# Green & Sustainable Remediation:

## Application, Uncertainties/Barriers, and Future Direction

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# Consider a Typical Cleanup Project…

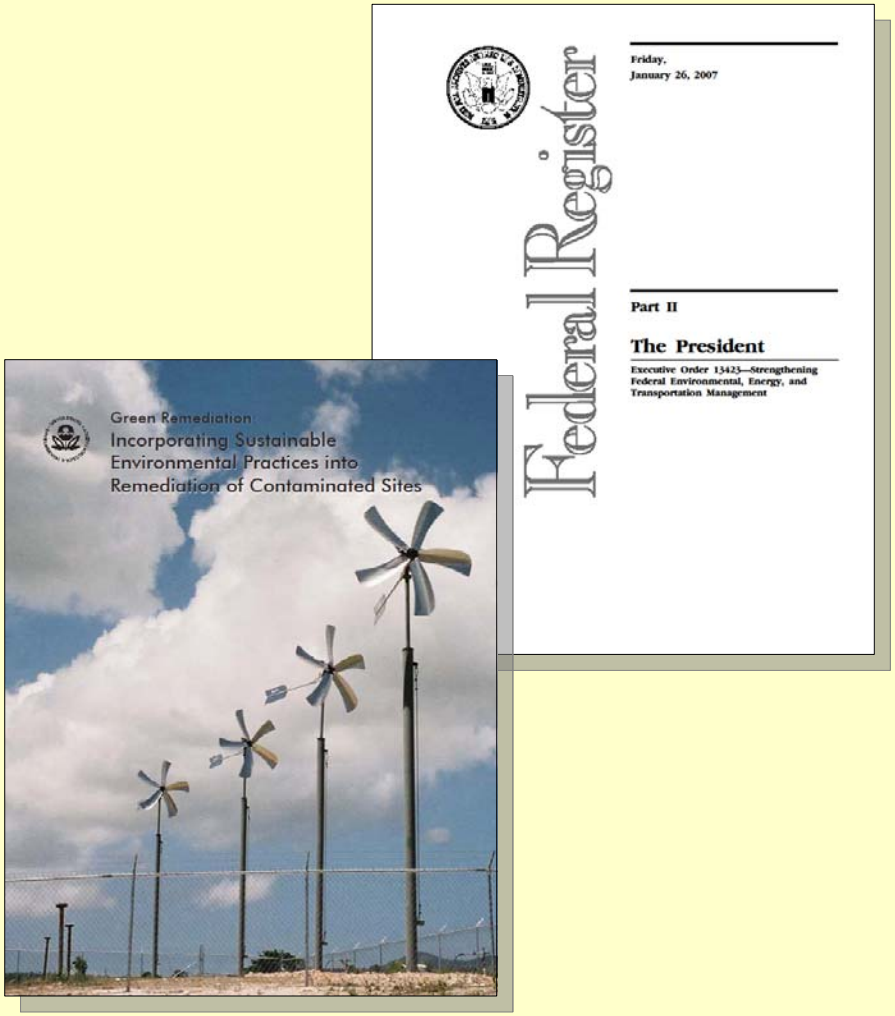
# Definitions

Green Remediation (GR): considers all environmental effects of remedy implementation and incorporates options to minimize the environmental footprint of a cleanup [environmental component]

Sustainable Remediation (SR): a remedy whose net benefit on human health and the environment is maximized through the judicious use of natural resources; includes GR [environmental, social, and economic components]

