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Evaluation of Implementation of the Superfund *Green Remediation Strategy*

Final Report

Promoting Environmental Results

Through Evaluation

ACKNOWLEDGEMENTS

This report, Evaluation of Implementation of the Superfund *Green Remediation Strategy*, was developed for the U.S. Environmental Protection Agency's Office of Policy (OP) under Contract EP-W-10-002 between EPA and Industrial Economics, Inc. (IEc) of Cambridge, MA. The IEc evaluation team included Cynthia Manson, Fauna Samuel, and Yeshaya Dobrusin.

Carlos Pachon, Suzanne Wells, and Ellen Treimel of EPA's Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation (OSRTI) provided critical assistance and background information on the Superfund *Green Remediation Strategy* program. John Heffelfinger and Shari Grossarth of OP's Evaluation Support Division (ESD) provided technical support and advice for the evaluation. Special thanks go to EPA staff at Headquarters and the Regions who shared thoughtful reflections, recommendations, and critiques during the conduct of this evaluation.

This evaluation was funded jointly by OSRTI and ESD, and was selected under the Program Evaluation Competition, sponsored annually by EPA's Office of Policy. Program evaluation is one of the performance management tools that EPA uses to assure itself, the public, and other interested stakeholders that EPA programs are protecting human health and the environment effectively and efficiently. The information obtained through program evaluations can shed light on whether EPA programs are meeting their goals and objectives, provide the evidence and road map needed to replicate successes, and identify those aspects of EPA programs needing improvement. To access copies of this or other EPA program evaluations, please go to EPA's Evaluation Support Division website at http://www.epa.gov/evaluate.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Superfund program is working to advance greener cleanups at Superfund sites. Green remediation (GR) is defined as the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of remedies. Central to this effort is the Superfund *Green Remediation Strategy*, which was published in final form in September, 2010. The strategy outlines 40 action items across three main areas with the ultimate goal of reducing the environmental footprint of cleaning up contaminated sites.

As part of the *Strategy*, the Superfund program is evaluating the implementation of the *Strategy* itself. The chosen approach is to conduct a "formative" evaluation of the national-level effort. The purpose of the evaluation is to document the *Strategy's* effectiveness in advancing greener cleanups. This evaluation was guided by nine questions organized under three key purposes:

Evaluation Purpose 1: Assess EPA experiences to date in implementing the *GR Strategy*

1. Does EPA have clearly defined goals and objectives for the *GR Strategy*? Should they be refined and improved to enhance usefulness (e.g., for management decision making, planning and budgeting, EPA's *Strategic Plan*)?
2. Which initial activities or initiatives from the *GR Strategy* have been most effective in increasing awareness, adoption and/or implementation of GR strategies?
3. How do Remedial Project Managers (RPMs) factor the *GR Strategy* into their approach to planning site cleanup?
    - What GR practices are being implemented?
    - What percentage of RPMs are implementing specific GR practices?
    - What do RPMs know about the energy usage at the sites they manage?
    - What information do RPMs track on other GR core elements?
4. What effect has the *GR Strategy* had on the practice of using green remediation techniques at Superfund sites?
5. What lessons have been learned as a result of implementing the *GR Strategy* at sites?
    - What factors affect the ability to implement the *GR Strategy* at sites? (e.g., technical issues, cost issues, legal issues, management support, contract provisions, or contractor capabilities)
    - How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?

Evaluation Purpose 2: Determine a baseline against which to measure EPA progress in implementing the *GR Strategy*

6. What options can we identify for developing a baseline?

   - What has changed since the implementation of the *GR Strategy*?
   - When did green remediation become important to site cleanup?
   - What options are available for quantifying the environmental footprint at sites?

Evaluation Purpose 3: Determine the best metrics for measuring the program's success in implementing GR practices

7. What performance measures are appropriate for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?
8. What are the best means for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of *GR Strategy?*

   - What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?

9. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

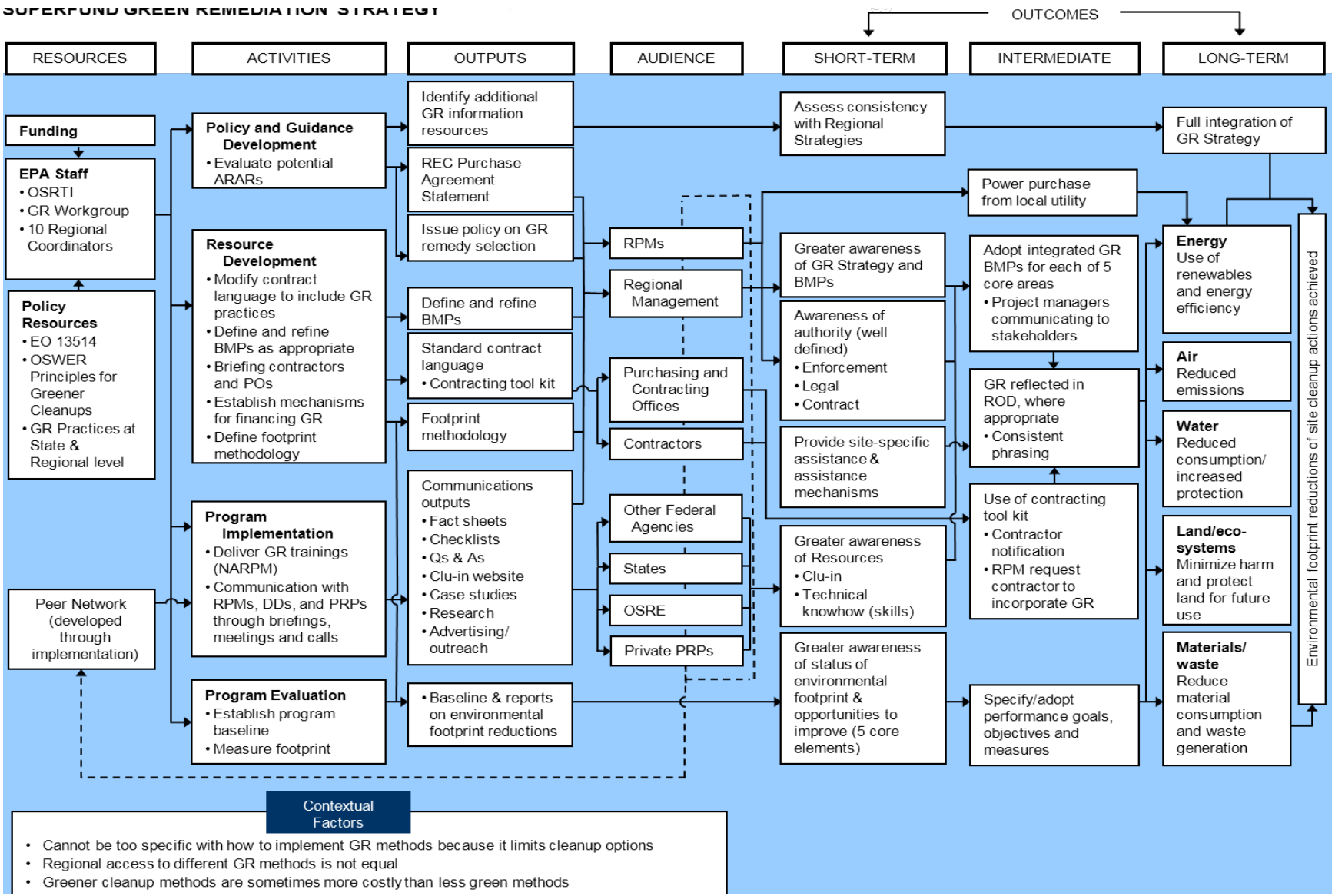
PROGRAM LOGIC MODEL

An initial step in the evaluation was the development of a program logic model (Exhibit ES-1) to illustrate the various components of the Superfund *Green Remediation Strategy* and to inform development of specific evaluation questions. For this evaluation, the logic model focuses on the outcomes that are most relevant to the Superfund *Green Remediation Strategy* and the ability to measure its progress. The logic model activities are organized to reflect the three main categories of actions in the *GR Strategy*, including policy and guidance development, resource development and program implementation, and program evaluation.

EVALUATION METHODOLOGY

As discussed in Chapter 2 of this report, this evaluation uses a range of data sources and analytic techniques. First IEc conducted a review of existing published background documents available online and provided by EPA. In addition, IEc reviewed, as relevant, site specific data (e.g., to identify available data to support specific metrics for documenting progress under the *GR Strategy* on the core elements). Finally, this evaluation relies primarily on data collected directly from EPA personnel who are currently involved in the implementation of the *GR Strategy*. IEc employs a combination of targeted interviews, literature review, and review of existing survey and site data to ensure high quality data collection and analysis. Exhibit ES-2 summarizes the methods and data sources used to address the evaluation questions.

EXHIBIT ES-1. SUPERFUND *GREEN REMEDIATION STRATEGY* LOGIC MODEL



ES-2. EVALUATION QUESTIONS AND DATA SOURCES FOR FORMATIVE EVALUATION OF THE *GR STRATEGY*

EVALUATION QUESTION	PRIMARY DATA AND METHODS	SECONDARY DATA AND METHODS
EVALUATION PURPOSE 1: ASSESS EPA EXPERIENCES TO DATE IN IMPLEMENTING THE *GR STRATEGY*		
1. Does EPA have clearly defined goals and objectives for the GR Strategy? Should they be refined and improved to enhance usefulness (e.g. for management decision making, planning and budgeting, EPA's Strategic Plan)?	Interviews: • Regional Coordinators • Outside-EPA staff	Interviews: • Regional attorneys • Front line managers Data Review: • *GR Strategy*
2. Which initial activities or initiatives from the GR Strategy have been most effective in increasing awareness, adoption and/or implementation of the GR Strategy?	Interviews: • Regional Coordinators Data Review: • Atlanta Meeting survey • State and regional strategies	Interviews: • Regional attorneys • Front line managers Data Review: • *GR Strategy*
3. How do Remedial Project Managers (RPMs) factor the GR Strategy into their approach to planning site cleanup?		
3a) What GR practices are being implemented?	Interviews: • Regional Coordinators Data Review: • Atlanta Meeting and regional surveys • State and regional strategies	Interviews: • Regional attorneys • Front line managers Data Review: • *GR Strategy*
3b) What percentage of RPMs are implementing specific GR practices?		
3c) What do RPMs know about the energy usage at the sites they manage?		
3d) What information do RPMs track on other GR core elements?		
4. What effect has the GR Strategy had on the practice of using green remediation techniques at Superfund sites?	Interviews: • Regional Coordinators	Data Review: • *GR Strategy* • CLU-IN case study site profiles • Regional surveys • State and regional strategies
5. What lessons have been learned as a result of implementing the GR Strategy at sites?		
5a) What factors affect the ability to implement the *GR Strategy* at sites (e.g., technical issues, cost issues, legal issues, management support, contract provisions, or contractor capabilities)?	Interviews: • Regional Coordinators	Interviews: • Regional attorneys • Front line managers • Outside-EPA staff Data Review: • CLU-IN website use data
5a) How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?		

EVALUATION QUESTION	PRIMARY DATA AND METHODS	SECONDARY DATA AND METHODS
EVALUATION PURPOSE 2: DETERMINE A BASELINE AGAINST WHICH TO MEASURE EPA PROGRESS IN IMPLEMENTING THE *GR STRATEGY*		
6. What options can we identify for developing a baseline?		
6a) What has changed since the implementation of the *GR Strategy*? 6b) When did green remediation become important to site cleanup? 6d) What options are available for quantifying the environmental footprint at sites?	Data Review: • *GR Strategy* • Footprint methodology • Published studies • CLU-IN case studies	Interviews: • Regional coordinators • Measurement specialists • Outside-EPA staff Data Review: • Regional tracking data
EVALUATION PURPOSE 3: DETERMINE THE BEST METRICS FOR MEASURING THE PROGRAM'S SUCCESS IN IMPLEMENTING GR PRACTICES		
7. What performance measures are appropriate for measuring the effectiveness of the GR Strategy in achieving intended outcomes at a regional or national level?	Data Review: • Footprint methodology • Published studies • Regional tracking data • Atlanta meeting and regional surveys	Interviews: • Regional coordinators • Measurement specialists • Outside-EPA staff
8. What are the best means for measuring the effectiveness of the GR Strategy in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of the GR Strategy?		
8a) What options exist for using qualitative or quantitative measures to assess the five core elements of the *GR Strategy*?	Data Review: • Published studies • CLU-IN website use data and case studies	Interviews: • Regional coordinators Data Review: • Atlanta meeting and regional surveys • Regional tracking data • Footprint analyses and tools
9. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the GR Strategy?	Interviews: • Regional coordinators • Measurement specialists Data Review: • Published studies	Data Review: • Footprint analyses and tools

EVALUATION FINDINGS

Chapter 3 presents the evaluation findings, organized by the evaluation purposes and then the evaluation questions. We provide a short summary below:

Evaluation Purpose 1: Assess EPA experiences to date in implementing the *GR Strategy*

Overall, interview respondents were uniformly positive in their opinions of the *GR Strategy* structure and purpose, though responses identified some differences of opinion in how best to present "goals" and objectives. Several respondents noted that a more precise goal statement could be useful both in increasing awareness and focusing further implementation of the *GR Strategy*.

In the strongest finding, EPA and non-EPA interviewees had very positive views of several key products of the *GR Strategy*, and felt that these tools and products have been a key driver in facilitating an expansion of GR activities. Respondents felt that awareness of the *GR Strategy* document was more limited, though publication of the *GR Strategy* has facilitated the use of GR by raising the national profile of GR.

Interview responses from the regions indicate that RPMs typically do not use the *GR Strategy* directly in their decision-making for GR implementation, though it is clear they use many of the tools and products developed to support the *GR Strategy*. The *GR Strategy* document was identified to be a more important tool for managers than for RPMs.

It is difficult to assess the distinct contributions of either the national strategy or regional policies separately, since they influence each other. A few regional policies informed the *GR Strategy*, while others many not have been released without the national focus on GR. Examination of regional data from surveys provides a snapshot of activities underway, and it is apparent that regions have increased emphasis on GR training and outreach as the *GR Strategy* has emerged.

A range of challenges face the broader implementation of the *GR Strategy*, with key concerns including the level of funding and support for *GR Strategy* personnel and project efforts. Other hurdles include a concern about policy and liability uncertainty, and limited participation from managers and other key staff.

Evaluation Purpose 2: Determine a baseline against which to measure EPA progress in implementing the *GR Strategy*

Interview responses from the regions indicated that most have not focused to date on developing a baseline. Overall most of the regions (eight of ten) identified that their current practices represent a fairly accurate baseline before the *GR Strategy* was released because the implementation of GR efforts is just beginning. A complexity of the *GR Strategy* is that it has been implemented as a unifying approach encompassing some existing efforts, and in some cases it clearly post-dates regional activities (e.g., Region 2 and 9). Moreover, a key goal of the program is awareness, and in some cases people are "doing" GR without calling it GR. The findings from this evaluation suggest that EPA

consider whether one baseline is adequate to support the program. If EPA wishes to document contribution of the *GR Strategy* generally then a single date-driven baseline may be appropriate. To document attribution, however, use of different regional baselines for site-specific action may be necessary.

Evaluation Purpose 3: Determine the best metrics for measuring the program's success in implementing GR practices

A review of the logic model associated with the *GR Strategy* suggests that a suite of appropriate performance measures for program performance would directly assess the short-term (changes in awareness), intermediate term (changes in behavior), and long-term (changes in site practice and impacts) outcomes of the *GR Strategy*. Metrics for each type of outcome would also allow EPA to assess the extent to which the *GR Strategy* is effectively implemented and successful in integrating GR principles throughout the remediation process. Successful metrics will also likely require only limited data collection and analysis.

Review of existing and emerging tools for calculating environmental footprint suggest EPA's efforts to craft and test a footprint methodology to support GR activities at sites provides a comprehensive set of metrics that map to four of the five *GR Strategy* core elements (excluding land and ecosystems). Several metrics listed in the footprint methodology appear consistent with other sources and may be able to be adopted with limited additional effort. The most successful metrics may be those that HQ can estimate using standardized values and limited regional data.

Interview responses suggest that a number of key challenges exist for understanding the impacts of GR. As was noted in Evaluation Purpose 1, a larger issue that arose from the interview process is the identification of the need for policy-level clarity of the *GR Strategy*. The lack of clear direction from EPA providing legal and policy justification for incorporating GR techniques at sites seems to have decreased momentum for moving GR forward in some regions. Other limitations that inhibit a better understanding of the results of implementing the *GR Strategy* include concerns about resource constraints (e.g., time, funding, manpower), concerns that clear legal authority for requiring GR practices is not well defined, and reluctance on the part of EPA staff in many regions to use the methodology to conduct footprint analyses.

EVALUATION CONCLUSIONS AND SUGGESTED NEXT STEPS

Chapter 4 of this report provides conclusions and suggested recommendations for the future implementation of the Superfund *Green Remediation Strategy*. In summary, they include recommendations that EPA:

- Focus on clarity of goals and implementation objectives.
- Continue emphasis on practical tools for GR implementation.
- Increase focus on policy and legal information and tools, or on other HQ "signaling."

- Consider the following as a starting point for establishing two baselines:
    - A region-specific baseline for documenting site-level changes (core elements) and attributing change to the *GR Strategy*.
    - A national baseline for documenting integration of GR practices into EPA cleanup culture.
- Work with regions and develop guidance on how and when to conduct footprint analyses.
- Start a dialogue with each of the regions to agree on the best way to leverage case study and other available data to develop an estimation tool or "average" values for GR practices.
- Select metrics to measure program success based upon appropriate EPA criteria.

CHAPTER 1 | INTRODUCTION AND PURPOSE

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, the U.S. Environmental Protection Agency (EPA) has, since 1980, investigated and assessed contaminated hazardous waste sites, and undertaken enforcement and remediation activities to ensure protection of human health and the environment. Hazardous waste site investigation and remediation uses resources such as energy, water, and materials, and also creates a physical environmental "footprint" at the site and any related disposal areas. In recent years, EPA has focused on identifying and employing "green remediation" techniques at Superfund sites. Green remediation (GR) is defined as the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of remedies. A centerpiece of this effort is EPA's Superfund *Green Remediation Strategy (*the *GR Strategy)*, which was published in draft form in 2009 and in final form in September, 2010. The strategy outlines 40 action items across three main areas: policy and guidance development; resource development and program implementation; and program evaluation. The central goal of the strategy is to reduce the environmental footprint of cleaning up contaminated sites by focusing on five core elements:

- Energy requirements of the treatment system;
- Air emissions;
- Water requirements and impacts on water resources;
- Material consumption and waste generation; and
- Land and ecosystem impacts.

In addition to the Superfund *Green Remediation Strategy*, EPA's Office of Superfund Remediation and Technology Innovation (OSRTI) in the Office of Solid Waste and Emergency Response (OSWER) has published a number of fact sheets and a technology primer, *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites*, to help guide decision-makers about the options that are most appropriate for specific site circumstances. Moreover, the Superfund site remediation programs in the ten EPA regions have begun to integrate GR practices at some sites. In some cases regional focus on GR pre-dates the publication of the *GR Strategy*. As EPA begins to incorporate GR more broadly, it is important to ensure that the *GR Strategy* and related efforts are appropriately focused, widely understood and applied where appropriate, and able to demonstrate and measure key impacts related to the five core elements.

As part of pursuing the *GR Strategy*, the Superfund program is evaluating the implementation of the strategy itself. Industrial Economics, Incorporated (IEc), with the support of EPA's Evaluation Support Division (ESD) in the Office of Policy, is conducting a "formative" evaluation of the national-level effort. A formative evaluation is conducted early in implementation of the program to assess how program activities and priorities are being implemented, and to ensure that program design and objectives are well-aligned. The purpose of the evaluation is to help focus the *GR Strategy's* future efforts to advance greener cleanups by examining three main parameters:

- Insights from EPA experiences to date in implementing the *GR Strategy*;
- Options for developing a baseline against which to measure EPA progress in implementing the *GR Strategy*;
- Options to assist OSRTI in developing the best metrics for measuring the program's successes in implementing GR practices.

Nine evaluation questions address different aspects of these evaluation parameters. The evaluation is designed to shed light on cross-cutting issues in implementing the *GR Strategy*, and to inform future efforts undertaken by OSRTI to integrate GR and reduce environmental footprints at National Priorities List (NPL) sites. As a formative evaluation, this effort does not focus on "performance" in achieving long-term "program" (i.e., *GR Strategy*) goals. Therefore, we do not attempt to quantify environmental footprint reductions at sites.

The Superfund program envisions the eventual integration of GR as standard business practice in site remediation, and anticipates a future evaluation that will assess the impact of the strategy. To further this effort, IEc has assisted EPA in developing a comprehensive logic model that identifies the key data needed to support related activities, outputs, and outcomes of the *GR Strategy* implementation efforts.

1.1 OVERVIEW OF THE SUPERFUND *GREEN REMEDIATION STRATEGY*

In September 2009, EPA issued its first formal strategy on green remediation for public review. In September 2010, EPA revised and reissued the strategy, after incorporating comments from the public review. The final *GR Strategy* outlines nine key actions, which describe 40 specific activities that the program intends to implement to promote green remediation. The actions are separated into three categories:

- Policy and guidance development;
- Resource development and program implementation; and
- Program evaluation.

One long-term goal of the *GR Strategy* is the eventual integration of GR as standard business practice in site remediation. The ultimate goal is to establish a process that routinely ensures that the environmental footprints of site cleanup actions are minimized to the extent practical. OSRTI plans to treat the Superfund *Green Remediation Strategy* as

a "living" document and update the *GR Strategy* as Agency policy progresses, as activities are modified within the key actions and, as green remediation practices develop. A *GR Strategy Activity Tracking Chart*, published in February 2011, provides an update documenting the implementation of the components of the *GR Strategy*. Exhibit 1-1 summarizes the 40 activities and their status as of February 2011.

EXHIBIT 1-1. SUPERFUND *GREEN REMEDIATION STRATEGY* OVERVIEW

SUPERFUND *GR STRATEGY*: SUMMARY OF STRATEGIC ACTIONS (AS OF FEBRUARY 2011)		
POLICY AND GUIDANCE DEVELOPMENT		
Key Action #1: Clarify the role of green remediation in remedy selection and implementation		**Status**
1.1	Develop OSWER policy on green remediation in remedy selection for remedial and non-time critical removal actions	Under Development
1.2	Evaluate potentially applicable or relevant and appropriate requirements (ARARs)	Under Development
RESOURCE DEVELOPMENT AND PROGRAM IMPLEMENTATION		
Key Action #2: Develop a compendium of protocols and tools to help project and program managers integrate green remediation practices		**Status**
2.1	Identify green remediation resource needs	Implemented
2.2	Identify additional green remediation information resources	Implemented
2.3	Develop technology-specific assessment tools and fact sheets	Implemented
2.4	Develop green remediation Q&A's	Under Development
2.5	Produce green remediation checklists	Under Development
2.6	Deliver or host green remediation training through the Technology Innovation and Field Services Division's training infrastructure	Implemented
2.7	Provide site-specific assistance and assistance mechanisms	Implemented
Key Action #3: Identify options that enable use of green remediation practices		**Status**
3.1	Identify methods to maximize use of renewable energy with a goal of using 100% renewable energy to power site operations	Under Development
3.2	Identify methods for increasing energy efficiency	Under Development
3.3	Develop a better understanding of the costs or savings associated with use of green remediation strategies and practices	Under Development
3.4	Develop a fact sheet on using green power for site cleanup	Implemented
3.5	Identify methods to increase use of renewable energy generated onsite for site remediation at remote locations	Under Development
3.6	Explore and/or establish funding mechanisms to finance green remediation research, development, and demonstration (RD&D) and initial deployment efforts at Superfund sites	Under Development
3.7	Participate in development of a national standards and certification process	Under Development
Key Action #4: Address air pollutant emissions		**Status**
4.1	Develop a fact sheet on clean fuel and emission technologies	Implemented
4.2	Develop cleanup contract requirements for incorporating clean fuel and emission technologies	Under Development
4.3	Identify opportunities for recovering and using methane gas emitted from landfills on Superfund sites	Under Development
Key Action #5: Develop pilot projects to evaluate and demonstrate green remediation applications		**Status**
5.1	Develop a database of innovative green remediation pilot projects	Under Development
5.2	Develop and pilot test a green remediation analysis template to help collect information during various phases of the remediation process at any site	Implemented

SUPERFUND *GR STRATEGY*: SUMMARY OF STRATEGIC ACTIONS (AS OF FEBRUARY 2011)		
5.3	Incorporate green remediation factors into remedy optimization evaluations	Implemented
5.4	Support the Re-Powering America's Land Initiative by identifying Superfund sites with outstanding or superb renewable energy potential	Implemented
Key Action #6: Establish opportunities in contracts and assistance agreements to identify green remediation practices in selected remedies		**Status**
6.1	Modify EPA contract language to include green remediation practices	Under Development
6.2	Modify contract language to require reporting of selected activities	Under Development
6.3	Develop and periodically update a green remediation contracting tool kit	Implemented
6.4	Develop model terms and conditions for assistance agreements and IAs concerning site cleanup	Under Development
6.5	Explore additional opportunities to use existing federal agreements and establish new agreements	Under Development
6.6	Explore and promote opportunities to use local expertise in green cleanups	Under Development
Key Action #7: Communicate and share success stories and lessons learned among "implementers" across the Program and the public		**Status**
7.1	Develop a communication plan	Under Development
7.2	Conduct outreach to contractors and industry	Under Development
7.3	Partner with other federal agencies and state organizations to promote national use of green remediation strategies	Implemented
7.4	Engage local communities in assessing and implementing green remediation options	To Be Initiated
PROGRAM EVALUATION		
Key Action #8: Establish a roadmap for evaluating the environmental footprint of a cleanup at a project level		**Status**
8.1	Analyze existing methods and software tools for evaluating the environmental footprint of a cleanup	Implemented
8.2	Develop an Agency methodology for evaluating the environmental footprint of a cleanup	Under Development
8.3	Develop evaluation modules for green remediation strategies	Under Development
Key Action #9: Evaluate the environmental footprints of Superfund cleanups at a programmatic level		**Status**
9.1	Estimate a Program baseline for the environmental footprints of Superfund cleanups	Under Development
9.2	Establish performance goals, objectives, and measures for the Superfund *Green Remediation Strategy*	Under Development
9.3	Develop options for addressing possible gaps in measures or metrics	Under Development
9.4	Characterize the state of practice and implications of life cycle assessment on Program operations	Under Development

EPA Regions, Headquarters, and external stakeholders have issued a number of other green remediation policy and guidance documents both prior to the first draft of the *GR Strategy* that was released in September of 2009, and since the final *GR Strategy* has been published. Exhibit 1-2 provides a timeline noting publication of some of the key green remediation policy documents that form the broader context of GR efforts. One focus of this evaluation will be examining the extent to which the *GR Strategy* builds on, supports, and aligns with existing efforts.

