NEW YORK STATE | Department of Environmental Conservation

DEC Sustainability Policy Summary

Policy Goals and Actions

Materials and Waste

Goals:

- Strive for Zero Waste
- Minimize the use of hazardous wastes and material

Actions:

- Recycle on-Site waste
- Use Green Products
- Regenerate Carbon
- Use pre-excavation sampling to minimize volume of soils transported to landfills
- Consider rail transport for soil disposal with long transportation distances
- Purchase products from ethical sources

Energy

Goals:

- 100% renewable by 2030
- Carbon neutral by 2050

Actions:

- Use variable speed drives
- Install solar panels, wind turbines or geothermal heat exchangers
- Use high efficiency equipment
- Consider pulsed operation of equipment as possible
- Consider energy consumption in remedy selection

Air Emissions

Goals:

- At least 85% decrease in GHG emissions by 2050 with any remaining offset
- 100% electrified light-duty fleet by 2035 and medium- and heavy-duty fleet by 2040

Actions:

- Monitor & reduce GHG emissions
- Use equipment with exhaust filtration
- Incorporate fuel efficient or electric vehicles into fleets
- Encourage the use of renewable fuels, such as bio-diesel for heavy equipment

Water Consumption

Goals:

- Minimize water usage
- Restrict use of bottled water at State facilities

Actions:

- Reuse extracted groundwater for irrigation/cooling
- Use treated ground-water for injections
- Consider groundwater sampling techniques that minimize purging
- Take steps to allow employees to refill reusable bottles rather than using single-use ones (in accordance with proper health/ safety protocols)

Land and Ecosystems

Goals:

- Species and Habitat Protection
- Promote Green & Resilient Infrastructure

Actions:

- Incorporate pollinator friendly plants into restoration
- Maintain & enhance existing habitat
- Minimize habitat destruction during investigation and remediation
- Encourage on-site stormwater infiltration when possible

New York State Department of Environmental Conservation

Guide for Implementing Green & Sustainable Remediation In Project Lifecycle*

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

STEP 1

Site Characterization/ Remedial Investigation

- Minimize mobilizations
- Use local contractors and staff
- Consider sampling techniques, field analysis kits or advanced tools (MIPs/ CPT)
- Minimize investigation derived waste
- Include GSR metrics summary in SCR and RIR

STEP 2

Feasibility Study & Remedy Selection

Identify Greener technologies/process options

- Define RAOs independent of GSR
- Generate estimate of treatment areas including areas, volumes, COC concentrations & mass per media, zone & phase
- Determine level of GSR analysis (1, 2 or 3) based on site complexity (SURF 2009)
- Include GSR considerations in remedy selection (as balancing criteria)

STEP 3

Remedial Design & Remedial Action

"Greening the Remedy"
Add or incorporate GSR techniques to reduce lifecycle impacts on core elements

- Incorporate BMP elements into design
- Consider ecology improvement in remedy
- Design for project lifecycle, not only initial conditions
- Consider incorporating renewable energy generation
- Tabulate and track cumulative impact of GSR steps to understand full impact on project footprint
- Include GSR requirements in specifications
- Include GSR metrics summary in FER

STEP 4

Periodic Review Reports

- Assess engineering controls with respect to climate change vulnerability (flood, winds, temperature, etc.)
- Review OM&M data and reduce volumes/frequencies as appropriate
- Propose corrective measures or changes to SMP
- Include GSR metrics summary with PRR and assess against prior reports

Hint: *Improved GSR metrics (i.e., energy efficiency) should also result in overall project cost savings.*

STEP 5

Remedial System Optimization

- Determine if system configuration and operation changes are needed to achieve RAOs
- Propose modifications to system operations, components, controls or maintenance schedule to enhance performance and improve GSR metrics (e.g., using smaller, equally protective equipment)
- Assess potential for renewable energy to reduce/offset electrical or fuel consumption

* *Not intended to be comprehensive. DER-10, DER-31 and CP-49 should be consulted for additional guidance, strategies and tactics.*

