

# Sustainable Remediation – An Evaluation Of The Carbon Footprint Associated With “Classic” Remediation Efforts

Presented by Shaun Gilday  
Environmental Standards, Inc.

East Tennessee Environmental Conference  
Kingsport, Tennessee

March 17, 2010



# Who we are ...

- Privately Held Firm
- Founded in 1987
- Headquartered in Valley Forge, PA
- Regional Offices in Charlottesville, VA and Kingston, TN
- Specialty “Niche” Environmental Consultants
- National Fortune 500 Client Base
- Inc. 5000 List of America’s Fastest Growing Private Companies
- \$10 Million Revenue & Growing



# What we do ...

- Chemistry Quality Assurance
- Geosciences Services
- Environmental Data Management
- Indoor Air Quality & Mold Assessments



# Sustainable Remediation – An Evaluation Of The Carbon Footprint Associated With “Classic” Remediation Efforts

# Summary

- Analysis confirms alternative closure strategies can be implemented at certain retail sites with low levels of constituents providing lower carbon footprint impacts while protective of human health and the environment.
- Closure criteria under New Jersey's Site Remediation Program (SRP) can be achieved, however timing and specific requirements vary from those prescribed in the existing regulations.
- Implementing sustainable practices will significantly reduce the carbon footprint associated with these sites while meeting existing closure goals.



# Case Studies

- Developed 2 & 3 dimensional models of constituents of interest (COIs) at 10 retail petroleum sites in New Jersey.
- Created comprehensive activity forecasts to obtain site closure under current NJDEP requirements.
- Estimated the carbon footprint associated with completing those activities.
- Evaluated the progress of the current remedial strategies both from COI degradation and carbon footprint standpoints over a 4-year period to determine overall environmental benefit.

# Carbon Footprint Contribution

- Energy consumption associated with site closure activities included:
  - Gasoline usage
  - Diesel usage
  - Electricity usage
  - Natural Gas usage
- Energy consumption was conservatively estimated for closure activities including:
  - Field investigation and engineering activities
  - Sample collection
  - Laboratory analysis
  - Remediation
  - Administrative closure activities
- Risks were not calculated for field personnel traveling/working at sites.



# Findings

- Hydrocarbons (Mass) estimates at the 10 Retail Sites:
  - Ranged from 0.05 pounds to 7.5 pounds or an average of 1.5 pounds per site.
  - Equates to a gasoline volume equivalent ranging from 0.04 gallons to 9 gallons or an average of 1.8 gallons per site.
  - Conservative value estimates.

# Findings (cont.)

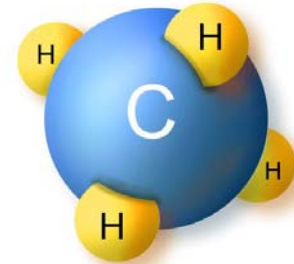
- Closure under the current SRP regulations results in:
  - The generation of 1,587 pounds to 6,820 pounds of carbon dioxide emissions or an average of 4,646 pounds per site.
  - An amount of carbon dioxide equivalent to burning between 81 to 349 gallons of gasoline or an average of 237 gallons of gasoline per site.