EXHIBIT 1-2. GREEN REMEDIATION STRATEGIES

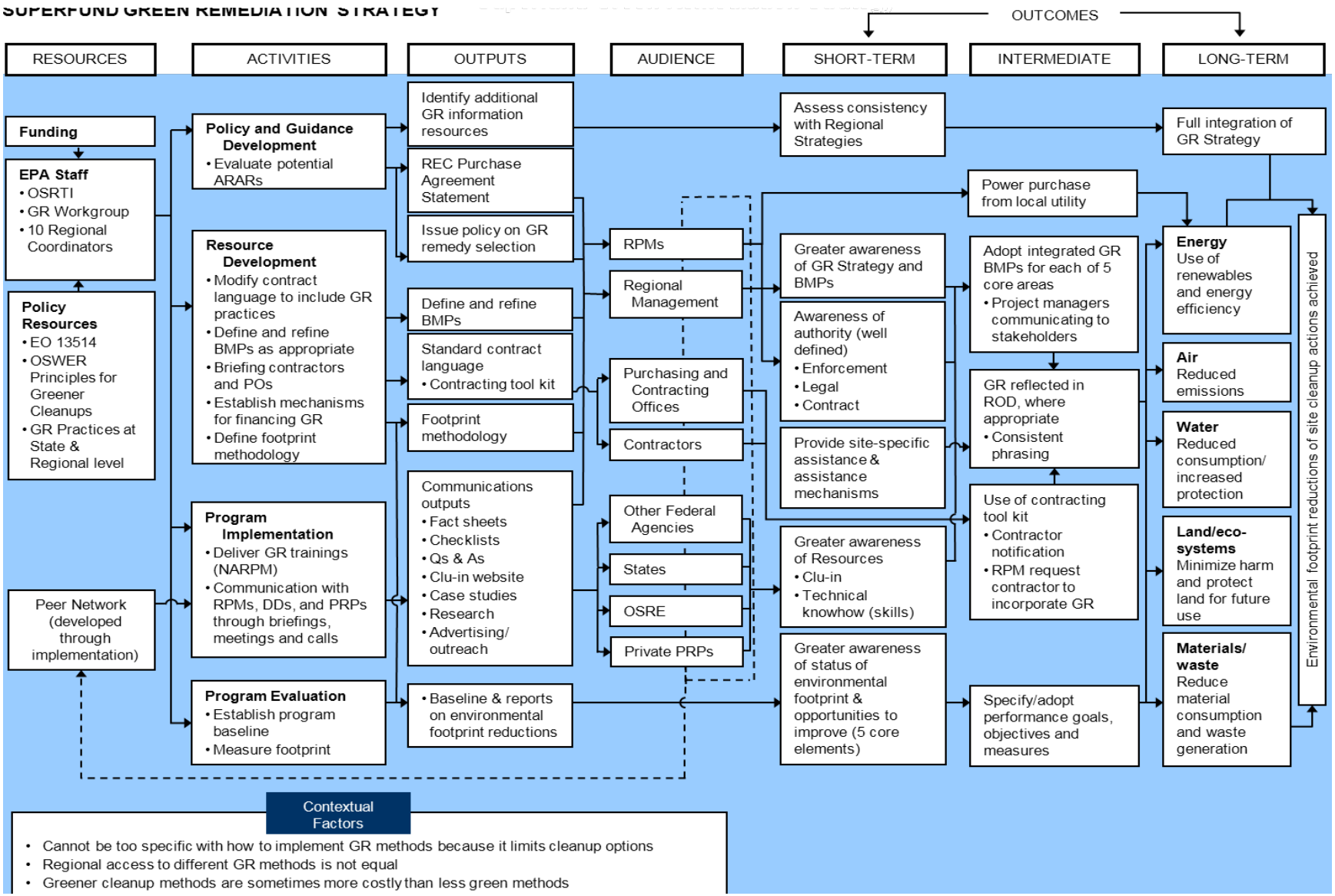
YEAR	SOURCE	GREEN REMEDIATION POLICIES
Apr 2008	OSWER	Green Remediation Primer: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites
Mar 2009	Region 2	Clean and Green Policy
Aug 2009	OSWER	Principles for Greener Cleanups
Aug 2009	Region 8	Green Remediation Policy
Aug 2009	Region 10	Clean and Green Policy
Summer 2009	Sustainable Remediation Forum(SURF)	SURF White Paper—Integrating Sustainable Principles, Practices, and Metrics Into Remediation Projects
Sept 2009	OSWER/OSRTI	Superfund *Green Remediation Strategy*, Public Review Draft
Sept 2009	Region 6	Clean and Green Policy
Sept 2009	Region 7	Interim Green Cleanup Policy
Sept 2009	Region 9	Greener Cleanups Policy
Nov 2009	Region 5	Greener Cleanup Interim Policy
Jan 2010	Region 3	Greener Cleanup and Sustainable Reuse Policy
Feb 2010	Region 1	Clean and Green Policy for Contaminated Sites
Feb 2010	Region 4	Clean and Green Policy
Sept 2010	OSWER/OSRTI	Superfund *Green Remediation Strategy*
Feb 2011	OSWER	Superfund *Green Remediation Strategy, Activity Tracking Chart*

1.2 SUPERFUND *GREEN REMEDIATION STRATEGY* LOGIC MODEL

To illustrate the various components of the Superfund *Green Remediation Strategy* and to inform development of specific evaluation questions, EPA has developed a logic model (i.e., a graphical representation of the relationships between program inputs, outputs, and intended outcomes). A logic model synthesizes the key activities of a program into a picture of how it is expected to work. A program logic model helps determine the degree to which a program's activities and other related inputs affect the expected outcomes. In addition, the logic model's outputs and outcomes can help identify potential indicators or measures of performance. As shown in Exhibit 1-3, the key components of the model include:

- **Resources:** basic inputs of funds, staffing and knowledge dedicated to the program.
- **Activities:** the specific procedures or processes used to achieve program goals.
- **Outputs:** the immediate products that result from activities and are often used to measure short-term progress.
- **Audience:** the groups that the program seeks to influence.
- **Short-Term Outcomes:** the changes in awareness, attitudes, understanding, knowledge, and skills resulting from program outputs.

EXHIBIT 1-3. SUPERFUND *GREEN REMEDIATION STRATEGY* LOGIC MODEL



- **Intermediate Outcomes:** the changes in behavior that are broader in scope than short-term outcomes. Intermediate outcomes often build upon the progress achieved in the short-term.
- **Long-Term Outcomes:** the outcomes that demonstrate the *GR Strategy's* overall capability to be effective as well as the overall environmental improvements made through the strategy.

For this evaluation, the logic model focuses on the outputs that are most relevant to the Superfund *Green Remediation Strategy* and the ability to measure its progress. The logic model activities are organized to reflect the three main categories of actions in the *GR Strategy*, including policy and guidance development, resource development and program implementation, and program evaluation. The resource development and program implementation category was divided into two sections to allow for easier tracking of outputs and intended audiences. The last column of the logic model outlines the two parallel long-term goals of the *GR Strategy*: 1) measurable reductions in the environmental footprints of site cleanup actions, and 2) the full integration of the *GR Strategy* itself into EPA decision-making during Superfund site cleanup.

1.3 EVALUATION QUESTIONS AND PURPOSES

IEc conducted an initial data and document review, and coordinated with EPA to finalize the following evaluation purposes and questions:

1.3.1 Evaluation Purpose 1: Assess EPA experiences to date in implementing the *GR Strategy*

1. Does EPA have clearly defined goals and objectives for the *GR Strategy*? Should they be refined and improved to enhance usefulness (e.g., for management decision making, planning and budgeting, EPA's *Strategic Plan*)?
2. Which initial activities or initiatives from the *GR Strategy* have been most effective in increasing awareness, adoption and/or implementation of GR strategies?
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- How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?

1.3.2 Evaluation Purpose 2: Determine a baseline against which to measure EPA progress in implementing the GR Strategy

6. What options can we identify for developing a baseline?
   - What has changed since the implementation of the *GR Strategy*?
   - When did green remediation become important to site cleanup?
   - What options are available for quantifying the environmental footprint at sites?

1.3.3 Evaluation Purpose 3: Determine the best metrics for measuring the program's success in implementing GR practices

7. What performance measures are appropriate for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?
8. What are the best means for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of *GR Strategy?*
   - What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?
9. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

1.4 REPORT ORGANIZATION

This evaluation report is organized as follows:

- Chapter 2 presents the methodology used in this evaluation.
- Chapter 3 presents the evaluation findings, organized by the evaluation purpose and evaluation question. The chapter concludes with a summary of key findings.
- Chapter 4 presents conclusions and recommendations to ensure the continued success of the *GR Strategy*.

This report also includes appendices with copies of interview guides, regional survey data, CLU-IN website use data, and list of references.

CHAPTER 2 | METHODOLOGY

2.1 EVALUATION DESIGN

This evaluation seeks to synthesize available information on the implementation of the Superfund *Green Remediation Strategy*. As a formative evaluation of the national-level effort, this evaluation is primarily a qualitative assessment of how well the *GR Strategy* program activities and priorities are being implemented, based on information gathered from the early phases of implementation of the *GR Strategy*.

The information needed to support the evaluation reflects a variety of sources, including:

- The Superfund *Green Remediation Strategy* (draft, final and update to the final *GR Strategy*);
- EPA national and regional data such as surveys conducted during the *GR Strategy* development, data on website and document access, regional policies and data, and methods and case studies for calculating environmental footprints;
- Published studies and external data including existing GR literature, State GR strategies, and private sector efforts such as the Sustainable Remediation Forum (SuRF) White Paper;
- Superfund records, including site profiles; and
- Interviews with EPA and non-EPA staff involved in green remediation implementation efforts.

The analytical approach for this evaluation combines content analysis of interview responses with examination of data from surveys, studies, literature, and databases to answer the evaluation questions. Our evaluation design relies principally on new data collection through interviews with key EPA personnel involved in implementing GR techniques and the *GR Strategy* (e.g., OSRTI staff, Superfund GR Regional Coordinators, the GR Workgroup participants, RPMs, regional managers and attorneys, other Agency representatives), and other federal agency and state government officials. In addition, IEc reviewed existing data including GR literature, site-specific data, and documents and publications specific to the *GR Strategy* prior to the interviews to inform interview guides and also to resolve issues that arose during the interviews.

Exhibit 2-1 on the next page provides a summary of the evaluation questions as they link to the key objectives (purpose) of the evaluation. Exhibit 2-1 also includes a brief map of the key data sources that IEc employed in answering each of the questions.

EXHIBIT 2-1. EVALUATION QUESTIONS AND DATA SOURCES FOR FORMATIVE EVALUATION OF THE *GR STRATEGY*

EVALUATION QUESTION	DATA SOURCES					NOTES ON DATA SOURCE(S):
	SUPERFUND *GR STRATEGY*	EPA REGIONAL STRATEGIES, SURVEYS AND TRACKING DATA	PUBLISHED STUDIES AND EXTERNAL DATA	CLU-IN WEB USE DATA AND CASE STUDY SITE PROFILES	INTERVIEWS	
EVALUATION PURPOSE 1: ASSESS EPA EXPERIENCES TO DATE IN IMPLEMENTING THE *GR STRATEGY*						
1. Does EPA have clearly defined goals and objectives for the GR Strategy? Should they be refined and improved to enhance usefulness (e.g. for management decision making, planning and budgeting, EPA's Strategic Plan)?						
	x				x	Interviews with Regional Coordinators, non-EPA staff, evaluation of *GR Strategy*
2. Which initial activities or initiatives from the GR Strategy have been most effective in increasing awareness, adoption and/or implementation of the GR Strategy?						
	x	x			x	Interviews with Regional Coordinators, regional attorneys, front line managers, and non-EPA staff, Atlanta meeting survey, state and regional strategies
3. How do Remedial Project Managers (RPMs) factor the GR Strategy into their approach to planning site cleanup?						
3a) What GR practices are being implemented?	x	x		x	x	Interviews with Regional Coordinators (including some RPMs), evaluation of *GR Strategy* (and Update), Region 3 and 4 surveys, Region 9 tracking list, Atlanta meeting survey, state and regional strategies, site profiles, website use data
3b) What percentage of RPMs are implementing specific GR practices?		x			x	Interviews with Regional Coordinators, Region 3 and 4 survey, Atlanta meeting survey

EVALUATION QUESTION	DATA SOURCES					NOTES ON DATA SOURCE(S):
	SUPERFUND *GR STRATEGY*	EPA REGIONAL STRATEGIES, SURVEYS AND TRACKING DATA	PUBLISHED STUDIES AND EXTERNAL DATA	CLU-IN WEB USE DATA AND CASE STUDY SITE PROFILES	INTERVIEWS	
3c) What do RPMs know about the energy usage at the sites they manage?		x			x	Interviews with Regional Coordinators, Region 3 and 4 surveys, Region 2 tracking database, and Atlanta meeting survey
3d) What information do RPMs track on other GR core elements?		x			x	Interviews with Regional Coordinators, Region 3 and 4 surveys, Region 2 tracking database, and Atlanta meeting survey
4. What effect has the GR Strategy had on the practice of using green remediation techniques at Superfund sites?						
			x	x	x	Interviews with Regional Coordinators , Superfund records, Region 3 and 4 surveys, and state and regional strategies
5. What lessons have been learned as a result of implementing the GR Strategy at sites?						
5a) What factors affect the ability to implement the *GR Strategy* at sites (e.g., technical issues, cost issues, legal issues, management support, contract provisions, or contractor capabilities)?		x		x	x	Interviews with RPMs, Regional Coordinators, regional attorneys, front line managers, non-EPA staff, Contract Specialists, and website use data
5a) How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?		x		x	x	Interviews with Regional Coordinators (Region 2 and Region 9), regional attorneys, front line managers, non-EPA staff, and website use data

EVALUATION QUESTION	DATA SOURCES					NOTES ON DATA SOURCE(S):
	SUPERFUND *GR STRATEGY*	EPA REGIONAL STRATEGIES, SURVEYS AND TRACKING DATA	PUBLISHED STUDIES AND EXTERNAL DATA	CLU-IN WEB USE DATA AND CASE STUDY SITE PROFILES	INTERVIEWS	
EVALUATION PURPOSE 2: DETERMINE A BASELINE AGAINST WHICH TO MEASURE EPA PROGRESS IN IMPLEMENTING THE *GR STRATEGY*						
6. What options can we identify for developing a baseline?						
6a) What has changed since the implementation of the *GR Strategy*?	x	x			x	Interviews with Regional Coordinators, measurement specialists, evaluation of *GR Strategy* (and Update)
6b) When did green remediation become important to site cleanup?		x	x	x	x	Interviews with Regional Coordinators, measurement specialists, evaluation of *GR Strategy*, and the SURF White Paper
6d) What options are available for quantifying the environmental footprint at sites?		x		x	x	Interviews with Regional Coordinators, measurement specialists, Footprint Measurement Methodology (Tetra Tech), Region 2 Metrics, Region 9, and Case Studies
EVALUATION PURPOSE 3: DETERMINE THE BEST METRICS FOR MEASURING THE PROGRAM'S SUCCESS IN IMPLEMENTING GR PRACTICES						
7. What performance measures are appropriate for measuring the effectiveness of the GR Strategy in achieving intended outcomes at regional or national level?						
		x	x		x	Interviews with Regional Coordinators, measurement specialists, SURF White Paper, Region 3 and 4 survey, Region 2 tracking database, Atlanta meeting survey, and Case Studies

EVALUATION QUESTION	DATA SOURCES					NOTES ON DATA SOURCE(S):
	SUPERFUND *GR STRATEGY*	EPA REGIONAL STRATEGIES, SURVEYS AND TRACKING DATA	PUBLISHED STUDIES AND EXTERNAL DATA	CLU-IN WEB USE DATA AND CASE STUDY SITE PROFILES	INTERVIEWS	
8. What are the best means for measuring the effectiveness of the GR Strategy in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of the GR Strategy?						
8a) What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?		x	x	x	x	Interviews with Regional Coordinators, SURF White Paper, Region 3 and 4 survey, Region 2 tracking database, Atlanta meeting survey, footprint analyses and tools, and Case Studies
9. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the GR Strategy?						
		x	x		x	Interviews with Regional Coordinators, measurement specialists, SURF White Paper, footprint analyses and tools

2.2 STEPS IN CONDUCTING THE EVALUATION

Consistent with the purpose of formative evaluations, this effort was designed to be exploratory, and we did not develop a quantitative analysis of measuring progress or assessing effectiveness. In addition, the purpose of this evaluation is to capture a range of insights and ideas to guide next steps for the program. Therefore, we did not implement a statistically robust survey methodology with random sampling and analysis of statistical significance of results. Instead, our approach uses qualitative assessment methods and integrates data sources as follows:

The five broad steps for this evaluation are:

1. Conduct an initial review of existing survey data regarding implementation of the *GR Strategy*;
2. Conduct in-depth interviews with EPA regional staff who are actively involved in implementing the *GR Strategy*, including all regional GR coordinators;
3. Validate and expand on interview responses, assess data from regional surveys, tracking efforts, and footprint methods and EPA's Profiles of Green Remediation case studies;
4. Resolve questions raised and obtain detailed technical information to inform questions, conduct a second round of targeted interviews focusing on specific skill areas, issues, and perspectives (including non-EPA individuals, non-Federal organizations, and regional attorneys and managers); and
5. Report results.

In assessing the results of interviews, we used descriptive statistics as appropriate. We also verify the strength of key conclusions by using multiple data sources, with a particular focus on any areas where initial data collection efforts and verification steps appear to provide conflicting results. The remainder of this Chapter describes the approach in more detail.

2.2.1 COLLECTION OF DATA FROM EXISTING DATA SOURCES

Evaluation Purpose 1 is informed primarily through new data collected in interviews of key EPA personnel and individuals familiar with GR practices. Evaluation Purposes 2 and 3, however, rely on published literature as well as interviewee input. Additional data sources also support the issues and perspectives identified in the interviews with EPA personnel for Evaluation Purpose 1. These additional sources are organized into the following four categories: Existing Surveys and Tracking Efforts, Footprint Analyses, CLU-IN web use data, and Literature and EPA Publications. The subsections below describe these categories of data sources in more detail.

Analysis of Existing Surveys and Tracking Efforts

IEc analyzed the following EPA surveys and tracking efforts:

- **Region 3 Green Remediation 2009 Questionnaire:**
  The survey, which included 46 RPMs managing a total of 190 Region 3 Superfund sites, was conducted in 2009 prior to the release of the final *GR Strategy* in September, 2010.[1] Responses to the questionnaire provide information on current GR practices being implemented at Superfund sites in Region 3 in 2009, and included:
    - General GR status question for each RPM: Do you manage a site that is using green remediation?
    - Technical questions linked to specific topics (including some of the *GR Strategy's* five core elements)
        - Stormwater control;
        - Wetlands;
        - Land use;
        - Recycling;
        - Energy; and,
        - Long-term stewardship.

- **Region 4 2010 Superfund Greener Cleanup Survey:**
  The survey, which included responses from 31 Region 4 RPMs, was conducted in early 2010 and the summary of results was released in May 2011. The survey goal was to identify what Greener Cleanup (using OSWER policy language) activities are occurring in the region and what actions could be taken to help personnel further implement Greener Cleanup techniques (e.g., trainings). The survey responses provide a snapshot of the type of GR activities occurring in Region 4 and which of the five core elements are being addressed. The survey's questions were categorized by five "Principles for Greener Cleanup" that are identical to the *Strategy's* five core elements. Questions under each element included:
    - Have you implemented this principle? (not verbatim)
    - Reason for implementing principle?
    - Did the principle play a role in the selection of a remedy?
    - Did the principle affect the way the remedy was implemented?
    - Did the principle affect post construction activities?

- Additional questions at the end of the survey included:

[1] A draft *GR Strategy* was released in September, 2009, and development of the final *GR Strategy* was ongoing and may have influenced the Region 3 survey results.

- Are you familiar with the EPA Region 4 Clean and Green Policy?
- Are you familiar with the Superfund *Green Remediation Strategy*?

- **Region 9 List of GR Activities:** The Region 9 list reports GR activities taking place at 21 sites in Region 9.[2] The list does not address a specified time frame, but the Region 9 respondent indicated that it was originally developed during 2010 and was updated prior to being sent to IEc in August 2011. The regional contact noted that the table may not contain the most current activities occurring in the region and that some of the sites are part of the Brownfields program. However, the table provides information on the type of activities occurring in the region and which of the five core elements are being addressed. The elements that appear to be covered by the listed activities are:

  - Air Emissions;
  - Energy, and;
  - Material Consumption and Waste Generation.

  Additionally, the list notes two sites that have begun footprint/life cycle analyses.

- **2010 EPA Green Remediation Coordination Atlanta Workshop Surveys:** The October 19th-20th, 2010 workshop was intended to ensure consistency and collaboration across all GR efforts (i.e., program specific and regional efforts). EPA conducted two surveys in relation to this workshop in October 2010. The first survey, dated October 15th, polled EPA Cleanup Program representatives from programs and offices implementing GR strategies at contaminated sites (i.e., Superfund, RCRA, Brownfields) for their opinions, status, and suggestions on GR in general. The second survey, dated October 27th, polled EPA regional representatives (a majority from the Superfund program). The surveys included questions such as:

  Survey of Program Representatives

  - Is there anything in your program that could be leveraged to help move GR forward?
  - Are there aspects of your program that could be obstacles to moving GR forward?
  - Do you have a GR training program?

  Survey of Regional Representatives

  - What is your region doing as part of implementing its regional "clean and green" policy?

[2] There are 22 activities listed in the table, but only 21 sites are included.

- Does your region have a GR implementation plan?
- Is your region collecting any measures data?
- Are any of your project managers using any of the environmental footprint calculator tools?
- Has your region implemented or conducted any kind of GR training?

The findings from these surveys and tracking efforts primarily support the analysis for Evaluation Questions 1 through 5.

Footprint Analyses

IEc reviewed the following EPA footprint resources:

- **EPA's Footprint Methodology:** EPA's "Methodology for Understanding and Reducing a Project's Environmental Footprint" was released for public comment on September 16, 2011. The document outlines specific guidelines and required metrics for performing a footprint analysis at a contaminated site. The document is organized by core element as identified in the *GR Strategy*. The methodology acknowledges that there are other footprint analysis guidelines and tools that can be used and also does not require RPMs to conduct a footprint analysis on all or any sites. The methodology simply provides suggested guidelines and metrics to use if applicable at a site.
- **Footprint Methodology Webinar:** The "Greener Cleanups - EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint" webinar was held on August 10, 2011. The primary purpose of the webinar was to update the remediation community and other interested parties on the progress and intent of the Footprint Methodology. The webinar discussed how EPA envisioned the methodology would be used and clarified that it was not intended to be applied to all contaminated sites. The presenters continued to walk through specific examples for quantifying metrics on site and how to use the methodology as a set of guidelines rather than a template or tool.
- **Case Studies:** EPA has been developing 28 case studies of contaminated sites where a footprint analysis, or part of a footprint analysis, has been implemented. These case studies, titled "Profiles of Green Remediation" were last updated in July 2011 and include basic information for which core elements were included in the footprint analysis at each site. All of the 28 contaminated sites are not specifically Superfund sites, but provide references for footprint analysis implementation.

The findings from these resources were used to evaluate the overall progress of the *GR Strategy's* footprint initiative and to identify potential metrics that could be used to assess

the success of the *GR Strategy*. IEc used these resources primarily to support the analysis for Evaluation Questions 6 through 9.

CLU-IN Web Use Data

IEc reviewed CLU-IN Web Use Data provided by EPA in September 2011. The data included download statistics for specific *GR Strategy* resources (e.g., BMP Fact Sheets or Greener Cleanups Contracting and Administrative Toolkit), attendance statistics for trainings sessions and webinars, and general monthly access statistics for the GR CLU-IN homepage ranging from September 2009 to August 2011. The findings from the CLU-IN data primarily support the analysis for Evaluation Questions 1 through 5.

Literature and EPA Publications

Because implementation of the *GR Strategy* is ongoing, it was helpful to examine how the Strategy has evolved from the draft issued in September of 2009 to the final *GR Strategy* in September of 2010, through the updated *Activity Tracking Chart* released in February of 2011. IEc collected and evaluated these documents to better understand how the *GR Strategy* has progressed over this time period.

2.2.2 NEW DATA COLLECTION

After the initial review of key existing program survey data and the *GR Strategy*, IEc conducted a number of telephone interviews to support this evaluation. IEc used the interviews in two ways: 1) to provide central information on specific evaluation questions (e.g., Questions 1 through 6); and 2) to investigate specific data questions from the qualitative analysis of existing survey data.

The initial interviewees were selected through a targeted consultation process with key OSRTI personnel. This approach ensured that key "thought leaders" and subject matter experts across EPA regions were captured in the initial data collection. To gain an understanding of current issues related to implementation of the *GR Strategy*, and to begin the identification process for potential interviewees, IEc attended the 2011 National Association of Remedial Project Managers (NARPM) Training Program held in Kansas City, Missouri. While at NARPM, IEc solicited input from key EPA representatives to make recommendations for interview candidates for the evaluation.

In total, IEc interviewed 28 individuals during the conduct of 24 separate interview sessions (some sessions had multiple participants). IEc used survey data and program information to craft the initial interviews with Regional GR Coordinators, and also to identify data gaps, anomalies, and inconsistencies among responses which became the focus of follow-on interviews. IEc conducted 10 interviews with GR Coordinators at the regional level, and approximately four interviews with key GR Workgroup members. We then conducted eight follow-on interviews. A list of the interviewees and copies of the interview guides are provided in Appendices A and B, respectively.

The interviews were focused roughly as follows:

EPA Staff

- Superfund Green Remediation Regional Coordinators
    - Interviews were conducted with at least one GR coordinator from each region; with several respondents from Region 2 and Region 9.
    - Interviews with GR Regional Coordinators addressed many facets of *GR Strategy* implementation but focused primarily on Evaluation Questions 1 through 6.
- Subject Matter Experts and Key Regional Staff
    - Five interviews targeted EPA staff and other contacts with specific areas of expertise in implementing the *GR Strategy*. Specifically, IEc interviewed two measurement specialists (one from Region 9 and a private sector contractor), one contract specialist from Headquarters, one regional attorney, and one regional front line manager. These interviews inform Evaluation Questions 5 through 9.
- Green Remediation Workgroup Participants
    - Four interviews with GR Workgroup participants were used to follow-up and verify findings from analysis of existing survey data and interviews of the GR Regional Coordinators, particularly to inform Evaluation Questions 1 through 6.

Non-EPA Contacts

- Other Federal Contacts
    - One representative from the Army Corps of Engineers that partners with EPA in GR efforts was interviewed, primarily to provide insights into the extent to which the *GR Strategy* has been raising awareness and changing practices outside the Agency (e.g., Evaluation Questions 1, 2, 4, and 5).
- State Officials
    - Two state officials were interviewed to supplement data collection efforts for the Evaluation Questions 1 through 6, where data gaps exist. Specifically, these interviews focused on the extent to which the *GR Strategy* is supporting state GR efforts.

2.2.3 REVIEW OF PUBLISHED STUDIES AND EXTERNAL DATA

In addition to the interview effort, IEc relied on existing data and published studies as the secondary sources of information to inform responses to several of the evaluation questions. Specifically, Evaluation Questions 6, 7, 8, and 9 required the review of data

related to baseline assessments and footprint analysis to draw conclusions about the current focus of the *GR Strategy*. In addition, development of responses to a number of other questions involved validating or expanding on data collected in interviews by reviewing external, published information about GR activities. Below we outline a number of key existing data sources and note the evaluation questions that they inform.

State and Regional Strategies

Many states and Regions have begun to integrate GR practices at some sites—in some cases regional focus on GR pre-dates the publication of the *Strategy*. IEc collected and analyzed state and regional strategies to better understand how EPA Regions are implementing GR approaches and to understand the role that the *GR Strategy* is playing in continuing these efforts. The data collected informs Evaluation Questions 2, 3 and 4.

SURF White Paper

In late 2007, the Sustainable Remediation Forum (SURF) initiated a study to collect, clarify and express the experiences of SURF members on the incorporation of GR principles. The white paper on "Integrating Sustainable Principles, Practices, and Metrics into Remediation Projects" was published in the summer of 2009. Data collected from this report informs Evaluation Questions 6 through 9. Because SURF membership is primarily composed of corporate members in the United States, evaluation of this report provides a private-sector perspective on GR practices.