NEW YORK STATE | Department of Environmental Conservation

Guide For Implementing Green and Sustainable Remediation In Feasibility Studies*

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

STEP 1

Define Remedial Action Objectives (RAOs)

- Requires completed CSM, completed RI, stakeholder input, understanding of potential future site uses
- Review NYSDEC DER-31, CP-49 for GSR considerations
- Consider maintaining or enhancing land use in the RAOs, including establishing valuable habitats

STEP 2

Remedial Action Screening

- Requires treatment area definition: areas, volumes, COC concentrations & mass per media, zone & phase
- Develop/screen alternative technologies and process options for each treatment area (individually or in treatment train)

STEP 3

Detailed Analysis of Alternatives

*Identifying **"Greener"** Technologies/Process Options*
Select Assessment Level: 1, 2 or 3

- **Level 1:** Follow Best Management Practices (BMPs)
- **Level 2:** Use GSR Tools (SiteWise® or SEFA®)
- **Level 3:** Develop site specific tools (complex sites)
- Assemble remedial alternatives/ response actions
- Develop conceptual construction and OM&M plans for cost estimating and GSR analyses
- Compare remedial alternatives against threshold, balancing & modifying criteria plus GSR

***Hint:** Don't focus on "Greening" technologies with minor process components at this stage.*

STEP 4

Remedy Selection

- Consider all screening criteria as part of selection
- Confirm that full lifecycle of project is considered
- View project holistically – All parts of the remedy should be considered (including future off-site impacts such as landfill operations)

***Hint:** GSR is not a basis for a less protective or no-remedy option. RAOs defined in Step 1 are the driver. GSR metrics are a "balancing criteria".*

NEXT STEP: DESIGN

Remedial Design "Greening the Remedy"

- Consult and apply BMPs to small and large projects: track and report using appropriate tools
- Remedy should be designed for full lifecycle: Consider installation, start-up, OM&M and site closure
- Document and track GSR metrics through design

***Hint:** many small steps can add up to large project impacts.*

* *Not intended to be comprehensive. DER-10, DER-31 and CP-49 should be consulted for additional guidance, strategies and tactics.*

NEW YORK STATE | Department of Environmental Conservation

Guide for Implementing Green and Sustainable Remediation in Site Management Plans (SMPs)

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Engineering Controls	Remediation Systems and Controls	Building Operations	Inspection	Metrics & Reporting
• As possible, incorporate vegetated caps over gravel or concrete, based on site conditions • Use capped areas for ecosystems or habitat enhancement • Consider remote monitoring for engineering controls as applicable • Use renewable energy sources for active mitigation systems with appropriate backup power to ensure active mitigation systems remain active.	• Effectiveness & Protectiveness highest priority • Perform routine monitoring and evaluations to minimize inefficiencies • Reduce waste (e.g., reuse treated water, regenerate carbon) • Use renewable energy to power portions of systems with appropriate backup power to ensure active mitigation systems remain active • Use wind turbines on passive venting stacks to enhance flows	• Use high efficiency HVAC equipment • Maintain modest HVAC setpoints • Ensure proper building insulation • Consider on-Site renewable energy generation • Use timers on lights and use LED bulbs • Collect stormwater for irrigation use • Use solar power for exterior lighting	• Install Telemetry for remediation and monitoring systems • Reduce inspection frequency as appropriate • Reduce number of sample points as appropriate • Use efficient vehicles/ mass transit for travel • Consider passive samplers to reduce purging	• Be accurate in GSR reporting • Identify multiple small GRS actions in routine activities • Update current GSR measures in Periodic Review Reports (PRR) and Remedial System Optimization (RSO) • Consider land and ecosystem use

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practice: Site Investigation and Environmental Monitoring

NEW YORK STATE | Department of Environmental Conservation

Guide for Implementing Green and Sustainable Remediation in Excavation Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning

- Complete comprehensive delineation to limit the excavation volume
- Incorporate direct push sampling to save energy
- Use field test kits on-Site or nearby laboratories
- Identify local sources for backfill
- Establish staging areas to minimize disruption
- Perform reuse sampling to minimize imported backfill

