Everything is Social: Stakeholder Values-Based Assessment of Remediation Sustainability

Apıtz S.E.[1,*], Fıtzpatrıck A.[2], Mcnally A.[3] Harrıson D.[4], Coughlın C.[4], And Edwards D.A.[5]

[1] SEA Environmental Decisions, Little Hadham, UK

[2] Geosyntec Consultants, Seattle WA, USA

[3] AECOM, Pittsburgh, PA, USA

[4] NERA Economic Consulting, Boston, MA, USA

[5]ExxonMobil, Dallas, TX, USA

*corresponding author:

e-mail: drsea@cvrl.org

Abstract

The Portland Harbor Superfund Site (PHSS), contaminated by more than 100 years of agricultural, urban, wartime, industrial, combined sewer overflow, and storm water inputs, encompasses about 10 miles of the Willamette River in downtown Portland, Oregon. This site affects residents, businesses, tribes, recreation and wildlife; there is considerable contention over remedial options. The Environmental Protection Agency (EPA) released a proposed plan for the Site on June 8, 2016. Although the plan addresses trade-offs in option selection, inviting public comment, this analysis is qualitative, and sustainability is only invoked as the application of best management practices after option selection. However, regulatory decisions should consider affected communities' needs, and how these might be impacted; this requires that diverse stakeholders are able to engage in a transparent consideration of value trade-offs and of the distribution of risks and benefits of remedial actions and outcomes. The PHSP assessed the sustainability of a range of remedial options, including the EPA's preferred option. The Sustainable Values Assessment (SVA) tool was developed to link environmental quality, economic viability and social equity metrics to a range of stakeholder values; metrics were scored and aggregated and options were ranked in terms of stakeholder group (SG) priorities.

Keywords: Sediment remediation, social sustainability, Portland Harbor Superfund Site, social equity, Sustainable Values Assessment (SVA)

1. Introduction

The Portland Harbor Superfund Site Sustainability Project (PHSP) developed a framework to evaluate the environmental, economic and social sustainability of remedial alternatives proposed by the United Stated Environmental Protection Agency (USEPA) for the Portland Harbor Superfund Site (Site). The Site encompasses about 10 miles (2,167 acres) of the Willamette River in Portland, Oregon, from the Broadway Bridge at river mile (RM) 11.8 just below the urban downtown to Sauvie Island at RM 1.9 near the confluence of the Willamette and Columbia Rivers (see Figure 1). Sediment contamination includes PCBs, dioxins, and other substances from many industrial, commercial, municipal, and marine activities carried out over more than 100 years. USEPA formally listed the Site on the National Priorities List in December 2000, and it has been designated by USEPA as a "mega-sediment site" (> $50 million cleanup). The Willamette River provides critical habitat for fish, birds, and other aquatic species (USEPA 2016a), but sediment, fish tissue, and surface water at the Site have been contaminated with many hazardous substances, including polychlorinated biphenyls (PCBs; the principal contaminant), polycyclic aromatic hydrocarbons (PAHs), dioxins/furans, pesticides, and heavy metals; this poses a threat to human health and ecological endpoints in the surrounding area. Human exposure to PCBs via fish and shellfish consumption was determined to be the principal exposure pathway driving Site risk. Because risk-based cleanup levels protective of fish consumption exposure were determined to be below background concentrations, the sediment cleanup level for the Site defaulted to background concentrations (9 ppb) for total PCBs (USEPA 2016b). As described in the Feasibility Study (FS) (USEPA 2016a), the remedial technologies potentially applicable to the Site include a combination dredging, isolation capping, enhanced natural recovery, monitored natural recovery, in situ treatment with activated carbon, off-site dredged material disposal in Subtitle C and D landfills, and off-site thermal treatment for sediment that exceeds acceptable landfill criteria. The Proposed Plan (PP) (USEPA 2016b) evaluated eight remedial alternatives, labeled A through I. Alternative A is the "no further action" case and is considered the baseline alternative in the PP and in the PHSP analysis. The estimated non-discounted costs for the five remedial alternatives evaluated as part of this study (Alternatives B through I) range from $642 million to about $2.2 billion for remediation of 201 to 533 acres. The USEPA-preferred remedial option described in the PP was Alternative I, with 150 acres of dredging, 1.7 million cubic yards (cy) dredge volume, 291 total active acres, an estimated cost of $1.2

billion, and 7 years of construction time (USEPA 2016b). In the context of remediation, sustainability has been defined as "the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact, and that the optimum remediation solution is selected through the use of a balanced decision-making process" (SuRF-UK 2011). In the remedy decision documents (FS, PP, and ROD), USEPA developed detailed information on expenditures, risks, and construction duration for the remedial alternatives, but they did not provide a comprehensive sustainability analysis that fully considered all relevant impacts associated with sediment cleanups. USEPA guidance for sustainability typically focuses on green remediation and best management practices (BMPs) to reduce the "green environmental footprint" of a remedy (USEPA 2015). Until recently (Woodford *et al*. 2016), the focus has been on optimization of a selected remedy and not on the fuller consideration of sustainability (environmental, economic, and social aspects) to guide remedy selection. The PHSP expanded the scope of sustainability assessment by evaluating six remedial alternatives in terms of the three pillars of sustainability: environmental quality, economic viability and social equity (Dernbach and Cheever 2015). The PHSP evaluated 2016 USEPA Alternatives A (no further action), B, D, I, E, and F (in order of increasing cost); the two largest alternatives, G and H, were not included in this study. The assessment for each pillar included various quantitative metrics; the results for the three pillars were integrated into a framework that aggregated metrics in terms of stakeholder values and priorities. In addition, a probabilistic risk assessment was conducted to evaluate risk assumptions and risk distributions for various local population groups, considering current conditions and an alternative post-remedy scenario. The Stakeholder Value-Linked Assessment of Remedial Options for the Portland Harbor Superfund Site links environmental, economic, and social metrics to a range of stakeholder values; metrics were developed, scored, and aggregated, and remediation alternatives were ranked in terms of stakeholder group (SG) values and priorities.

