ASTM's Standard Guide for Greener Cleanups ASTM E2893

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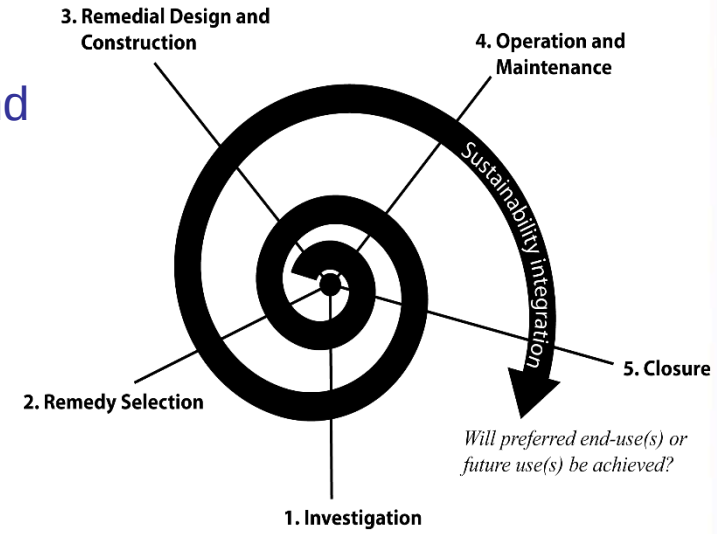
ASTM Framework for Greener Cleanups

- Greener Cleanup is a Process, not a Technology
  - Greener cleanup principles should be integrated into cleanup projects
  - Applied on a phase-by-phase basis
  - Is not just about remedy selection and green technologies
- "Only is green if it works"
  - Focus on how to incorporate BMPs into projects



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ASTM's Standard Guide Development

- EPA requested that ASTM prepare a green remediation standard
- Initiated in October 2009 at an ASTM meeting in Atlanta
- Developed a task group to prepare standard following ASTM consensus-based process
- Final standard published in November 2013
- In the process of updating the standard

ASTM Standard Guide for Greener Cleanups

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ASTM Definition of Greener Cleanup

Greener cleanup—the incorporation of practices, processes, and technologies into *cleanup* activities with the goal of reducing impacts to the environment through reduced demands on natural resources and decreased *emissions* to the environment. A *greener cleanup* considers the five *core elements*, while protecting human health and the environment. In the environmental remediation industry, this term is used interchangeably with green *cleanup*, green remediation, and greener remediation.

ASTM INTERNATIONAL

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Standard Guide for Greener Cleanups[1]

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The Basics

- Provides a step-by-step approach
- Flexible, with qualitative and quantitative options
- Includes reporting expectations
- Documentation must be publicly available (inhibits “green washing”)
- Environmental professional must lead the team and sign attestation that the standard was followed
- Designed to be the industry standard; particularly if adopted by regulatory agencies

ASTM Standard Guide for Greener Cleanups

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ASTM Standard Guide Overview

- Fundamental core is selecting BMPs
- Flexible evaluation process
- Qualitative evaluation (BMP selection)
- Quantitative evaluation (numerical)
- Standard is applied on a phase-by-phase basis
  1. Site Assessment
  2. Remedy Selection
  3. Remedy Design and Implementation
  4. Operation, Maintenance and Monitoring
  5. Remedy Optimization

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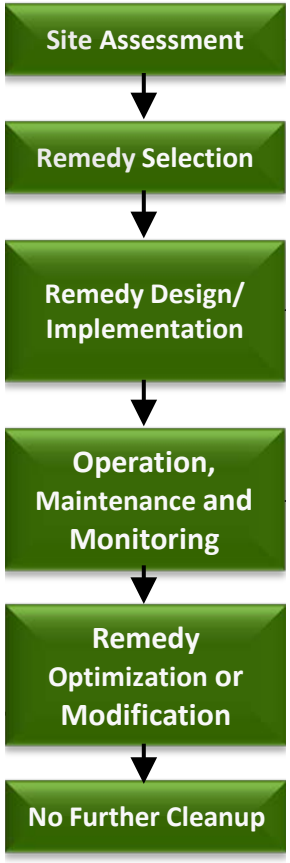
Working With Existing Phases



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ASTM Greener Cleanups Standard

Sections

1. Scope
2. Referenced Documents
3. Terminology
4. Significance and Use
5. Planning and Scoping
6. BMP Process
7. Quantitative Evaluation
8. Documentation and Reporting

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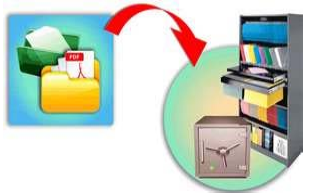
Standard Management Practices *are not* Best Management Practices

- Standard Management Practice (not included because routine)
  - Considered industry standards and are truly basic in nature
    - Recycling office waste
    - Using compact fluorescent light bulbs
    - Minimizing paper use with electronic filing systems
- Best Management Practice
  - Activity that reduces the environmental footprint of a remedy
  - ASTM developed a comprehensive list BMPs