Equipment

- Select suitably sized equipment
- Use surveyors/on-board GPS to minimize over excavation
- Prevent engine idling
- Retrofit equipment with additional exhaust filters
- Use ultra-low sulfur or bio-diesel
- Use wheel cleaning stations with recycled water
- Conduct maintenance on-time
- Minimize noise and vibrations

Disposal

- Use local disposal facilities when possible to minimize transportation
- Use treatment facilities as possible to minimize long term monitoring requirements
- Allow for solids to dewater prior to shipping off-site to minimize transportation weight
- Minimize volumes going to hazardous waste landfills

Water

- Use treated water for dust suppression and other on-site needs
- Cover soils with tarps/ mats for dust
- Minimize off-site disposal of water
- Control/capture stormwater runoff before entering excavation
- Restore area to allow for stormwater infiltration
- Consider remediation amendment blending in bottom of excavations to reduce groundwater impacts

Restoration

- Minimize ecosystem disturbance
- Re-use uncontaminated organic debris for mulch, in-fill or compost
- Encourage landscaped caps, with pollinator friendly vegetation
- Use native species
- Incorporate green infrastructure into restoration
- Source topsoil locally
- Use local labor to monitor restoration

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices for Excavation and Surface Restoration

New York State Department of Environmental Conservation

Guide for Implementing Green and Sustainable Remediation in Pump & Treat Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning & Installation

- Collect site specific design data for capture zones and flow rates (aquifer tests)
- Design efficient extraction wells
- Flow rates are most critical design criteria
- Plan for later project stages:
- Leave additional capacity in system
- Scale back as influent concentrations decrease

Materials & Waste

- Consider groundwater re-injection/reuse
- Consider discharge options (POTW, Surface water, Groundwater)
- Use filters that can be backwashed to avoid filter disposal
- Consider sequestering agents to avoid excess filtering and solids disposal
- Use re-generated GAC when possible, and send spent GAC for regeneration

Operation & Monitoring

- Automate the system and use telemetry systems to reduce site visits as much as practical
- Use local staff for routine inspections
- Incorporate dewatering in waste treatment to reduce weight
- Conduct energy intensive operations as batch processes, operate at off-peak hours
- Incorporate energy storage capacity to continue operating monitoring equipment during grid outages

Energy

- Install renewable energy on site to provide supplemental system power
- Use variable frequency drives to reduce pump throttling
- Use high efficiency pumps for extraction and processes
- Use solar heating or heat exchangers to reduce HVAC costs
- Consider pulsed pumping to reduce overall energy use

Retrofits & Optimization

- Adjust operations for actual influent concentrations, not historic values
- Switch to less energy intensive processes as concentrations diminish
- Look for opportunities for in-situ treatment in portions of plume
- Conduct bench scale testing for alternate chemicals/loading rates to maintain minimal dosage rates

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices: Pump and Treat Technologies

New York State Department of Environmental Conservation

Guide for Implementing GSR in Soil Vapor Extraction (SVE) Projects

STEP 1

Define Treatment Objectives

- Determine the treatment objectives: Timeframe, Prevention of Contaminant Migration, Continued Site Use
- Is the treatment zone understood? Are pre-design investigations needed to refine extent of treatment?
- Are non-aqueous phase liquids present? Consider sequenced effluent treatment (e.g., oxidizer for initial operation)

Note: *Electrical consumption from a typical SVE system will be equivalent to powering 7 homes for a year*

STEP 2

Design GSR Into the Remedy – Optimize Use of "Greener" Process Options

- Minimize mobilizations/demobilizations during PDI & pilot testing
- Conduct pilot tests whenever possible
- Ensure efficient system design (consult BMPs)
- Design for the entire SVE system lifetime
  - Select blowers that are appropriate for lifecycle
  - Incorporate VFDs into system design
- Consider horizontal wells for shallow applications
- Include automation when possible
- Use regenerated/reactivated vs. virgin GAC
- Consider multiple effluent treatment options
  - Establish triggers to change to lower energy technologies
- Balance number of wells with operating duration
- Minimize aboveground enclosure size