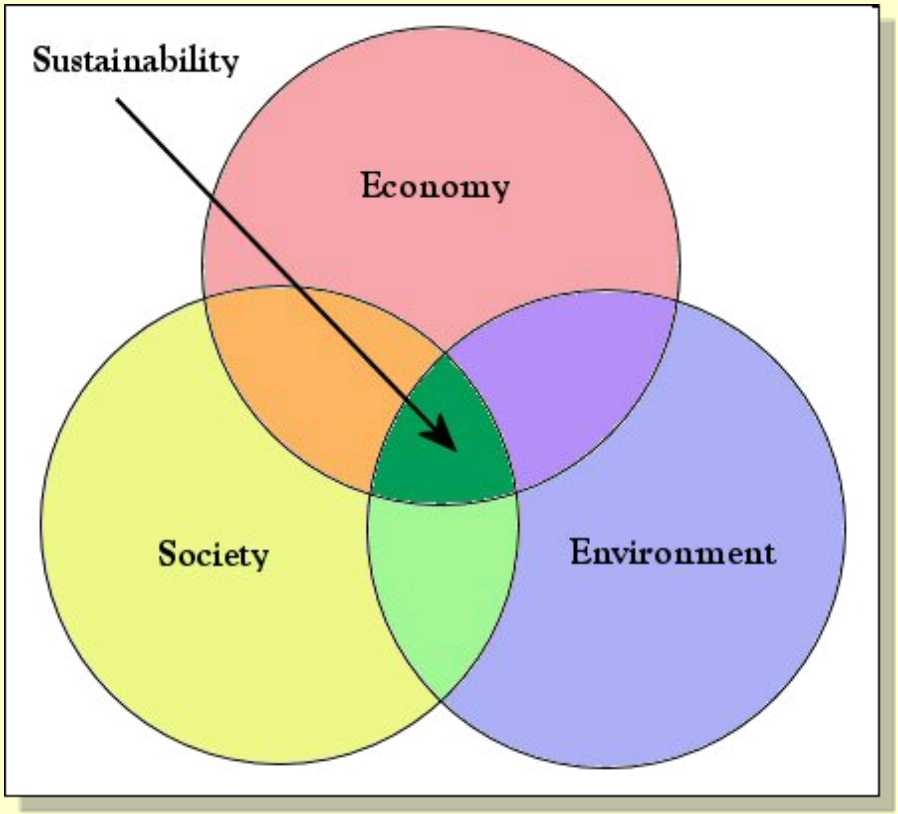
# Drivers

- US EPA Strategic Plan 2006-2011 (2006)
- EO 13423 (2007)
- *Green Remediation Primer* (2008)



# GSR Contributions

- US EPA
- US DOD
- US DOE
- US Navy
- US Air Force
- US Army
- State Regulators
- SERDP/ESTCP
- ITRC
- ASTM
- ASTSWMO
- SURF



# Authority

- All 10 EPA regions have a Green Remediation Policy or Interim Policy (Region 5 – 11/12/09)
- Some state regulators are following suit with their own policies
- Ohio EPA supports Region 5 Interim Policy and has began internal discussions regarding agency education and policy development

***Currently, GSR is not enforced but is expected to be considered…we may soon see GSR language in regulations and permits***

# Metrics

- Energy consumption
- Pollutant and GHG emissions
- Water impacts and resources
- Ecological impacts
- Resource consumption
- Worker safety
- Community impacts
- Capital and O&M cost
- Material use and waste production
- Land use and value

# Methods & Tools

- Life Cycle Assessment (LCA)
- Net Environmental Benefit Analysis (NEBA)

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- Sustainable Remediation Tool (SRT™)
- SiteWise™
- Web-based calculators (e.g. GHG)