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Best Management Practices

- BMPs drive environmental footprint reduction
- BMPs are organized on a technology or activity basis, but are applied based on the phase of the project
- BMPs assigned to EPA's five core elements
  - Energy
  - Air Emissions
  - Water Impacts
  - Material and Waste
  - Land and Ecosystem
- Also established 10 Categories

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Green BMP Categories

1. Buildings
2. Materials
3. Power & Fuel
4. Project Planning & Team Management
5. Residual Solid & Liquid Waste
6. Sampling & Analysis
7. Site Preparation/Land Restoration
8. Surface/Storm Water Management
9. Vehicle & Equipment Management
10. Wastewater Management

Insider note: likely reducing to 9 categories by merging Wastewater Management into other categories

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BMP - Step 1 Opportunity Assessment Greener Cleanup BMP Table

- Task Group painstakingly compiled table with over 160 BMPs
- ASTM offers the table in Excel format as an “Adjunct”
- Arranged by category, core element and technology
  - 10 Categories (e.g., power & fuel, materials, vehicles…)
  - 5 Core elements
  - 11 Technologies (e.g., SVE, P&T, excavation…)
- User strongly encouraged to add BMPs to the table
- User can sort the Excel table by technology, core element or category

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BMP Process "Five Steps to Greening Cleanups"

1. Opportunity Assessment
   - Review master list of BMPs and retains those that warrant further consideration.
   - Consider BMPs not on the master list
   - Should be a pretty straightforward exercise
2. BMP Prioritization
   - Identify BMPs with the greatest potential for reducing the environmental footprint and prepare prioritized list
3. BMP Selection
   - Unless a compelling reason to do otherwise, select each BMP from Step 2 for implementation
   - What is a "compelling reason to do otherwise"?
   - Substantive issues associated with applicability, implementation, impracticability and cost
4. BMP Implementation
   - Document BMPs that can not be implemented and why
5. BMP Documentation and Reporting
   - Record BMPs implemented
   - If BMPs from Steps 3 & 4 were not implemented, explain why

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ASTM BMP Table

		Core Element Addressed (at Site Level)					Remediation Technology										
Category	Best Management Practice	Energy	Air	Water	Materials and Waste	Land and Ecosystems	Soil Vapor Extraction	Air Sparging	Pump and Treat	In-situ Chemical Oxidation	Bioremediation/MNA	In-situ Thermal Treatment	Phytotechnology	Subsurface containment & Treatment Barriers	Excavation and Surface Restoration	ex-Situ Bio/chemical oxidation	Vapor Intrusion Mitigation
Buildings	Minimize the size of the housing for above-ground treatment system and equipment	X			X	X	X	X	X	X	X	X	X	X	X	X	X
Buildings	Install energy recovery ventilators in buildings to allow incoming fresh air while capturing energy from outgoing, conditioned air	X					X	X	X	X	X	X	X	X	X	X	X
Buildings	Reuse existing structures for treatment system, storage, sample management, etc.				X		X	X	X	X	X	X	X	X	X	X	X
Buildings	Build energy efficent heating and cooling into new buildings by using natural conditions such as prevailing wind directions for cooling/heating, passive solar building design, and/or existing	X					X	X	X	X	X	X	X	X	X	X	X
Buildings	Design energy efficient HVAC systems (e.g., programmable heating and cooling systems)	X					X	X	X	X	X	X	X	X	X	X	X
Buildings	Properly insulate buildings	X					X	X	X	X	X	X	X	X	X	X	X
Buildings	Build energy efficiency lighting into new buildings by using natural conditions such as passive lighting and by using designed systems such as energy star lighting.	X					X	X	X	X	X	X	X	X	X	X	X
Materials	Use dedicated materials when performing multiple rounds of sampling of all matrices				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Purchase materials in bulk quantities and packed in reusable/recyclable containers and drums to reduce packaging waste				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Use products, packing material, and equipment that can be reused or recycled				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Prepare, store, and distribute documents electronically using an environmental management				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Recycle all non-usable/spent equipment/materials following completion of project				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Use materials that are made from recycled materials (e.g., steel, concrete, plastics and asphalt; tarps made with recycled or biobased contents instead of virgin petroleum-based contents)				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Link a deconstruction project with an on-site or local current construction or renovation project to facilitate reuse of clean salvaged materials.				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Use on-site/local materials, when possible.	X	X		X							X			X		
Materials	Steam-clean or use phosphate-free detergents or biodegradable cleaning products instead of organic solvents or acids to decontaminate sampling equipment			X	X		X	X	X	X	X	X	X	X	X	X	X
Materials	Use wood based materials and products that are certified in accordance with the Forest Stewardship Council (FSC) Principles and Criteria for wood building components				X		X	X	X	X	X	X	X	X	X	X	X
Materials	Use regenerated GAC for use in carbon beds				X		X		X			X					X
Materials	Consider preheating vapors to reduce relative humidity prior to treatment with vapor-phase GAC to improve adsorption efficiency when additional analysis supports approach				X		X					X					X