Footprint Methodology and Case Studies

OSRTI has already undertaken a number of activities related to measurement of the impact of GR on site footprints. The most comprehensive effort is the development of a methodology for performing footprint analyses at NPL sites. The methodology was released for public comment in September 2011, and is accompanied by 28 case study sites with comprehensive or partial footprint analyses. IEc uses OSRTI's Footprint Methodology and EPA's "Profiles of Green Remediation" case studies as primary data sources to answer Evaluation Questions 6, 7, 8, and 9, coupled with information from the life cycle assessment (LCA) literature and other published approaches to assessing site footprints.

EPA Website Use Data

OSRTI currently tracks a number of website use indicators related to the CLU-IN website and specific *GR Strategy* documents. IEc worked with EPA to review these data. EPA website use data provides external validation for the interviews and primarily informed Evaluation Questions 3 and 5.

Additional Data Resources: Site Profiles, etc.

IEc also performed a targeted review of other existing data sources (e.g., site profiles, and footprint analyses and tools) that interviews indicated would be helpful to the evaluation.

2.2.4 ANALYSIS AND INTEGRATION OF DATA COLLECTION EFFORTS

After collecting all of the data and information described above, IEc went through a process to validate findings across multiple sources. The following bullet points outline the data integration process used for each of the three Evaluation Purposes.

- Evaluation Purpose 1:
    - Collect primary data – Interviews with Regional GR Coordinators
    - Review external data sources to refine, expand, and validate findings from the primary data collection.
    - Develop verified findings that integrate multiple data sources.
- Evaluation Purposes 2 and 3:
    - Review existing literature and program information.
    - Interview subject matter experts based on information from literature review and responses from the primary data collection.
    - Validate and expand findings with information from Evaluation Purpose 1.

CHAPTER 3 | FINDINGS

This evaluation aims to explore the *GR Strategy's* progress to date in advancing greener cleanup and to inform the program's priorities going forward. The evaluation considers three main parameters: assessing EPA experiences to date in implementing the *GR Strategy*; determining a baseline against which to measure EPA progress in implementing the *GR Strategy*; and determining the best metrics for measuring the program's success in implementing GR practices. As a formative evaluation of the national-level effort, this evaluation is primarily a qualitative assessment of how well the *GR Strategy* program activities and priorities are being implemented, based on information gathered from the early phases of implementation of the *GR Strategy*.

This chapter summarizes the results of our analyses as outlined in Chapter 2. We organize our results first by evaluation purpose, and then by the individual evaluation questions pertaining to that evaluation purpose. For each evaluation question, we briefly note key data sources and analytical approaches that are discussed in more detail in Chapter 2. We follow the description of data sources with a discussion and tabulation of our findings related to the question. The chapter concludes with a brief summary of general findings for each of the three evaluation purposes.

3.1 EVALUATION PURPOSE 1: ASSESS EPA EXPERIENCES TO DATE IN IMPLEMENTING THE *GR STRATEGY*

To assess EPA's experiences in implementing the *GR Strategy*, IEc relies on data collected through interviews and other sources focusing on different aspects of the implementation and integration of the *GR Strategy* across EPA and in the 10 Regions. IEc designed this data collection effort around the following five evaluation questions:

- **Evaluation Question 1**: Does EPA have clearly defined goals and objectives for the *GR Strategy*? Should they be refined and improved to enhance usefulness (e.g., for management decision making, planning and budgeting, EPA's *Strategic Plan*)?
- **Evaluation Question 2:** Which initial activities or initiatives from the *GR Strategy* have been most effective in increasing awareness, adoption and/or implementation of the *GR Strategy*?
- **Evaluation Question 3:** How do Remedial Project Managers (RPMs) factor the *GR Strategy* into their approach to planning site cleanup?
- **Evaluation Question 4:** What effect has the *GR Strategy* had on the practice of using green remediation techniques at Superfund sites?

- **Evaluation Question 5:** What lessons have been learned as a result of implementing the *GR Strategy* at sites?

As described in more detail in Chapter 2 – Methodology, the primary findings for this purpose reflect insights collected directly from designated GR coordinators and other staff actively focusing on implementation of GR in each of EPA's ten regions. These contacts represent the staff most clearly aware of the *GR Strategy* and its use. To verify and expand on the initial findings for each question, we present relevant information obtained from additional interviews with EPA managers, legal staff, and other contacts specializing in certain areas of GR implementation, as well as data tracking the use of the CLU-IN website, several surveys, and a site characteristic tracking database being developed by Region 2.[3]

3.1.1 SUMMARY OF FINDINGS

Overarching findings related to Evaluation Purpose 1 are as follows:

- Respondents are generally positive about the *GR Strategy* structure and purpose, though some difference of opinion exists on how best to present "goals" and objectives. Several respondents feel that a more clearly defined statement of goals could be useful both in increasing awareness of the *GR Strategy* and in focusing *GR Strategy* implementation. A key interest is ensuring that GR efforts maintain momentum in the implementation phase.
- Interview respondents have strong, positive views of many key products of the *GR Strategy*, and feel that these tools and products have been important in facilitating an expansion of GR activities. Respondents are less able to connect the *Strategy* itself to site-level actions, and report a limited awareness of the document. However, respondents agree that the release of the *GR Strategy* has reached many decision-makers and has facilitated GR by raising its national profile.
- RPMs typically do not use the *GR Strategy* directly in GR implementation, though they document use of many of the tools associated with the CLU-IN web site and other *GR Strategy* products. Respondents consider the *GR Strategy* document itself as a more important tool for managers than for RPMs.
- It is difficult to identify specific changes in practice associated directly with the *GR Strategy*, due in part to the limited time that has elapsed since publication, and in part to the fact that other factors such as regional strategies and costs savings also contribute to GR efforts. The national *GR Strategy* and regional policies (e.g., "clean and green") influence each other, and it is therefore difficult to attribute influence to each separately. However, regional data from surveys does provide a snapshot of activities underway, and suggests regions have increased emphasis on GR training and outreach as the *GR Strategy* has emerged.

[3] Data were provided by Environmental Management Support (EMS) on August 18, 2011.

- A range of challenges face the broader implementation of the *GR Strategy*, with key concerns including the level of funding and support for *GR Strategy* personnel and project efforts. Other broader hurdles include a concern about policy and liability uncertainty, and limited participation from managers and other key staff. One overall concern raised in different contexts is the need for momentum and Headquarters signaling about commitment to GR to ensure that progress continues.

Below we document the more detailed findings for each of the five questions contributing to Evaluation Purpose 1.

3.1.2 Evaluation Question 1: Does EPA have clearly defined goals and objectives for the *GR Strategy*? Should they be refined and improved to enhance usefulness (e.g., for management decision making, planning and budgeting, EPA's *Strategic Plan*)?

This general question presented a challenge for interview respondents because the *GR Strategy* is organized around three purposes (policy and guidance development, resource development, and program implementation). Within those purposes are nine key actions and 40 specific actions, but the *GR Strategy* does not present a separate, specific set of goals. In addition, interview participants preferred different definitions of the term "goal" – with some focusing on measurable, timed objectives and others focusing more broadly on strategic priorities.

To encourage open-ended input in the interviews, IEc did not provide a specific definition of *GR Strategy* goals and objectives for the respondents, but discussed respondents' perceptions of the *Strategy's* overall goals in the context of the purposes and key actions. The following are brief summations of respondents' answers to the general question of whether EPA has clearly defined goals and objectives for the *GR Strategy*:

- Respondents in four of nine Regions that addressed this question find the *GR Strategy* goals and objectives to be fairly well-defined. However, three of these respondents voiced concerns about the inclusion of aspirational and unachievable goals, and all of these cited the target of 100 percent renewable energy (RE) on Superfund sites as an example of an aspirational goal.[4] One regional respondent expressed concern with the purchase of renewable energy credits (RECs) as a way to achieve this goal and noted that it can be difficult to ensure the quality of the RECs being purchased. These respondents explained that aspirational goals, which they believe are clearly unattainable, could deter from the overall

[4] EPA's Office of Solid Waste and Emergency Response (OSWER) is in the process of making a national bulk REC purchase to achieve the goal of powering site operations with 100 percent renewable energy. A REC is a certificate that represents the generation of one megawatt-hour (MWh) of electricity from an eligible source of renewable energy. The purchase of RECs facilitates the development of the renewable energy market. OSWER believes a bulk REC purchase to be the most immediate and cost-effective way to power all Superfund sites with renewable energy.

implementation and integration of the *Strategy* and GR in general. Respondents indicate that there is some difference of opinion whether RECs are equivalent to installation of renewable energy projects at specific sites.

- Respondents from two regions stated that while the *GR Strategy* goals and objectives are somewhat well defined, most regional staff, including RPMs and front line managers, are not aware of the goals. One respondent suggested that EPA HQ should focus on spreading awareness and educating regional staff on the goals and objectives of the *GR Strategy*.
- Finally, respondents in three regions felt that the goals and objectives of the *GR Strategy* should be more clearly indicated and defined. When the question was posed, these respondents were unable to answer with confidence that they were aware of or could clearly identify the goals and objectives of the *GR Strategy*. All of these respondents felt that this might indicate a challenge for ensuring that the *Strategy* would be implemented, and that an effort to identify goals and objectives could provide momentum to the program.

In addition, some respondents provided the following insights and suggestions for improvement to the *GR Strategy* goals and objectives:

- Two respondents noted that their lack of familiarity with the goals and status of the *GR Strategy* is a result of their relatively "low profile" in contributing to *GR Strategy* activities since the publication of the document. Both noted that the general purpose of the *GR Strategy* and the key actions are well crafted, but they had not remained informed about progress in implementing key actions. They focused their comments on the difficulty in maintaining momentum to implement changes after milestones like *GR Strategy* publication.
- One respondent suggested that EPA HQ should provide a summary document (fact sheet) laying out the goals and objectives of the *GR Strategy* in a more concise manner. They felt that people would be more willing to become familiar with a short concise document rather than a long document. Summarizing key goals and objectives in a more manageable format could help meet a broader method to ensure effective outreach and education. Two respondents felt that EPA should reconsider and restructure the goals and objectives. Primarily, EPA should reduce the number of unachievable goals and replace them with more realistic objectives. Goals cited most often as particular examples of this are the aim to provide 100 percent renewable energy (RE) on all Superfund sites, and an aim to reduce impacts on land use and ecosystems.

To complement the input from the regional coordinators, IEc reviewed written documents on *GR Strategy* implementation and survey responses from Regions 3 and 4. We also asked technical expert interviewees for feedback on this question. However, only the regional coordinators had any specific knowledge of or insights into *GR Strategy* goals.

Most respondents, including the regional coordinators, did say that the general focus of the *Strategy* and the key actions identified were appropriate and well-designed. Overall, the lack of awareness of goals does not appear to indicate any negative impressions of the *GR Strategy* itself but instead appears to suggest a challenge in implementation.

Additionally, an underlying theme identified in responses to Evaluation Question 1 is the need for more momentum surrounding the GR program and *GR Strategy* specifically. Respondents explained that Headquarters clearly defining the goals of the *GR Strategy* could reenergize the program and benefit the *Strategy's* integration into Superfund Program site cleanup culture.

3.1.3 Evaluation Question 2: Which initial activities or initiatives from the *GR Strategy* have been most effective in increasing awareness, adoption and/or implementation of the *GR Strategy*?

Key respondents to this question were the Superfund GR Regional Coordinators. While not asked directly, interviews of non-EPA contacts provided verification of regional responses to this question. Data on participation in training sessions and on use of resources on the CLU-IN web site also provided a second important source of information.

An initial finding of significance is that Regional GR Coordinators focus on different aspects of "awareness" as it relates to the *GR Strategy*. To some, the question considers visibility of specific products that have been developed through implementation of the *GR Strategy* (i.e., CLU-IN website and BMP fact sheets). Others focused on awareness of the *GR Strategy* as a document and policy implementation exercise. Finally, one respondent discussed the success of the initial development of the *GR Strategy* as an exercise that increases awareness. Detailed insights include:

Key Products

All respondents stated that the most visible and successful manifestation of the *GR Strategy* is the set of products presented on the CLU-IN web site. Respondents noted five specific products in identifying effective activities that facilitated GR implementation:

- BMP Fact Sheets
- NARPM Trainings
- Case Studies (any examples of success are helpful)
- CLU-IN Website as a total resource
- "Doughnut of Remedy Implementation" (as referred to by respondent)[5]

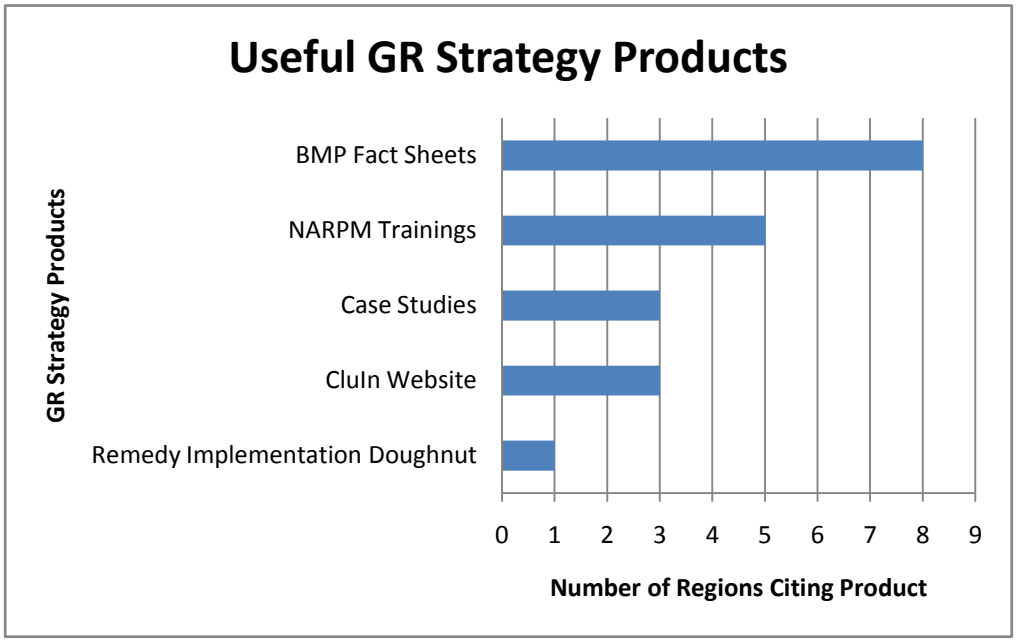
[5] The "Doughnut of Remedy Implementation" refers to the graphic of the OSWER five core elements presented on p.2 of the *GR Strategy* document.

Exhibit 3-1 below summarizes graphically, the number of regional respondents that cited each product as being useful to GR awareness and implementation in their region.

It is noteworthy that the interview questions did not include or prompt a specific discussion of *GR Strategy* products. Respondents readily and quickly identified the set of products as a critical resource in expanding the use of GR approaches, and expressed very positive opinions of the quality and focus of the BMPs in particular.

We were unable to confirm these responses with the CLU-IN Website use data due to limited available data.[6] However, the CLU-IN use data do indicate that the website and products of the *GR Strategy* are referenced and used by EPA, other government organizations, and third party individuals/companies.[7] We summarize the EPA CLU-IN use data in the Exhibit 3-2 below:

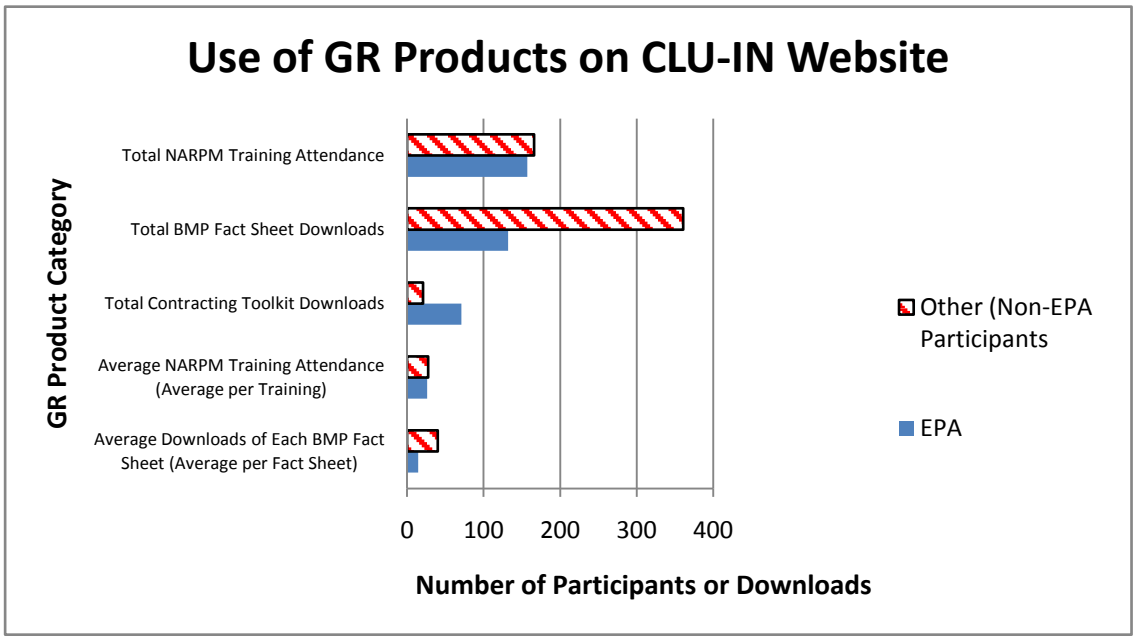
EXHIBIT 3-1. PRODUCTS IDENTIFIED AS USEFUL IN FURTHERING ADOPTION OF GR PRACTICES



[6] EPA's contractor for documenting CLU-IN use, has explained that the download data do not account for copies of the documents distributed via email or hard copy distribution. Additionally, the EPA training data may not fully capture all participants for online trainings because multiple users could access the training via a single user ID.

[7] Non-EPA interview responses confirm this.

EXHIBIT 3-2. CLU-IN WEBSITE DOWNLOAD AND PARTICIPATION STATISTICS [8, 9]



EPA also provided data on downloads of the BMP Fact Sheets' release schedule ("Upcoming Topics" PDF on CLU-IN website). The data is as follows:

- EPA: 14 Downloads
- Other Government: 5 Downloads
- Non-Government: 413 Downloads

These data suggest that individuals maintain interest in the other topics that will be covered by future BMP Fact Sheets and actively check the proposed release schedule.

In addition to the NARPM trainings, as presented above, EPA provided participation statistics for CLU-IN web seminars and "On-Scene Coordinator (OSC) Readiness" training sessions. Although the data do not support definitive conclusions about total use of *GR Strategy* materials, the information does demonstrate that EPA staff are actively participating and seeking out *GR Strategy*-based information. The most heavily EPA attended CLU-IN web seminars were:

[8] The "total" values in the table are all inclusive (i.e., Total NARPM Training Attendance is the total attendance for all NARPM trainings).

9 For NARPM trainings, the "EPA" category represents only RPMs and the "Other" category represents all other participants at the trainings including either EPA staff and non-EPA government and private sector staff.

- "Your Role in Green Remediation Implementation and Case Studies in Green Remediation - This Year's Models and Tools"[10] – Specifically the first of three sessions held on December 8, 2010 (EPA had 80 identified participants).
- "Green Remediation: Applying Strategies in the Field"[11] – Specifically the first of three sessions held on October 8, 2009 (EPA had 53 identified participants).

The data for NARPM trainings show that the first three GR NARPM trainings had the best in-person RPM attendance. These trainings are:

- "Green Remediation: Opening the Door to Field Use." July 9, 2008 – 43 RPMs were identified at this training.
- "Green Remediation - What's Next." June 3, 2009 – 30 RPMs were identified at this training.
- "Your Role in Green Remediation Implementation and Case Studies in Green Remediation: This Year's Models and Tools." May 26, 2010 – 35 RPMs were identified at this training.

Although the trend in NARPM attendance does not necessarily suggest a decrease in GR momentum, the CLU-IN use data does not show big growth in NARPM attendance that would demonstrate a clear expansion of interest and awareness. The lack of growth in NARPM attendance is difficult to interpret: it could be indicative of increased regional trainings, an increased saturation of trained RPMs, or that interest in GR is stabilizing. Additionally we note that these values may understate participation at these events because multiple users can register/view a webinar training presentation under a single ID. Regional respondents noted that that some regions held NARPM training webinar sessions in-house and therefore may have used only one registration ID.

EPA has not to date tracked use statistics for the 28 case studies (Profiles of Green Remediation) listed on the Superfund GR CLU-IN website, but this could be tracked in the future.

Finally, although not a target audience, non-EPA individuals have expressed a positive reaction to the *GR Strategy's* products. These respondents cited several of the same resources have been useful in informing their organizations' GR initiatives and staff.

Awareness of *GR Strategy*

While *GR Strategy* products are well-known, respondents in three regions noted that the *GR Strategy* itself is not well known or used by regional staff such as RPMs. Several respondents also noted that regional policies (i.e., GR, Greener Cleanup, or Clean and Green) appear to have higher profiles in triggering individual staff interest in exploring greener cleanups.

[10] This was a follow-up web seminar to a 2010 NARPM GR session.

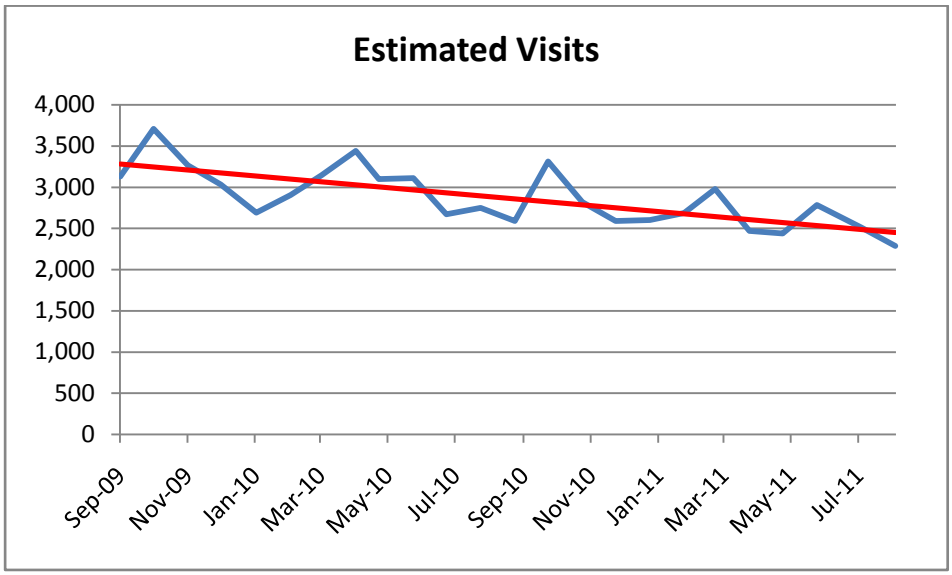
[11] This was a follow-up web seminar to a 2009 NARPM GR session.

In a related finding, respondents in all regions emphasized that "awareness" of GR as an option is complicated because GR is often "common sense," and many RPMs would likely implement cost saving actions at their sites even without the national *GR Strategy* (and possibly without regional policies). However, respondents felt that the publication of the *GR Strategy* has generally raised the national profile of GR and contributed to interest in the subject.

Interviews with front line managers confirmed these findings and noted that during the development of the *GR Strategy*, they observed a growing interest in learning to implement GR. However, the managers noted that after the release of the final document, they witnessed a clear decrease in "buzz" surrounding the initiative.

Data on the number of visits to the Superfund GR CLU-IN webpage generally confirm the insights shared by front line managers. The data span the time frame from September 2009 to August 2011. The following charts (Exhibits 3-3 and 3-4) present trends in the monthly data. Exhibit 3-3 depicts the number of estimated visits per month, while Exhibit 3-4 depicts the percentage of visitors making repeat visits. Both charts include a line of best fit to depict the general trend over time. In Exhibit 3-3, the spike in monthly visits in October 2010 corresponds with the release of the final *GR Strategy* document. Other spikes in the data typically correspond with the release of the different BMP fact sheets. Currently the data do not allow examination of trends of unique visits or visitors over time.[12]

EXHIBIT 3-3. CLU-IN WEBSITE MONTHLY ESTIMATED VISITS



[12] EPA does not track data by individual, which currently limits the use of this analysis. However, if desired, it may be possible to implement tracking by individual in the future, assuming that no policy or legal restrictions exist.

EXIBIT 3-4. CLU-IN WEBSITE MONTHLY VISITOR REPEAT RATE

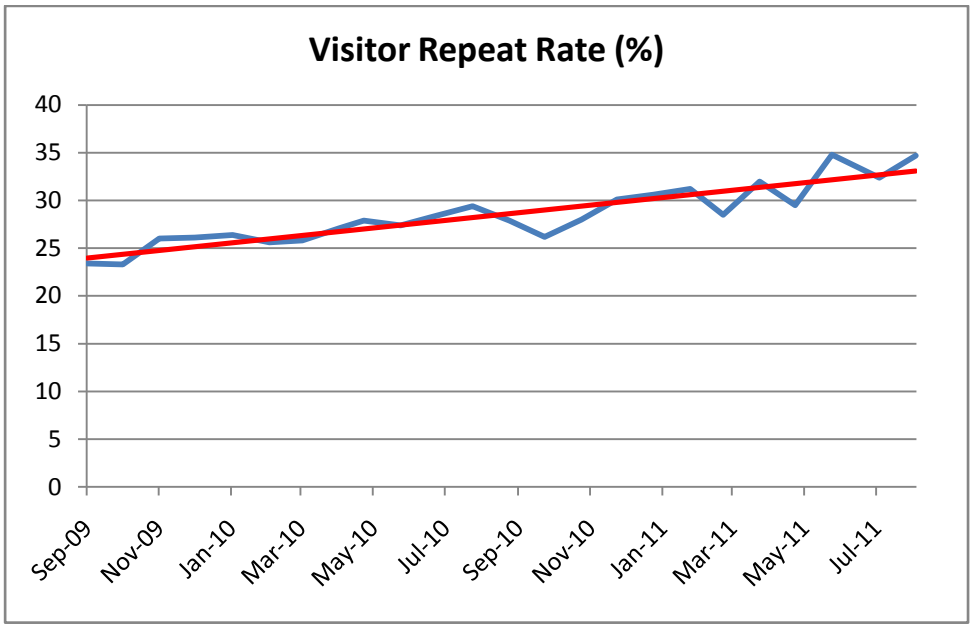


Exhibit 3-3 indicates an overall downward trend in monthly visits to the CLU-IN website implying that the website is getting used less over time. This observation echoes the concern raised by interview respondents that the *GR Strategy* implementation could potentially lose momentum. However, Exhibit 3-4 shows that the estimated monthly visitor repeat rate is trending upward over time. This suggests:

- The population of prior users is increasing over time as GR is more broadly considered, and;
- Individuals that have previously viewed the CLU-IN website are returning to the website, which may imply that it is a valuable resource to users.

One caveat of the EPA CLU-IN Website Use Data is that it may not accurately report EPA staff awareness of the *GR Strategy* and its products (i.e, trainings and BMP Fact Sheets) because the web site is not the only source of information. EPA's Intranet website contains some of the same information found on the CLU-IN website, and the GR workgroup regularly distributes products by e-mail. Although not conclusive in and of itself, the downward trend in monthly CLU-IN website visits, as depicted in Exhibit 3-3, echoes insights from the interviews with Regional GR Coordinators and other EPA staff that a general need for more focus on the program's objectives and goals might help increase GR awareness and momentum.

3.1.4 Evaluation Question 3: How do Remedial Project Managers (RPMs) factor the *GR Strategy* into their approach to planning site cleanup?