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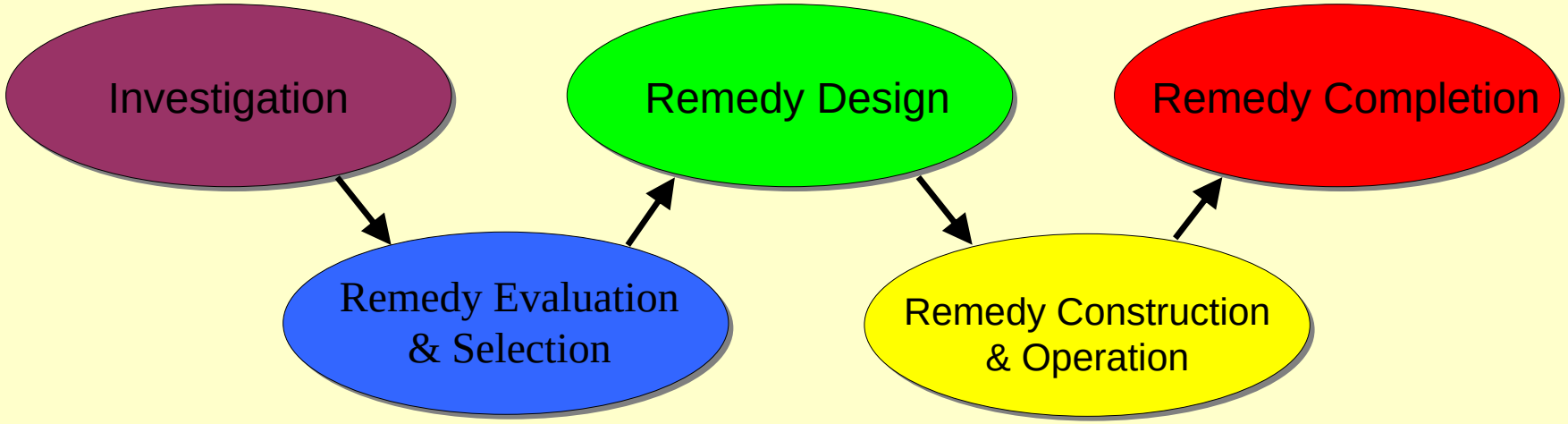
- Various Others

# Resources

- EPA GR Best Management Practices (BMPs) Fact sheets
  - Site investigation
  - Excavation & surface restoration
  - Pump & treat technologies
  - Bioremediation
  - AS/SVE
  - Clean fuel & emission technologies
  - Additional fact sheets to be released
- Various Others

# GSR Examples

GSR examples throughout the remediation lifecycle…




- *Stakeholder and community engagement should occur throughout all phases*
- *There will always be circumstances in which all potential remedies or the implemented remedy is not the most green & sustainable due to site-specific conditions – GSR opportunities still exist!*

# Overarching Planning & Assessment

- *The following GSR considerations, questions, and approaches apply to all phases of the remediation lifecycle:*
  - Goals/objectives/drivers
  - Capabilities of project team
  - Incentives
  - Time and budget constraints
  - Contractual mechanisms
  - Evaluation boundary
  - Stakeholder identification/engagement
  - Documentation and tracking

# Investigation

- Real-time data collection technologies & mobile labs
- Local contractors
- Direct push technology
- Triad approach
- Limit sample shipments
- Low-flow or passive groundwater sampling
- Reduce investigation derived waste
- Anti-idling policy & ULSD

# Remedy Evaluation & Selection

- *This phase offers greatest opportunity to reduce the environmental footprint*
  - Identify relevant GSR considerations in existing evaluation criteria of the program
  - Develop a list of GSR metrics applicable to the remedial alternatives and project
  - Select a tool or method to calculate metrics and perform calculations
  - Perform comparative analysis by ranking or scoring (apply weighting as appropriate)
  - Consolidate comparative analysis results with detailed analysis of remedial alternatives

# Remedy Design

- Maximize efficiency
- Allow for flexibility
- Consider the most important GSR concepts
- Alternative energies
- Automation & telemetry
- Develop/update exit strategy

# Construction, Operation & Maintenance

- GSR contract language
- Anti-idling policy
- Particulate filters or oxidation catalysts
- ULSD or biodiesel
- Local contractors
- Recycle demolition debris
- Limit road congestion
- Community awareness, education, & involvement
- Carbon offset credits
- Periodic assessment and optimization

# Long-Term Monitoring & Closeout

- Consider maximum beneficial use of property during decommissioning
- Evaluate GSR options for long-term site management and monitoring

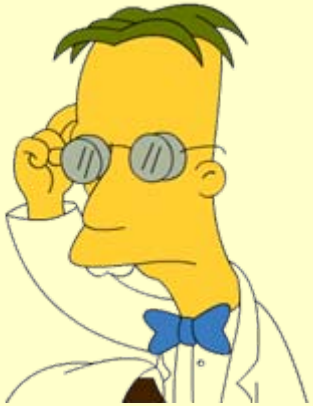
# Green Washing

Use of GSR should not be an excuse to conduct a poor cleanup….the regulatory authority will not allow green washing to occur

Green washing is very subjective and may likely be viewed differently in the future as GSR evolves