2. Methods

A framework was developed (Fig 1) under which the social aspects of sustainability (which are often less well developed than are other pillars) drive how evaluations for all pillars are integrated and communicated. Stakeholder values were linked to the pillars of sustainability and also to a range of metrics of these values. Remedial options were scored for each metric, using data provided in the USEPA Feasibility Study and a range of standard and innovative approaches such as Net Environmental Benefit; Regional Economic Impact, footprint, GIS and stakeholder analyses; metric scores were aggregated to generate value and pillar scores. This provided a values-linked integration of option sustainability. In parallel, the views (in terms of regional remediation, restoration, planning and development) of >280 SGs were evaluated via reviews, surveys, discussions, interviews and meetings, documenting a diversity of priorities. The sensitivity and robustness of values-based sustainability assessments to diverse SG priorities was assessed by weighing value scores in terms of SG priorities. To address environmental justice, a qualitative social effect distribution assessment was also carried out, evaluating who bears the costs, and who reaps the benefits of remedial options, in terms of demographics, space and time.

3. Results and discussion

Using this approach, the impacts of the EPA's remedial alternatives on SG Values in the Portland metropolitan area, taking into account both risks and benefits, were evaluated. The study found that (a) The net sustainability scores show a clear pattern, with progressively lower net scores for the larger alternatives (Fig 2); (b) the small incremental decrease in risk for more aggressive alternatives is outweighed by the increased environmental, economic, and social costs and impacts; and (c) the SVA-based sustainability scores are sensitive to SG priorities, but the relative rankings are robust, even considering diverse SGs with very different priorities.

4. Conclusions

A comprehensive analysis of the environmental, economic and social impacts associated with remedial alternatives provides a broader basis for decision-making rather than focusing on a narrow set of criteria. Moreover, integrating all of these factors into a common framework allows one to develop robust conclusions of potential trade-offs among the remediation alternatives.

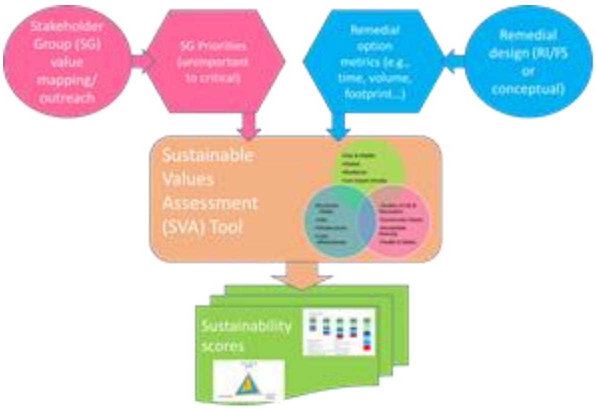

Figure 1. SVA Conceptual approach

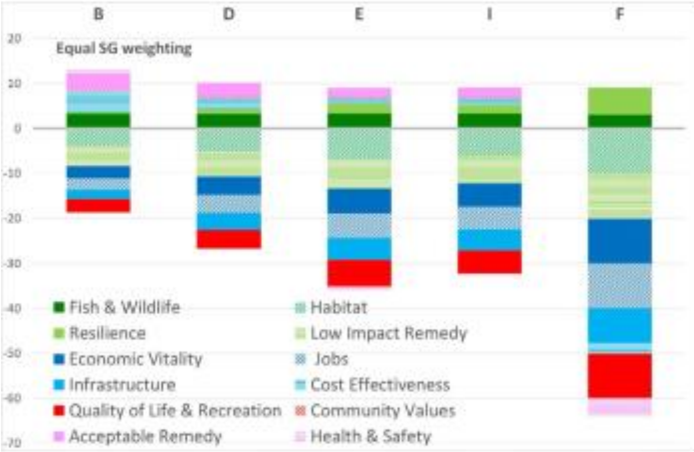

Figure 2. SG Values for remedial options B-F, weighted equally; metrics weighted according to relevance to values.

The application of a sustainability framework to complex environmental decisions is consistent with recommendations from the NRC and recent US executive directives, requiring that federal decision making should consider community needs and how they are affected. For Portland Harbor, as with other contaminated sites, risks, benefits and costs are not borne equally, in terms of time, space, stakeholders, or demographics. These issues should be kept in mind when the trade-offs are considered – it is important to consider the needs of a diverse population. Although some SGs are very active and vocal, there is evidence of diverse values and priorities throughout the region, and these disparate priorities should be considered, even if not all stakeholders are fully engaged in the decision making. The application of sustainability tools for complex environmental issues should, ideally, be considered earlier in the remedial process with a high level of stakeholder engagement, in order to develop more realistic and effective options. An informed, transparent, and balanced decision making process will enable selection of a remedy that more stakeholders can support earlier in the process. For this tool to be most useful in optimizing sustainable options, a wide range of remedial options with a broad range of potential risk reductions should be evaluated, to identify the point where additional impacts overwhelm the additional gains. Identification of the risks and benefits of most interest to stakeholders can allow for negotiation and optimization of alternatives under consideration, and for collaborative design of more sustainable options; this approach is currently being developed for testing at another Superfund site.

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