To answer this question IEc relies principally on responses from GR Regional Coordinators, and supplements and verifies that information with data from regional surveys. In general, responses to this question were consistent. Key themes are:

- **RPMs do not typically use *GR Strategy*.** Respondents from eight regions explained that RPMs do not specifically consider the *GR Strategy* in their approach to planning a site cleanup. Respondents noted that this is not equivalent to saying that RPMs do not consider GR in their cleanups. Instead, RPMs often use regional green cleanup policies as a guide to implement GR techniques rather than the *GR Strategy* itself. Respondents believe that RPMs, at most, only have a general familiarity with the *GR Strategy*, unless they were involved it its development through the Superfund GR Workgroup.
- ***GR Strategy* is and should be more of a tool for management.** Respondents also noted that they do not expect RPMs to take time to consult the *GR Strategy* during the remediation process. Additionally, three respondents specifically noted that they view the *GR Strategy* as a guide for management and do not think that RPMs need to be familiar with the document itself. This sentiment was also shared by non-EPA GR specialists. Respondents explained that the *GR Strategy* document is very helpful, but as an internal strategy. They felt that the document was too technical and prescriptive to be used as a site-level resource for implementing GR practices.
- ***GR Strategy* has been successful in raising general awareness among RPMs.** Although respondents do not feel RPMs are factoring the *GR Strategy* directly into their site cleanup plans, they do believe that the *GR Strategy* publication has increased overall awareness and interest in GR among RPMs. These respondents believe that the development of the *GR Strategy*, at the least, has resulted in more RPMs considering GR in the remediation process. All respondents said that their regions have facilitated some form of training in connection to the *GR Strategy*. Although the EPA CLU-IN data cannot inform whether GR activities and techniques are being implemented and used by RPMs, it does confirm that RPMs and EPA employees have been actively participating in trainings and downloading materials from the CLU-IN website, as discussed in Evaluation Question 2. Based on the NARPM attendance data, it seems that RPMs have been most interested in learning about basic integration of the *GR Strategy* and more specifically information on "Pump and Treat" technologies.

Responses to Evaluation Question 3 noted that it is still relatively early in the implementation and integration of the *GR Strategy*. Although RPMs may be currently involved in GR activities, it is not always the case that they classify their efforts as GR. This suggests that awareness of GR practices is increasing, but as respondents explained,

individuals are referencing multiple GR resources aside from the *GR Strategy* and its products. The following sub questions provide further insight into RPMs current level of GR awareness and the type of GR activities currently occurring:

What GR practices are being implemented?

Interview Data

While six, of the nine respondents that addressed this question, were able to provide one or two examples of specific green remediation activities currently occurring at sites in their regions, these respondents indicated that GR practices are not tracked formally. Several respondents cited specific projects that identified energy or material savings opportunities, but noted that these activities are attributable to one or more factors other than the *GR Strategy* (e.g., regional policies, individuals' interest in GR and site optimization, or cost reduction).

While most respondents answered this question at the site level, interview responses on other questions revealed that all regions are considering or implementing at least one program-level change to encourage GR, with activities such as training and implementation of contract language specifying GR.

In the remaining three regions, some GR activity tracking effort is currently underway. Each tracking effort varies in period of time and level of detail. The results of these tracking efforts are summarized below.

Region 4 2010 Survey Data

Early 2010 survey results (released in May 2011) of RPMs in Region 4 provide a snapshot of the activities in use at sites in that region, and reveal that GR-related activities are not uncommon. However, survey responses echo interview responses in noting that the specific role of the *GR Strategy* is not always clear. A majority of respondents in Region 4 that reported implementing GR activities at their sites did not feel that explicit consideration of the five core elements had a significant role in selecting or implementing a remedy. However, 90 percent of the RPMs that responded to the Region 4 survey were familiar with the *GR Strategy*.[13]

Although not attributed to the *Strategy* or the five core elements, some activities that can be considered GR and are being implemented in Region 4 include:

- **Total Energy Use and Renewable Energy Reuse:**
  (12 of 31 respondents, or 39 percent)
  - Consider use of optimized passive-energy technology
  - Look for energy efficient equipment

[13] Note that self-selection bias may be significant here, if only interested RPMs chose to respond to the survey.

        - Maintain equipment at peak performance
        - Consider installing renewable energy systems
    - **Air Pollutants and GHG Emissions:**
      (14 of 31 respondents, or 45 percent)
        - Minimize use of heavy equipment
        - Use cleaner fuel
        - Minimize dust export of contaminants
    - **Water Use and Impacts to Water Resources:**
      (17 of 31 respondents, or 55 percent)
        - Minimize fresh water consumption
        - Maximize water reuse
        - Prevent impacts to water quality of nearby water bodies
            - Erosion prevention
    - **Materials Management and Waste Reduction:**
      (19 of 31 respondents, or 56 percent)
        - Use technologies to minimize waste generation
        - Reuse materials
        - Recycle waste materials
    - **Land Management and Ecosystem Protection:**
      (16 of 31 respondents, or 52 percent)
        - Use minimally invasive technologies
        - Use passive energy technologies
        - Minimize habitat disturbance

Region 3 2009 Survey Data

The survey responses were from 46 RPMs from Region 3 about activities at 190 sites in that region, and only 2 RPMs reported using GR techniques at some of their sites. However, some techniques reportedly being used by RPMs could be considered GR even if the RPM did not classify it as such. These activities include, but are not limited to:

- **Stormwater Control** – about 50 sites reported some form of stormwater control with 23 percent using vegetative swales;
- **Minimize Water Use –** about 10 percent of sites reported minimizing water use; and
- **In-Situ Technology –** 39 to 45 percent of sites with a ground water component reported using In-Situ technology rather than traditional pump and treat.

Region 9 List of GR Activities

The Region 9 list of GR activities reports the activities for 21 sites in the Region.[14] The list does not include dates, but provides a brief description and the current status of each activity. Exhibit 3-5 below summarizes the information reported in the Region 9 list.

EXHIBIT 3-5. SUMMARY OF REGION 9 LIST OF GR ACTIVITIES

GR ACTIVITY CATEGORY	*GR STRATEGY* CORE ELEMENT	NUMBER OF SITES	STATUS OF ACTIVITIES
Renewable Energy	Energy	15	8 – In Process 7 - Operational 1 – Planning/Not Feasible
Footprint/Life Cycle Analysis	N/A	3	In Process
Clean Diesel/Bio-Diesel	Air Emissions	1	Completed
Burning Landfill Gas	Material Reuse and Waste Generation	1	Operational
Other	N/A	2	Operational

Overall, responses and survey data reveal that most regions have some GR activities occurring. During interviews, however, only two regional respondents (Region 2 and Region 9) identified use of GR as routinely implemented. Additionally, Regions 3 and 4 survey data reveal a high level of GR activity taking place, as well. However, the majority of RPMs in these regions are not considering their activities as GR. In the remaining regions GR activities are in developmental stages, and it does not appear that RPMs specifically incorporate the *GR Strategy* itself into decision-making, though they appear to access materials and projects.

What percentage of RPMs are implementing specific GR practices?

Regional responses to this question ranged across regions, with respondents estimating that as few as 10 percent to as high as 90 percent of RPMs are aware of GR practices and implement them where they can.[15] However, most responses were concentrated at the lower end of this range, indicating that awareness and use of GR practices is still limited in many regions.

The 2009 Region 3 survey results show that four percent of the respondents are implementing GR. Note that these results only reflect activities that the respondent considered GR at the time of the survey. Survey results from Region 4 do not lend

[14] One site is listed twice for two separate GR activities.

[15] Not all sites have opportunities for GR and there may by RPMs that cannot conduct GR because of that.

themselves to this computation. However, the "principle" with the highest activity percentage was "Materials Management and Waste Reduction" with approximately 60 percent of respondents conducting some related activity in Region 4.

Some of the variability across regions could be attributed to respondents' interpretation of GR practices. This issue is prevalent in the Region 3 survey results. As discussed in the prior sub-question, only two RPMs (managing 3 sites) out of 46 (190 total sites) reported implementing GR techniques. However, although RPMs did not classify their remediation activities as such, several reported activities could be considered GR.[16]

It also appears that regional responses could be significantly influenced by the existence of regional green cleanup policies prior to the release of the *GR Strategy*, and by regional specific characteristics such as the level of senior management involvement in GR. IEc's analysis of the interview data reveals that regions with Greener Cleanup or GR policies established before the national *GR Strategy* typically reported higher percentage of RPMs involved with GR activities.

What do RPMs know about the energy usage at the sites they manage?

All respondents agreed that information on energy use is available for Fund-lead sites, though it is not routinely collected and tracked, except in Region 2. However, for other categories of sites, a majority of regions explained that the availability of information varies by site and the RPM in charge of the site. Respondents from six regions noted that tracking energy use is becoming more important, and several also noted that the national REC purchase policy has increased the profile of energy use. Specifically, some RPMs are voluntarily trying to track their consumption of energy to assist the national effort.

At the regional level, interviews for this evaluation and the 2010 Survey of EPA Regional Representatives following the Atlanta GR Coordination Workshop confirm that only one region routinely tracks and measures energy consumption. However, Region 2 has received funding from HQ to develop a tracking database that could then be used by all RPMs to track energy consumption and the other core elements at their sites.[17] The database would require RPMs to report sites' monthly energy usage. If implemented broadly, the database could provide information for national tracking.

What information do RPMs track on other GR core elements?

Respondents from nine of the regions report having the ability to track some information on the other core elements identified in the *GR Strategy*. However, for the most part, very little is currently tracked and quantified. RPMs most often track energy consumption, as

[16] Another factor limiting the use of GR is the limited number of sites that are at appropriate stages of remediation for considering GR. This was noted by several respondents but is not directly linked to the *GR Strategy* itself.

[17] The database was created to collect and compile data in Region 2 related to the implementation of the regional Clean and Green Policy and not the national *GR Strategy*. The Region 2 Clean and Green touchstone practices only address three of the five core elements of the *GR Strategy* (energy, air emissions, materials and waste).

mentioned above, as well as material use and recycling, waste management, and air emissions. Only one respondent mentioned that the region tracks water use metrics.

Respondents noted that not all sites have opportunities for using GR practices, so limited opportunities exist for tracking implementation at sites.

The Region 2 database that is currently under development would track metrics related to the Region 2's 2010 Clean and Green Policy. Although the database, in its current state, does not require RPMs to report information on all five core elements, several site specific data will be available. More specifically, in addition to energy use, the database will require RPMs to report the following information for their sites:

- Clean Diesel:
    - Type of Equipment being used on site
    - Fuel Volume of total fleet of equipment
    - Total number and type of retrofits on equipment
    - Usage rate of equipment
- Material Reuse, Reduction, and Recycling:[18]
    - Amount of materials reused
    - Amount of materials reduced
    - Amount of materials recycled
    - Amount of materials landfilled
    - Amount of materials combusted
    - Amount of materials composted

Respondents to the 2010 Survey of EPA Regional Representatives following the Atlanta Workshop confirmed that the database was designed to address four core elements, and did not include the land and ecosystems core element.

In responding to these subquestions and other evaluation questions, two cross-cutting themes from the interviews emerged. First, respondents from all regions expressed concern that any significant requirements to track GR impacts could potentially reduce interest among RPMs. As discussed in more detail in Question 5, limited resources (e.g., time, manpower) represent a significant challenge in GR implementation. As an example of this, one respondent emphasized that RPMs do not require metrics to do their job successfully and therefore it is more difficult to get people to track these sorts of metrics. Respondents recommended developing a simplified universal system to assist the metric tracking effort, which could also be tied to performance reviews.

[18] Note that this information will be reported by material type (i.e., aluminum cans, glass, food scraps etc.).

In addition, a review across regional responses reveals that many regions appear to focus on one aspect of the *GR Strategy* at one time. One respondent remarked that taking this approach to implementation would allow the *Strategy* to move further without spending time "reinventing the wheel." Respondents from different regions noted identifying and implementing renewable energy efforts (either through the REC purchase or generation on site), waste reduction and management, and reduction of air emissions through the use of newer technology and clean diesel as specific regional areas of interest. This practice may be important in considering national-level tracking options and coordination efforts, and may limit the practicality of tracking multiple indicators at all sites.

3.1.5 Evaluation Question 4: What effect has the *GR Strategy* had on the practice of using green remediation techniques at Superfund sites?

Consistent with Question 2 responses, most respondents across regions could not identify or attribute specific changes in regional practice to the *GR Strategy*. In general, respondents thought that the *GR Strategy* has been most successful in refocusing and defining GR. They explained that it has provided some momentum to the GR effort and has assisted in spreading awareness of GR, but they noted three factors that complicate the identification of specific activities with the *GR Strategy:*

- **Not enough time has elapsed:** Respondents generally felt that it is "too soon" to see significant impacts of the *GR Strategy*. They believe it has had a general positive impact, but ongoing site efforts typically started before its publication.[19]
- **Focus on regional policies:** Regions that have a GR policy stated that their RPMs refer to these regional policies rather than the *GR Strategy*. The BMP fact sheets and CLU-IN website, rather than the *GR Strategy* itself, have been useful guides for RPMs when attempting to implement GR principals. Respondents from three regions also asserted that the *GR Strategy* has not impacted regional practice because the region was involved in GR activities prior to the final *GR Strategy*.
- **Attribution poses challenges:** Two respondents felt that GR is generally common sense, and it is difficult to attribute any changes in activities to the *GR Strategy* or to regional strategies because some RPMs would be implementing or exploring GR activities and opportunities even without the policies in place.

The surveys conducted in Region 3 and 4 in 2009 and 2010, respectively, are consistent with these responses.[20] As discussed in Evaluation Question 3, very few RPMs in Region 3 report that they are implementing GR activities in the survey responses. However, the

[19] Due to limited tracking of GR practices within regions it is difficult to assess which activities were implemented prior to, during, and after the development of the draft and final *GR Strategy*.

[20] The Region 2 database and Region 9 list of GR activities do not report the reason (i.e., regional policy or national strategy) for implementing specific GR techniques at sites, but Region 2 states specifically that the database is intended to track data related to the series of touchstone practices outlined in their regional Clean and Green Policy. Region 9 does not provide such a distinction.

Region 3 survey was completed prior to the publication of the *GR Strategy* and therefore does not specifically address the role of the *Strategy*. Similarly, a majority of Region 4's respondents who are implementing GR activities do not attribute those activities to the *GR Strategy* or its five core elements. Again, because the survey was completed several months prior to publication of the final *GR Strategy*, it is not unexpected that impacts would be limited.

Responses to the 2010 Survey of Regional Representatives following the GR Coordination Workshop did identify several activities underway to implement GR in their regions. Although the survey responses do not specifically link activities with the *GR Strategy*, these activities represent an increased awareness and interest in GR practices at the time of publication. Key examples of the activities identified include:

- GR Trainings;
- Focus on site-specific opportunities for renewable energy development;
- Development of RPM guidance documents and checklists;
- Development of websites with links to resources and contact information for experts; and,
- Added GR language to contracts.

The CLU-IN website use data generally confirms the statement that the *GR Strategy* has been successful in increasing overall GR awareness and providing momentum to GR efforts. As was discussed in Evaluation Question 2, a large (over 20 percent) increase in CLU-IN site visits in October 2010 corresponded with the release of the final *GR Strategy* document. However, this level of activity later dropped back to the August level of visits, which suggests a decrease in momentum.

Training and Awareness

Interview respondents echoed the Region 4 2010 survey results in the key area of training. While most respondents did not attribute specific changes in practice to the *GR Strategy*, all regions report taking part in or delivering some form of GR training and/or GR outreach. Regional GR training is a key action under the *GR Strategy*, and represents a change in regional practice. The trainings and outreach identified by regions include:

- Development of a regional GR Website
- Brownfields conference
- Regional facilitated GR trainings
- GR sessions and speakers during regional meetings and green seminars
- CLU-IN web seminars: (3,863 participants across 22 sessions, including 623 EPA participants and 1,013 Other Government participants)

- NARPM webinars and trainings: (323 total participants across six sessions, including 157 RPM participants)
- OSC readiness trainings: (105 total participants across three sessions, including 45 OSC participants)

Although data do not document trends in participation or overall RPM or OSC participation percentages, participation and interest among EPA staff continues.

3.1.6 Evaluation Question 5: What lessons have been learned as a result of implementing the *GR Strategy* at sites?

This question had two distinct themes. Respondents were asked to discuss the general themes and lessons that they've gained from their experiences with GR and specifically with the implementation of the *GR Strategy*. They were also asked a specific set of sub-questions related to challenges and opportunities in connection to the *GR Strategy*.

Notably, respondents had difficulty drawing broad conclusions from their experiences implementing the *GR Strategy*. Specifically, seven of ten respondents could not cite specific lessons learned from implementation. This limitation appears to reflect the fact that some regions are in the early stages of implementing GR into site and regional practices. The insight in Evaluation Questions 3 and 4 that it is too early to document *GR Strategy* impacts is consistent with the reticence in identifying broad lessons.

Three respondents with broad insights about GR implementation shared the following:

- GR is not always more expensive;
- What may work at one site may not work at every site; and,
- Working through the challenges and limiting factors has been a learning experience.

These insights are echoed and expanded in an Association of State and Territorial Solid Waste Management Officials (ASTSWMO) document that explained state experiences implementing GR.[21] The document provides a short summary of seven common misperceptions about green remediation, along with a rebuttal for each, including: 1) GR is an additional regulatory burden that agencies will have to impose on projects and responsible parties; 2) GR will divert resources from our primary responsibility of protecting human health and the environment from releases of petroleum and hazardous substances; 3) cleanup is already green. There is no need to change our approach; 4) GR will cost more; 5) the benefits or trade-offs of different GR approaches are too difficult to assess; 6) responsible parties will use GR to argue for doing no remediation at all; and, 7) we don't have the authority to do green remediation.

[21] In September 2009 as the draft *GR Strategy* was released for public comment, the Greener Cleanups Task Force of the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Sustainability Subcommittee released the *Green Remediation: Getting Started by Debunking Some Myths* document noting a number of lessons learned and popular challenges related to green remediation.

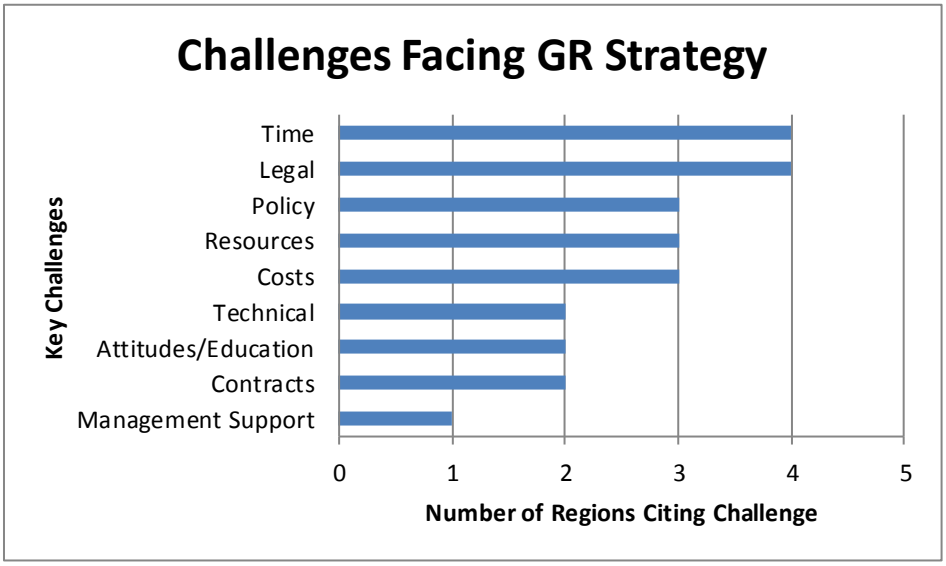
In response to the specific questions about issues or factors affecting the implementation and integration of the *GR Strategy*, and GR in general, in their regions, respondents had much more to discuss. The responses are organized by sub-question below.

What factors affect the ability to implement the *GR Strategy* at sites (e.g., technical issues, cost issues, legal issues, management support, contract provisions, or contractor capabilities)?

Each regional respondent cited a different mix of factors affecting their ability to implement the *GR Strategy* or GR in general. Key factors included limited resources, limited staff time (including lack of dedicated staff time), costs associated with assessing sites, concerns about legal authority, lack of clear policy addressing some circumstances, and limited support from management, legal staff, and contractors.

Exhibit 3-6 below identifies the key factors (challenges) mentioned by respondents and the number of respondents that cited each factor.

EXHIBIT 3-6. KEY CHALLENGES TO IMPLEMENTATION OF THE *GR STRATEGY*



How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?

Interview responses describing each of the factors identified provide some additional insights.

Time and resources – Respondents noted that GR efforts in most regions do not involve dedicated staff. Many respondents expressed concern that RPMs, and regional Superfund programs as a whole, are "stretched too thin," and thus GR becomes a "second-tier priority." Several respondents felt that additional resources would be necessary to fully implement and integrate GR techniques into the regional remediation process.

Costs – Separate from resources, respondents noted that the cost of GR itself is difficult to justify if it exceeds the cost of other options. This is true both for analysis and implementation of GR practices, and a key concern is the ability to justify GR when demanding cost recovery from PRPs. Respondents suggested that HQ and regions improve RPM and front-line manager education about the costs of GR, to ensure that staff accurately measure both short- and long-term costs and benefits and can identify situations where GR is not more expensive than alternatives.

Legal authority – Several regional respondents discussed challenges in convincing PRPs to pursue GR. Respondents noted a lack of clear legal justification and broader Headquarters support for promoting GR activities during remedy selection and design. Separately, respondents also noted that third party liability concerns limit the interest of some renewable energy developers in using Superfund sites for renewable energy (RE) generation.

Front line managers also focused specifically on the challenge of addressing third party liability. They discussed recent efforts to clarify operator liability and encourage third party operators to implement GR projects.

Policy direction – In response to this question, three respondents directly identified limited available policy direction as a hurdle to implementing GR. Specifically, respondents noted that many managers and RPMs are unwilling to undertake GR efforts without clear indication that HQ will support these actions.

More broadly, several regional respondents noted that the policy direction and information is "lagging" somewhat compared with the high-quality technical materials associated with the *GR Strategy*. Respondents noted that draft policy statements related to GR in remedial design have been circulated but expressed a desire for a more visible role by HQ in reaffirming support for GR by clarifying policy where possible. While this issue was most clearly articulated in the responses to this evaluation question, the interest in more evident HQ support emerged in response to several questions.

Interviews with other regional staff (attorneys and front line managers) and non-EPA individuals involved in other GR initiatives confirmed that the lack of policy or explicit direction from EPA HQ limits the implementation of the *GR Strategy*. However, respondents cite some individuals who have successfully implemented GR techniques without explicit direction, in part through direct negotiation with PRPs and contractors to incorporate GR practices. Many respondents noted that some PRPs can see the value in GR without it being a matter of law, though legal clarity is critical in the event of litigation.

Both regional and HQ staff noted that GR should not become a separate "tenth criteria" in considering remedial design, and several respondents noted that HQ should be cautious in

providing policy direction to avoid being too prescriptive.[22] However, clear input from HQ, including completion of the policy portions of the *GR Strategy*, will assist in the integration of the *GR Strategy* into regional culture and will provide a key signal that HQ regards GR as a priority. Both regional and HQ respondents agreed that HQ is a critical driver of momentum to ensure the success of the *GR Strategy*. In addition to specific policy clarification, respondents suggested other HQ actions such as inclusion of GR targets in performance agreements and other incentives. Overall, the importance of HQ involvement in GR is a key theme that emerges across questions.

In addition to these main issues, respondents identified the following hurdles:

- **Obtaining legal support** – some attorneys hesitate to pursue GR in the absence of clear legal authority. This is separate from concerns about development of clear policy, but respondents agreed that attorney hesitation could reflect limited policy direction and lack of clear EPA HQ support for the *GR Strategy*.
- **Management support and direction** – One respondent noted that GR will not happen if management doesn't state it as a priority. Efforts to work with regional managers to pursue GR may therefore be a key part of expanding implementation.
- **Contractors** – Two respondents noted that contractors may resist suggestions from RPMs to consider GR. Introduction of clear and concise policies related to contracting on the regional and national level could potentially address this issue.
- **Technical ability** – One respondent noted that an aggregated source of information and training on GR technologies could help RPMs identify and compare GR technologies with traditional approaches. This would support efforts to work with contractors and PRPs.

In addition to the obstacles mentioned during the interviews, according to the 2010 Survey of EPA Program Representatives, the Superfund representative(s) felt that there was not enough awareness of the goals and objectives of GR; this result provides independent corroboration for the responses to Evaluation Question 1.

Also, although somewhat outside the scope of this evaluation, one non-EPA interviewee expressed interest in having more coordination of GR efforts across EPA Offices (i.e., RCRA and Superfund). The respondent explained that EPA and non-EPA organizations alike would benefit from seeing an EPA-wide GR policy and a single web-based portal consolidating program efforts. Currently GR resources are spread across programs and are difficult to locate.

[22] This references the Nine National Contingency Plan Evaluation Criteria under CERCLA.

3.2 EVALUATION PURPOSE 2: DETERMINE A BASELINE AGAINST WHICH TO MEASURE EPA PROGRESS IN IMPLEMENTING THE *GR STRATEGY*

This evaluation purpose is to create a starting point for measuring the performance of the *GR Strategy* implementation. Consistent with the purpose of a formative evaluation, EPA is currently considering options for the development of an appropriate baseline against which to measure progress in implementing the *GR Strategy*. Evaluation Question 6 directly addresses this purpose, and includes three sub-questions:

- **Evaluation Question 6:** What options can we identify for developing a baseline?
  - What has changed since the implementation of the *GR Strategy*?
  - When did green remediation become important to site cleanup?
  - What options are available for quantifying the environmental footprint at sites?

To determine a baseline for the *GR Strategy*, IEc first interviewed the designated GR Regional Coordinators and RPMs actively attempting to implement GR in the 10 EPA regional offices. In addition, IEc interviewed key measurement specialists that have been involved in the development of the *Draft Footprint Analysis for Environmental Cleanup* document. Based on this input and a review of pertinent literature, we provide an initial set of options for considering baselines.

3.2.1 Evaluation Question 6: What Options Can We Identify For Developing A Baseline?

Developing a clear baseline is an important step in effectively measuring outcomes of the *GR Strategy*. A number of factors are important to consider when developing a baseline. Ideally a program or strategy has clear initial data and a unique set of activities and metrics that are readily tracked.

A complexity of the *GR Strategy* is that it has been implemented as a unifying approach encompassing some existing efforts, and in some cases it clearly post-dates regional activities. Moreover, a key goal of the program is awareness, and in some cases people are "doing" GR without calling it GR. Therefore, in evaluating responses to this question, we consider:

- **Timing:** Have regions begun to implement GR practices (and when)? Many GR activities implemented in Region 2 and Region 9 pre-date the *GR Strategy*, while some other regions have not yet formally implemented GR practices, and still others are in early stages of implementation at a limited number of sites. The progress of implementing GR practices may be affected by the stage at which site cleanup is in the "Superfund pipeline" (e.g., Remedial Investigation, Record of Decision (ROD) development, remedial design (RD), remedial action (RA), O&M, or five-year review). Incorporating GR activities into the ROD allows for greatest opportunities for footprint reductions, because the RD/RA phases are based on specifications described in the ROD. Opportunities to optimize the

remediation through GR practices may not be available again until the five-year review period.[23]

- **Multiple baselines:** As multiple types of outcomes (awareness, behavior, and condition) are associated with the program, is it helpful to think about different baselines? Are different baselines appropriate for measuring awareness and site activities? Regional respondents noted that a number of current GR activities are not called "GR," suggesting that awareness of GR is at a different level than site activities.
- **Tracking:** Another factor in identifying a clear baseline is collecting data on current GR activities. It is therefore important to assess the data that regions currently and routinely collect and identify data that regions could collect.

