SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
Element: **Equipment Selection**								
Mobilization	Minimize transport distance.	Fuel and miles traveled	QN	EN, EC	Construction plan	Consider local procurement of services.	Encourages local procurement (S).	--
Equipment size	Ensure correct equipment size for tasks.	Air emissions	QL	EN, EC		Balance equipment cost with operational efficiency and emissions.	Reduces carbon footprint (EN), operational costs (EC), and emissions impact to environment and workers needed on-site (EN, S). Increases operational efficiency.	--
Equipment operation	Minimize idling time.	Percent idle time	QN	EN, EC		Use best management practices.		--
Diesel equipment tailpipe retrofit	Minimize emissions of particulate matter and hydrocarbons.	Percent reduction in tailpipe pollutants	QN	EN, S		Tailpipe retrofits of diesel equipment can significantly reduce particulate matter emissions as effectively as alternate fuels.	Increases worker and community health (S).	--
Renewable fuel	Maximize use of renewable fuels.	Percent renewable fuel and global warming credit	QN	EN		Consider use of renewable fuels.	Stimulates equipment retrofits and renewable fuel supplies (EN).	Sourcing alternative fuel and available equipment that will operate using alternative fuels can be difficult.
Element: **Materials Procurement and Handling**								
Material selection	Reuse site materials or off-site recycled materials, and minimize virgin material requirements.	Percent virgin, renewable, reused, and/or recycled materials; cost savings; and miles traveled	QN	EN, EC	Construction plan and vendor information	Consider local purchase of virgin materials when recycled or reusable materials are not available. Consider recyclability of materials at end of operating life. Use green waste (e.g., fly ash, recycled concrete, and demolition debris) for fill, soil stabilization, or road construction. Use local resources (e.g., Chamber of Commerce, local recyclers, landscapers) to identify suppliers of recycled material. Include sampling to optimize recycle and reuse.	Increases labor and equipment to prepare materials for reuse (EC) and landfill longevity (EN, S). Reduces trucking emissions (EN) and costs (EC), community traffic (S), local trucking labor (S), and amount of waste disposed of in landfill (EC). Mitigates use of raw materials (i.e., environmental impacts) for manufacturing (EN, S, EC).	Recycled materials may not be more cost effective, may be difficult to locate, and may generate off-site contamination concerns.
	Reduce environmental impacts from materials manufacturing	Environmental impacts**	QN	EN	Manufacturer bid, cut sheet, and/or information; public life-cycle assessment databases	Consider resulting pollution emissions and/or waste material generation from materials manufacturing.	--	--

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
EN = environmental

SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
	Select alternate materials to reduce environmental impacts and toxicity.	Environmental impacts** and air emissions	QN	EN	Design plan and vendor information; public life-cycle assessment databases	Consider durability (e.g., does the project require highly durable materials?) and shipping distance.	Reduces environmental impact (EN).	Calculating the carbon footprint of materials manufacturing may require moderate to significant technical capability. Considering the carbon footprint of materials may slow material sourcing.
		Contaminant releases and toxicity potential	QL	EN	Third-party certification, material safety data sheets, and vendor information	Consider the use of paints with low volatile organic compounds.	Reduces environmental risk to on-site workers and subsequent users of site (EN, S).	While material toxicity information is readily available, comparing the aggregate toxicity of multiple materials is moderate to highly subjective in lieu of guides and/or references. Materials with lower toxicity levels may be more expensive.
Green and sustainable purchasing	Purchase from vendors that have green or sustainable policies, programs, and/or certifications (e.g., LEED facilities).	Proof of program and/or policy	QL	EN, S, EC	U.S. EPA Green Purchase Program and vendor information	--	Promotes implementation of sustainability policies and/or programs and conscious efforts to implement and track sustainable projects (EN).	A skilled sustainability practitioner may need to perform a sustainability assessment of vendors to balance sustainability criteria against other objectives, elements, or metrics such as pricing and experience. A sufficient amount of vendors may not be available.
Traffic	Minimize nuisance dust and noise.	Particulate matter levels	QN	EN, S	Traffic plan and monitoring plan	Cover stockpiles with tarps and apply dust control measures or vegetate stock piles. Minimize double handling.	Reduces potential short-term hazards to on-site crews and community (S) and equipment maintenance (EC). Improves community relations (S). Minimizes off-site migration of contamination (EN, EC).	--
		Number of complaints from local community	QN, QL	EN, S, EC	Site logs and community outreach			
Element: **Operations**								
Material handling	Minimize double handling on-site.	Air emissions	QN	EC	Traffic plan and materials staging plan	--	Reduces labor and equipment costs (EC). Minimizes construction time (EC).	--