STEP 3

Construction BMPs

Piping Network:

- Overhead piping indoors when possible
- Reduce friction losses by increasing pipe diameter
- Reduce pipe lengths by manifolding wells
- Pitch pipes to reduce condensate production

Well Drilling:

- Use emission control technologies
- Ensure good well seals: prevent short circuiting
- Reduce equipment mobilizations
- Avoid using drilling fluids if possible
- Reduce concrete/asphalt removal & replacement
- Reuse native soils to the extent possible
- Recycle asphalt and concrete rather than offsite landfilling
- Consider sharing trenches with other utilities as possible

Treatment System Enclosure:

- Use insulation to reduce heating/cooling costs
- Consider solar/wind energy for lighting, cooling
- Consider tall stack to reduce treatment requirements
- Protect effluent stack from rain water

STEP 4

OM+M BMPs

- Consider treatment/reuse/recharge of treated condensate
- Target portions of operations with largest footprint
- Focus operations on wells with high VOC yield
- Pulsing/Cycling Operations:
  - Group SVE Wells into zones
  - Rotate to optimize VOC mass removal
  - Potential for reduced GAC consumption
- Reduce site visit frequency after optimization
- Use local staff for site visits
- Plan for system shut-off/conversion to passive (e.g., wind turbine) with appropriate backup power to ensure active mitigation systems remain active
- Consider procurement of renewable energy credits
- Track GSR metrics during operations:
  - Check against design & construction phase projections
  - Document reductions in energy & material consumption
  - Assess in PRR and RSO phase

Not all GSR options are included in this graphic.
Further Reference: USEPA Green Remediation Best Management Practices: Soil Vapor Extraction

NEW YORK STATE | Department of Environmental Conservation

Guide for Implementing Green and Sustainable Remediation in Injection Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning & Scoping

- Conduct pre-design investigation (PDI) to define treatment area well before injection design
- Incorporate direct sensing equipment in PDI
- Conduct bench or pilot scale testing as possible to gain site specific design data including flow rates, loading rates and radius of influence (ROI)
- Consider tow behind renewable energy equipment to off-set energy use

Materials

- Use groundwater for injections
- When possible, select amendments made from recycled materials or renewable resources
- Decontaminate hoses and pumps after projects and reuse in subsequent events
- Use long lasting amendments if using temporary injection points
- Use recovered stormwater, as possible

Means and Methods

- Use permanent injection wells in source areas/zones where multiple rounds of injections are expected
- Recirculate groundwater to improve distribution, contact, treatment control/efficiency
- Use gravity feed when appropriate to reduce operating equipment
- Evaluate delivery approaches to overcome access limitations, including: horizontal & angled wells or hydraulic manipulation

Equipment and Waste

- Avoid idling drill rigs/ Geoprobes™ during injections
- Do not run generators or compressors when not in use/under load
- Recover any surfaced injection fluid and prevent it from entering stormwater infrastructure
- Reuse recovered injection fluid as possible
- Retrofit equipment to reduce emissions

Monitoring

- Sample only wells that will provide actionable data
- Collect sufficient data to understand remediation progress
- Use passive samplers when COCs allow
- Use local resources/ staff for monitoring events
- Monitor wetlands/ surface waters during injections to prevent impacting natural receptors

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices: Bioremediation

NEW YORK STATE | Department of Environmental Conservation

Guide for Implementing Green and Sustainable Remediation in Thermal Remediation Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning and Scoping

- Conduct detailed pre-design investigation (PDI) to define treatment area before design
- Limit treatment area to source zone with highest concentrations
- Consider lower temperature treatment (i.e., hydrolysis/azeotropic boiling point, biological processes) when possible
- Consider local power source in footprint evaluation (renewable energy sources are preferred)
- Consider phased treatment approach to reduce equipment size
- Minimize piping length between wells and treatment system
- Seek potential uses for waste heat