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Example Selection from BMP Table

Best Management Practice	Core Element Addressed (at Site Level)				
	Energy	Air	Water	Materials and Waste	Land and Ecosystems
Operate system during off-peak hours of electrical demand, without compromising cleanup progress	X				
Use pulsed rather than continuous injections when delivering or extracting air to increase energy efficiency when nearing asymptotic conditions	X				
Use gravity flow where feasible to reduce the number of pumps for water transfer after subsurface extraction	X			X	
Install amp meters to evaluate consumption rates on a real-time basis to evaluate options for off-peak energy usage	X				
Use on-site generated renewable energy (including but not limited to solar photovoltaic, wind turbines, landfill gas, geothermal, and biomass combustion, etc.) to power cleanup activities	X	X			
Use excess plant steam as an energy source to power cleanup activities	X				

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Section 7: Quantitative Evaluation Overview

- Most applicable to large and complex site
- Types of quantitative evaluation
  - Footprint Analysis
  - Life Cycle Assessment
- Seven step process
- Uses for quantitative evaluation
  - Opportunity Evaluation
  - Technology Evaluation
  - Metrics for BMPs

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Section 8: Documentation and Reporting

Step 1: Document for each phase

- BMP Summary Tables
  - List applicable BMPs, prioritized by anticipated environmental benefit
  - Identify those implemented
  - Include rationale for those not implemented
  - Identify BMPs required by law or regulation
- Quantitative Evaluation Report, if applied

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Section 8: Documentation and Reporting

Step 2: Make publicly available

- Technical Summary (Appendix X2 form)
  - General Information
  - Environmental Footprint Reductions
- BMP Summary Tables and Quantitative Evaluation Report, if applicable (for each phase)
- Self-declaration
- Public repository
- Post on a website
- Submit to a regulatory agency, with prior agency consent

ASTM will post on website. Contact Kate McClung at:

kmcclung@astm.org

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Green BMP Compilation Process

- Identified sites where green BMPs were utilized
  - ASTM reports
  - EPA reports
  - SURF reports
  - Private reports
- Excluded sites with less than 3 BMPs or if greenwashing was suspected
- Inventoried BMPs from 18 sites
- Total of 163 BMPs (Average = 9 BMPs/site)

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Green BMP Compilation Process

- Assigned BMPs to the generic ASTM BMPs (160 different BMPs)
- Compiled master database of all BMPs
- Sorted database to develop results
  - BMPs used most frequently
  - EPA core elements
  - ASTM categories
- Also, evaluated results based on experience to identify observations about implementing BMPs at cleanup sites

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Top 10 BMPs

# Sites Used	Green BMP
6	Use biodiesel as fuel source
6	Use on-site or nearby sources of fill material
5	Use native species for vegetative cover
5	Reclaim uncontaminated material for reuse, salvage value or recycling
5	Use on-site generated renewable energy (e.g., solar, wind, landfill gas)

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Top 10 BMPs

# Sites Used	Green BMP
5	Incorporate wetlands, bioswales and other natural resources into cleanup
4	Use biodegradable hydraulic fluids in equipment
4	Use local staff to minimize resource consumption
4	Use dedicated materials for sampling
4	Re-vegetate excavated or disturbed areas quickly

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Frequency of Various Categories

- Materials — 32 BMPs
- Site Preparation/Land Restoration — 32 BMPs
- Power & Fuel — 26 BMPs
- Project Planning — 16 BMPs
- Lower Use
  - Sampling & Analysis — 11 BMPs
  - Vehicles & Equipment — 11 BMPs
  - Wastewater Management — 11 BMPs
- Very Low Use
  - Residual Solid & Liquid Waste — 7 BMPs
  - Building — 6 BMPs
  - Surface Water/Storm Water Management — 4 BMPs

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Frequency of EPA Core Elements Addressed by BMPs

❖ Materials and Waste	101 BMPs
❖ Energy	89 BMPs
❖ Air	66 BMPs
❖ Land and Ecosystem	58 BMPs
❖ Water	52 BPMs

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Observations/Conclusions

- Heavily focused on recycling and reuse
- Also, vegetative related BMPs frequently used
- Appeared to be little quantitative evaluation and, if used, focused on a specific issue (e.g., thermal treatment and energy use in pump & treat)
- Very little greenwashing observed

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Observations

- Missing some low hanging fruit
  - Looking at LEED from a programmatic perspective
  - Including green requirements into RFPs and contracts
  - Purchasing green products
  - Implementing idle reduction plans
  - Retaining local laboratories
  - Using advanced testing to better delineate sites (e.g., Triad and surgical delineation)

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Recommendations

1. Get the Word Out!
   - Post green remediation reports to ASTM website
   - Post GSR case studies to SURF website through SURF's Case Study Initiative
2. Expand database and evaluation
3. Compile environmental footprint findings
4. Provide summary of lessons learned
5. Update BMP table – which is in progress

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Questions?

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