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
EN = environmental

SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
Field buildings	Use energy efficient systems, processes, and equipment for field office.	LEED (Leadership in Energy and Environmental Design) rating for office environment and 5-Star energy rating office equipment	QL	EN, EC	Industry service provider proposal and final report, U.S. Green Building Council membership and certification listings, and EPA Green Purchase Program	Include carbon offset costs in economic analysis of higher efficiency equipment.	Reduces carbon footprint (EN) and energy costs (EC).	Use of higher efficiency equipment increases equipment costs.
	Use renewable energy systems to power field office.	Kilowatts used, kilowatts purchased, and carbon offset	QN	EN	U.S. Department of Energy resources (e.g., equipment lists, calculators)			
	Reuse existing or reusable structure as field office.	Air emissions and cost savings	QN	EN, EC	Site design drawings and local vendor information	Balance costs of retrofitting structures or preconstructed buildings with costs to demolish, transport, and dispose of existing structures.	Reduces trucking emissions (EN) and costs (EC), community traffic (S), and waste disposed of in landfill (EC). Increases landfill longevity (EN, S). Mitigates use of raw materials for manufacturing (EN, S, EC).	--
Lodging for industry service providers	Minimize daily travel to site.	Commuting mileage	QN	EN, S, EC	Industry service provider proposal and online mapping calculation	Locate a hotel within a close proximity to the site to minimize travel of crews to and from site.	Reduces labor travel time (EC, S) and vehicle use (EN).	--
	Purchase from vendors that have green or sustainable policies, programs, and/or certifications.	LEED certification and proof of program and/or policy	QL	EN, S, EC	Vendor information and U.S. Green Building Council membership and certification listings	Support other vendors in the value chain striving to improve the sustainability of their industry's operations. Balance with operational costs.	--	A skilled sustainability practitioner may be required to assess the sustainability of vendors. A sufficient amount of suitable vendors may not be available.
Health and safety performance	Reduce on-site risk of injury or accidents.	Proof of health and safety plan and number of near misses, unsafe conditions, unsafe acts, and/or lost work days	QN, QL	S, EC	Industry service provider daily logs and final report	Include site-specific, shift-specific, or activity-specific guidance or focus for review at the outset of the project, shift, or activity. Set standard goal of zero lost days and accidents. Track and report successes and issues in a transparent manner on an on-going and consistent basis. Communicate best practices and corrective actions in a transparent manner.	Increases operational efficiency (EC) and worker morale (S). Reduces downtime related to health and safety (S, EC) and agency compliance risks and issues (S, EC).	Advanced planning, intentional training, and leadership follow-through are necessary to ensure that owner expectations for health and safety are implemented.

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
EN = environmental

SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
Element: **Monitoring, Sampling, and Analysis**								
Monitoring and sampling	Minimize travel.	Miles traveled and labor hours for travel	QN	EN, S, EC	Industry service provider monitoring work plan	Balance the local impacts (e.g., reduced travel and lodging, local development, goodwill generated) with operational impacts (e.g., job knowledge, experience).	Reduces mobilization costs (e.g., labor and equipment) (EC) and carbon footprint (EN). Balances needed operational capability of workers (EC). Supports local economy (S, EC).	Utilizing the local labor pool can lead to unsustainable outcomes (e.g., lack of necessary technical knowledge or health and safety capabilities).
	Minimize shipping.	Miles shipped and cost of shipping	QN	EN, EC		Consider use of an on-site laboratory.	Reduces carbon footprint (EN).	
	Optimize sampling events.	Number of samples eliminated	QN	EN, EC		Consider sampling efficacy, step-out sampling, and concurrent multimedia sampling. Include data quality assurance and quality control.	Reduces fuel use (EC, EN) and labor and material costs associated with resampling (EC).	--
Analysis	Use laboratories with green and/or sustainable programs and policies.	Proof of policies and programs	QL	EN	Monitoring plan and vendor information	Reference *12 Principles of Green Chemistry* by the EPA and *Labs for the 21st Century* sponsored jointly by the EPA and Department of Energy.	Reduces carbon footprint (EN).	Analytical laboratories implementing green practices may be not be available.
Element: **Waste Management**								
Waste generation	Minimize off-site waste disposal.	Environmental impacts**	QN	EN, S, EC	Engineering design, industry service provider proposal and final report	Include transportation impacts in sustainability assessment. Abandon rather than remove subsurface structures. Reuse aboveground structures. Balance costs of retrofitting structures or using preconstructed buildings with costs of demolishing, transporting, and disposing of existing structures.	Reduces trucking emissions (EN) and costs (EC), community traffic (S), and amount of waste disposed of in landfill (EC). Increases landfill longevity (EN, S). Mitigates use of raw materials for manufacturing (EN, S, EC).	If regulations change, potential future liability exists.
	Maximize scrap value.	Tons scrap recovered and dollars scrap value recovered	QN	EN, EC	Industry service provider proposal, daily logs, and final report	Balance operational costs of labor and equipment with recovery value and disposal offset. Crush existing structures to optimize scrap recovery and generate fill materials.	Generates value-producing material (EC). Reduces waste being disposed of in landfill (EC). Increases landfill longevity (EN, S).	Additional labor, equipment, and time on-site may be necessary.

