DER-31 / Green Remediation

New York State Department of Environmental Conservation

DEC Program Policy

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I. Summary

This document identifies the New York State Department of Environmental Conservation (DEC) Division of Environmental Remediation (DER) approach to remediating sites in the context of the larger environment, a concept known as green remediation. "Green Remediation" (or greener cleanups) can be defined as *"the practice of considering **all** environmental effects of remedy implementation and incorporating options to **minimize the environmental footprint** of cleanup actions."* It is intended to be a holistic approach which improves the overall sustainability of the cleanups by promoting the use of more sustainable practices and technologies. Such practices and technologies are, for example, less disruptive to the environment, generate less waste, increase reuse and recycling, and emit fewer pollutants, including greenhouse gases (GHGs), to the atmosphere. The approach also recognizes the potential for positive economic and social benefits of site reuse and supports coordination of site reuse and remediation to effect the most beneficial and sustainable reuse of the site.

This document provides concepts and techniques of green remediation and guidance on how to apply them to DER's remedial programs, but does not specify methods or criteria to be used to quantify the effectiveness of the various green remediation concepts or remedial alternatives. The concepts will be considered and implemented to the extent feasible, and documented.

This policy applies to all phases of the site cleanup process, from investigation through completion of remediation for sites in the Spill Response Program, Inactive Hazardous Waste Disposal Site Remedial Program (State Superfund Program), Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and the Resource Conservation and Recovery Act (RCRA) Program.

II. Policy

DER is dedicated to developing and promoting innovative cleanup strategies that restore contaminated sites to productive use, promote environmental stewardship, and reduce associated costs while minimizing ancillary environmental impacts from these cleanups. Applying green remediation concepts, such as minimizing energy consumption, reducing GHG emissions, maximizing the reuse of land and the recycling of materials, and conserving natural resources such as soil, water and habitat helps to achieve that objective. Green remediation concepts will be applied to the existing (ongoing) cleanups and future cleanup of contaminated properties. This policy does not modify or replace existing remedial program goals. It is also not intended to encourage, and does not justify, implementation of a "no action" or lesser remedy when a more comprehensive remedy is called for, appropriate, and feasible. *The priority remains implementing remedies that are protective of public health and the environment*.

DER remains committed to implementing protective remedies in each program. Applying green and sustainable principles and technologies to each program, consistent with each program's enabling legislation and regulations, will increase the long term effectiveness, permanence and cost effectiveness of the cleanups and will minimize the overall environmental footprint of remediation.

Consistent with existing laws, including Environmental Conservation Law (ECL) Articles 1 and 3, regulations, DEC policy and with the growing national trend, this policy establishes an expectation (Section V) for proactive consideration and/or application of green remediation techniques to all phases of work in existing and future cleanups.

The procedures set forth in this policy document are intended for the use and guidance of both DEC staff and remedial parties. They are not intended to create any substantive or procedural rights enforceable by any party in administrative or judicial litigation with DEC. DEC reserves the right to act at variance with these procedures to address site-specific circumstances and to change them at any time.

III. Purpose and Background

Remediation clearly benefits the environment at and near the site by making the site protective of public health and the environment and by reducing or eliminating localized contamination. There is an environmental footprint (footprint), however, inherent in remediating sites. A remedy may, for example, require significant energy and material use, and contribute emissions of carbon dioxide (CO_2) and other GHGs to the atmosphere. It can also impact, for example, land use and aquifer recharge. This footprint can extend beyond the site property lines and even beyond adjacent properties to the larger environment. The larger environment may include, for example, the atmosphere at a significant distance from the site due to the emissions from power generation which provides electricity to operate remedial equipment. Decisions made during the course of planning and implementing the investigation and remediation impact the footprint of the cleanup.

Cleanup of our sites must be considered in a larger context, as demanded by issues such as GHG emissions and climate impacts, sprawl, and the effects of energy generation and use. Increasingly, cleanup programs across the nation are considering remedial activities that minimize ancillary environmental impacts by minimizing energy consumption, conserving natural resources, maximizing the reuse of land and recycling of materials. As cleanup technologies and incentives continue to evolve, green remediation strategies offer significant potential for increasing the net benefit of cleanup, cost savings, and the universe of long-term property reuse options without compromising cleanup goals.

Many of the green remediation techniques such as optimizing remedial system operation or implementing enhanced biological degradation have long been available and have been applied to cleanups in New York to yield greater efficiency, cost savings and reduced impact. The purpose of this policy on green remediation is to consider cleanups in the context of the larger environment and consistently and pro-actively apply more sustainable methods to remediate the site while still protecting public health and the environment and striving to achieve the established cleanup goals. This will result in cleanups that are more sustainable, meet long-term needs of all stakeholders, protect valuable state resources such as soil, water, habitat, and the atmosphere while respecting cost concerns.