Regional respondents provided three different suggestions for determining a baseline for the *GR Strategy.*

- **Date-dependent Baseline:** In general, responses indicated that most regions have not yet focused on developing a baseline. Respondents from eight regions stated that current practices represent a fairly accurate "before GR" baseline, because they are just beginning to implement green remediation efforts. They noted that the *GR Strategy* and accompanying regional efforts are the driving force behind all identified GR activities from this time forward. While some uncertainty would accompany these estimates (e.g., if projects have been underway), the respondents felt the total impact on metrics would be negligible.

  In Regions 2 and 9, however, it is clear that significant GR activities pre-date the *GR Strategy*, and it would be difficult to attribute all future activity to the *Strategy.*

  Based on these insights, one option for a baseline is to exclude these regions (Regions 2 and 9) when measuring site-level activities related to the *GR Strategy*, except for specific activities that are clearly connected with the *GR Strategy* (e.g., energy purchase policies or contract implementation).

  A second option is to consider all site-level GR activities as related to the *GR Strategy*, at least indirectly, but stop short of "attributing" the impacts of these activities to the *GR Strategy*. This approach would consider "contribution" and assume that the *Strategy* contributes to all activities, without asserting that the *Strategy* is solely responsible.

[23] The purpose of a five-year review is to evaluate the implementation and performance of a remedy (on a site-by-site basis) in order to determine if the remedy is or will be protective of human health and the environment. Five-year reviews should be conducted either to meet the statutory mandate under CERCLA §121(c) or as a matter of EPA policy. In general, five-year reviews are required whenever a remedial action results in hazardous substances, pollutants, or contaminants remaining on site.

- **Three Separate Baselines (Multiple Baselines):** A respondent from another region offered three distinct scenarios to describe the current state of GR practices in the regions. If a baseline were to be measured at the present time each of the regions would fall into one of three categories including,
    - **Date is prior to all GR activity.** Regions in this category have integrated little to no GR practices at sites. Eight of the ten regions generally fall into this category;
    - **Region is in the "opportunistic phase" when GR starts to be considered in site cleanup.** Regions in this category have integrated energy and cost saving practices, but are not referring to them as GR. An accurate baseline measurement of GR practices due to the *GR Strategy* would include these practices since they are not attributable to the *GR Strategy*. This scenario relays the importance of determining a baseline for changes in awareness and a separate baseline for changes in behavior. At least one region potentially falls into this category, and;
    - **GR is main stream.** Regions in this category already widely practice GR techniques and had policies in place to address GR prior to the release of the national *GR Strategy*. Two regions fall into this category.

  This would provide an accurate and informative assessment of different *GR Strategy* priorities, including integration of GR throughout the remediation process, but requires significant data collection, and could lead to potential confusion as regions transition from one category to another.
- **Results from the tracking database:** Finally, Region 2 has been implementing GR since before the *GR Strategy* was developed. In this situation, current measurements may not accurately capture the region's baseline. However, Region 2 has received funding to develop a metric tracking database and it may be possible to identify specific activities associated with the *GR Strategy* using the data from this effort.[24]

Exhibit 3-7 summarizes the number of regions that fall into each of the three categories of baseline measurement as discussed above and provides a summary of responses to the three sub-questions under Evaluation Question 6.

[24] The database is intended to track data related to the series of touchstone practices of the Region 2 Clean and Green Policy, which addresses the energy, air emissions, and materials and waste, but does not address water, or land and ecosystems core elements.

EXHIBIT 3-7. OVERVIEW OF FINDINGS RELATED TO BASELINE MEASUREMENT

EVALUATION QUESTION 6 SUB-QUESTIONS	REGIONAL INSIGHTS ON BASELINE DEFINITION		
	SINGLE DATE-DEPENDENT BASELINE: ASSUME ALL ACTIVITY AFTER SPECIFIC DATE IS RELATED TO THE *GR STRATEGY*	ESTABLISH THREE BASELINES FOR REGIONS DEPENDING ON GR STATUS AND ASSUME DIFFERENT GR STRATEGY IMPACT LEVELS	TRACK SITE-SPECIFIC GR STRATEGY ACTIVITIES USING TRACKING DATABASE
Number of Regions Providing this Answer	Eight	One	One
What has changed since the implementation of the *GR Strategy*?	Respondents noted that little has changed "yet" at the site level since publication of the *Strategy*. GR activities currently being implemented would likely have been implemented absent the *GR Strategy*, but new activities reflect increasing awareness.	The respondent explained that current projects reflect opportunistic actions, and felt that the *GR Strategy* should identify time frames for different types of impacts in each region as GR efforts evolve.	The respondent did not address this question.
When did green remediation become important to site cleanup?	Responses included considering, as a starting point, the development of the *Strategy* in 2009, the 2010 release of the *Strategy*, and assertions that "it is still not considered important."	Respondent explained that it was difficult to pinpoint an exact time because each effort evolved differently.	The respondent did not address this question, but the regional GR policy predates the *GR Strategy.*
What options are available for quantifying the environmental footprint at sites?	Respondents felt that limited baseline data on footprints exists, with the exception of Fund-lead site energy use. Survey results from Regions 3 and 4 generally corroborate this; data are collected at specific sites but footprint data are not collected in any standardized way that would support broad baseline development.	The respondent did not have any suggestions for quantifying the environmental footprint.	The respondent did not have suggestions for quantifying site footprints. However, the region is developing a metric tracking database, and may have suggestions when the database is complete.

Overall, the interview responses to this question and the data review suggest the following:

- **Site-level outcomes may require two baselines to clarify attribution.** For site-level activities, a single uniform baseline across regions may not be as robust as a dual baseline if EPA wishes to attribute activities specifically to the *GR Strategy*. This baseline would assume that eight regions are "new" at GR (and all GR activities from this time on can be linked to the *GR Strategy*), and the remaining two regions can only be considered responding to the *GR Strategy* if they report significant and specific changes in activity. If EPA considers only a more general "contribution" approach, then a single baseline of 2009 or 2010 might be an appropriate starting point.
- **Program-level outcomes may use single date-driven baseline.** For broader changes in awareness and integration of GR tools and techniques throughout the Agency, a single national baseline is more feasible. While interview and survey respondents report undertaking activities that are "GR," the responses to this question and prior questions suggest that broad awareness of GR as a concept and practical approach are clearly linked to the development of the *GR Strategy*.
- **Regions have not collected baseline footprint data.** Because very little information about GR activities is currently tracked across regions, identifying a broad and reliable baseline "site footprint" is difficult. It is possible to measure the environmental effects (for four of the five core elements) at each site, but resources (e.g., time, manpower) for conducting measurements are scarce and no standard method for tracking such data currently exists. The exception to this may be the documentation of typical energy use, because data from Fund-lead sites could provide a basis for estimation. However, a measured baseline footprint might be unnecessary if EPA can develop reliable metrics that quantify "typical footprint impacts" associated with specific GR practices (see Evaluation Question 8 below).

3.3 EVALUATION PURPOSE 3: DETERMINE THE BEST METRICS FOR MEASURING THE PROGRAM'S SUCCESS IN IMPLEMENTING GR PRACTICES

To examine the best metrics for measuring the program's success in implementing GR practices, IEc evaluated a number of existing data sources, and supplemented and corroborated these with interview responses from relevant parties working on GR. To review the metrics for measuring program success, IEc investigated the following questions:

- **Evaluation Question 7:** What performance measures are appropriate for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?

- **Evaluation Question 8:** What are the best means for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of the *GR Strategy*?
- **Evaluation Question 9:** Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

The findings for this evaluation purpose are based primarily on evaluation of the following existing data sources: surveys from Region 3 and Region 4, the survey following the Atlanta Green Remediation Meeting held in October 2010, the Region 2 database, the Region 9 GR activity tracking list, the *Sustainable Remediation Forum (SURF) White Paper on Integrating Sustainable Principles, Practices and Metrics into Remediation Projects*, the draft *Footprint Analysis for Environmental Cleanup*, and other footprint analyses and tools.

In addition, the review of existing data was supplemented with information gathered in a first round of interviews with RPMs and GR Regional Coordinators active in promoting GR practices in each of the 10 EPA Regions, along with a second round of interviews with measurement specialists familiar with metrics and measurement techniques. The second round of interviews also includes other non-EPA professionals working in state or other federal agencies on GR activities.

3.3.1 SUMMARY OF FINDINGS

Overarching findings related to this evaluation purpose are as follows:

- **Identification of performance measures for the *GR Strategy:*** The logic model associated with the *GR Strategy* (Exhibit 1-3) suggests that a suite of appropriate performance measures (metrics) for program performance would include: 1) specific metrics identifying awareness (near-term outcomes), changes in behavior (medium-term outcomes) and changes in site practice and impacts (long-term outcomes) and 2) metrics for each type of outcome that allow EPA to assess the extent to which the *GR Strategy* is effectively implemented and successful in integrating GR principles throughout the remediation process. Another key feature of successful metrics is ease of data collection and analysis. A detailed list of possible metrics is presented in the results for Question 7.
- **Identification of metrics for assessing site footprints:** EPA's efforts to craft and test a footprint methodology to support GR activities at sites provides a comprehensive set of metrics that map to four of the five *GR Strategy* core elements. A number of these metrics appear consistent with other sources and may be able to be adopted with limited additional effort. In other areas, particularly in the area of land and ecosystem protection, practical options may be limited to basic process metrics (e.g., reviewing sites for critical or sensitive habitats) or qualitative descriptions.

- **Key data gaps and challenges:** Direct responses to this question were very limited, but a number of themes emerged in both data reviews and interview responses to other questions. One concern was the reluctance of EPA staff in many regions to conduct footprint analyses. While some interview responses noted that resources for conducting the analyses were an issue, a broader concern appears to be uncertainty about the defensibility of using these analyses in negotiations.

  A related, key concern noted by several regional respondents is the need for more clear policy guidance on implementation of GR practices, to serve as both a guide and a "signal" from Headquarters to reticent regional staff. Interviewees, including two subject-matter experts, also noted HQ policy guidance is constrained by the statutory authority that is available to require GR practices in cleanups, and by the need to ensure appropriate flexibility for regions to implement the program as they see fit. Given the constraints, it appears unlikely that HQ will issue guidance as prescriptive as some regional respondents suggested. The challenge for HQ is to determine how to provide information that will continue to enable and motivate regions to implement GR practices at site cleanup, and will provide assurance that HQ continues to consider GR a high priority.

It appears that the *GR Strategy* has been successful in both raising general awareness of GR and in providing specific practical information and tools for implementation, but it has been more difficult to provide information on the appropriate contexts and approaches for different types of GR activities.

Below we document the more detailed findings for each of the three questions contributing to this Evaluation Purpose.

3.3.2 Evaluation Question 7: What performance measures are appropriate for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?

To determine the best metrics for measuring the program's success in implementing the *GR Strategy*, IEc used two different approaches, including the collection of new data through interviews and review of existing program evaluation literature and other data sources identifying specific GR metrics. Consistent with the focus of a formative evaluation, we consider a range of outcome (performance) measures that could measure progress toward goals.[25]

As an initial step, IEc reviewed the *GR Strategy* logic model to identify activities and outcomes that EPA is seeking to measure, and examined literature to identify criteria that would help describe appropriate metrics.

[25] Handbook of Practical Program Evaluation p.101.

To generate potential metrics for consideration, IEc interviewed the Region GR coordinators, as well as key measurement specialists that have been involved in the development of the draft *Footprint Analysis for Environmental Cleanup*.

IEc then used the *Handbook of Practical Program Evaluation* to assess each of the metrics listed below. Aside from threshold requirements of validity and reliability, the Handbook describes five other criteria for identifying appropriate measures:[26]

- **Meaningful and Understandable Measures** – Measures focus clearly on the goals and objectives of the evaluated program. Additionally, the program's intended audience should be able to easily understand the suggested metrics.
- **Timely and Actionable Measures** – Measures should be actionable, focus on results that decision makers can have leverage over, and present dimensions that are directly affected by the program's elements. Additionally, measures should be based on fresh data and provide results in a timely manner.
- **Practical Considerations and Cost** – Measures should be cost-effective to document. Metrics that require new data collection systems and procedures may be less optimal.
- **Balanced and Comprehensive Measures** – As a group, measures should provide a balanced and comprehensive picture of the evaluated program.
- **Goal Displacement** – Measures should not cause managers to alter or sacrifice the program's goals (e.g., by focusing on "bean counting" at the expense of best practices).

The metrics identified in Exhibit 3-8 below consider the first three criteria described. Potential challenges for measuring these metrics are highlighted in the last column of the table. The last two criteria represent considerations in identifying an appropriate suite of several metrics. These should be considered throughout the metric selection process and evaluated once all available data are collected.

Insights from interview responses: In general, the regional respondents considered this to be a "difficult question" and could not offer many suggestions for appropriate performance measures to assess the effectiveness of the *GR Strategy* in achieving national or regional level outcomes. One regional respondent suggests avoiding "*green beans*," or "counting" green activities as the sole metric to evaluate program success without encouraging the actions with the most impacts.[27]

Responses from the measurement specialists echoed the difficulty in measuring program success. One respondent stressed that tracking the use of the footprint methodology is one

[26] Handbook of Practical Program Evaluation p.110-111.

[27] Under a system focused on counting green beans, people may be motivated to do as many "green" activities as possible, which may hinder the overall goal of site remediation and protection of human health and the environment.

metric that could be used to assess implementation of the *GR Strategy*, but that quantifiable reductions in environmental footprint is the key metric. All respondents remarked that it would be interesting to track the number of sites that complete an environmental footprint analysis and the number that use the Footprint Methodology outlined in the *Footprint Analysis for Environmental Cleanup* document in order to assess the implementation of the *GR Strategy*.

Insights from literature: The *Sustainable Remediation Forum (SURF) White Paper* provides a framework to achieve sustainable remediation, which outlines activities in the following three categories: technical resource integration, cooperative communication, and outreach and recognition. Under each category the paper provides examples of metrics that could be used to assess performance. Technical resource integration includes the development and acceptance of a sustainability framework, technical and regulatory guidance documents, pilot studies and research, lessons learned and case studies, and technical stewardship.

These resources track well with the intended outputs and outcomes of the *GR Strategy*. Cooperative communication at the project and Agency levels can include BMPs, fact sheets and other publications, meetings and trainings, as well as dedicated attention to stakeholder questions and concerns. Finally, the paper notes that outreach and recognition activities will provide momentum for green remediation activities. Examples include publications, participation at conferences, maintenance of a central Web site as a repository for green remediation activities, and the establishment of awards for creative and sustainable projects. Analogous to the metrics included in the *SURF White Paper*, Exhibit 3-9 contains a list of *GR Strategy*-related measures that may be used to assess performance.

EXHIBIT 3-8. IDENTIFICATION AND REVIEW OF POTENTIAL PERFORMANCE MEASURES

OUTCOMES	LOGIC MODEL OUTCOMES	POTENTIAL METRIC	DATA SOURCES	DATA COLLECTION REQUIREMENTS
Short-Term: Changes in Awareness and Attitudes	*Status of regional policies*	Measure of regional policies' consistency with the *Strategy* over time	Review and Comparison of all Regional policies and the *Strategy*	Medium (Would be easy to do, but consistency not only goal)
		Development of regional implementation plans	Regions	Medium (requires data collection form regions)
	Awareness of GR Strategy & BMPs	Use of CLU-IN Website and downloads of specific materials	EMS CLU-IN Website Use Data	Low; data available
		Attendance at NARPM and other Trainings	EMS CLU-IN Website Use Data	Low; data available
		RPM survey responses regarding awareness of *Strategy* over time	Regional RPM Surveys	High (would require survey)
		Number of *GR Strategy* actions/products completed and published to web	HQ	Low; data available but not direct indicator of awareness
	Awareness of resources and site specific assistance	Use of CLU-IN Website and Posted *Strategy* Products	EMS CLU-IN Website Use Data	Low; data available
		Attendance at NARPM and other Trainings	EMS CLU-IN Website Use Data	Low; data available
		Number of phone calls placed to specific experts about site specific assistance and/or resources	Call log or other information on amount of requested assistance	Medium (Depends on the availability of a call log or if the information is tracked some other way)

OUTCOMES	LOGIC MODEL OUTCOMES	POTENTIAL METRIC	DATA SOURCES	DATA COLLECTION REQUIREMENTS
	Awareness of footprint	Use of Pilot Studies and Footprint Assessment CLU-IN Pages	EMS CLU-IN Website Use Data	Low; data available
		Number of participants and organizations attending Footprint Methodology Webinar and subsequent trainings	CLU-IN List of Participants	Low; data available
		Number of "footprinted" sites	Case Studies, technical experts in R9	Low; data available
	Interest in GR Coordination	GR Workgroup call participation	HQ	Low, but not direct awareness indicator
Intermediate: Changes in Behavior	*Adopt BMPs for core areas*	Number of times BMPs are used on sites	Regional Surveys or interviews with RPMs	High (Current surveys do not ask about BMPs. Surveys and interviews can be difficult to coordinate.)
			Does CLU-IN have a feedback section on the BMP page?	Medium (If there is a feedback section, those results may inform this question.)
	GR reflected in ROD	Number of RODs with GR language	Regional review and count of RODs	High; requires review of RODs
	Use of Contracting Tool Kit	Use or number of views of the Contracting Tool Kit	EMS CLU-IN Website Use Data	Low; data available
		Number of Regional master contracts that contain GR language	Review/ count of Regional master contracts	Medium

OUTCOMES	LOGIC MODEL OUTCOMES	POTENTIAL METRIC	DATA SOURCES	DATA COLLECTION REQUIREMENTS
	Specify and adopt performance goals	Number of published implementation plans and "hard targets" in Regional policies	Regions	Medium (requires data collection from regions)
	Formalize GR positions in regions	Changes to more permanent staffing of GR positions	Regions	Low; data available
Long-Term: Changes in Condition	*Full integration of the GR Strategy*	Number of sites with completed footprint analyses.	Regions	High; though this could be a difficult metric to measure
		Agreement on integration of GR in different pipeline stages	HQ, Regions	Low, but requires significant work to achieve and document success
		Number of "non-*GR Strategy* specific" webinars and NARPM trainings that include GR in curricula	HQ	Low-medium; data collection reviews of NARPM materials
		Inclusion of GR practices and targets in management and performance requirements	Regions	Medium; would require data collection from Regions
		Integration of cross-program and cross-Agency GR strategies	HQ, work group	Low, but difficult to achieve
	Reductions in environmental footprint	Refer to Evaluation Question 8 for a more detailed discussion on available footprint metrics.		

3.3.3 EXAMPLE: USE OF CLU-IN WEB DATA

To examine the feasibility of one data set for supporting *GR Strategy* metrics, IEc reviewed a preliminary subset of the CLU-IN Website use data that track the number of participants for CLU-IN web seminars. Exhibit 3-9 tracks the number of CLU-IN web seminars and the number of participants from 2008 to 2011.[28]

EXHIBIT 3-9. REVIEW OF PARTICIPATION IN CLU-IN WEB SEMINARS

	YEAR OF CLU-IN WEB SEMINARS			
	2008	**2009**	**2010**	**2011**
Number of Web Seminar Conferences	5	8	4	5
Average Number of Participants per Conference	186	173	142	196
Number of EPA Participants	93	254	110	166
Number of Other Government Participants	332	338	142	201
Number of Non-Government Participants	507	795	314	611
Total Number of Participants	**932**	**1387**	**566**	**978**

Exhibit 3-9 shows that the two years with the most participants per seminar were 2008 and 2011, coinciding with the beginning of the *GR Strategy* development in 2008 and the period following publication of the final version of the *GR Strategy* in September 2010. However, the largest number of seminars took place in 2009, during *GR Strategy* development. These data do not account for the content of the seminars or outreach leading up to each seminar but continued high participation in future years would indicate awareness of GR.

It is also interesting to note that the number of non-government participants were consistently higher than the number of EPA and other government participants. This result may reflect a larger population and audience of non-government participants than government, but it may also suggest that EPA's *GR Strategy* is achieving awareness of GR outside the Agency. Data on the different categories of non-EPA participants might provide insights on the extent to which EPA is reaching targeted audiences.

3.3.4 Evaluation Question 8: What are the best means for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of the *GR Strategy*?

To determine the best means for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites, IEc first evaluated the *Footprint Analysis for Environmental Cleanups* document, which was recently released in draft form by

[28] IEc also examined data on NARPM training and annual OSC Readiness training, but we do not separately discuss results.

EPA's Office of Superfund Remediation and Technology Innovation GR Team in September 2011. The document is a robust starting place to evaluate the best means for measuring the *GR Strategy's* ability to reduce the environmental footprint at sites. The document lists a set of established parameters (metrics) to be quantified and a straightforward methodology for quantifying those metrics for four of the five core elements of the *GR Strategy* (materials & waste, water, energy, and air quality).[29]

To identify other possible metrics to measure the environmental footprint at sites, IEc mined site case studies (Profiles of Green Remediation), surveys, regional databases, regional metrics, interview responses, literature and other sources, and compared the findings with the metrics list provided by the *Footprint Analysis for Environmental Cleanups*.[30] Exhibit 3-10 arrays the possible metrics that were identified by this review.

As one source of data, we found that the use of the footprint methodology is not widespread throughout EPA regional offices since it was only recently released (September 2011). However, Superfund GR Workgroup members developed best management practices (BMPs) for minimizing the environmental footprint of site activities and have implemented at least one of them at 28 case study sites. These BMPs are in place under a range of cleanup programs including Superfund, RCRA, federal facility, brownfield, and state voluntary actions. A table of 28 Profiles of Green Remediation case studies available on the CLU-IN website summarizes the use of these BMPs.

An analysis of the case studies shows that the most frequently used BMPs are related to air emissions. Over 82 percent of the 28 sites utilized report reducing fossil fuel use over the course of the cleanup to achieve reductions in GHGs and air pollutants. Energy-focused BMPs (i.e., energy efficiency and renewable energy use) have been documented at 68 percent of the 28 sites. Over 64 percent of case study sites employed recycling or beneficial use BMPs to manage materials and waste generated on site. Just under half (12 sites) of the profiles identify strategies to conserve and reuse water treated at sites. Finally, nine sites include land and ecosystems BMPs, though no formal metrics for such activities were outlined in the footprint methodology.

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[29] The metrics are used to quantify the total environmental effects of a remedy by core element (e.g., total energy use, total air emissions, total water use, total waste generation/material consumption). In this way one or more potential remedy options can be compared across either the total environmental footprint or by a specific core element. The document does not provide guidance on quantitative metrics or a methodology for evaluating land and ecosystems, but rather stated that this core element would be evaluated through qualitative analysis. The details of this type of analysis are under development.

[30] Specific existing data sources include: Region 3 Green Remediation 2009 Questionnaire, Region 4 2011 Superfund Greener Cleanup Survey, results from the Atlanta Green Remediation Coordination Meeting in October 2010, the *SURF White Paper*, Region 2 metrics and database of GR practices, the 28 Profiles of Green Remediation case studies available on the CLU-IN Web site, a table of RPM activities that include GR practices from Region 9, and other footprint analyses and tools (e.g., SiteWise, Sustainable Remediation Tool, Greener Cleanups Matrix, Green Remediation Evaluation Matrix).

Exhibit 3-10 reflects the results of this data collection effort by identifying potential metrics and the data sources that report their use. The exhibit includes metrics that are currently being tracked or have the potential to be tracked. The exhibit includes interview responses indicating the availability of metric information summarized at core element level. Overall, our analysis identifies some metrics that are currently in use and other metrics that could be tracked rather easily. Other metrics cited in the footprint methodology appear less common or may be more difficult to track.

EXHIBIT 3-10. REVIEW OF POTENTIAL METRICS FOR CORE ELEMENTS OF THE *GR STRATEGY*

CORE ELEMENT	METRICS	FP[1]	CASE STUDIES[2]	SURVEYS & DATABASES[3]		INTERVIEWS[4] (# OF REGIONS)	OTHER SOURCES[5]
Materials & Waste	Refined materials used (lbs)	x	x (8 Super-fund, 10 others)		d	x (2)	j, k
	Percent of refined materials from recycled or waste material	x		a, b, c			k
	Unrefined materials used (tons)	x					j, k
	Percent of unrefined materials from recycled or waste material	x		a, c			k
	Hazardous waste generated (tons)	x					j
	Non-hazardous waste generated (tons)	x					j
	Percent of total potential waste diverted from landfill disposal	x		a, b, c			i, j
Water	On-site water used, including source, use, and fate of the used water (gal)	x	x (6 Super-fund, 6 others)	b	d	x (1)	i, j, k, l
	Off-site water used (gal)	x		b			i, j, l
	Drawdown of the water table 100 feet from pumping location (feet)	x					
	Percent reduction in stormwater runoff						g, k
Energy	Total energy used (MMBtu)	x	x (12 Super-fund, 7 others)	b	d	x (6)	i, k, l
	Percent of total energy use from renewable resources	x		a, c			i, k
Air Quality	Scope 1 Criteria Pollutant emissions (pounds)	x	x (14 Super-fund, 9 others)		d	x (3)	j
	Scope 1 HAP emissions (lbs)	x					i
	Total greenhouse gas emissions (lbs) CO2e)	x		a, c			i, j, l
	Total Criteria Pollutant emissions (lbs)	x					j, l
	Total HAP emissions (lbs)	x					
	Number of applications of clean diesel applied and amount of ULSD used (convert to CAP emissions reduced)			a, b, c			k
Land & Ecosystems	No metrics. Qualitative analysis.	x	x (3 Super-fund, 6 others)				i
	Percentage of land reforested for carbon sequestration						h
	Percentage of land used for community and utility scale solar						h

CORE ELEMENT	METRICS	FP[1]	CASE STUDIES[2]	SURVEYS & DATABASES[3]		INTERVIEWS[4] (# OF REGIONS)	OTHER SOURCES[5]
	Percentage of land used for community and utility scale wind						h

[1] *Footprint Analysis for Environmental Cleanups* Draft, May 2011

[2] Profiles of Green Remediation available online at <http://www.clu-in.org/greenremediation/tab_d.cfm>

[3] This column includes the following sources. If a source is not listed in the table above it indicates that we have reviewed the source and identified no relevant information.

[a] Region 2 database (not publically available) and list of recommended metrics (available online at *http://www.epa.gov/region02/superfund/green_remediation/metrics.html*)

[b] Region 3 Green Remediation 2009 Questionnaire

[c] Atlanta Green Remediation Coordination Meeting in October 2010 survey

[d] Region 4 2011 Superfund Greener Cleanup Survey. The survey asks respondents if "calculator used?" for each principle (core element). If there were any "Yes" responses recorded, we assume that some metrics corresponding to the specified principle were measured and used in some form of analysis. Note that the survey does not provide specific metrics under each principle. Therefore we can only match Region 4's Survey to footprint methodology metrics at the categorical level.

[e] Region 9 list of RPM activities

[4] This column reports the number of regions that noted, during interviews with IEc, that they currently track or could easily track the categories of core elements of the *GR Strategy*. The interviewees did not cite the specific metrics within each category and therefore we report the results at the categorical level. Interviews were conducted with Regional GR coordinators and RPMs actively attempting GR in the 10 EPA regional offices.

[5]The following sources constitute the "Other" Category. If a source is not listed in the table above it indicates that we have reviewed the source and identified no relevant information.

[f] SURF White Paper, 2009

[g] EPA Brownfields, Air and Water Quality Impacts of Brownfields Redevelopment, April 2011

[h] EPA OSWER, Opportunities to Reduce GHG Emissions through Material and Land Management Practices, Sept 2009

The following sources are other publicly available footprint analysis tools. We did our best matching the metrics listed in the following tools to the metrics included in the table above. However, the metrics in the following tools do not perfectly sync with the EPA's footprint methodology.

