SURF Metrics Toolbox – Remedial Design

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
Element: **Conceptual Design (including pre-design activities)**								
Remedial technologies	Optimize treatment (e.g., wells, injection points, treatment chemicals).	Environmental impacts** and energy usage	QN	EN, S, EC	Design plan	Consider including facility-wide footprint, waste generation and water discharge, number of mobilizations, equipment sizing, site plan, and infrastructure. Identify opportunities to specify recycled materials, reuse materials on-site, or recycle wastes at off-site facility. Consider an on-site weigh station. Develop an adaptive design to reduce footprint, power, and labor as remediation progresses.	Reduces water use (EN, S), energy consumption (EN), vehicle emissions (EN), costs (EC), waste required to be disposed of in landfill (EN, S), and demand for virgin materials (S) and associated production impacts (EN). Increases operational efficiency (EC) and landfill longevity (EN, S).	--
		Cost	QN	EC	Cost estimates			--
		Material use	QN	EN, S, EC	Design plan			Nontraditional materials may increase project costs and be difficult to source.
	Minimize land use for remediation life cycle.	Area	QL	S	Design plan	Minimize impact to and include restoration of the potential loss of land function, loss of aesthetic value, or inconvenience to the community.	Integrates with future long-term use (S).	The size of the remediation site and other site users (including at-risk populations or protected wetlands) may dictate placement and staging areas.
	Minimize toxic emissions to air and/or water.	Contaminant emissions	QN	EN	Emissions estimate	Optimize system design and move to less energy-intensive processes as remediation progresses (i.e., move to monitored natural attenuation or replace vapor incineration with activated carbon).	Provides long-term contaminant control (EN). Reduces local discharge of contaminants (EN).	The benefits or “costs” of the alternative technology must be balanced against the advantages and disadvantages of the incumbent technology.
	Design to minimize community impacts.	Noise, traffic, and odor	QN	S	Design plan	--	Reduces long-term negative effects on the community (S).	--
Future use	Maximize future land use and area.	Type of future use and area	QL	EN, S, EC	Design plan and remedial action objectives	Match with local planning. Identify future use and needed covenants with stakeholders early in design process.	Maintains focus on future use and stakeholder expectations (S, EC).	Long-term use may not be established at the remedial design phase.
	Increase local jobs.	Jobs created or maintained	QN	S, EC	Local planning agency	Consult local planning boards for estimates of job creation resulting from re-development.	Promotes stronger local communities (S, EC).	Estimates can be difficult to obtain.

Notes:
* Data sources in this table support predictive sustainability analyses conducted before remedial implementation. SURF is developing guides for post-implementation assessments (www.sustainableremediation.org/library/guidance-tools-and-other-resources) to support evaluation of in-place remedies and scoping of bid documents, technical specifications, and operation and maintenance plans to ensure that necessary data are collected for future evaluation.
** Environmental impacts: air emissions (global warming potential, nitrogen oxides, sulfur oxides, particulate matter, toxics), water demand, and waste generation
QN = quantitative S = social
QL = qualitative EC = economic
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Pre-design activities	Consolidate and minimize mobilization and on-site field tasks, resources, equipment, and materials.	Environmental impacts**	QN	EN	Fieldwork scope estimate, experience, and estimation of resources	When possible, build field screening, flexible (step-out) sampling protocol, and on-site laboratories into scope; and use direct push rather than rotary drill for well installation. If possible, locate pre-design well locations where useful in subsequent remedy actions.	Reduces vehicle emissions (EN), costs (EC), and traffic through the community (S).	Some regulations may not permit on-site laboratories without early consensus from regulators.
		Transport mileage	QN	EC				
		Materials consumed	QN	EN	Mass of materials used	Select the most appropriate materials for well installation. Specify reusable equipment that can be decontaminated. Include recycled materials in specifications and bid documents.	Reduces demand for virgin materials (S) and associated production impacts (EN).	Variances from traditional construction methods and materials may increase project costs.
		Waste generated	QN	EN	Waste manifests	Reduce or eliminate waste spoils generated during well installation. Use in-situ treatment technologies. When possible, use low-flow or passive groundwater sampling techniques to avoid purge water generation. Field screen or analyze to minimize treatment and/or disposal. Segregate waste to minimize hazardous waste quantities.	Reduces waste required to be disposed of into landfill (EC) and off-site energy, air, and water emissions related to waste treatment (EN). Increases landfill longevity (EN, S).	Nontraditional sampling methodologies and waste handling and disposal methodologies may require early consensus from regulators.
Element: **Construction Material Specifications**								
Material selection	Design for minimum-essential materials of construction.	Environmental impacts** and energy	QN	EN, S, EC	Design plan, manufacturer bid, cut sheets, or manufacturer information	Consider material durability and replacement rate for project life cycle, local availability of materials, materials manufacturing, and renewable resources.	Reduces long-term operations and maintenance costs (EC) and material costs, including off-site energy, air, and water requirements for manufacturing (EC).	Because the initial cost for durable materials may be higher, a cost-benefit analysis may be required to show a reduction in overall project costs.
	Use recyclable, renewable, and/or reusable materials.	Percent recyclable, renewable, or reusable	QN	EN, S	Design plan, manufacturer bid, cut sheets, or manufacturer information	Include recycled materials in specifications.	Reduces waste being disposed of in landfill (EC); the demand for virgin material (S); and air, water, waste, and energy emissions associated with manufacturing processes (EN). Increases landfill longevity (EN, S).	Nontraditional materials and new material sources may increase project costs.
	Optimize materials transport and source.	Air emissions, fuel usage	QN	EN, S	Design plan	Consider locally available materials.	Creates local jobs (S).	Local materials may not be available or of sufficient quality.

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	Minimize the toxicity of the construction materials.	Toxic emissions and human, marine, and freshwater toxicity potential	QL	EN	Third party certification, material safety data sheets, manufacturer information	Specify materials that minimize off-gas emissions during the remedial construction phase. Control potential health impacts to on-site workers during implementation, and provide additional air monitoring as necessary.	--	Alternative materials may increase project costs.
Element: **Energy Mix (on-site vs. off-site power)**								
On-site renewable energy	Identify opportunities for on-site renewable energy.	Environmental impacts**	QN	EN	Design plan	Evaluate feasibility of on-site energy generation equipment and infrastructure (e.g., solar, wind) and "green" energy where practicable.	Reduces load to local utility (S) and air and water emissions at the electrical generation plant (EN) and transmission line infrastructure and associated impacts (EN,EC).	Alternative energy may increase project costs.
		Cost	QN	EC	Cost estimates	Evaluate local government and utility incentive programs to defer initial costs.	Reduces local electrical grid usage (S) and improves power mix (S).	--
		Area required for on-site energy	QL	S	Community survey	Include loss of land use and community visibility.	Aligns with community interests (S).	--
	Purchase carbon offsets.	Global warming potential	QN	EN	Design plan	Include carbon offsets in cost estimates.	Directly benefits the off-site location where the offset program is purchased and implemented (S).	Offsets are a direct project cost with no direct economic return.
Element: **Value Engineering**								
Design plan	Optimize design and synergies.	Design metrics	QN, QL	EN, S, EC	Design plan, specifications, and schedule	Include sustainability metrics in the value engineering process.	Improves project team collaboration.	The flexibility to optimize may be limited by regulatory decisions.

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