Green and Sustainable Remediation


Sponsored by: Interstate Technology and Regulatory Council (www.itrcweb.org)
Hosted by: US EPA Clean Up Information Network (www.cluin.org)
ITRC (www.itrcweb.org) – Shaping the Future of Regulatory Acceptance

- Host organization
- Network
  - State regulators
    - All 50 states, PR, DC
  - Federal partners
- ITRC Industry Affiliates Program
- Academia
- Community stakeholders

- Disclaimer
  - Full version in “Notes” section
  - Partially funded by the U.S. government
    - ITRC nor US government warrantee material
    - ITRC nor US government endorse specific products
  - ITRC materials copyrighted

- Available from www.itrcweb.org
  - Technical and regulatory guidance documents
  - Internet-based and classroom training schedule
  - More...
The site-specific employment of products, processes, technologies, and procedures that mitigate contaminant risk to receptors while making decisions that are cognizant of balancing community goals, economic impacts, and net environmental effects.
Green & Sustainable Remediation

Sustainability

Environmental
Economic
Social
GSR Framework

GSR Planning + GSR Implementation

- Evaluate/Update Conceptual Site Model
- Establish GSR Goals
- Stakeholder Involvement
- Select Metrics, Evaluation Level, Boundaries
- Document GSR Efforts

- Identifying GSR Options
- Performing GSR Evaluations
- Implementing GSR Approaches
- Monitoring, Tracking, and Documentation

- Investigation
- Closeout
- Remedy Evaluation and Selection
- Remedy Design
- Remedy Construction
- Operation, Maintenance, and Monitoring
- Remedy Optimization

= GSR Framework
GSR Framework

Flexible and Scalable

- Flexibility similar to that found in conceptual remedial designs
- Scalable to the size and level-of-detail of the project

Example: UST site vs. Superfund site
GSR Planning

GSR Evaluation Levels

LEVEL 3
BMPs + Advanced Evaluation

LEVEL 2
BMPs + Simple Evaluation

LEVEL 1
Best Management Practices (BMPs)
GSR Evaluation

Level 1 Example

Operation, maintenance, and monitoring example BMPs

- Select local contractors
- Minimize mobilizations
- Engage the local community
- Use renewable energy
- Reduce noise, especially beyond site boundary
- Implement land revitalization opportunities
## GSR Evaluation

### Level 2 Example

### Hypothetical Remedy Evaluation and Selection

<table>
<thead>
<tr>
<th>Metric</th>
<th>In Situ Thermal</th>
<th>Bioremediation</th>
<th>In Situ Chemical Oxidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gases</td>
<td>☹</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Solid waste</td>
<td>☺</td>
<td>☺</td>
<td>☺</td>
</tr>
<tr>
<td>Sensitive species</td>
<td>☹</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Community disturbance</td>
<td>☺</td>
<td>☺</td>
<td>☺</td>
</tr>
<tr>
<td>Community acceptance</td>
<td>☺</td>
<td>☹</td>
<td>☹</td>
</tr>
<tr>
<td>Cost</td>
<td>☹</td>
<td>☺</td>
<td>☹</td>
</tr>
</tbody>
</table>
## Hypothetical Investigation

<table>
<thead>
<tr>
<th>Metric</th>
<th>Approach 1</th>
<th>Approach 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>2 metric tons</td>
<td>1.5 metric tons</td>
</tr>
<tr>
<td>Investigation Derived Waste</td>
<td>1,750 pounds</td>
<td>1,230 pounds</td>
</tr>
<tr>
<td>Waste Water</td>
<td>500 gallons</td>
<td>390 gallons</td>
</tr>
<tr>
<td>Local Economy Benefit</td>
<td>$62,000</td>
<td>$35,000</td>
</tr>
<tr>
<td>Cost</td>
<td>$120,000</td>
<td>$85,000</td>
</tr>
</tbody>
</table>
Before Selecting GSR Tools

Set GSR Goals and Select Metrics

<table>
<thead>
<tr>
<th>Example Goals</th>
<th>Example Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce emissions</td>
<td>Greenhouse gases</td>
</tr>
<tr>
<td></td>
<td>Air quality emissions</td>
</tr>
<tr>
<td>Conserve natural resources</td>
<td>Energy and water use</td>
</tr>
<tr>
<td></td>
<td>Resource consumption</td>
</tr>
<tr>
<td>Create habitat</td>
<td>Ecological service value</td>
</tr>
<tr>
<td>Improve community</td>
<td>Traffic volume</td>
</tr>
<tr>
<td></td>
<td>Jobs for local workers</td>
</tr>
</tbody>
</table>
### GSR Planning