[i] SiteWise available at <http://www.ert2.org/t2gsrportal/SiteWise.aspx>

[j] California DTSC Green Remediation Evaluation Matrix available at <*http://www.dtsc.ca.gov/OMF/Grn_Remediation.cfm*>

[k] Illinois EPA Greener Cleanups Matrix available at <*http://www.epa.state.il.us/land/greener-cleanups/matrix.pdf*>. The Illinois EPA's Greener Cleanups Matrix is more of a check list of activities than a footprint analysis tool or template and does not require specific metrics to be measured. However, we assume, based on our review of the document, that the metrics indicated in the table above would be available if the matrix, and activities outlined in the matrix, are implemented.

[l] Air Force Center for Engineering and the Environment(AFCEE) Sustainable Remediation Tool (SRT) available at <http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation/ srt/index.asp>

The review of metrics proposed by the *Footprint Analysis for Environmental Cleanups* draft documents shows that other sources typically highlight and track a subset of these markers. This suggests that the *Footprint Analysis* metrics list is generally comprehensive and highlights some of the more commonly used metrics that may be most appropriate for program-level examination. Below we briefly provide additional insights from the interview and data collection process, organized by sub-question.

What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?

OSRTI's metrics outlined in the *Footprint Analysis for Environmental Cleanups* draft document represent a clear set of quantitative options for direct measurement of reductions in the environmental footprint at sites. Review of additional sources and practices failed to identify any additional quantitative metrics that would be broadly useful.

In implementing these metrics, respondents to the GR Regional Coordinator interviews in nine regions noted that they may have some information or have the ability to track at least one core element (usually energy). However, no consistent method is currently used to track success across regions or even across sites. The most common elements tracked or for which some information is available are energy use, air emissions and waste management.

Respondents noted that the methods exist to track all four of the core elements outlined in the *Footprint Analysis for Environmental Cleanups* draft document, but resources necessary to conduct measurements are scarce. Respondents expressed concern about adding tracking requirements to RPM workloads—one regional respondent noted that RPMs do not need metrics to "do their jobs." Several respondents noted a centralized and simplified tracking system would be important in ensuring participation.

One option may be to document "typical sites" and "typical activities" based on case study and other existing data sources, and use these data to estimate reductions in environmental footprint resulting from specific GR practices. This option addresses the concern of limited resource availability for data collection and analysis efforts noted in several interviews. Under this scenario HQ could develop standard values for typical footprint reductions associated with specific activities and assess regional activities with limited regional data tracking. For example, with sufficient data it may be possible to estimate the average energy savings between two different pump-and-treat systems. In this case it would only be necessary to identify the number of sites that use such systems to calculate total savings.

3.3.5 Evaluation Question 9: Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

A key source for the response to this evaluation question was IEc's interviews with regional EPA staff, HQ staff, and outside-EPA contacts. Direct responses to this question were very limited, and typically focused on difficulties developing defensible footprint analyses. However, a brief review of insights in response to other questions (e.g., Evaluation Question 5's assessment of barriers) indicates three fundamental areas that affect the ability of EPA to fully integrate GR into the remediation process.

Concerns about use of the footprint methodology.

While agreeing that the core elements are well-focused and the quantitative measure of changes in site operation would be an ideal way to document GR success, respondents in several regions expressed concern about both the cost of conducting footprint analyses, and also the potential consequences if the data and methods are challenged by PRPs. Specific insights included:

- The challenge of finding additional resources to undertake (or contract) the analysis.
- A need for support and guidance in "triaging" sites to decide when and how to apply the analysis to ensure that results are not able to be misused (e.g., encourage PRPs to argue for selecting a less-prescriptive remedy because it is the "greener" option).[31]
- Clarity about how best to respond to PRPs with "competing analyses."

Need for policy guidance before implementation.

A broader concern expressed by respondents in several regions is the need for HQ to reaffirm the GR priorities. This issue arose in responses to Evaluation Purpose 1 questions, and was again stressed in response to this question as a "lack of information." Specifically, several respondents noted that a perceived "lack of guidance" confirming the statutory basis for GR is often cited by Regional staff who are tentative about using GR. Two respondents specifically stated that the *GR Strategy* has provided many useful and practical tools for implementation, but without more specific guidance addressing legal and policy questions, many RPMs and regional managers are reluctant to make significant efforts to implement GR. The forthcoming HQ guidance on GR in remedy selection may address this need to some extent, but a broader reaffirmation of HQ's focus on GR might also be helpful as part of any forward-looking effort to increase momentum.

Need to "revitalize" communication to ensure GR Strategy implementation.

Respondents from three regions also noted that the incentives to stay engaged in the GR implementation process are reduced after significant achievements such as the publication of the *GR Strategy*, and they are not always aware of what aspects of the *Strategy* are progressing. The respondents noted that the quality of their own participation was an issue, and emphasized that without dedicated funding for GR staff in the regions, the *GR Strategy* effort is by definition something that is addressed after other required responsibilities are met.

To supplement these insights, IEc examined the green remediation literature to see what other approaches had been addressed. The *Sustainable Remediation Forum (SURF)*

[31] These respondents had not yet reviewed the current *Footprint Analysis for Environmental Cleanups* draft document; some of these concerns may be resolved.

White Paper, specifically, identified a number of barriers preventing a broad implementation of green remediation practices. These barriers are not specific to a better understanding of the results of implementing GR practices or the *GR Strategy*, but they echo several issues raised by EPA interviews. These general barriers include a lack of regulatory guidance, insufficiently defined frameworks and metrics, few financial or other incentives [for PRPs to participate in GR efforts], and the lack of regulatory requirements for the incorporation of green remediation practices in remediation assessments. The *SURF White Paper* also notes that consensus has not yet been reached on specific remedial approaches and tools at sites.

3.4 SYNTHESIS OF KEY EVALUATION FINDINGS

This section provides a synthesis of the key findings of this evaluation organized by evaluation purpose.

Consistent with the general objective of the evaluation, we have explored the *GR Strategy's* progress to date in advancing greener cleanup and to inform the program priorities going forward. The evaluation considers three main parameters: assessing EPA experiences to date in implementing the *GR Strategy*; determining a baseline against which to measure EPA progress in implementing the *GR Strategy*; and determining the best metrics for measuring the program's success in implementing GR practices.

3.4.1 Evaluation Purpose 1: Assess EPA experiences to date in implementing the *GR Strategy*

Overall, interview respondents were uniformly positive in their opinions of the *GR Strategy* structure and purpose, though responses identified some differences of opinion in how best to present "goals" and objectives. Several respondents noted that a more precise goal statement could be useful both in increasing awareness and focusing further implementation of the *GR Strategy*.

In the strongest finding, EPA and non-EPA interviewees had very positive views of several key products of the *GR Strategy*, and felt that these tools and products have been a key driver in facilitating an expansion of GR activities. Respondents felt that awareness of the *GR Strategy* document was more limited, though publication of the *GR Strategy* has facilitated the use of GR by raising the national profile of GR.

Interview responses from the regions indicate that RPMs typically do not use the *GR Strategy* directly in their decision-making for GR implementation, though it is clear they use many of the tools and products developed to support the *GR Strategy*. The *GR Strategy* document was identified to be a more important tool for managers than for RPMs.

It is difficult to assess the distinct contributions of either the national strategy or regional policies separately, since they influence each other. A few regional policies informed the *GR Strategy*, while others may not have been released without the national focus on GR. Examination of regional data from surveys provides a snapshot of activities underway,

and it is apparent that regions have increased emphasis on GR training and outreach as the *GR Strategy* has emerged.

A range of challenges face the broader implementation of the *GR Strategy*, with key concerns including the level of funding and support for *GR Strategy* personnel and project efforts. Other hurdles include a concern about policy and liability uncertainty, and limited participation from managers and other key staff.

3.4.2 Evaluation Purpose 2: Determine a baseline against which to measure EPA progress in implementing the *GR Strategy*

Interview responses from the regions indicated that most have not focused to date on developing a baseline. Overall most of the regions (eight of ten) identified that their current practices represent a fairly accurate baseline before the *GR Strategy* was released because the implementation of GR efforts is just beginning. A complexity of the *GR Strategy* is that it has been implemented as a unifying approach encompassing some existing efforts, and in some cases it clearly post-dates regional activities (e.g., Region 2 and 9). Moreover, a key goal of the program is awareness, and in some cases people are "doing" GR without calling it GR. The findings from this evaluation suggest that EPA consider whether one baseline is adequate to support the program. If EPA wishes to document contribution of the *GR Strategy* generally, then a single date-driven baseline may be appropriate. To document attribution, however, use of different regional baselines for site-specific action may be necessary.

3.4.3 Evaluation Purpose 3: Determine the best metrics for measuring the program's success in implementing GR practices

A review of the logic model associated with the *GR Strategy* suggests that a suite of appropriate performance measures for program performance would directly assess the short-term (changes in awareness), intermediate term (changes in behavior), and long-term (changes in site practice and impacts) outcomes of the *GR Strategy*. Metrics for each type of outcome would also allow EPA to assess the extent to which the *GR Strategy* is effectively implemented and successful in integrating GR principles throughout the remediation process. Successful metrics will also likely require only limited data collection and analysis.

Review of existing and emerging tools for calculating environmental footprint suggest EPA's efforts to craft and test a footprint methodology to support GR activities at sites provides a comprehensive set of metrics that map four of the five *GR Strategy* core elements (excluding land and ecosystems). Several metrics listed in the footprint methodology appear consistent with other sources and may be able to be adopted with limited additional effort. The most successful metrics may be those that HQ can estimate using standardized values and limited regional data.

Interview responses suggest that a number of key challenges exist for understanding the impacts of GR. As was noted in Evaluation Purpose 1, a larger issue that arose from the interview process is the identification of the need for policy-level clarity of the *GR*

Strategy. The lack of clear direction from EPA providing legal and policy justification for incorporating GR techniques at sites seems to have decreased momentum for moving GR forward in some regions. Other limitations that inhibit a better understanding of the results of implementing the *GR Strategy* include concerns about resource constraints (e.g., time, funding, manpower), concerns that clear legal authority for requiring GR practices is not well defined, and reluctance on the part of EPA staff in many regions to use the methodology to conduct footprint analyses.

CHAPTER 4 | CONCLUSIONS AND SUGGESTED NEXT STEPS

Based on our analysis of data collected from interviews and from published and EPA internal sources, IEc's evaluation team offers the following conclusions and suggested next steps for consideration. We believe that implementing these suggested next steps could ensure continued momentum for implementation of the Superfund *GR Strategy* and help ensure the continued integration of GR principles into OSRTI activities.

We note that overall feedback from the interviews about experiences with the *GR Strategy* has been consistently positive, and available data generally support and confirm interview responses. Therefore, IEc's suggested next steps focus on how EPA may be able to strengthen the *GR Strategy* and its products to support the successful integration and implementation of the *Strategy*.

4.1 EVALUATION PURPOSE 1: ASSESS EPA EXPERIENCES TO DATE IN IMPLEMENTING THE *GR STRATEGY*

Based on findings from interviews, regional data, and CLU-IN website materials and use data, IEc concludes that the development and publication of the *GR Strategy* has had some initial success in spreading general awareness about GR concepts and best practices, educating EPA staff, providing tools for implementation of GR practices, and supporting Agency interest for incorporating GR techniques into site cleanups and remedial plans. However, interview responses suggest that the *GR Strategy* is at an important transitional point, with a need for clear focus to ensure its continued longevity and success. The timing of this formative evaluation is appropriate because the results can be used to help EPA to focus on next steps for the *GR Strategy*, to ensure that the momentum that was built during the development of the *GR Strategy* can be maintained to ensure implementation of GR practices. Specifically, we note the following:

- Even among GR Regional Coordinators and other active EPA participants in GR, the general conclusion is that *GR Strategy* could benefit from more clearly defined goals and objectives. While current documents focus on actions, it is difficult to quickly identify clear and concise goals that could guide implementation.
- Users have a very positive reaction to the range of practical tools and products for GR implementation that have been developed as part of the *GR Strategy* (e.g., BMP Fact Sheets and the Contracting Tool Kit). These products are regarded as user friendly, practical, and well-focused on common issues faced by RPMs. In contrast, the *GR Strategy* document is not regularly referenced during site cleanup or remedial design and selection, but is viewed as an internal document from and

for management that acts as a high-level guide for developing an implementation plan for GR at Superfund sites.

- To date, the *GR Strategy* has been most successful in refocusing, defining, and raising awareness for GR in general. Changes in practice due specifically to the *GR Strategy* are still limited since less than a year has passed since publication. Additionally, since regions also have developed separate GR guidance or policies, it is difficult to clearly attribute practice changes wholly to the *GR Strategy*. However, interviews and data suggest that, assuming momentum and interest are maintained, changes in practice should become more measurable over time, and will likely reflect use of the various *GR Strategy*-related implementation tools.
- Key factors limiting the implementation of GR practices include limited resources for dedicated GR staff at the regional level, and concerns about ensuring that GR approaches are also cost-saving or cost-neutral. However, the most widely-noted limitation of the current *GR Strategy* is the absence of published direction or information from HQ addressing several key policy and legal questions facing practitioners who are attempting to incorporate GR techniques at sites. It appears that clarification could provide both practical information and a continued indication of HQ support for GR. Moreover, it appears that other limiting factors identified, such as RPM interest and management support, may be able to be addressed in part by more policy-level information from HQ.

4.1.1 NEXT STEPS

The key conclusions above suggest that a number of near-term actions by EPA could improve the direction and effectiveness of the *GR Strategy* as implementation continues.

- **Focus on clarity of goals and implementation objectives.** EPA may want to establish a near-term focus on concrete goal setting to ensure implementation of *GR Strategy* key actions. At a minimum, this could involve clearly identifying and defining the overarching goals and objectives of the *GR Strategy* in a concise user-friendly document that can be widely used to promote GR principles. In addition, EPA could provide new structure and focus for the GR Regional Coordinators and other key GR participants by considering a more specific implementation plan for key actions. These actions would address the internal need for continued momentum to support GR, and could facilitate broader efforts to expand awareness and acceptance of GR among regional staff and managers.
- **Continue emphasis on practical tools for GR implementation.** A continued focus on development of high-quality, practical products and resources for using GR techniques, especially those with site-specific applicability, will help further implementation of GR practices. Moreover, use of these products provides a clear indication of changes in awareness of GR and implementation of GR practices.

- **Increase focus on policy and legal information and tools, or on other HQ "signaling."** As a complement to the well-received practical implementation tools, EPA may be able to support integration of GR practices by developing materials that address key policy and legal questions. This may include, but is not limited to, completion of the *Considering Green Remediation Measures in the Remedy Selection Process Q&A* document currently underway. In concert with other goal-setting priorities, an increased focus on practical assistance for addressing policy questions may be useful both in overcoming regional concerns about both specific policy issues and in reaffirming the general commitment to GR. Finally, expressions of HQ support for GR as a priority represent signals that are important to many front-line regional staff.

4.2 EVALUATION PURPOSE 2: DETERMINE A BASELINE AGAINST WHICH TO MEASURE EPA PROGRESS IN IMPLEMENTING THE *GR STRATEGY*

Development of a clear baseline is a critical step for a new program focusing on measuring its success. In the context of the effort to implement GR practices, the recent publication of the *GR Strategy* itself provides one possible starting point for measuring future changes. However, because the *GR Strategy* was developed over several years and involved several concurrent regional efforts, it is important to distinguish between "new" activities and those that were under development. Moreover, the *GR Strategy* has a dual purpose to both physically reduce the environmental footprints at sites, and improve awareness and integration of GR principles throughout the Superfund program. This dual purpose adds complexity to baseline development process. Below we summarize the conclusions for this evaluation purpose and discuss suggested next steps.

- Regional interviews confirm that most regions do not currently track GR activities across sites in any way that could be used to develop a reliable baseline "site footprint." With the exception of energy use, little information related to the five core elements is tracked consistently across sites.
- In the absence of existing baseline information, a time-defined baseline is likely to be most appropriate if *attribution* is a goal. However, to capture site-level activities, a dual baseline may be more robust than a single uniform baseline across regions. In eight of the ten regions, GR activities appear to be in beginning stages, and one approach that appears reasonable is to consider all future GR activity as an outcome of the *GR Strategy*. The remaining two regions, however, have pursued GR implementation since before the development of the *GR Strategy*; site-level activities in this regions would only be included if they report specific and significant changes that are directly attributable to the *Strategy.* If EPA prefers to measure the total change in GR activity without considering the specific role of the *GR Strategy* (a *contribution* analysis) then a national time-defined baseline is appropriate, and likely more feasible to implement.

- A single national baseline could be used to capture broader changes in awareness and integration of GR tools and techniques throughout EPA. While many regions report undertaking GR without calling it GR, the findings of this evaluation suggest that broad awareness of GR as a concept are clearly linked to the development of the *GR Strategy*.

4.2.1 NEXT STEPS

- As EPA considers appropriate metrics for measuring program performance, it will likely be necessary to employ two baselines. We suggest that EPA consider the following as a starting point for establishing baselines, assuming that attribution of impacts to the *GR Strategy* is a focus:
    - **A region-specific baseline for documenting site-level changes (core elements) and attributing change to the *GR Strategy*:** This baseline would assume that all reductions in site footprints associated with GR activities since 2010 are related to the *GR Strategy* in all regions except Regions 2 and 9, where established GR efforts pre-dated the *GR Strategy development*. Specific decisions about attribution could include methods for considering the impact of specific *GR Strategy* achievements in Regions 2 and 9, and could also consider the impacts of separate regional efforts in the remaining regions. Documenting attribution is challenging, and would also require correcting for other potential influences such as specific regional strategies, PRP initiatives, or other state or federal programs.
    - **A national baseline for documenting integration of GR practices into EPA cleanup culture:** This baseline would support measurement of changes in awareness and the integration of GR policy throughout the EPA cleanup community and among other audiences, and would assume that all measured changes in awareness and practice (e.g., use of training opportunities and implementation of changes such as contracting language) since September 2010 are related to the *GR Strategy*.

4.3 EVALUATION PURPOSE 3: DETERMINE THE BEST METRICS FOR MEASURING THE PROGRAM'S SUCCESS IN IMPLEMENTING GR PRACTICES

After careful review of the findings of the evaluation we conclude that a number of strong data sources and methodologies exist for measuring the program's success in implementing GR practices. The CLU-IN Website use data can be used to track awareness of the *GR Strategy* and related products (e.g., BMPs, Contracting Tool Kit). In addition, the footprint methodology developed by EPA appears to be a promising tool for measuring site-level impacts of GR activities and Region 2 has developed a Clean and

Green Policy Metrics Tracking Tool database for compiling site-level data, though it is still in the testing phase. Below we summarize the conclusions for this evaluation purpose and discuss suggested next steps.

- To address the goal of the *GR Strategy* of reducing the environmental footprint of cleanup activities, EPA must identify a method for measuring footprint reductions resulting from implementing GR practices. We conclude that it will be necessary for EPA to either directly measure the environmental gains at each site or develop a set of standardized "average" site-level effects for common GR activities that can be used to estimate national effects. One limitation of using site-level data is that it may be necessary to establish a centralized system for tracking data, which could be very resource intensive to manage, especially across a large number of sites. Alternatively, if EPA uses case study and other data to develop estimates of average site-level effects for specific GR techniques, the data collection would require only that regions identify the number of sites employing those techniques.
- The footprint methodology developed by EPA represents a clear set of quantitative options directly measuring site performance, but interview responses suggest that the methodology is too resource-intensive to use at every site. Review of an array of emerging tools for calculating environmental footprint did not identify any additional metrics or methods that would be more useful than those in EPA's footprint methodology. We conclude that EPA's tool is appropriate for directly measuring site-level gains for four core elements. However, to address resource concerns among regional staff, EPA should examine options for developing average values for specific GR activities that can be used to estimate site progress without direct data collection and measurement.
- The Superfund *Green Remediation Strategy* Logic Model (Exhibit 1-3) suggests a number of measures that could be used to assess the success of the program. Given that the *GR Strategy* was created to be a "living" document that is constantly evolving, EPA will have to consider metrics that best align with current objectives of the *GR Strategy*. While EPA must ultimately select metrics, the selection should include a balanced suite that directly assesses the short-term, intermediate term, and long-term out outcomes of the *GR Strategy*. Other criteria of the best metrics could include that they: 1) track data that are readily available and easy to collect, 2) clearly address the goals of the program (clearly linked to logic model), 3) are resource- and cost-effective, 4) are easy to understand, and 5) are meaningful to the intended audiences of the *GR Strategy*.
- Respondents identified a number of key data gaps and challenges related to measuring program success. Many of the challenges focused on the use of the EPA footprint methodology. Many regions noted the reluctance of EPA staff in their regions to conduct footprint analyses, the difficulty of implementing

footprint analyses without clear policy direction, and the limited resources available for conducting such analyses.

4.3.1 Next Steps

- We recommend that EPA work with regions and develop guidance on how and when to conduct footprint analyses and to examine the potential for utilizing such tools to quantify environmental impacts at sites.
- EPA may want to start a dialogue with each of the regions to agree on the best way to leverage case study and other available data to develop an estimation tool or "average" values for GR practices that can be used to estimate national impacts based on simple data collection from regions on GR activities underway.
- We recommend that EPA select metrics to measure program success based upon the proposed criteria listed above.

APPENDICES

APPENDIX A: LIST OF INTERVIEWEES

We would like to thank the individuals who provided information for this evaluation.

NAME	POSITION	ORGANIZATION	DATE INTERVIEWED
Carol Donna	Chemical Engineer and Primary Author of Interim Guidance Incorporating GR into Environmental Remediation	Army Corps of Engineers	September 16, 2011
Robin Anderson	Writing Policy Piece for *GR Strategy*	EPA OSWER	September 28, 2011
Barbara McDonough	Chief of Contracts Management Branch and Oversees Grants and Inter-Agency Agreements	EPA OSWER	August 30, 2011
Ellen Treimel	Program Analyst, Member of ASTM Greener Cleanup Standard Workgroup	EPA OSWER	September 29, 2011
Carlos Pachon	Superfund Green Remediation National Coordinator	EPA OSWER	September 27, 2011
Suzanne Wells	Branch Chief	EPA OSWER	May 17-18, 2011
Ginny Lombardo	Superfund GR Regional Co-Coordinator and RPM	EPA Region 1	July 14, 2011
John Podgurski	Superfund GR Regional Co-Coordinator	EPA Region 1	July 14, 2011
Nicoletta Diforte	Superfund GR Regional Coordinator and RPM	EPA Region 2	July 11, 2011
Kristin Giacalone	Chair of Regional GR Workgroup and Regional Superfund Enforcement Coordinator	EPA Region 2	July 11, 2011
Stephanie Vaughn	RPM and member of GR workgroup and energy forum	EPA Region 2	July 11, 2011
Hillary Thorton	RPM and Presenter/Moderator at NARPM	EPA Region 3	July 12, 2011
Candice Jackson	New Superfund GR Regional Coordinator and RPM	EPA Region 4	July 18, 2011
Don Rigger	Branch Chief	EPA Region 4	September 23, 2011
Brad Bradley	Superfund GR Regional Coordinator and Brownfields Project Officers' Assessment and Cleanup Coordinator	EPA Region 5	July 11, 2011
Raji Josiam	Superfund GR Regional Coordinator, RPM, Co-Lead National Engineering Subcommittee on GR, and On-Scene Coordinator	EPA Region 6	July 13, 2011

NAME	POSITION	ORGANIZATION	DATE INTERVIEWED
Clint Sperry	RPM and Co-Chair of Federal Facilities Forum	EPA Region 7	July 29, 2011
Timothy Rehder	Superfund GR Regional Coordinator and Associate with Super Fund Brown Fields	EPA Region 8	July 12, 2011
Andria Benner	RPM	EPA Region 9	July 19, 2011
Rusty Harris-Bishop	Former Superfund GR Regional Coordinator (Currently Communication Coordinator, Liaison to OPA)	EPA Region 9	July 19, 2011
Jeff Dhont	Superfund GR Regional Coordinator	EPA Region 9	August 1, 2011
Karen Scheuermann	Author of Superfund GR Strategy Activity Tracking Chart, Key Action lead (Also Considered an Environmental Engineer in Region 9 RCRA)	EPA Region 9	August 11, 2011
Julie Santiago-Ocasio	Former Superfund GR Regional Coordinator and Presenter/Moderator at NARPM	EPA Region 9 (Formerly at EPA Region 4)	July 18, 2011
Beth Sheldrake	Superfund GR Regional Coordinator and Superfund Regional Program Management Unit Manager	EPA Region 10	July 15, 2011
Clifford Villa	Assistant Regional Counsel and Unit Manager for Staff Attorneys	EPA Region 10	September 9, 2011
Heather NiFong	Program Advisor Member of Green Standards Work Group and ASTM Greener Sustainable Cleanup Team, ASTSWMO	Illinois EPA	August 17, 2011
Kevin Carpenter	Technology Staff for the Division of Environmental Remediation	New York State Department of Environmental Conservation	September 20, 2011
Doug Sutton	EPA Consultant (assisted in the development of the Footprint Methodology and performs site optimization analyses)	Tetratech	August 8, 2011

APPENDIX B: INTERVIEW GUIDES

Each interview guide was sent to interviewees with the following cover letter.

Superfund Green Remediation Strategy: Implementation Evaluation

CONTACT INFORMATION

Name: _____

Title: _____

Email: _____

Phone number: _____

INTRODUCTION

Thank you for participating in this interview process. As you are aware, the Superfund program is working to advance greener cleanups at Superfund sites. Central to this effort is the *Superfund Green Remediation (GR) Strategy*, which was published in final form in September, 2010. With the support of Industrial Economics, Inc. (IEc) and EPA's Evaluation Support Division (ESD) in the Office of Policy, EPA's Office of Superfund Remediation and Technology Innovation (OSRTI) is evaluating the implementation of the *GR Strategy*. The evaluation is jointly funded by OSRTI and ESD, and was selected under OP's Program Evaluation Competition, a long-term effort to build capacity for program evaluation among headquarters and regional offices.

As part of the *GR Strategy*, the Superfund program is evaluating the implementation of the *GR Strategy* itself. The chosen approach is to conduct a "formative" evaluation of the national-level effort. The purpose of the evaluation is to document the *GR Strategy's* effectiveness in advancing greener cleanups based on three main parameters:

- Assessing EPA experiences to date in implementing the *GR Strategy*;
- Determining a baseline against which to measure EPA progress in implementing the *GR Strategy*;
- Determining the best metrics for measuring the program's successes in implementing GR practices.

Throughout the interview, we would like to know about the processes with which you are most familiar. We also encourage you to raise any items or topics you think are important to our evaluation. Information shared during the interviews will be anonymous and summarized thematically, and will not be attributed to specific individuals in the evaluation report. In presenting findings from the interviews, IEc may attribute findings to groups of interviewees, (e.g., a regional staffer), but we will not attribute findings or quotes to individuals without first obtaining permission from the respective interviewees.

The following interview questions are intended to serve as a guide for our conversation and are provided in advance to spur your thinking and responses. Where possible, please be prepared to provide specific examples. Your responses are important, and we look forward to speaking with you. If you have any questions or would like to provide any additional feedback or information, please contact:

Cynthia Manson, Industrial Economics, Inc.
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617-354-0074

Interview Guide for Regional GR Coordinators and RPMs

INTERVIEW QUESTIONS

Implementation of *Superfund Green Remediation Strategy*

General Information:

- Please briefly describe your position at Region 7.
- What is your role in implementing the *GR Strategy*?
- How do you use the *GR Strategy*?