IV. Responsibility

The responsibility for maintaining and updating this policy lies with the Bureau of Technical Support in DER. DER program staff are responsible for implementing this policy, with input from other involved DEC divisions.

V. Procedure

A. General Procedures

The protection of public health and the environment threshold and programmatic requirements must always be met when undertaking investigation and remediation. Green remediation concepts and techniques will be considered during all stages of the remedial program from site characterization through implementation of the remedy, to long-term site management obligations with the goal of improving the sustainability of the cleanup. Specific techniques are provided in Attachment 1. The major green remediation concepts below, and the attached green remediation techniques, will be considered and used to the extent feasible by remedial parties and DEC's staff and contractors.

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term when choosing a site remedy;
- Reducing direct and indirect GHG and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

Opportunities to increase the sustainability of site cleanups exist throughout the remedial process. The application of these concepts and techniques to the investigation, design, construction, operation, and monitoring phases is fairly straightforward. Relevant techniques should be pro-actively selected from the list in Attachment 1 or from other sources, combined to form the most sustainable approach for the site and/or remedial phase and applied.

Additionally, there are a number of green remediation techniques which by their nature are easy to implement, and either save money or are only negligibly more expensive. DEC expects that the techniques identified below will be implemented at sites unless a site-specific evaluation demonstrates impracticability or favors an alternative green approach.

- Use of renewable energy and/or the purchase of renewable energy credits (RECs) or a combination of the two techniques to offset 100% of the electricity demand at the site.[1]

[1] Purchase of "green Power" through an energy services company (ESCO) generally costs less than 0.5% of the overall operation and maintenance cost of a remedy. This cost may be off-set by more efficient designs.

- Reduce vehicle idling. All vehicles, both on and off road (including construction equipment) will be shut off when not in use for more than 5 minutes, consistent with 6 NYCRR Part 217 Motor Vehicle Emissions, Subpart 217-3 Idling Prohibition For Heavy Duty Vehicles.
- Design cover systems, to the extent possible, to be usable for alternate uses such as habitat or passive recreation, require minimal maintenance (e.g. less mowing), allow for infiltration of storm water and/or be integrated with the next use of the site.
- Beneficially reuse materials that would otherwise be considered a waste (e.g. crushed clean concrete as base or fill).
- Use of Ultra Low Sulfur Diesel (ULSD).

B. Role of Sustainability in Remedy Selection

Frequently the greatest benefit to the environment from the application of the green remediation concept can be realized at the remedy selection phase. Many factors are considered when selecting a remedy (e.g. the nine remedy selection criteria in 6NYCRR Part 375). Sustainability/green remediation is an aspect of one or more of the existing criteria. DEC is utilizing these concepts to support selection of the best remedy for a site. The consideration of sustainability in remedy selection is consistent with existing statutes, regulations, and guidance. Remedies will still be selected in accordance with applicable regulations, standards, policies, and guidance documents and all selected remedies shall still, at a minimum:

- protect public health and the environment;
- address source removal and control;
- address groundwater protection and restoration; and
- strive to meet the cleanup goal of the respective program (e.g., pre-disposal conditions for State Superfund sites; pre-release for petroleum spills).

All remedial parties, DER staff, and DER standby consultants and contractors should now consider sustainability/green remediation concepts when assembling and evaluating remedial alternatives.

Remedies selected under programs subject to 6NYCRR Part 375 (i.e., the State Superfund Program, Brownfield Cleanup Program, and Environmental Restoration Program), shall still be selected in accordance with the nine remedy selection criteria set forth at 375-1.8(f). Under Part 375, sustainability is primarily evaluated as part of the long-term effectiveness and permanence criterion and the short-term impacts and effectiveness criterion, but it may affect implementability, cost effectiveness, community acceptance, and land use.

Determining which remedial alternative will have the greatest net benefit to the environment or create the least direct, indirect, or life-cycle impact is not always obvious, and can be complex. Both quantitative and qualitative green metrics can help in this determination. However, these metrics can be difficult to normalize across technologies and alternatives. In order to compare the potential impacts of remedial alternatives, the following specific evaluations will be included as indicated in alternatives analysis documents (including feasibility and corrective measures studies).

- At a minimum, a qualitative assessment of total impacts related to the remedial alternatives being considered (e.g., direct and indirect sources of GHGs and relative scale of the GHGs, material reused on site or disposed, travel required to maintain the remedy) will be discussed

and relative impacts of the remedies compared. For example, "Alternative A uses significantly less electricity over the anticipated life of the remedy than the other alternatives and therefore results in less indirect emissions of GHGs. However, Alternative A requires the use of more heavy equipment for transportation, resulting in greater direct emissions and fuel use".