*Direct discharge*
*In place of air treatment?*

*Passive rather than active remediation?*



# Barriers & Uncertainties

- *Develop guidance for incorporating GSR into various regulatory programs*
- *Need to establish a consistent approach for calculating, evaluating, and reporting GSR metrics*
- *Provide incentives and recognition for GSR implementation*

# Barriers & Uncertainties

- *Implementation of various GSR BMPs may be difficult due to (1) lack of contractual mechanisms when using preferred contractors or facility personnel and (2) workers having set routines and many not be aware of or understanding GSR benefits*

- *Empower regulators who are proactive and demonstrate GSR Support*

# Future Direction

ASTM Standard: Standard Guide for Green and Sustainable Site Assessment and Cleanup (WK23495)

- Option 1: Basic Qualitative Analysis
  - G1: green BMPs
  - S1: sustainable BMPs
- Option 2: Quantitative Analysis
  - G2: green and environmental data measurements and analysis
  - S2: sustainability evaluation

# Future Direction

Interstate Technical & Regulatory Council (ITRC)
GSR Team Documents:

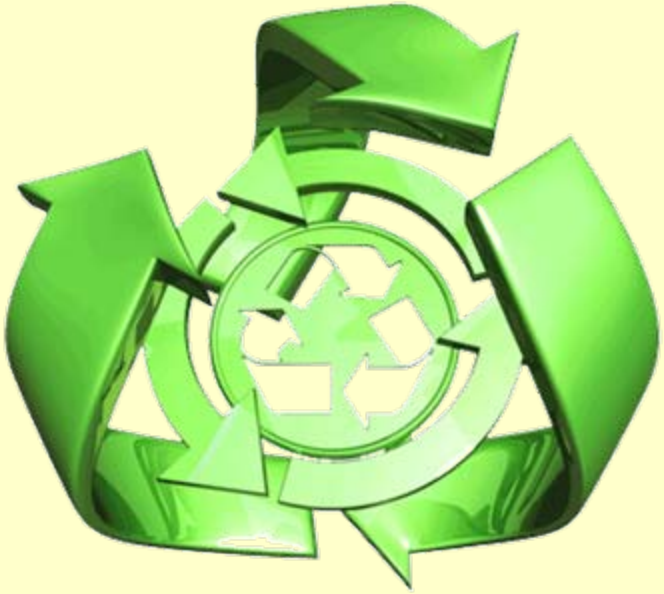
- Overview document (early 2011)
  - Current state of science and practice
  - Explanation of terminology
  - Summary of federal and state efforts
  - Intro to metrics, methods, and tools
- Technical/Regulatory document (late 2011)
  - GSR planning and assessment approach
  - GSR framework for each remediation phase
  - Tools and methods
  - Various other topics

# Future Direction

U.S. EPA Superfund Green Remediation Strategy (Sept. 2010)

- Actions focused on Superfund but will influence many federal & state programs
- Various partnering to accomplish Strategy
- 9 key actions with associated sub-actions and activities
  - Policy and guidance development
  - Resource development and program implementation
  - Program evaluation
- Some actions completed, most underway

# Key Guidance

- Sustainable Remediation Forum (SURF), Integrating Sustainable Principles, Practices, and Metrics into Remediation Projects, Remediation Journal, 19(3), pp 5 - 114, editors P. Hadley and D. Ellis, Summer 2009.
- U.S. Army Corps of Engineers, Decision Framework for Incorporation of Green and Sustainable Practices into Environmental Remediation Projects, Environmental and Munitions Center of Expertise, Interim Guidance, March 5, 2010.
- U.S. EPA, Green Remediation Primer: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites, Office of Solid Waste and Emergency Response, EPA 542-R-08-002, April 2008.
- U.S. EPA, Region 5 Greener Cleanup Interim Policy, Superfund Division, Land and Chemicals Division, November 12, 2009.
- U.S. EPA, Superfund Green Remediation Strategy, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, September 2010.
- U.S. EPA, Green Remediation Best Management Practices: Fact Sheets on Specific Remedies and Other Key Issues, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, September 2010 Update.

# Questions?