#### Metric Examples from Part of Table 4-1 in GSR-1

<table>
<thead>
<tr>
<th>Metric</th>
<th>Metric Units</th>
<th>Metric Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Water Consumption</td>
<td>gallons</td>
<td>volume of fresh water used</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>species count</td>
<td>assessment of impacts on biodiversity</td>
</tr>
<tr>
<td>Renewable Energy Use</td>
<td>gallons; BTU; kWh</td>
<td>measure of use of renewable energy</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>CO₂ equivalents emitted</td>
<td>tons of GHGs emitted</td>
</tr>
<tr>
<td>Material Use</td>
<td>Kg</td>
<td>kg of total material use, or mass by category of material</td>
</tr>
<tr>
<td>Employment</td>
<td>jobs created</td>
<td>number of jobs created as a result of implementing remedy</td>
</tr>
<tr>
<td>Capital Costs</td>
<td>$</td>
<td>capital costs of project</td>
</tr>
<tr>
<td>Community Impacts</td>
<td>subjective</td>
<td>impacts of project on the community</td>
</tr>
<tr>
<td>Cultural Resources</td>
<td>subjective</td>
<td>impacts of project on cultural resources</td>
</tr>
</tbody>
</table>
Tool Selection

Wide Range of Available Tools

- Choose simplest tool that gets the job done
- BMPs (Level 1) are most often used
## Tool Selection
### Select the Right Level of Evaluation

<table>
<thead>
<tr>
<th>Description</th>
<th>Level 1 BMPs</th>
<th>Level 2 BMPs + Simple</th>
<th>Level 3 BMPs + Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>• Best practices (e.g., no idling of truck engines at job site)</td>
<td>• Qualitative ranking process</td>
<td>• Quantitative analysis (e.g., footprint analysis, Net Environmental Benefits Analysis)</td>
</tr>
<tr>
<td>Pros</td>
<td>• Simple</td>
<td>• Evaluates multiple metrics</td>
<td>• Quantifies multiple metrics</td>
</tr>
<tr>
<td></td>
<td>• Cost-effective</td>
<td>• Simple calculations only (lb CO₂/lb contaminant treated)</td>
<td>• Track impacts from cradle to cradle</td>
</tr>
<tr>
<td></td>
<td>• Easy to implement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cons</td>
<td>• Does not evaluate trade-offs</td>
<td>• Requires scoring method</td>
<td>• Requires scoring method</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• More costly, time-consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• More data required</td>
</tr>
</tbody>
</table>
Key Lessons

- **Flexibility**: GSR process can be applied to a variety of sites, remediation phases and regulatory programs.

- **Communication**: Communication with stakeholders is critical to successful application of GSR.

- **Assumptions**: Because evaluation methods are new, users must understand the assumptions of the tools being used.

- **Holistic**: This holistic approach will minimize a project’s life cycle impacts.
Relationship to Other GSR Efforts

Information clearinghouse, Core Elements, fact sheets, best management practices, standard guide

Detailed information specific to metrics, framework, and life-cycle assessment

White papers, BMPs, and incentives

Sustainable Remediation Tool™, SiteWise™ Tool, Fact Sheets, Case Studies

Practical guidance with a framework, metrics and tools for remedial practitioners
Resources and Contacts

ITRC Guidance Document

Internet Based Training
https://cluin.org/live/archive/default.cfm?display=all&group=itrc

Buddy Bealer
Policy and Advocacy Regional Manager
DS SGW FDG Risk Management and Advocacy
128 East Center Street, Nazareth PA 18064
Email: leroy.bealer@shell.com
Internet: http://www.shelloilproductsus.com/

Internet Based Training

Tom O’Neill
NJDEP SRWMP
Publicly Funded Response Element
401 E. State Street, 5th Floor
P.O. Box 420
Trenton, New Jersey 08625-0420
Email: tom.o’neill@dep.nj.gov
Internet: http://www.nj.gov/dep/srp/