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
EN = environmental

SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
	Reuse and recycle wastes on-site.	Tons reused and/or recycled, virgin material dollars offset, and waste transportation and disposal dollars offset	QN	EN, EC	Industry service provider proposal, daily logs, and final report	Grind waste wood and other organics for use in site access road construction and surface stabilization.	Mitigates use of raw materials for manufacturing (EN, S, EC).	Additional labor, equipment, and time on-site may be necessary.
On-site waste management	Reduce waste-related incidents.	Waste management plan and training, waste incidents, and waste issues corrected without incident	QN, QL	EN, S, EC	Industry service provider prequalification or proposal, daily logs, and final report	Prior to project initiation, establish a plan for handling wastes on-site and contingencies for mitigating waste-related incidents. Track incidents and issues corrected.	Minimizes environmental impacts (EN) and unnecessary operational costs of incidents (EC).	--
	Maximize the economies of scale (e.g., drums versus roll-offs; roll-offs versus rail car) and minimize the material footprint of containerization.	Number of containers and percent reused containers	QL	EN, EC	Industry service provider daily logs, waste management records, and manufacturer data	Use or reuse waste containers and/or containers manufactured with recycled content. Use waste bulking methodologies.	Reduces trucking emissions (EN) and costs (EC), community traffic (S), and amount of waste container material disposed of in landfill (EC). Increases landfill longevity (EN, S). Mitigates use of raw materials for manufacturing containers (EN, S, EC).	Changing site conditions, particularly regarding the types and quantities of wastes, can present challenges.
Transportation	Minimize waste transport.	Number of waste trips, fuel usage, and time	QN, QL	EN, EC	Waste bills of lading and manifests	Practice load bulking or consolidation as appropriate or use a 'milk run' concept. Balance cost of obtaining alternative fuel or idle/emission controls with carbon offset and impact to operational efficiency.	--	--
	Minimize miles transported.	Amount of miles transported and driver hours	QN	EN			--	--
	Use alternative fuels.	Air emissions			Vehicle records		--	--
Treatment and disposal	Minimize post-remediation legacy.	Environmental impacts** and percent contaminant destruction	QN	EN, S	Waste manifests and disposal facility data	Consider diverting organic waste streams to a waste-to-energy plant. Consider using a facility with technology that permanently destroys contaminants, generates energy or other benefit, and/or uses green and/or sustainable practices.	Increases longevity of disposal facility (S). Reduces potential future liability (S, EC).	Distance to waste-to-energy plant may not economically viable. Approach may increase short-term costs.

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
EN = environmental

SURF Metrics Toolbox – Remedial Construction

Parameter	Objective	Metrics	QN, QL	EN, S, EC	Data Source(s)*	Implementation Guidance and Comments	External Benefits	Challenges
Element: **Constructability**								
Sustainable design	Build as designed.	Design-phase metrics	QL	EN, S, EC	Project meeting notes	Review the feasibility of field approaches and techniques (i.e., constructability) at each field activity stage.	Improves project team communication (S). Minimizes construction costs (EC).	Constructability reviews must be integrated into the overall project schedule to minimize delays or rework. At this point, the ability to change primary technologies is limited by established agency decisions and stakeholder requirements. Rather, the focus of performing constructability reviews is to streamline the construction phase.
	Build on schedule.	Milestone and critical path completion	QL	EN, S, EC	Contractor meetings	Evaluate work sequence, permits, long lead time equipment, availability of key materials, and access.	Meets stakeholder expectations (S).	--
Constructability review	Improve design metrics.	Design phase metrics	QN, QL	EN, S, EC	Contractor review	Perform collaborative review of design, focusing on established sustainability and project metrics from design step.	Includes contractor experience and strengths (S).	Early contractor involvement can be difficult due to contracting strategy and implementation schedule.

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
EN = environmental