# Site # 944 Map

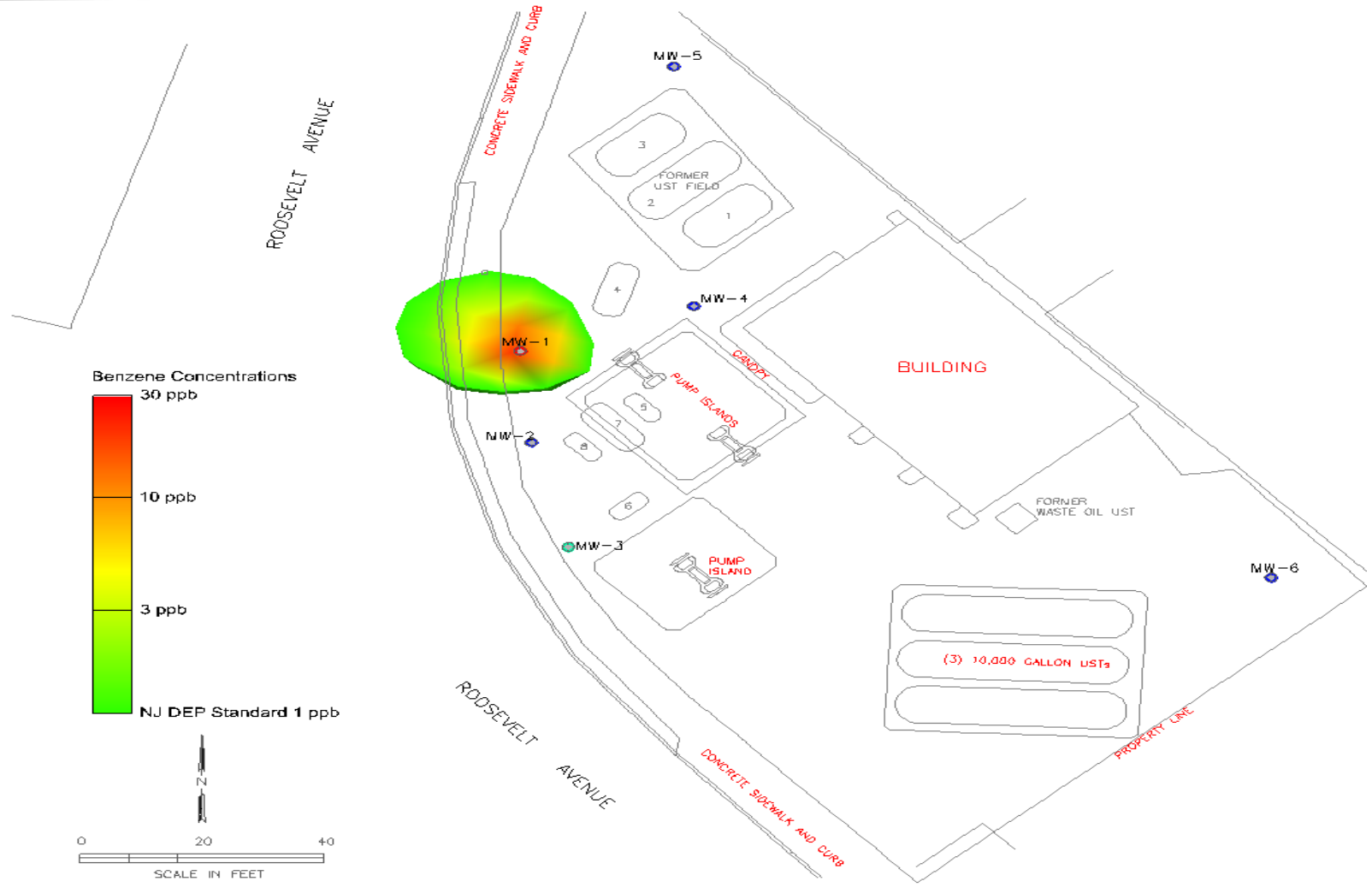


# Site # 944

- Estimated Hydrocarbon mass at site:
  - 0.05 pounds (22 grams)
  - 0.04 gallon (150 milliliters)
- Targeted compounds (average modeled concentration [AMC]):
  - Benzene (AMC = 0.3  $\mu\text{g/L}$ ) v. NJ DEP Standard (1  $\mu\text{g/L}$ )
  - MTBE (AMC = 6.2  $\mu\text{g/L}$ ) v. NJ DEP Standard (70  $\mu\text{g/L}$ )
  - TBA (AMC = 11.5  $\mu\text{g/L}$ ) v. NJ DEP Standard (100  $\mu\text{g/L}$ )