Evaluation Questions:

1. Which initial activities or initiatives from the *GR Strategy* have been most effective in increasing awareness, adoption and/or implementation of GR activities in your Region?
    - How well is the *GR Strategy* getting used?
    - Which activities have been least effective?
    - How successful has the *GR Strategy* been at helping to implement GR practices?
    - What are the main challenges in advancing GR?
    - Which audiences have been most easily reached by the *GR Strategy*? Which audiences have been more challenging or have not yet been reached?
2. How do Remedial Project Managers (RPMs) in your Region factor the *GR Strategy* into their approach to planning site cleanup?
    - Has your region conducted a survey of GR practices in your Region? If so, to whom?
    - What GR practices are being implemented?
    - What percentage of RPMs are implementing specific GR practices?
    - What do RPMs know about the energy usage at the sites they manage?
    - What information do RPMs track on other GR core elements?
3. What effect has the *GR Strategy* had on the practice of using green remediation techniques at Superfund sites in your region?
    - What practices/activities have you changed as a result of the *GR Strategy?*
    - Does your region have a GR implementation plan?

- What other policies/strategies do you use for implementing GR practices?
- Are there other regional programs helping to move GR forward?

4. What lessons have been learned as a result of implementing the *GR Strategy* at sites?
    - What successes have you had?
    - What factors affect the ability to implement the *GR Strategy* at sites?
        i. Technical issues
        ii. Cost issues
        iii. Legal issues
        iv. Management support
        v. Contract provisions
        vi. Contractor capabilities
        vii. Other?
    - How is integration of the *GR Strategy* priorities (e.g., policy guidance, training, and tools) affected by the above factors and experiences to date?
    - Has your region implemented or conducted any kind of GR training?

Strategic Implementation

5. **Review of GR Strategy goals and objectives**
    - Please tell us how your work has used or focused on *GR Strategy* goals and objectives.
    - In your opinion, does EPA have clearly defined goals and objectives for the *GR Strategy*?
    - Are these objectives and goals well aligned for different uses?
        i. Management decision-making
        ii. Planning and budgeting
        iii. Strategic planning?
    - Do you have suggestions for refining goals or objectives?

Baseline Development

6. What options can we identify for developing a baseline?
    - What has changed since the implementation of the *GR Strategy* in your Region?
    - When did green remediation become important to site cleanup?
    - What options are available for quantifying the environmental footprint at sites?

THE FOCUS OF THIS INTERVIEW IS ON THE SIX QUESTIONS LISTED ABOVE, BUT ANOTHER PURPOSE OF OUR EVALUATION AIMS AT EVALUATING THE BEST METRICS FOR MEASURING THE PROGRAM'S SUCCESS IN IMPLEMENTING GR PRACTICES. PLEASE LET US KNOW IF YOU HAVE THOUGHTS ON THE FOLLOWING THREE QUESTIONS RELATED TO THAT TOPIC.

Metrics for Measuring Progam Success

7. What performance measures do you think could be used for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?
8. What approaches are useful for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of *GR Strategy*?
    - What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?
    - Is your region collecting any measurement data related to the use of GR? What type?
9. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

Additional Information

10. Please discuss any other issues affecting the efficiency or effectiveness of the *GR Strategy*. Do you have any other suggestions to improve the *GR Strategy*, from either the perspective of EPA or the intended audiences?

Interview Guide for Regional Attorneys

INTERVIEW QUESTIONS

1. Please briefly describe your position in your Region.
2. Do you work on green remediation (GR) issues?
    - *Where in your work have you encountered GR?*
3. What is your impression of GR?
    - *What seems most promising?*
    - *What seems most troubling?*
4. In your opinion, what are the challenges for implementing GR practices?
    - *What factors affect the ability to implement the GR Strategy at sites?*
        i. *Technical issues*
        ii. *Cost issues*
        iii. *Legal issues*
        iv. *Management support*
        v. *Contract provisions*
        vi. *Contractor capabilities*
        vii. *Other?*
    - *Is there currently sufficient policy or legal justification for the legal department in your Region to support GR activities? Does the legal department support RPMs' requests/orders to contractors or PRPs to consider GR activities?*

5. What experience have you had with *Superfund Green Remediation (GR) Strategy?*
    - *In your experience, what aspects of the GR Strategy work well?*
    - *What aspects don't work well?*
    - *Do you have suggestions for improvements to the GR Strategy?*
6. What effect has the *GR Strategy* had on the practice of using GR techniques at Superfund sites in your region?
    - *In what way has the GR Strategy shaped policy in your Region?*
    - *How has the GR Strategy been helpful to your work?*
    - *How has the GR Strategy made your job more difficult?*
7. How do you coordinate with Headquarters in your GR work?
    - *Is there anything that HQ could provide to make your work with GR easier?*
    - *Are there specific people that you work with frequently?*
    - *Which topics do you typically address?*
    - *Are there other people or resources you consult with outside of HQ?*
8. Please discuss any other issues affecting the efficiency or effectiveness of the GR Strategy. Do you have any other suggestions to improve the GR Strategy?

Interview Guide for Regional Supervisors

INTERVIEW QUESTIONS

1. Please briefly describe your position in your Region.
2. Do you work on green remediation (GR) issues?
    - *How do you encounter GR?*
    - *Where in your work do you use GR?*
3. What experience have you had with *Superfund Green Remediation (GR) Strategy?*
    - *In your experience, what aspects of the GR Strategy work well?*
    - *What aspects don't work well?*
    - *Do you have suggestions for improvements to the GR Strategy?*
4. In your opinion, what are the challenges for implementing GR practices?
    - *What factors affect the ability to implement the GR Strategy at sites?*
        i. *Technical issues*
        ii. *Cost issues*
        iii. *Legal issues*
        iv. *Management support*
        v. *Contract provisions*
        vi. *Contractor capabilities*

vii. *Other?*

5. What effect has the *GR Strategy* had on the practice of using GR techniques at Superfund sites in your region?
    - *Has the GR Strategy been helpful to this effort?*
6. Please discuss any other issues affecting the efficiency or effectiveness of the GR Strategy. Do you have any other suggestions to improve the GR Strategy?

Interview Guide for EPA Contract Specialists

INTERVIEW QUESTIONS

1. Please briefly describe your position as it relates to the Green Remediation Strategy.
    - *How are you involved with the GR Strategy?*
    - *In what capacity does your work promote the GR Strategy?*
2. Please briefly describe the process of incorporating GR clauses into Superfund contracts.
    - *What does your work entail?*
    - How does putting GR into a contract work?
    - Which types of contracts have GR clauses been incorporated into?
        i. *Removal action*
        ii. *Remedial response*
        iii. *Support services*
        iv. *Technical enforcement support*
        v. *Policy, program management, and administrative services*
        vi. *Other contract venues*
    - Are the GR clauses in contracts sufficient to promote GR practices?
        i. *Are they followed or ignored?*
    - You are listed as a contributor to the *Greener Cleanups Contracting and Administrative Toolkit.* Do you participate in the periodic updates of this document?
        i. *Who else is involved?*
        ii. *How are updates communicated to the intended audiences?*
3. With whom do you work in the Regions? At HQ?
    - *What level of staff do you work with in the Regions?*
    - *Do you work with Regional Coordinators or RPMs directly?*
4. What are your goals for incorporating GR in Superfund contracts?
    - Are there metrics that you track related to GR in contracts?
        i. *If not, what could be tracked?*
        ii. *Do you have a list of all contracts that incorporate GR?*
    - How would you measure the success of what your work is trying to accomplish?
        i. *What successes have you had?*
    - What challenges have you faced in incorporating GR into contracts?
        i. *What factors affect the ability to incorporate GR into contracts?*

5. Please discuss any other issues affecting your work as it relates to the *GR Strategy*. Do you have any other suggestions to improve the *GR Strategy*, from either the perspective of EPA or the intended audiences?

Interview Guide for EPA *GR Strategy* Evaluation Work Group Members

INTERVIEW QUESTIONS

1. What do you see as the next steps for the strategy?
    - What things are you working on now?
2. What type of feedback have you received about the strategy?
    - What type of feedback from EPA HQ?
    - What type of feedback from regional staff (e.g., RPMs, front line managers, attorneys)?
3. What do you see as areas of the strategy that need the most work/attention?
    - Which areas are most pressing?
4. What do you see as the next steps for the footprint methodology?
    - Are you planning to issue any further guidance on using the methodology?
5. What are the challenges facing the integration and implementation of the strategy?
6. What is the status of the Region 2 database for tracking site level data?
    - Is that something that is intended to be shared with all the regions?
7. How do you intend to use EMS and their data in the future?
    - In addition to what has been tracked and collected, are there other metrics you have or will request?
8. We received feedback that EPA should be more coordinated with other programs. Are there any plans to do this in the future?
    - How would this happen?
    - For outside EPA contacts what do you think the coordination with EPA on GR should be?

Interview Guide for EPA *GR Strategy* Policy Expert

INTERVIEW QUESTIONS

1. What is your role in the GR Strategy?
2. Tell us about the current piece you are working on.

3. What is next for you?
4. What are the next steps for the GR Strategy as a whole?
    - What are the most pressing?
5. What other policy guidance to you see coming in the future?
    - What else is in the works?

Interview Guide for Non-EPA Federal Agencies

INTERVIEW QUESTIONS

1. Please briefly describe your position as it relates to green remediation.
2. What experience have you had with the Superfund *Green Remediation (GR) Strategy?*
    - *In your experience, what aspects of the GR Strategy work well?*
    - *What aspects don't work well?*
    - *Do you have suggestions for improvements to the GR Strategy?*
3. How does the *GR Strategy* help with your green remediation efforts?
    - *Does the GR Strategy create any problems?*
    - *How does the GR Strategy effort differ from yours? Is it complementary?*
4. How do you coordinate with the Regional and national (Headquarters) EPA offices in your green remediation work?
5. How does your coordination with EPA compare with your coordination with other federal agencies?
6. Has the *GR Strategy* had any effect on the practice of using green remediation techniques at remediation sites in your Agency?
    - *What practices/activities have you changed as a result of the GR Strategy?*
    - *What other policies/strategies do you use for implementing GR practices?*
7. Please discuss any other issues affecting the efficiency or effectiveness of the *GR Strategy*. Do you have any other suggestions to improve the *GR Strategy*?

Interview Guide for State Programs

INTERVIEW QUESTIONS

1. Please briefly describe your position as it relates to green remediation.
2. What experience have you had with the *Superfund Green Remediation (GR) Strategy?*

- *In your experience, what aspects of the GR Strategy work well?*
- *What aspects don't work well?*
- *Do you have suggestions for improvements to the GR Strategy?*

3. How does the *GR Strategy* help with your state-level green remediation efforts?
    - *Does the GR Strategy create any problems?*
    - *How does the GR Strategy effort differ from yours? Is it complementary?*
4. How do you coordinate with the Regional and national (Headquarters) EPA offices in your green remediation work?
5. How does your coordination with EPA compare with your coordination with other federal agencies?
6. Has the *GR Strategy* had any effect on the practice of using green remediation techniques at Superfund sites in your state?
    - *What practices/activities have you changed as a result of the GR Strategy?*
    - *What other policies/strategies do you use for implementing GR practices?*
7. Please discuss any other issues affecting the efficiency or effectiveness of the *GR Strategy*. Do you have any other suggestions to improve the *GR Strategy*?

Interview Guide for Measurement Specialists

INTERVIEW QUESTIONS

1. Please briefly describe your position as it relates to the Green Remediation Strategy.

    - *How are you involved with the GR Strategy?*
    - *In what capacity does your work promote the GR Strategy?*

2. Please give us an update of the status of the footprint methodology.

    - How will this be rolled out and integrated in the Regions?
    - What are your plans for how people will use this?
        i. *Will there be guidance on how Regions can overcome some of the limiting factors mentioned in the first round interviews? (i.e., time, money, resources, availability of a universal measurement system, and educating contractors on the methodology)*
    - How will it be determined which sites to footprint?
        i. *Will the EPA eventually want the analysis conducted on every Superfund site?*

- Who will provide the resources and funding to conduct the footprint analysis?
- Some Regions raised the issue of PRPs coming back with competing analyses. How is the footprint methodology designed to limit this problem?
- How does the footprint methodology address land use?

Baseline Development

3. What ideas do you have for measuring a baseline?
    - What options are available for quantifying the environmental footprint at sites?

Metrics for Measuring Progam Success

4. What performance measures do you think could be used for measuring the effectiveness of the *GR Strategy* in achieving intended outcomes at a regional or national level?
5. What approaches are useful for measuring the effectiveness of the *GR Strategy* in reducing the environmental footprint at sites that have implemented GR practices with respect to the five core elements of *GR Strategy*?
    - What options exist for using qualitative or quantitative measures to assess the five core elements of *GR Strategy*?
    - What types of measurement data are being collected related to the use of GR in the Regions?
6. Where are the primary data gaps and limitations that inhibit a better understanding of the results of implementing the *GR Strategy*?

Additional Information

7. Please discuss any other issues affecting the efficiency or effectiveness of the *GR Strategy*. Do you have any other suggestions to improve the *GR Strategy*, from either the perspective of EPA or the intended audiences?

APPENDIX C: REGIONAL SURVEY AND TRACKING DATA

REGION 3 GREEN REMEDIATION 2009 QUESTIONNAIRE:

The Region 3 Green Remediation 2009 Questionnaire results could not be formatted effectively to include in the appendices. Instead, we include the actual questionnaire that was sent to RPMs in the region to offer some context for the information available in the results.

Green Remediation 2009 Questionnaire

Site Name Location:
☐Private ☐Army ☐Navy ☐Air Force
List RPM of the site Name

WATER	
Stormwater Management:	
1) Have you installed any of the following landscape features to control stormwater:	
A) bioretention cells	☐ yes ☐ no
B) vegetative swales	☐ yes ☐ no
C) porous pavement/stones	☐ yes ☐ no
D) trees	☐ yes ☐ no
E) biosocks	☐ yes ☐ no
F) coconut logs	☐ yes ☐ no
1a) What is the area?	
Water Usage:	
2) Did you minimize water use on site?	☐ yes ☐ no
2a) How?	
3) Did you store site generated water or storm water for reuse on site? (i.e. rainwater for dust suppression)	☐ yes ☐ no
3a) How is the water stored and how much?	
4) Did you recycle water for use on site?	☐ yes ☐ no
4a) How is it used?	
5) Have you created open space ☐ to filter water ☐ other explain: ☐ storm water control ☐ create wetlands	
Wetlands as water management features :	
6) Have you constructed wetlands for:	
a) Stormwater control	☐ yes ☐ no
b) act as a filter before entering surface water	☐ yes ☐ no
c) treat contaminants	☐ yes ☐ no
d) enhancement	☐ yes ☐ no
e) replacement	☐ yes ☐ no

6a) How many acres? If not known where could we find this information?	

Green Groundwater remedy:

7) Is there a groundwater or surface water component at your site? a) monitoring only b) pump and treat c) in-situ treatment: d) Was the in-situ treatment part of a pump and treat optimization? e) other **Explain**	☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no

8) What was the reagent used to treat the groundwater contaminant(s):

☐ molasses ☐ vegetable oil ☐ chemical compound like potassium permanganate ☐ other

9) Have you installed a permeable reactive barrier as a remedy rather than groundwater pump and treat system?	☐ yes ☐ no

9a) Was this part of the original remedy or a post-ROD modification?	9b) If post-ROD why?

10) Have you performed an optimization study on your site? What were the results?	☐ yes ☐ no

LAND USE

Priority Questions

11) Is the site currently being reused?	☐ yes ☐ no

11a) When did you start planning for reuse?

☐ Pre ROD ☐ ROD ☐ Post ROD

11b) What was the type of re-use:

☐ commercial ☐ ecological ☐ residential ☐ municipal ☐ other explain

12) What type of revegetation did you perform at your site?	☐ landfill cover ☐ replacement ☐ wetland ☐ enhance existing land ☐ other:

12a) What type of species	☐ native grass ☐ trees/shrubs ☐ other: ☐ wetland
12b) How many acres were planted?	

13) What was the purpose of the revegetation on your site? **a)** Stormwater control **b)** Create, enhance, or preserve wetlands **c)** Treatment of contaminants **d)** Reduce green house gases **e)** Enhance ecological habitat **f)** Replacement of destroyed vegetation Explain:	☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no ☐ yes ☐ no
14) Did the remedy include plants or trees (phytoremediation) to remediate contamination?	Soil ☐ yes ☐ no Groundwater ☐ yes ☐ no Surface Water/Springs ☐ yes ☐ no
14a) What type of plants were used, how many acres were planted or number of plants?	
15) Did you reduce or minimize destruction of ecologically significant habitats?	☐ yes ☐ no Amount: Explain:

SOIL:

16) Did you treat contaminated soils on-site and reuse the soils for cover or fill rather than dig/haul contaminated soils for off-site disposal?	☐ yes ☐ no
17) Did you minimize off-site disposal via onsite containment and/or treatment?	☐ yes ☐ no
17a) How much soil, sediment, other waste? Describe materials and quantify.	☐ Soil ☐ Sediment ☐ Other waste Total: Explain:
18) Were any amendments and/or plants used to improve soil quality?	☐ yes ☐ no
18a) What type of amendment?	Example: pine bark, bio-solid

18b) What quantity of soils were treated?	
18c) Do you have information about the impacts of soil amendments have on sequestering green house gasses?	☐ yes ☐ no

RECYCLING

Priority Questions

19) Were recycled materials used to construct anything on site i.e. buildings, roads, parking lots or pavement? **Explain:**	☐ yes ☐ no
20) Did you separate materials for re-use or recycling at your site?	☐ yes ☐ no

20a) What type of material?

☐ soil for cover ☐ wood ☐ metal ☐ oil ☐ other: ☐ tire ☐ Construction & Demolition Debris

☐ green concrete

20b) How did you reuse on-site materials?
Amount:

Explain:

21) How did you minimize waste generation at the site? Explain.

Secondary Questions:

22) Did you use waste streams from other sources in your remedy? For example, biosolids for a cover, pickle liquor for groundwater treatment.	☐ yes ☐ no
22a) What type of waste?	

ENERGY

Priority Questions

23) Do any of the components of your remedy uses low energy? (i.e. monitoring groundwater)	☐ yes ☐ no

24) Did you design the treatment system with optimum efficiency?	☐ yes ☐ no
24a) Did you perform an optimization study of the groundwater pump and treat system and as a result did you find energy efficiency and/or cost savings?	☐ yes ☐ no
24b) As a result of the optimization study, how did you alter the groundwater pump and treat system?	
24c) Have you tracked your energy usage or cost over time? What figures do you have? Where are they reported?	
24d) Are you using energy efficient equipment (pumps, lights) at your site?	☐ yes ☐ no
24e) Are you using Energy Star equipment like computers at your site?	☐ yes ☐ no
25) Is the power used at the site from a renewable energy source?	☐ yes ☐ no
a) Are you using solar energy, hydro energy or wind power for energy at your site?	☐ yes ☐ no
b) Has methane gas from a landfill at your site been used for energy?	☐ yes ☐ no
c) Did you purchase energy from a renewable energy source?	☐ yes ☐ no
26) Did you use field techniques to minimize energy used? (i.e. XRF, TAGA Van, TRIAD) # of samples	☐ yes ☐ no
27) Did you use low energy remedy such as bioremediation, reactive barrier or phytoremediation?	☐ yes ☐ no
AIR QUALITY AND GREEN HOUSE GASSES *Priority Questions*	
28) Did you minimize the generation of air emissions and greenhouse gases? i.e. reduce equipment and transportation usage	☐ yes ☐ no
28a) If so, how?	

28b) Did you include additional treatment on an air stripper to reduce air emissions?		☐ yes ☐ no
29) Have you used or plan to use alternative fuels such as biodiesel, electricity, ethanol, hydrogen, natural gas, propane in the equipment on the site?		☐ yes ☐ no
29a) Did you try to reduce the usage of equipment i.e. hand excavate?	☐ yes ☐ no Explain:	
29b) Did you repair an existing engine or equipment to make it more efficient?	☐ yes ☐ no Explain:	
29c) Did you install emission reduction technology on equipment such as clean diesel equipment?	☐ yes ☐ no Explain:	
30) Are plans in place to reduce truck transport either to dispose of waste or bring supplies to the site?	☐ yes ☐ no Explain:	
LONG TERM STEWARD *Priority Questions*		
31) Have you evaluated operation and maintenance procedures in order to increase efficiency or reduce energy usage?		☐ yes ☐ no
31a) For example, did you reduce monitoring frequency (number of wells, contaminants) while still gathering sufficient data to monitor the remedy? If yes, explain.		☐ yes ☐ no
31b) For example, have you modified landfill vegetation so there is less maintenance? If yes, explain.		☐ yes ☐ no
31c) For example, have you looked at composite sampling versus discrete sampling or different levels of validation for sampling? If yes, explain.		☐ yes ☐ no
32) Have you installed a new technology to make the remedy more efficient?		☐ yes ☐ no
32a) For example, have you installed a computer based monitoring system?		☐ yes ☐ no

32b) For example, have you installed energy efficient equipment for the operating systems?	☐ yes ☐ no

CLOSING QUESTIONS	
33) What training or resources would help you use green remediation?	
34) What are the greenest aspects of your remedy? Or planned green remedy? Can any other RPM's who had the site elaborate on green aspects of the remedy?	
35) What type of documentation do you have on the green component of the remedy including reasons why it was implemented and cost and where could we find this information?	
36) Would you be interested in attending the Green Cleanup Symposium scheduled for February 10th & 11th, 2010? Or present a case study at the Green Cleanup Symposium?	

REGION 4 2010 GREENER CLEANUP SURVEY:

MEMORANDUM

United States Environmental Protection Agency B&V Project 049049
TO 49 - Green Remediation May 26, 2011

To: Julie Santiago-Ocasio, U.S. Environmental Protection Agency

Subject: Greener Cleanup Survey Summary Memorandum
Document Control Number 49049-0872-02-E-00833R0

This memorandum summarizes the results of the U.S. Environmental Protection Agency (EPA) Region 4 Superfund Greener Cleanup Survey. Region 4 conducted this survey to assess progress in implementing Greener Cleanup practices at Superfund sites across Region 4. The information obtained through this survey will help to identify training needs and opportunities to aid personnel in implementing Greener Cleanup practices at their sites. This information will also be utilized to develop tools and case studies to help Remedial Project Managers (RPMs) learn from successes and/or failures of the implementation process.

This memorandum has been prepared by Black & Veatch Special Projects Corp. (Black & Veatch) under Contract Number EP-S4-09-02 with EPA Region 4 and under specific authorization of EPA Region 4 through the Task Order (TO) Number 049.

The results of the survey are presented below. For reference, the definitions of the five Principles for Greener Cleanups are included.

Principle 1: Total Energy Use and Renewable Energy Use

- Minimize energy consumption (e.g. use energy efficient equipment).
- Power cleanup equipment through onsite renewable energy sources.
- Purchase commercial energy from renewable resources.

Principle 2: Air Pollutants and Greenhouse Gas Emissions

- Minimize the generation of greenhouse gases.
- Minimize generation and transport of airborne contaminants and dust.
- Use heavy equipment efficiently (e.g. diesel emission reduction plan).
- Maximize use of machinery equipped with advanced emission controls.
- Use cleaner fuels to power machinery and auxiliary equipment.

Principle 3: Water Use and Impacts to Water Resources

- Minimize water use and depletion of natural water resources.
- Capture, reclaim and store water for reuse (i.e., recharge aquifer, drinking water irrigation).
- Minimize water demand for revegetation (i.e., native species).
- Employ best management practices for stormwater.

Principle 4: Materials Management and Waste Reduction

- Minimize consumption of virgin materials.

- Minimize waste generation.
- Use recycled products and local materials.
- Beneficially reuse waste materials (e.g., concrete made with coal combustion products replacing a portion of the Portland cement).
- Segregate and reuse, or recycle materials, products, and infrastructure (e.g. soil, construction and demolition debris, buildings).

Principle 5: Land Management and Ecosystem Protection

- Minimize areas requiring activity or use limitations (e.g., destroy or remove contaminant sources).
- Minimize unnecessary soil and habitat disturbance or destruction.
- Use native species to support habitat.
- Minimize noise and lighting disturbance.