Construction & Materials

- Minimize installation of new concrete or use cementitious replacement materials
- Favor coconut sourced GAC over coal and regenerate spent GAC
- Use regenerated GAC and send spent GAC for regeneration
- Minimize water use during drilling operations
- Minimize mobilizations for well installations
- Use direct push technology when feasible
- Consider compacted soil caps to reduce air intrusion
- Chose vapor capping materials high in recycled content that minimize heat losses

Operation and Maintenance

- Limit the use of oxidizers to periods of peak extraction rates
- Consider combined cryogenic technology for vapor treatment to produce a recyclable waste
- Limit heat losses at surface and perimeter
- Consider timing peak energy use with non-peak power demand times, especially in summer months
- Coordinate with local power providers to optimize demand with excess power capacity
- Consider transitioning to polishing technologies that benefit from residual heat (e.g., bioremediation, persulfate injection)
- Refer to SVE and P&T resources for additional information

Equipment and Waste

- Reuse or re-inject extracted groundwater and condensate
- Evaluate potential benefits to minimizing discharges to POTW
- Utilize heat-exchangers and high efficiency equipment for steam generation and injection
- Reduce soil disposal volumes from drilling and installation activities
- Reuse below grade system infrastructure for future site geothermal heating and cooling systems
- Use efficient blowers for vapor recovery system
- Incorporate variable frequency drives (VFD) in blowers & pumps
- Consider smaller redundant units that can be taken off-line at late project phases

Not all GSR options are included in this graphic.
Further Reference: USEPA Green Remediation Best Management Practices: Implementing In Situ Thermal Technologies

Guide for Implementing Green and Sustainable Remediation in Landfill Projects

NEW YORK STATE Department of Environmental Conservation

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land & Ecosystems

GSR Opportunities on Landfills: Energy Generation (landfill gas, solar or wind), Ecosystem Creation/Enhancement, Community Use & Passive Recreation

Note: This document is intended for legacy landfills and not for the closure of modern operating landfills

Landfill Closure & Capping

- Ensure proposed cap area covers all waste
- Relocate and consolidate waste and minimize land use restrictions, when possible
- Source capping material locally
- Re-use soils/dredge materials in or under cap for grading
- Use permeable caps if appropriate:
  - Reduce LFG management
  - Allow for deep rooted plants
  - Reduce stormwater runoff
- Plant native species on cap that require minimal maintenance
- Create high value habitat on/around cap
- Consider incorporating renewable energy generation into closure plan
- Minimize the use of synthetic materials in cap construction

Landfill Gas (LFG) and Leachate

- Prevent uncontrolled/fugitive emissions
- Design leachate and LFG management systems based on site specific data
- Use LFG for energy generation if viable
- Consider passive venting if methane levels are low
- Power LFG and leachate recovery with renewable energy
- Operate active LFG systems intermittently, if appropriate, to reduce energy use
- Maintain leachate extraction at lowest flow rates for hydraulic control
- Consider constructed wetlands for leachate treatment
- Re-use treated leachate, or allow to infiltrate outside of landfill footprint

Maintenance

- Use local contractors to conduct routine landscaping work
- Maintain & enhance high value ecosystems
- Prohibit the use of pesticides & herbicides on the cap
- Source cap repair material locally
- Minimize disposal of landscaping waste, re-use for mulch.
- Incorporate habitat areas that require minimal maintenance
- Minimize use of fossil fuel powered equipment (use battery powered equipment)

Monitoring

- Reduce monitoring frequency over time, as appropriate
- Focus on collecting actionable data
- Use local staff and high efficiency, low emission vehicles for routine monitoring
- Use remote sensors and telemetry to collect data, reducing site visits
- Monitor habitat areas in addition to engineering controls
- Continue to seek footprint reductions during monitoring
- Use low-flow sampling techniques when possible to minimize purge volumes

Not all GSR options are included in this graphic.

Further Reference: USEPA Green Remediation Best Management Practices: Landfill Cover Systems & Energy Production