- If necessary to differentiate between remedies that offer equivalent public health and on/near site environmental protection, relevant and readily calculable metrics related to direct and indirect impacts for each alternative should be quantified. DER is not requiring a life-cycle analysis to determine upstream impacts as part of this quantitative analysis. Normalizing appropriate data to a common unit such as tons GHGs or CO_2 equivalents may be helpful and would be acceptable. Quantitative tools for calculating the relative impacts of various remedies are becoming widely available and may be used. All relevant metrics should be included in the analysis. The following are examples of the types of metrics that may be included.

    - Energy or emissions required to construct and operate the remedy. Direct emissions that are most relevant include stationary combustion of fuels (for generation of electricity, heat, etc.) and mobile combustion of fuels (for construction and transportation, including transportation of materials and waste and travel for operation and maintenance). Direct emissions could also include fugitive emissions and emissions from physical and/or chemical processes on site. Indirect energy use or emissions which are most relevant are related to generation of purchased electricity, heat, etc.;
    - Fuel use (e.g. gallons of diesel fuel or gasoline);
    - Volume or weight of material (e.g. construction and demolition debris) reused on site;
    - Tons of waste disposal avoided;
    - Linear feet of stream bank returned to natural conditions (e.g. from bulkhead to vegetated); and
    - Any other large direct or indirect imparts, emissions or potential emission sources may also be considered.

- Quantification of upstream emissions from the extraction, production and transportation of purchased materials and fuels is not anticipated to be required to differentiate remedial alternatives. DEC may consider any voluntary submission of upstream emissions data. This analysis, if provided, should be completed using widely available and generally accepted tools and techniques, and following generally accepted protocols such as the Climate Registry General Reporting Protocol. DEC could request upstream emissions quantification if needed to support remedial decisions.

DER will consider all sustainability and green remediation information presented, including qualitative and quantitative metrics. Energy use, emissions, effect on habitat and site reuse, and other sustainability issues will help to differentiate remedial alternatives that offer the same or similar level of on/near site environmental and public health protection. The concept of green remediation will not be used to justify "no action" or to implement a lesser remedy when a more comprehensive remedy is appropriate and feasible. *Sustainability will be considered as part of the evaluation of an appropriate remedy.* Alternatives with the following characteristics will likely be the greenest:

- Fewer short-term and long-term ancillary impacts to the environment;

- Fewer GHG emissions;
- Smaller environmental footprint;
- Achieves the remedial action objectives more sustainably;
- Allows for the greenest reuse;
- Achieves a complete and permanent cleanup; and
- Permanently and significantly reduces the toxicity, mobility or volume of contamination.

C. Documentation of Green Remediation Efforts

All green remediation efforts will be documented by the project lead (State, RP, etc.). DER is not requiring that the green remediation documentation conform to a particular format at this time. The information may be included in the document text, included as an appendix, or submitted and referenced as a separate supporting document such as a sustainability analysis report.

- In general, since green remediation/sustainability concepts are to be considered and/or implemented in all phases of site investigation and cleanup, any report of work during these phases which is submitted to DEC should describe the green remediation/sustainability efforts.

- All remedial alternatives analysis and decision documents will describe the green remediation principles considered in the evaluation and/or selection of the remedy, will present or reference any qualitative and/or quantitative sustainability information generated in support of remedy selection, and will discuss how the impacts can be minimized during implementation. Decision documents will also require that green remediation and sustainability efforts be implemented to the extent feasible in the design and implementation of the remedy.

- Corrective action modules for new Hazardous Waste Management Permits or Permit renewals issued under 6 NYCRR 373-2 (the RCRA Program) shall include conditions which require the Permittee to consider green remediation principles in all phases of the remedial process and to document their evaluation.

- In addition to statutory and regulatory requirements, final engineering reports must include a discussion of the green remediation practices/technologies employed throughout the remedial program.

- Green remediation principles must also be considered during each periodic review and remedial system optimization review conducted during the site management phase. The reports of the these reviews will discuss the green remediation principles employed during the past reporting cycle and any associated quantitative or qualitative reductions in impacts to the environment and will make recommendations that can be employed during the next reporting cycle.

VI. Related References

Web Sites:

NYSDEC Mission and Issue Priorities
NYSDEC Environmental Cleanup and Brownfields
EPA Green Remediation
ASTSWMO Greener Cleanups Information Resources

Documents:

EPA Green Remediation Primer: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites. EPA 542-R-08-002. April 2008.