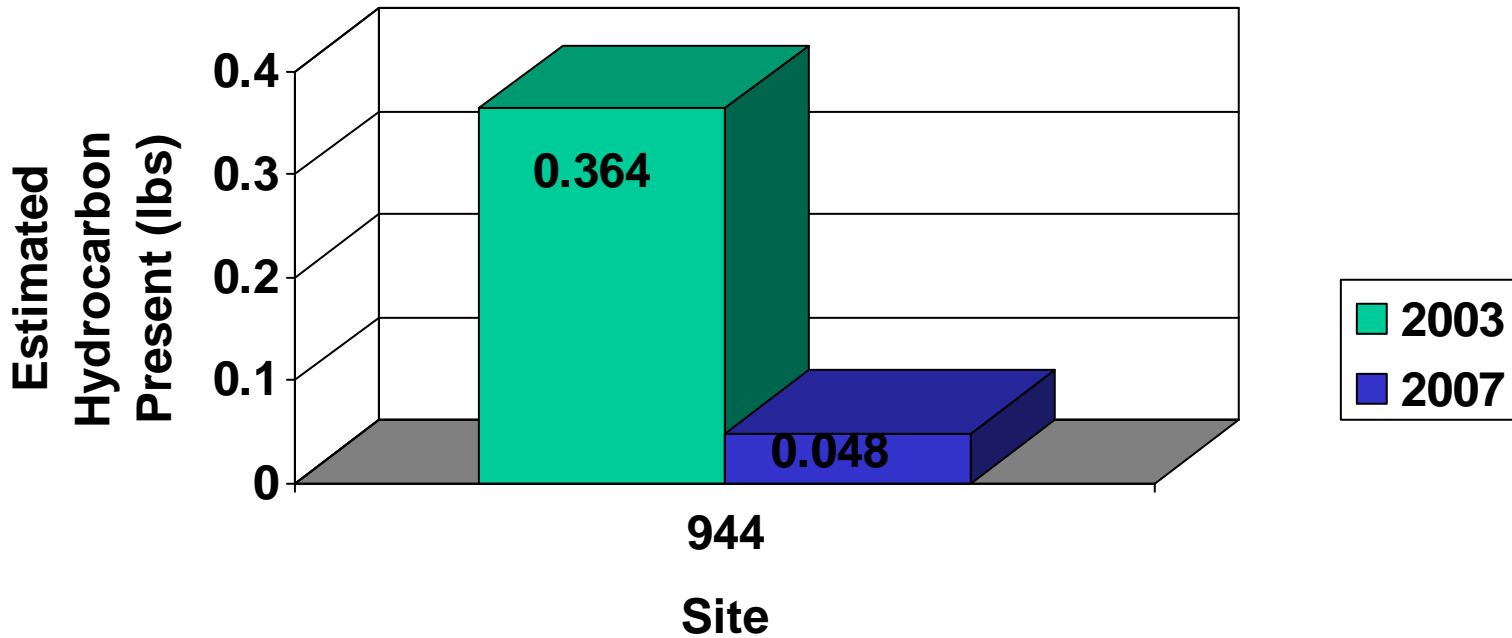


# Site # 944 Map



# Site # 944

## Hydrocarbon Mass at Site



# Carbon Assessment by Year and Task

Carbon Footprint Assessment (Activity Totals By Year)				
Activity totals	Units	Total Resources Required for Activity	Units	Total CO <sub>2</sub> Emissions (Pounds)
<b>Activity totals - year 1</b>				CO <sub>2</sub> Equivalent
485.4	light miles	23.08	gallons of gasoline	452
40	heavy miles	5.71	gallons of diesel	128
8	heavy machine hours	160.00	gallons of diesel	3,581
219	kW hours	219.00	kW hours	235
4	Ccf natural gas consumption	4.00	Ccf	48
	<b>Pounds of CO<sub>2</sub> Year 1</b>			<b>4,444</b>
<b>Activity totals - year 2</b>				CO <sub>2</sub> Equivalent
451.4	light miles	21.47	gallons of gasoline	420
228	kW hours	228.00	kW hours	244
4	Ccf natural gas consumption	4.00	Ccf	48
	<b>Pounds of CO<sub>2</sub> Year 2</b>			<b>712</b>
<b>Activity totals - year 3</b>				CO <sub>2</sub> Equivalent
451.4	light miles	21.47	gallons of gasoline	420
228	kW hours	228.00	kW hours	244
4	Ccf natural gas consumption	4.00	Ccf	48
	<b>Pounds of CO<sub>2</sub> Year 3</b>			<b>712</b>
<b>Activity totals - year 4</b>				CO <sub>2</sub> Equivalent
451.4	light miles	21.47	gallons of gasoline	420
228	kW hours	228.00	kW hours	244
4	Ccf natural gas consumption	4.00	Ccf	48
	<b>Pounds of CO<sub>2</sub> Year 4</b>			<b>712</b>

Carbon Footprint Assessment (Activity Totals By Task)				
Activity totals	Units	Total Resources Required for Activity	Units	Total CO <sub>2</sub> Emissions (Pounds)
<b>Task Total - task 1 - Groundwater Monitoring</b>				
1805.7	light miles	85.86	gallons of gasoline	1,680
423	kW hours	423.00	kW hours	453
	<b>Pounds of CO<sub>2</sub> Task 1</b>			<b>2,133</b>
<b>Task Total - task 2 - Remediation</b>				
MNA	<b>Pounds of CO<sub>2</sub> Task 2</b>			<b>0</b>
<b>Task Total - task 3 - Reporting</b>				
480	kW hours	480.00	kW hours	514
16	Ccf natural gas consumption	16.00	Ccf	193
	<b>Pounds of CO<sub>2</sub> Task 3</b>			<b>707</b>