General

The Greener Cleanup Survey was sent to 63 EPA Remedial Project Managers (RPMs). A total of 34 RPMs, or 54%, responded to the survey; however, only 31 respondents answered all of the questions. The following is a list of all EPA RPMs who participated in the study:

Femi Akindele	Bill Denman	Leigh Lattimore	Michael Taylor
Cathy Amoroso	Carl Froede Jr.	Lila Llamas	Michelle Thornton
Jim Barksdale	Rachel Hall	McKenzie Mallary	Peter Thorpe
Martha Berry	Corey Hendrix	Keriema Newman	Samantha Urquhart-Foster
Jon Bornholm	Ralph Howard	Rob Pope	Debbie Vaughn-Wright
Randy Bryant	Candice Jackson	Jon Richards	Tim Woolheater
Carolyn Callihan	Constance Jones	Carmen Santiago-Ocasio	Craig Zeller
Loften Carr	Yvonne Jones	Pam Scully	
Peter Dao	Rusty Kestle	Erik Spalvins	

Type of Site

- Superfund – 20
- Superfund with Federal Facilities Sites – 13
- Both Superfund & Superfund with Federal Facilities Sites – 1

Number of sites managed by each of the responding RPMs

Number of Sites	Number of RPMs
1	8
2	5
3	1
4	3
5	3
6	4
7	3
8	1
9	1
10	2
11	1
15	1
20	1

Principles for Greener Cleanups

Principle 1: Total Energy Use and Renewable Energy Use

- 12 RPMs, or 35% of the respondents, have implemented this principle.
- Specific elements include:
  - Consider use of optimized passive-energy technologies (with little or no demand for external utility power) that enable all or part of the remediation objectives to be met - 8
  - Look for energy efficient equipment and maintain equipment at peak performance to maximize efficiency - 6
  - Periodically evaluate and optimize energy efficiency of equipment with high energy demands - 2
  - Consider installing renewable energy systems to replace or offset electricity requirements otherwise met by the utility (i.e., solar powered sampling devices) - 5
  - Other – solar powered surface water monitoring system
- Reason for implementing the principle
  - Technical - 10
  - Financial - 5
  - To comply with Region 4 Clean and Green Policy - 3
  - To comply with Greener Cleanup language added in an enforcement document - 0
  - Other: No onsite power source.
- Did the principle play a role in the selection of a remedy?
  - Yes - 1
  - No - 10

- Did the principle affect the way the remedy was implemented?
  - Yes - 3
  - No – 6

  - Not applicable - 2
- Did the principle affect post construction activities?
  - Yes - 3
  - No - 5
  - Not applicable – 3

- Sites where Principle 1 has been implemented

Site Name	Calculator Used?	Phase
Marshall Space Flight Center	No	Investigation, Remedy Selection, Remedial Design, and Implementation
P Area OU 94	No	Remedy Implementation
Landia Chemical	Yes	Remedy Implementation
Savannah River Site	No	Remedy Implementation
Sanford Gasification	No	Remedy Implementation
M Area OU	No	Remedy Implementation
Cape Fear	No	Post-Construction Complete
Savannah River Site	No	Remedy Implementation
Barite Hill	No	Investigation
Nevada Goldfields	No	Investigation
Redstone	No	Investigation
Oak Ridge Reservation	No	Remedial Design and Implementation
East TN Technology Park	No	Remedial Design and Implementation

Principle 2: Air Pollutants and Greenhouse Gas Emissions

- 14 RPMs, or 41% of the respondents, have implemented this principle.
- Specific elements include:
  - Minimize use of heavy equipment requiring high volumes of fuel - 4
  - Use cleaner fuels and retrofit diesel engines to operate heavy equipment, when possible - 2
  - Reduce atmospheric release of toxic or priority pollutants (ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead) (i.e., use of anti-idling policies) - 6
  - Minimize dust export of contaminants - 12
  - Other - minimization of personnel traveling to the site
- Reason for implementing the principle
  - Technical - 10
  - Financial - 2
  - To comply with Region 4 Clean and Green Policy - 3
  - To comply with Greener Cleanup language added in an enforcement document - 0
  - Other - This is a standard operating procedure at SRS, To control fugitive dust emissions, Generally good practice.
- Did the principle play a role in the selection of a remedy?
  - Yes - 2
  - No - 11
- Did the principle affect the way the remedy was implemented?
  - Yes - 3
  - No – 9
  - Not applicable - 1
- Did the principle affect post construction activities?
  - Yes - 0
  - No - 8
  - Not applicable – 5

- Sites where Principle 2 has been implemented

Site Name	Calculator Used?	Phase
East TN Technology Park	No	Treatability Study
Oak Ridge National Lab	No	Remedy Implementation
Savannah River Site	No	Remedy Implementation
Landia Chemical	Yes	Remedy Implementation
Aqua Tech	No	Remedy Implementation
T Area OU	No	Post-Construction Complete
Sanford Gasification	Yes	Remedy Implementation
TVA Kingston	Yes	Remedy Implementation
Cape Fear	No	Post-Construction Complete
Barber Orchard	No	Remedy Implementation
Barite Hill	No	Investigation
NAS Jacksonville	No	Investigation, Remedy Selection, Implementation, and Post-Construction Complete
Redstone Arsenal	No	Investigation, Remedy Selection, Remedial Design, and Implementation
Oak Ridge Reservation	No	Remedy Implementation
East TN Technology Park	No	Remedy Implementation
Smokey Mountain Smelters	No	Investigation & time critical remedy
Sprague Electric	No	Remedial Design

Principle 3: Water Use and Impacts to Water Resources

- 17 RPMs, or 50% of the respondents, have implemented this principle.
- Specific elements include:
  - Minimize fresh water consumption and maximize water reuse during daily operations and treatment processes - 6
  - Reclaim treated water for beneficial use such as irrigation - 3
  - Use native vegetation requiring little or no irrigation - 7
  - Prevent impacts such as nutrient loading on water quality in nearby water bodies (i.e., erosion prevention methods like silt fences) - 14
  - Other – Recycling treated groundwater – 2 and using straw to retain water in soils being revegetated
- Reason for implementing the principle
  - Technical - 14
  - Financial - 7
  - To comply with Region 4 Clean and Green Policy - 2
  - To comply with Greener Cleanup language added in an enforcement document - 0
  - Other – Standard DOE policy, Request of FWS, Common sense, Generally good practice
- Did the principle play a role in the selection of a remedy?
  - Yes - 4
  - No - 12
- Did the principle affect the way the remedy was implemented?
  - Yes - 4
  - No – 9
  - Not applicable - 3
- Did the principle affect post construction activities?
  - Yes - 4
  - No - 7
  - Not applicable – 5

- Sites where Principle 3 has been implemented

Site Name	Calculator Used?	Phase
Oak Ridge National Lab	No	Remedy Implementation
Anniston PCB	No	Remedy Selection/Feasibility Study
Marshall Space Flight Center	No	Investigation, Remedy Selection, Remedial Design, and Implementation
Savannah River Site	No	Post-Construction Complete
Escambia Treating Company	No	Remedy Implementation
Landia Chemical	Yes	Remedy Implementation
Aqua Tech	No	Remedy Implementation
Lexington County Landfill	No	Remedy Implementation and Post-Construction Complete
Holtrachem	No	Investigation
Reasor Chemical	No	Post-Construction Complete
Shuron	No	Remedy Implementation
Sanford Gasification	Yes	Remedy Implementation
TVA Kingston	Yes	Remedy Implementation
Cape Fear	No	Post-Construction Complete
Geigy Chemical	No	Post-Construction Complete
Redstone Arsenal	No	Remedy Implementation
Site 12 Jericho Island	No	Post-Construction Complete
Site 3 Causeway Island	No	Post-Construction Complete
Site 45 Former Drycleaner	No	Remedy Selection/Feasibility Study and Maintenance Action
ET Cover	No	Post-Construction Complete
Oak Ridge Reservation	No	Remedy Implementation
East TN Technology Park	No	Remedy Implementation
Sprague Electric	No	Remedial Design
Gurley Pesticide	No	Soil Remedial Action Complete
Stauffer Chemical Tarpon Springs	No	Remedy Implementation

Principle 4: Materials Management and Waste Reduction

- 19 RPMs, or 56% of the respondents, have implemented this principle.
- Specific elements include:
  - Use technologies designed to minimize waste generation - 8
  - Reuse materials whenever possible - 10
  - Recycle materials generated at or removed from the site whenever possible - 15
  - Minimize natural resource extraction and disposal - 2
  - Use passive sampling devices producing minimal waste, where feasible (i.e., use of baroball, remote controlled sampling devices, etc.) - 7
  - Other – autonomous sampling and monitoring system reduces the generation of waste, use of local products, resale/salvage/re-use of SVE blower unit
- Reason for implementing the principle
  - Technical - 14
  - Financial - 13
  - To comply with Region 4 Clean and Green Policy - 3
  - To comply with Greener Cleanup language added in an enforcement document - 0
  - Other – Because it's smart to recycle, Generally good practice
- Did the principle play a role in the selection of a remedy?
  - Yes - 0
  - No - 19
- Did the principle affect the way the remedy was implemented?
  - Yes - 8
  - No – 7
  - Not applicable - 4
- Did the principle affect post construction activities?
  - Yes - 5
  - No - 10
  - Not applicable – 4

- Sites where Principle 4 has been implemented

Site Name	Calculator Used?	Phase
American Creosote Works	No	Post-Construction Complete
National Southwire Aluminum	No	Post-Construction Complete
Marshall Space Flight Center	No	Investigation, Remedy Selection, Remedial Design, and Implementation
National Electric Coil	No	Post-Construction Complete
Savannah River Site	No	Remedy Implementation
Escambia Treating Company	No	Remedy Implementation
ITT Thompson Institute	No	Remedy Implementation
Solitron Microwave	No	Post-Construction Complete
Solitron Devices	No	Post-Construction Complete
Aqua Tech	No	Remedy Implementation
Lexington County Landfill	No	Remedy Implementation and Post-Construction Complete
Medley Farm Drum Dump	No	Remedy Implementation
Staley PCE	No	Investigation
Sheet Metal Restoration	No	Investigation
Holtrachem	No	Investigation
Oak Ridge	No	Remedial Design and Implementation
Sanford Gasification	Yes	Remedy Implementation
Aberdeen Pesticide Dump	No	Post-Construction Complete
Barber Orchard	No	Remedy Implementation
Blue Ridge Plating	No	Post-Construction Complete
Cape Fear	No	Post-Construction Complete
Chemtronics	No	Remedy Selection/Feasibility Study and Post-Construction Complete
National Stach & Chemical Co	No	Post-Construction Complete
Savannah River Site - T Area GW - EOS	No	Remedy Implementation
Barite Hill	No	Investigation
Nevada Goldfields	No	Investigation
Redstone Arsenal	No	Remedy Implementation

Site 12 Jericho Island	No	Post-Construction Complete
ET Cover	No	Post-Construction Complete
Oak Ridge Reservation	No	Remedy Implementation
East TN Technology Park	No	Remedy Implementation
Smokey Mountain Smelters	No	Time critical removal action

Principle 5: Land Management and Ecosystem Protection

- 16 RPMs, or 47% of the respondents, have implemented this principle.
- Specific elements include:
  - Use minimally invasive in situ technologies - 7
  - Use passive energy technologies such as bioremediation and phytoremediation as primary remedies or "finishing steps," where possible and effective - 7
  - Minimize soil and habitat disturbance - 13
  - Minimize bioavailability of contaminants through adequate source control/containment - 8
  - Reduce noise and lighting disturbance - 4
  - Other – Use of native plants where new planting was required – 2 and early soil source removal
- Reason for implementing the principle
  - Technical - 13
  - Financial - 6
  - To comply with Region 4 Clean and Green Policy - 2
  - To comply with Greener Cleanup language added in an enforcement document - 0
  - Other – Better for the environment, To keep citizens happy, Good practice – especially for the site environment
- Did the principle play a role in the selection of a remedy?
  - Yes - 5
  - No - 11
- Did the principle affect the way the remedy was implemented?
  - Yes - 5
  - No – 11
  - Not applicable - 0

- Did the principle affect post construction activities?
  - Yes - 3
  - No - 5
  - Not applicable – 8
- Sites where Principle 5 has been implemented

Site Name	Calculator Used?	Phase
Oak Ridge National Lab	No	Remedy Implementation
National Southwire Aluminum	No	Post-Construction Complete
Marshall Space Flight Center	No	Investigation, Remedy Selection, Remedial Design, and Implementation
Savannah River Site	No	Remedy Implementation
Escambia Treating Company	No	Remedy Implementation
ITT Thompson Institute	No	Remedy Implementation
GMH Electronics	No	Remedy Selection/Feasibility Study and Remedy Implementation
Murray Ohio Dump	No	Remedial Design
M Area OU	No	Remedy Implementation
Cape Fear	No	Post-Construction Complete
Savannah River Site	No	Remedy Implementation
Barite Hill	No	Investigation
Nevada Goldfields	No	Investigation
Redstone Arsenal	No	Investigation
M Area OU	No	Remedy Implementation
Aberdeen Pesticide Dump	No	Post-Construction Complete
Barber Orchard	No	Remedy Implementation
Blue Ridge Plating	No	Post-Construction Complete
Cape Fear	No	Post-Construction Complete
Chemtronics	No	Remedy Selection/Feasibility Study and Post-Construction Complete
National Stach & Chemical Co	No	Post-Construction Complete
Geigy Chemical	No	Post-Construction Complete
Redstone Arsenal	No	Remedy Implementation
Site 1 Incenirator	No	Post-Construction Complete

Site 5 Jericho Causeway Landfill	No	Post-Construction Complete
Site 45 Former Drycleaner	No	Remedy Selection/Feasibility Study and Maintenance Action
ET Cover	No	Post-Construction Complete
Oak Ridge Reservation	No	Remedy Implementation
East TN Technology Park	No	Remedy Implementation
Sprague Electric	No	Remedial Design

Other Greener Cleanup Practices

PRP Lead Sites

Do you have any PRP-Lead sites?
22 - YES
9 – NO

Is there an enforcement agreement in place for any of your PRP-Lead sites?
20 - YES
2 – NO

Was there Greener Cleanup Language in any of the agreements?
0 - YES
20 – NO

Did you have any PRPs that were willing to incorporate aspects of your regional Clean and Green policy or other Greener Cleanup elements or best management practices?
16 - YES
6 – NO

Did any PRPs perform actions above and beyond the minimum Greener Cleanup requirements?
4 – YES
6 – NO
11 - Not applicable

Additional Questions

Are you familiar with the EPA Region 4 Clean and Green policy?
26 - YES
5 – NO

Are you familiar with the Superfund Green Remediation Strategy?
28 – YES 3 – NO

REGION 9 LIST OF GR ACTIVITIES:

Region 9 Superfund Green Remediation Projects

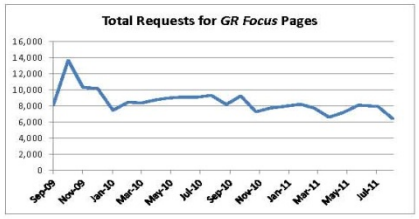
Site	Type	Project	Status
Aerojet	Superfund	3.6 MW PV	Operational; additional 2.4 MW in planning
Apache Powder	Superfund	Wind and 1.4 KW PV system for constructed wetlands to conduct bioremediation	Operational
Camp Pendelton Marine Base	Superfund	Clean diesel/biodiesel/DPF for non-road equipment during earthmoving operation	Completed
Del Amo	Superfund	Oxygen injection to reduce time (and energy use) of soil vapor extraction system	Operational
Frontier Fertilizer	Superfund	5.7 KW PV system for groundwater treatment	Operational
Frontier Fertilizer	Superfund	500 KW PV system for in-ground heating	Planning/not feasible
Iron Mountain Mine	Superfund	Ran transmission line to use local hydro power instead on on-site diesel generators	Operational
Lawrence Livermore Lab	Superfund	PV to power groundwater treatment	Operational
Leviathan	Superfund	NREL renewable energy evaluation	In process
McColl	Superfund	PV panel to power sump pump	Operational
Newmark	Superfund	PV powered monitoring equipment at 50 wells	Operational
Ohlone College/Newark Center	Brownfields	600 KW PV system—45% of campus electricity need	Operational
Pemaco	Superfund	3.4 KW PV system	Operational
Selma Treating Company	Superfund	Molasses injection into groundwater plume reduced cleanup time 30-50 years/energy use	Operational
Stringfellow	Superfund	NREL renewable energy evaluation	In process
Alameda NAS	Superfund	Life Cycle Analysis	In process
Travis AFB	Superfund	Life Cycle Analysis	In process
Tucson International Airport	Superfund	Life Cycle Analysis (HQ support)	In process
Apache Powder	Superfund	Technical support for solar farm development	In process
McKinley Mine, Navajo Nation	(none--closed coal mine-no substantive EPA program)	Technical support for renewable energy development	In process
Nineteenth Avenue Landfill	Superfund	Support for Phoenix and ADEQ for possible solar development	In process
Operating Industries	Superfund	Six-70 KW microturbines burn landfill gas	Operational

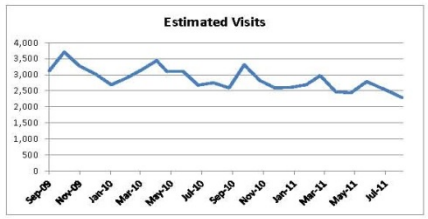
APPENDIX D: EPA CLU-IN USE DATA

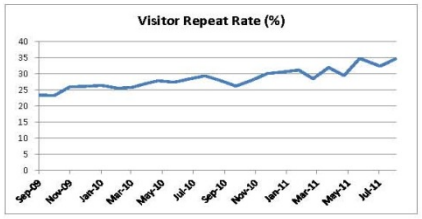
GR Focus Stats

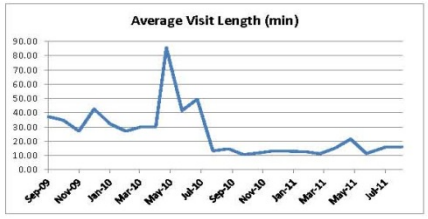
Extracted from monthly CLU-IN reports; compiled September 20, 2011

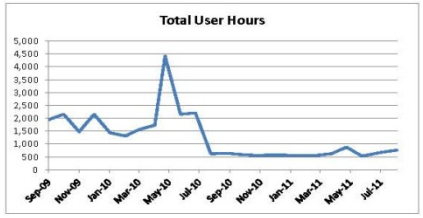
	draft SF Strategy												annual snapshot	final SF Strategy											annual snapshot	
	Aug-11	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Total
Total Requests for *GR Focus* Pages		8,179	13,673	10,300	10,210	7,463	8,478	8,405	8,771	8,973	9,102	9,076	9,348	8,203	9,248	7,266	7,739	7,967	8,224	7,758	6,598	7,181	8,107	7,950	6,425	204,644
Percent Change from Previous Month		19	67	-25	1	-27	14	-1	4	2	1	-1	3	-12	13	-21	6	3	3	-6	-15	9	13	-2	-19	
Estimated Visits		3,129	3,706	3,263	3,029	2,687	2,904	3,142	3,437	3,095	3,107	2,670	2,746	2,587	3,309	2,817	2,587	2,600	2,685	2,975	2,466	2,437	2,782	2,510	2,285	68,955
Visitor Repeat Rate (%)		23.4	23.3	26.0	26.1	26.4	25.6	25.8	27.1	27.9	27.4	28.4	29.4	27.9	26.2	28.0	30.1	30.6	31.2	28.5	32	29.5	34.8	32.4	34.7	
Direct Visitors (%)		52.7	56.4	56.1	61.5	56.5	59.8	57.0	64.3	58.0	56.6	56.8	54.8	53.1	55.2	53.0	60.1	54.0	57.8	60.2	60.9	60.8	66.2	64.6	61.9	
Average Visit Length (min:sec)		37:18	34:50	27:11	42:42	32:05	27:07	29:55	30:11	1:25:34	41:32	49:32	13:22	14:47	10:38	11:53	13:15	13:04	12:37	11:12	15:16	21:33	11:23	16:08	20:06	
Average Visit Length (minutes)		37.30	34.83	27.18	42.70	32.08	27.12	29.92	30.18	85.57	41.53	49.53	13.37	14.78	10.63	11.88	13.25	13.07	12.62	11.20	15.27	21.55	11.38	16.13	16.1	
Total User Hours		1,945	2,152	1,478	2,156	1,437	1,312	1,567	1,729	4,414	2,151	2,204	612	637	586	558	571	566	565	555	627	875	528	675	765	30,665











Notable Postings:

methodology doc/input solicitation	September 16, 2011
methodology announcement	July 7, 2011
UST fact sheet	June 14, 2011
intro fact sheet (update)	May 15, 2011
renewable energy fact sheet	April 13, 2011
contracting toolkit	February 1, 2011
Superfund GR Strategy	September 28, 2010
clean fuels/emissions fact sheet	August 31, 2010
SVE & AS fact sheet	March 24, 2010
bioremediation	March 24, 2010
P&T	January 18, 2010
site investigation	January 18, 2010
excavation & restoration	January 23, 2009

Superfund Green Remediation Strategy: strategic action progress based on use of online products and training

Detailed CLU-IN GR Focus stats as of August 1, 2011, unless noted otherwise

Action 2.3 Develop technology-specific assessment tools and fact sheets	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov
An Introduction (May 11, 2011, update + original); http://www.cluin.org/greenremediation/docs/GR_Quick_Ref_FS_Intro.pdf					280	0	8	272
Excavation and Surface Restoration (EPA 542-F-08-012, December 2008); http://www.cluin.org/greenremediation/docs/GR_Quick_Ref_FS_exc_rest.pdf					2,659	10	8	2,641
Site Investigation (EPA 542-F-09-004, December 2009); http://www.cluin.org/greenremediation/docs/GR_Fact_Sheet_SI_12-31-2009.pdf					1,190	31	33	1,126
Pump and Treat Technologies (EPA 542-F-09-005, December 2009); http://www.cluin.org/greenremediation/docs/GR_Fact_Sheet_P&T_12-31-2009.pdf					2,120	37	31	2,052
Bioremediation (EPA 542-F-10-006, March 2010); http://www.cluin.org/greenremediation/docs/GR_factsheet_biorem_32410.pdf					1,842	24	47	1,771
Soil Vapor Extraction & Air Sparging (EPA 542-F-10-007, March 2010); http://www.cluin.org/greenremediation/docs/GR_factsheet_SVE_AS_032410.pdf					1,717	26	111	1,580
Sites with Leaking Underground Storage Tank Systems (EPA 542-F-11-008, June 2011); http://www.cluin.org/greenremediation/docs/UST_GR_fact_sheet.pdf					430	0	112	318
Total					**10,238**	128	350	9,760

Action 2.6 Deliver or host green remediation training through the Technology Innovation and Field Services Division's Training infrastructure (as of August 17, 2011)					
CLU-IN Web Seminars (open to the public)	**# of Participants**	EPA	other gov	non gov	**Hours**
Greener Cleanups - EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint. August 10, 2011.	359	40	87	232	2
NARPM Presents: Ecological Revitalization: Turning Contaminated Properties into Community Assets. March 15, 2011.	76	24	19	33	2
US and EU Perspectives on Green and Sustainable Remediation (Part 2 of ConSoil 2010 follow-up). March 15, 2011.	125	12	19	94	2
Your Role in Green Remediation Implementation and Case Studies in Green Remediation - This Year's Models and Tools *(2010 NARPM green remediation session follow-on Webinar series)*					2
Session 1; December 8, 2010	199	80	39	80	2
Session 2; January 11, 2011	200	45	33	122	2.25
Session 3; February 10, 2011	218	45	43	130	2.25
Identifying & Evaluating Ecosystem Services at Contaminated Sites Prior to Remediation. August 18, 2010.	119	9	44	66	1.5
US and EU Perspectives on Green and Sustainable Remediation. July 12, 2010.	174	4	49	121	2
Energy for the Future: Exploring Methane Gas-to-Energy Projects at Superfund Sites. May 6, 2010.	74	17	10	47	2
Green Remediation: Applying Strategies in the Field *(2009 NARPM green remediation session follow-on Webinar series)*					
Session 1; October 8, 2009	193	53	40	100	2
Session 2; November 12, 2009	160	36	35	89	2
Session 3; December 15, 2009	157	26	24	107	2
Understanding Life Cycle Assessment: Applications for OSWER's Land and Materials Management. September 23, 2009.	105	33	41	31	1.5
Solar Energy on Closed Landfills: Regulatory and Technical Considerations. September 9, 2009.	191	14	69	108	1
Tackling the Carbon Footprint at Pump and Treat Projects: A Case Study in Energy Efficiency. March 10, 2009.	202	17	41	144	1
Green Remediation Voluntary Standards Initiative. March 4, 2009	190	30	40	120	2
Green Remediation: Opening the Door to Field Use *(2008 NARPM green remediation session follow-on Webinar series)*					
Introduction and Carbon Calculus: A RCRA Case Study. Session A: November 24, 2008	200	32	43	125	2
Green Remediation Tools and Examples. Session B: December 16, 2008	205	29	37	139	2
Green Remediation Tools and Examples. Session C: January 13, 2009	189	45	48	96	2
USEPA-ILEPA Green Remediation Update. December 3, 2008	267	12	179	76	2
ConSoil 2008 Special Session: Green Remediation. June 5, 2008	28	3	4	21	1.5
Earth Day 2008 Green Remediation Panel Session; green remediation, soil amendments for impaired lands, and renewable energy on contaminated lands. April 2008.	232	17	69	146	
Total	3,863	623	1,013	2,227	39.00

Training Courses (in-person sessions open to the public, based on OSRTI tally of August 10, 2011)		EPA	other gov	non gov	
Best Management Practices for Green Remediation Footprint Reduction; August 29, 2011; Westin New Orleans Canal Place, New Orleans, LA	near future				8
Best Management Practices for Green Remediation Footprint Reduction; November 15, 2011; U.S. EPA Region 2, New York, NY	near future				8

Total	0				16				
Total number of participants and training hours in public venues	3,863	623	1,013	2,227	55.00				
Annual NARPM Training Conference (based on OSRTI tally of August 10, 2011)	**# of Partipcants**	**RPMs**		other	**Hours**				
18th: Green Remediation: Opening the Door to Field Use. July 9, 2008	85	43		42	8				
19th: Green Remediation - What's Next. June 3, 2009	55	30		25	8				
20th: Your Role in Green Remediation Implementation and Case Studies in Green Remediation: This Year's Models and Tools. May 26, 2010	57	35		22	8				
21st: Greener Cleanups									
An RPM's Primer. May 17, 2011	47	17		30	4				
Case Studies and Discussion. May 18, 2011	33	13		20	4				
Addressing Your Project's Environmental Footprint - Theory and Practice. May 18, 2011	46	19		27	4				
Total	323	157		166					
Annual OSC Readiness (based on OSRTI tally of August 10, 2011)			**OSCs**	other					
12th: Greening Response Actions I. February 12, 2009	31		10	21	4				
13th: Greening Response Actions II. February 1, 2010	46		22	24	4				
14th: Greening Response Actions III. January 31, 2011	28		13	15	4				
Total	105		45	60					
Total number of RPMs/OSCs trained and training hours delivered	202				48				
Total number of others trained at NARPM and OSC Readiness	226								
Action 3.4 Develop a fact sheet on using green power for site cleanup	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
Using input from RPMs experienced in applying onsite renewable energy, OSRTI issued a fact sheet entitled: *Green Remediation Best Management Practices: Integrating Renewable Energy into Site Cleanup* (EPA 542-F-11-006) in March 2011. http://www.cluin.org/greenremediation/docs/Integrating_RE_into_site_cleanup_factsheet.pdf					332	0	5	327	
Action 4.1 Develop a fact sheet on clean fuel and emission technologies	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
With input from OTAQ and regional offices, OSRTI issued a fact sheet entitled: *Green Remediation Best Management Practices: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 542-F-10-008) in August 2010. http://www.cluin.org/greenremediation/docs/Clean_FuelEmis_GR_fact_sheet_8-31-10.pdf					347	4	6	337	
Action 4.3 Identify opportunities for recovering and using methane gas emitted from landfills on Superfund sites	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
Using a screening tool developed by OSRTI, the Agency evaluated feasibility of methane recovery at six NPL sites, as described in the *Superfund Landfill Methane-to-Energy Pilot Project* (OSWER 9200.081, December 2010) released in June 2011. http://www.cluin.org/greenremediation/docs/Landfill_Methane_Final_Report_051011.pdf					46	0	0	46	
Action 5.2 Develop and pilot test a green remediation analysis template to help collect information during various phases of the remediation process at any site	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
Romic Environmental Technologies Corporation facility in Palo Alto, CA; http://www.cluin.org/greenremediation/romic/index.cfm; http://www.cluin.org/greenremediation/romic/docs/romic_report_rev_051110.pdf	1,037	96	10	931	146	14	2	130	
Former BP Products North America, Inc. facility in Wood River, IL; http://www.cluin.org/greenremediation/bpwoodriver/index.cfm; http://www.cluin.org/greenremediation/bpwoodriver/docs/final_BP_report_111510.pdf	270	19	2	249	50	3	0	47	
Travis Air Force Base	unavailable 8/1								
Total	1,307				196				
Action 5.3 Incorporate green remediation factors into remedy optimization evaluations	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
As part of remedy optimization studies at Superfund sites, OSRTI has evaluated various options for reducing the environmental footprint of cleanup at Shepley's Hill Landfill in Devens, MA. http://www.cluin.org/greenremediation/docs/Final%20Shepleys%20Hill%20Landfill%20RSE%20082109.pdf					268	8	3	257	
Action 6.3 Develop and periodically update a green remediation contracting toolkit	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	
In June 2009, OSRTI initially released the *Green Response and Remedial Action Contracting and Administrative Toolkit* , which was updated in October 2010. In January 2011, OSRTI issued the (re-titled) document, *Greener Cleanups Contracting and Administrative Toolkit.http://www.cluin.org/greenremediation/docs/Greener_Cleanups_Contracting_and_Administrative_Toolkit.pdf*					1,227	71	21	1,135	
Action 8.1 Analyze existing methods and software tools for evaluating the environmental footprint of a cleanup	**# of Views**	EPA	other gov	non gov	**# of Downloads**	EPA	other gov	non gov	

OSRTI has identified more than 50 Web-based calculators, software models, and other tools that can help quantify environmental outcomes associated with one or more core element of green remediation. Four additional, no-cost online tools have been developed by other federal agencies or states to specifically address green and sustainable site cleanup. http://www.clu-in.org/greenremediation/subtab_b3.cfm

548	276		121	151				

Action 8.2 Develop an Agency methodology for evaluating the environmental footprint of a cleanup

# of Views	EPA	other gov	non gov	# of Downloads	EPA	other gov	non gov
near future							

OSRTI released *Footprint Analysis for Environmental Cleanups*

Footprint Assessment: Methodology [www.cluin.org/greenremediation/methodology page to be activated September 8]

Footprint Analysis for Environmental Cleanups [PDF to be posted September 8 on "methodology" page]

near future

APPENDIX E: LIST OF REFERENCES

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