EPA Draft Green Revitalization Think Piece. December 26, 2007.

Smart Energy Resources Guide (SERG). EPA/600/R-08/049. March 2008.

Introduction to Energy Conservation and Production at Waste Cleanup Sites. EPA Engineering Forum Issue Paper. EPA 542-S-04-001. May 2004.

Better Site Design. NYSDEC, Division of Water. April 2008.

EPA Case Study: " A Construction and Demolition Waste Reduction Success Story ". EPA 560-F-09-001. January 2009.

Recover Your Resources: Reduce, Reuse, and Recycle Construction and Demolition Materials at Land Revitalization Projects. EPA 560-F-08-242. April 2008.

Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements. NYSDEC Commissioner Policy, Office of Air, Energy and Climate. July 15, 2009.

CP-49/Climate Change and DEC Action. NYSDEC Commissioner Policy. October 2010.

Air Force Center for Engineering and the Environment Sustainable Remediation Tool (SRT™)

Navy/Army Corps/Battelle SiteWise™ Tool

Protocols for life-cycle GHG emissions estimation:

- EPA's Climate Leaders Program Design Principles Guidance and Climate Leaders Basic Information
- Climate Registry General Reporting Protocol

Attachment 1
Examples of Green Remediation Techniques

Examples of Green Remediation Techniques Applicable to all Phases of the Remedial Programs
Increase energy efficiency/Minimize total energy use and direct and indirect CO_2/GHG emissions to the atmosphere
Reduce emissions of air pollutants
Minimize habitat disturbance and create or enhance habitat or usable land
Conserve natural resources such as soil and water; promote the sequestration of carbon through reforestation or afforestation
Minimize fresh water consumption and maximize water reuse during daily operations and treatment processes
Prevent long-term erosion, surface runoff, and off-site water quality impacts
Prevent unintended soil compaction
Minimize waste or implement beneficial use of materials that would otherwise be considered a waste
Minimize equipment and truck idling and use sustainably produced biofuels to reduce discharges of pollutants and GHGs to the atmosphere
Utilize clean diesel (new or retrofitted) equipment to reduce emissions to the atmosphere
Minimize truck travel for disposal to save energy, reduce emissions, reduce localized noise, vibration, and wear and tear on roads
Minimize use of heavy equipment to save energy and reduce emissions
Examples of Green Remediation Techniques Applicable to the Remedy Selection, Design and/or Construction Phases
Maintain, use, mimic or enhance natural processes where possible to effect remediation
Encourage development and evaluation of low energy alternatives such as enhanced bioremediation, phytoremediation, permeable reactive barriers (PRBs), source removal with monitored natural attenuation (MNA), enhanced attenuation of chlorinated organics (EACO), engineered wetlands, and remedies which can be driven to MNA or monitoring only (e.g., remedies which will not need external power indefinitely)
Use renewable energy if possible, or purchase Renewable Energy Credits
Evaluate if a remediation system could be protective with an intermittent energy supply (e.g., pumping or venting only during daytime or adequate winds)
Encourage the use of remediation technologies that permanently destroy contamination to reduce impacts associated with long-term site management
Address sources more aggressively to reduce long-term operation and maintenance of treatment or containment systems

Design for efficiency (e.g., size motors optimally) to reduce indirect emissions of electricity production
Design adaptable systems (e.g., systems that use less energy as the site cleans up)
Incorporate green building design
Reuse existing buildings and infrastructure to reduce waste
Reuse and Recycle construction and demolition (C&D) debris and other materials
Maximize beneficial use of materials that would otherwise be considered a waste
Integrate remedial design with contemplated reuse of site
Design cover systems to be usable (e.g., habitat, recreation, renewable energy generation, bio-fuel crop production)
Design storm water management or cover systems to recharge aquifers/minimize the creation or replacement of impervious surfaces
Use native vegetation requiring little or no irrigation
Reclaim treated water for beneficial use such as process water or irrigation
Examples of Green Remediation Techniques Applicable to Site Management
Focus on optimization to reduce energy use or time to closure
Increase energy efficiency/minimize total energy use and CO_2/GHG emissions to the air by replacing equipment, altering operation or shutting down unnecessary equipment
Improve reliability to reduce O&M visit frequency
Evaluate the possibility of switching to renewable energy either directly (generated on site, off-grid or grid-tied), or indirectly through a utility (green power purchase program)
Complete the Remedial Site Optimization Process to identify opportunities to reduce energy and other impacts
Incorporate sustainability into periodic reviews to identify opportunities to reduce energy and other impacts
Assess if an energy intensive remedy is still the best remedy for the site
Evaluate the possibility of MNA for sites where this was not originally considered