels
- Conclusions:
  - Wind and biofuel are not viable for this site
  - Solar is viable, but cost-prohibitive (payback period >30 years)

Sustainability Evaluation Steps and Decision Analysis

1. Identified sustainability indicators
2. Grouped into three domains, in addition to technical effectiveness & implementability
3. Used an adaptation of CH2M HILL's and Owner's sustainability assessment framework
4. Reduced redundancy and identified those most applicable to this project

Project Sustainability Framework and Decision Criteria with Weights

Environment	Energy	Optimize Energy Use	25.00%	10.00%
	Climate Change	Decrease GHGs		20.00%
	Air Quality	VOCs		10.00%
	Air Quality	SO2		10.00%
	Energy	Use of non-renewable fuel		10.00%
	Material Use/Waste	Minimize Waste		10.00%
	Biodiversity/Habitat	Use of biomimicry to meet project goals		30.00%
Social	Health and Safety	Minimize Injury/illness rate	30.00%	20.00%
		Minimize fatality potential		80.00%
Economic	Cost	Cash Flow O&M	15.00%	10.00%
	Cost	Cash Flow Capital		15.00%
	Cost	Total Life Cycle Cost (10 yrs at 10%)		0.00%
	Cost	Cost Growth Potential		25.00%
	Assets and Liabilities	Limit long-term liabilities		50.00%
Effectiveness and Implementation (E&I)	Effectiveness	Confidence Remedy will Meet Goals	30.00%	50.00%
	Implementation	Anticipated Regulatory Acceptance		40.00%
	Implementation	Coordination with Other Property Owners		10.00%

Emissions and Energy Use
(smaller is better)

Sustainability Analysis Summary: Emissions and Energy Use
Construction and Operation for 30 Years
Former Industrial Landfill Site

	Emission Intensity			Non-renewable Energy Footprint	
Alternative	Greenhouse Gases [a] (tons CO_2 equivalent)	VOCs (tons)	SO_2 (tons)	Fuel Consumption (tons)	Power Consumption (kW•h)
North-South AS/B	47,851	2.74	79.57	1,678	45,727,200
South AS with vapor extraction and treatment	60,044	3.36	97.40	2,823	55,976,400
South AS/B	17,685	1.04	30.18	44	17,344,800
South AS/B with vapor extraction and treatment	31,363	1.80	52.13	1,899	29,959,200
Expanded pump & treat	9,008	0.52	15.09	1,925	8,672,400

[a] Greenhouse gas emissions were calculated by normalizing carbon dioxide, nitrous oxide, and methane emissions to carbon dioxide equivalents.

Injury/Fatality/Waste Intensity
(smaller is better)

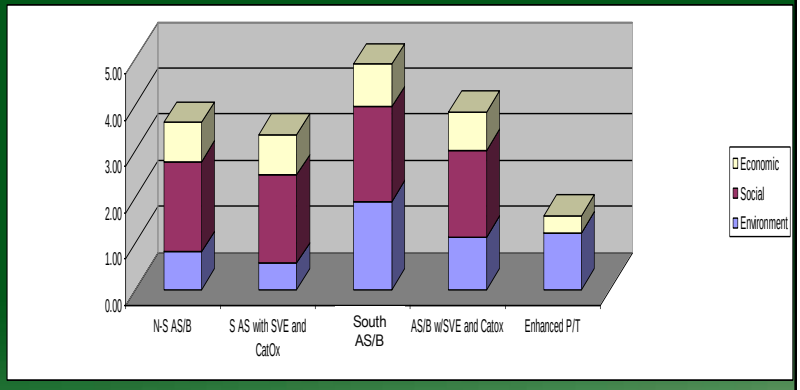
Sustainability Analysis Summary: Human Health Impacts and Material Intensity
Construction and Operation for 30 Years
Former Industrial Landfill Site

	Human Health Impacts		Material Intensity	
Alternative	Injuries	Fatalities	Waste (tons)	U.S. Personal Waste Generation Equivalents (persons) [a]
North-South AS/B	0.661	0.099	50	59
South AS with vapor extraction and treatment	0.722	0.1135	20	24
South AS/B	0.591	0.091	20	24
South AS/B with vapor extraction and treatment	0.717	0.113	50	59
Expanded pump & treat	1.702	0.298	80	95

[a] Municipal solid waste production of 4.62 pounds/person-day reported by EPA in 2007 (www.epa.gov/garbage/facts.htm)

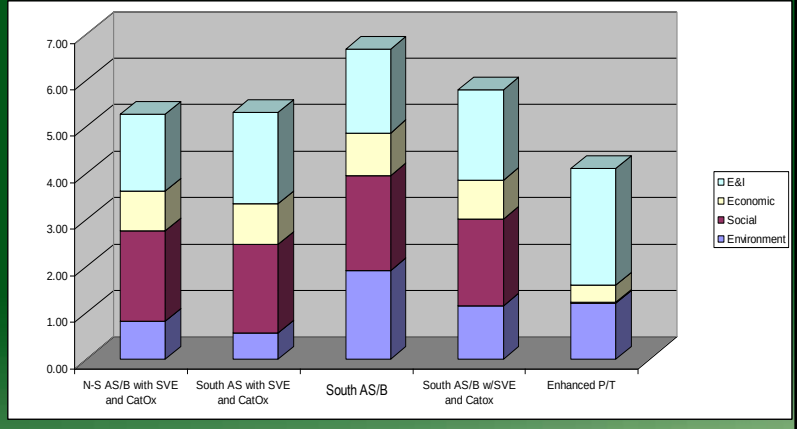
Comparing sustainability categories alone

(larger is better)



Decision analysis with Effectiveness and Implementation added

(larger is better)



Analyze cost of achieving sustainability metrics

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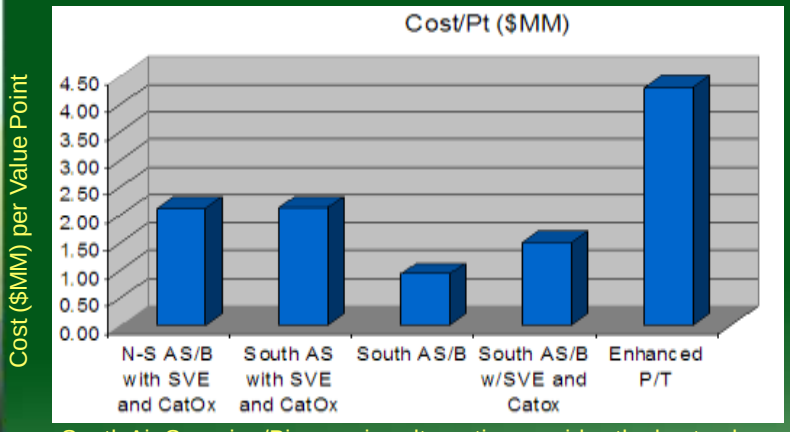

South Air Sparging/Biosparging alternative provides the best value

Minimize Impacts of Ongoing Cleanups

- Hexavalent chromium groundwater remediation
- Solar power for operating injection wells provides up to 200 kW•h per year
- Battery operated vehicles reduce fuel use, noise, and impact to sensitive desert habitat
- On-site field technician eliminates over 50 long-distance trips to the site each year

Mitigate Impacts of Remediation

1996 – Former Wood Treating Plant – Creosote Recovery Ongoing

Poplar trees planted to address remaining contaminants while providing ecological habitat and human use value
– Laramie River Greenbelt Bike Path

2004 – Former Wood Treating Plant – Creosote Recovery Completed


2010 Oregon Brownfields Conference & Awards Luncheon
Thank You!
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