



Methodology for Understanding and Reducing a Project's Environmental Footprint

An Online Continuing Education Course for Engineers

Course Number: EN-5013

Credit: 5 Hours / 5 PDH / 5 CPD

Methodology for Understanding and Reducing a Project's Environmental Footprint

1.0 Introduction

1.1 Background

The U.S. Environmental Protection Agency (EPA) defines green remediation as the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of cleanup actions. Green remediation strategies can include a detailed analysis in which components of a remedy are closely examined and large contributions to the footprint are identified. More effective steps can then be taken to reduce the footprint while meeting regulatory requirements driving the cleanup.

In context of the methodology, “metric” refers to a project parameter for which a quantitative value may be:

- Derived mathematically
- Estimated through engineering details, or
- Extracted from past project records with actual data.

Two concepts are central to analyzing the environmental footprint of a cleanup. The first is to establish those parameters (metrics) that are to be quantified, and the second is to establish a straightforward process (methodology) for quantifying those metrics. The term “footprint” refers to the quantification of a specific metric that has

been assigned a particular meaning. For example, the “carbon footprint” is the quantification of carbon dioxide (and other greenhouse gases [GHGs]) emitted into the air by a particular activity, facility, or individual. This common footprint measure has been established in the past because emissions of carbon dioxide and other GHGs have been linked to climate change. The term “environmental footprint” as referenced in the methodology comprehensively includes metrics such as energy use and water use as well as air emissions to fully represent the effects a cleanup project may have on the environment.

In context of the methodology, “metric” refers to a project parameter for which a quantitative value may be:

- Derived mathematically
- Estimated through engineering details, or
- Extracted from past project records with actual data.



This course presents EPA’s metrics and methodology for conducting an environmental footprint analysis of site cleanup activities and describes common approaches to reduce that footprint. The course’s structure corresponds to EPA’s five core elements of green remediation (Figure 1.1). Topics in the course include:

- The methodology’s purpose and limitations, the value of footprint analysis, and the level of effort and cost for footprint analysis
- Definitions of metrics aligning with the core elements of green remediation
- A seven-step process to quantify the metrics
 1. Step 1 – Set goals and scope of the analysis
 2. Step 2 – Gather and organize remedy information
 3. Step 3 – Quantify materials and waste metrics
 4. Step 4 – Quantify water metrics
 5. Step 5 – Quantify energy and air metrics
 6. Step 6 – Qualitatively describe affected ecosystem services
 7. Step 7 – Present results
- Considerations for analyzing and utilizing footprint results

- Illustrative approaches to reduce the environmental footprints.

Appendix A of this course provides exhibits containing supporting technical information.

In context of the methodology, “cleanup” or “remedy” generally refers to a remedial project, corrective action, or comparable effort conducted by government or private organizations to address contaminated sites under one or more programs.

The information needed and the process of obtaining the information for this methodology are the same used to develop remedy alternatives, design a remedy, or optimize a remedy. For this reason, it is suggested that a footprint analysis be conducted in concert with one or more of these project phases.

1.2 Purpose

The methodology presented in this course is intended to serve the following purposes:

- Facilitate implementation of EPA’s *Principles for Greener Cleanups* by providing a methodology to quantify materials, waste, water, energy, and air metrics that represent the environmental footprint of activities involved with contaminated site cleanup. The metrics are designed to 1) reflect parameters that a remedy project team has a relatively direct ability to change and 2) encourage practices that would result in favorable changes to the metric values.
- Encourage (not require) quantification of these metrics for cleanups. The methodology is a general framework to help site teams understand the remedy components with the greatest influence on the project’s environmental footprint. Quantifying the metrics can serve as an initial step in reducing the remedy footprint. The overall process allows those involved in the remedial process to analyze a remedy from another perspective and potentially yields viable and effective improvements that may not have been identified otherwise.
- Provide technical suggestions on approaches to reduce the footprint of a remedy (but not guidance on prioritizing the footprint reduction efforts).
- Expand technology transfer among stakeholders, by conveying lessons learned about footprint analysis conducted at numerous and varied sites undergoing remediation.
- Provide a process for footprint analyses conducted on behalf of EPA and for use by EPA in evaluating footprint analysis results submitted by other parties under any cleanup program.

- Determining the footprint of a remedy can be a complex process depending on the level of detail and accuracy sought from the analysis. The decision of whether to conduct a footprint analysis, the structure and detail of the analysis, and the level of effort to conduct the analysis depend on several factors, including:
- **Intended use of the footprint results:** Will the results be used to assist with determining the footprint for an entire organization or a portfolio of sites within the organization? Will the footprint be used to help document or quantify footprint reductions?
- **Complexity of a site cleanup:** Is the cleanup likely to be dominated by one or two aspects such that footprint analysis is not necessary in order to determine the largest footprint contributors? Without undertaking calculations, is it apparent that the cleanup will have a very small footprint relative to other cleanups within an organization's portfolio? Is the cleanup very complex (with many onsite and offsite components to the footprint) or is it relatively simple?

The methodology does not dictate circumstances in which footprint analysis should be conducted. Users of the methodology are encouraged to practice professional judgment and consult with other environmental professionals to determine the usefulness of footprint analysis in a given set of circumstances.

1.5 Level of Effort and Cost

Application of the methodology is expected to add a negligible amount to the level of effort and cost associated with overall remediation and a fraction of any particular remedial activity, such as a remedy design or an optimization evaluation. For example, footprint analysis is expected to add approximately 10 percent to the level of effort or cost of an optimization evaluation or less than 5 percent to the level of effort or cost of a remedial design. The level of effort and cost will vary depending on the site complexity, experience in conducting footprint analyses, and the level of analytical detail.

The level of effort to conduct a footprint analysis will vary depending on the cleanup project complexity, the availability of information, and prior experience. Most information used in a footprint analysis is generated during typical project phases or activities such as remedy design or remedy optimization and is documented in site reports. Coordinating a footprint analysis with these and other activities can help minimize the level of effort involved in footprint analysis.

The methodology focuses on green remediation metrics and therefore does not include quantification of cleanup cost. The cost of implementing footprint reduction measures is expected to be considered separately by a project team and evaluated on a project-by-project