<b>Task Total - task 4 - Additional Activities</b>				
34.0	light miles	1.62	gallons of gasoline	32
40	heavy miles	5.71	gallons of diesel	128
8	heavy machine hours	160.00	gallons of diesel	3,581
	<b>Pounds of CO<sub>2</sub> Task 4</b>			<b>3,741</b>

# Site # 944 Summary

- Minimum carbon footprint to close Site #944 under NJ DEP SRP is 6,581 pounds, assuming optimal attenuation rates (4 years) and current regulatory requirements for site.
- Actual carbon footprint to close Site #944 could be 10,000 pounds or higher depending on attenuation rates.

# Site # 944 Summary (cont.)

- Using a sustainable sampling/reporting strategy, energy and carbon emissions can be reduced while still meeting project closure goals. For example:
  - Modifying the monitoring/reporting frequency would reduce 30% of the CO2 emissions.
  - Eliminating the installation of the additional monitoring well would reduce 56% of the CO2 emissions.
  - Switching from MNA to ISCO would reduce 20% of the CO2 emissions.
- This CO2 amount is equivalent to not burning 350 gallons of gasoline, 305 gallons of diesel, or 57,590 cubic feet of natural gas, or not using 6,450 kilowatt hours of electricity.

# Conclusions

- Sustainable remediation should be evaluated at all sites to determine the total impact resulting from “active” remediation or current requirements at each site. Implementing sustainable practices into site cleanups can lead to significant reductions in the carbon footprint associated with remediation requirements.
- When sustainable practices are implemented in a manner consistent with the intent of the NJ DEP – closure requirements can be met within reasonable timeframes while being protective of human health and the environment.

# Thank You



**“Setting the Standards for Innovative Environmental Solutions”**

Environmental Standards, Inc.  
1140 Valley Forge Road  
P.O. Box 810  
Valley Forge, PA 19482  
610.935.5577  
solutions@envstd.com  
www.envstd.com