Association of State and Territorial
Solid Waste Management Officials
(ASTSWMO)

Incorporating Greener Cleanups into Remedy Reviews

Prepared by the Greener Cleanups Task Force
Under the Sustainability Subcommittee

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Acronyms

AS/SVE	Air Sparging/Soil Vapor Extraction
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
L.U.S.T	Leaking Underground Storage Tank
MNA	Monitored Natural Attenuation
NPL	National Priority List
O&M	Operation and Maintenance
RCRA	Resource Conservation and Recovery Act
RAO	Remedial Action Objectives
ROD	Record of Decision
RP	Responsible Party
RSE	Remediation System Evaluations
RSO	Remedial Site Optimization or Remedial System Optimization
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VCP	Voluntary Cleanup Program

Introduction

All remedies should be reviewed periodically to assess both the protectiveness and the net benefit to the environment (sustainability). Review of a remedy and recommendation of greener cleanup enhancements represents an investment in staff time and resources with the potential for significant returns in the areas of efficiency, effectiveness and net environmental benefit. Greener cleanups recommendations may also produce secondary benefits such as reducing costs and hastening site closure. This type of review can be incorporated into the existing periodic review processes, which have historically focused on the protectiveness of the remedy. The sustainability of the remedy could be integrated into the existing protectiveness review process or considered separately.

It is appropriate to review the sustainability of remedies regardless of the remedial technology or remedial program (e.g., CERCLA, State Superfund, RCRA, Responsible Party, Brownfields, Voluntary Cleanup, L.U.S.T. and Petroleum Spill Remediation sites).

Background/Drivers

CERCLA (Federal Superfund) Section 121 requires "that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site be subject to a five-year review."[1] These reviews focus on evaluating whether or not the remedy remains protective of human health and the environment. The CERCLA review process does not explicitly include review of the sustainability or net environmental benefit of a remedy, nor does it explicitly exclude it. CERCLA requires 5-year reviews of all remedies selected under CERCLA §121 but other 5-year reviews may be conducted at the discretion of the Regions. States may have similar programs which are voluntary or driven by State guidance or regulation.

In the absence of regulations or guidance, there are other drivers or incentives for remedy reviews such as improved benefit to the environment and cost savings. These other drivers or incentives can be particularly important when the State is funding the remediation. Reviewing the remedies relative to green remediation concepts[2] is consistent with State environmental agencies' missions to protect the environment. Further, States have begun to integrate sustainability goals into many of the programs which they implement externally and into internal policy and procedures.

Incorporating green remediation concepts into periodic reviews is most beneficial for remedies with active remedial components, such as extraction and treatment (pump and treat) or AS/SVE, which include pumps, blowers and other treatment equipment. It is also appropriate for less active remedies such as enhanced biological degradation. The opportunities for significant improvement in sustainability and cost are, however, fewer with the less active remedies.

Triggers/Timing for Remedy Reviews

CERCLA has defined triggers for the start of the 5-year review cycle. For non-CERCLA sites, unless established in regulation or guidance, a review period may be developed by the State. The following are suggested times when a sustainability review might be conducted:

- Following a reasonable period of operation in which adequate data to conduct the study could have been generated;
- Any time a project (case) manager identifies a need for an in-depth evaluation of an active remedy;
- If the net environmental benefit is in question (e.g., using significant amounts of energy for little or no apparent remedial gain);
- When management needs an assessment of how long an active remedy is expected to be required to operate;
- When a RP site in the site management phase comes into the State Superfund program through a bankruptcy; and
- When a NPL site is transitioned from the USEPA to the State.

Incorporating Sustainability into CERCLA 5-Year Reviews

EPA's Comprehensive Five-Year Review Guidance document describes the recommended 5-Year Review format. Exhibit 3-3 of the guidance (Contents of a Five-Year Review Report table) includes specific topics to include in each section. In Section VII, Technical Assessment, three questions are posed, followed by a summary. Question A asks: "Is the remedy functioning as intended by the decision documents?" One of the specific topics suggested in response to this question is "opportunities for optimization". This section is an appropriate place in the CERCLA 5-Year Review to introduce and include greener cleanup concepts.

The above referenced guidance continues:

> "***Opportunities for optimization*** – If readily apparent during the course of conducting five-year review activities, identify any opportunities to improve the performance and/or reduce the costs of sampling and monitoring activities and operating treatment systems. If changes in these activities are recommended in the Five-Year Review report, you should also provide the rationale/basis for such changes. If appropriate, your report can also recommend that an optimization study be conducted."

It further gives an example for recommendations:

> ***"Optimize remedy*** – For example, when the limits of a groundwater plume have contracted due to pumping, and some monitoring wells no longer register

contamination levels above cleanup levels, it may be appropriate to revise the sampling plan to eliminate these wells from the sampling routine or reduce the frequency of their sampling. It may also be possible to remove specific groundwater extraction wells from service and increase or reduce the pumping rate on others to optimize groundwater remediation. Similarly, it may be possible to remove treatment units that no longer contribute to the achievement of remedial goals."

The text quoted above opens, in the form of a relevant greener cleanup example (e.g., shutting down of unnecessary equipment), the possibility of incorporation of greener cleanup recommendations into the 5-Year Review.

Process/Procedure

There are a variety of processes and tools available to assess and improve the sustainability of a remedy. Some general tools, described below, include RSOs, RSEs, and Engineering Audits. There is also technology specific guidance available, such as USEPA's optimization guidance for pump and treat systems. Regardless of whether or not the greener cleanup recommendations are made within the framework of a CERCLA 5-Year Review, RSO, RSE, Engineering Audit, or other periodic process, the greener cleanup recommendations should focus on improving the efficiency, effectiveness, and net environmental benefit of a remedy.

Remedial Site Optimization or Remedial System Optimization (RSO)
A RSO can be envisioned as a continuous improvement loop whereby the performance of the remedy is assessed, recommendations for improvement are made and implemented, and after a period of time the performance is again assessed. The cycle is repeated through the life of the active remedy.

Remediation System Evaluations (RSE)
A Remediation System Evaluations RSE is a tool developed by USACE to increase the effectiveness of existing long-term remediation systems. It consists of a series of checklists for various remedial technologies. The RSE process goes beyond the CERCLA 5-year review to address optimization (defined as a process by which the operation costs are reduced to the extent possible given the RAOs and the RSE level of effort). It is focused on remedy efficiencies to be achieved through streamlining treatment systems, the use of more efficient technologies, and other similar improvements.

Engineering Audit
An engineering audit is an appropriate tool for active remediation systems which can supplement the remedy review. Suggested components of the audit include the following:

Research

- Background file search / information gathering phase;
- Site visit including interviews with present and past operator(s), photographing and making observations;
- Review of field and analytical data from the operation and maintenance of the remedy; and
- Drawing upon and documenting operational experience.

Evaluation

- Review of remedial goals and remedial action objectives to determine if they are still appropriate and realistic;
- Evaluation of the site conceptual model for accuracy;
- Evaluation of the operation of the remedy to determine consistency with the ROD;
- Evaluation of progress toward the cleanup and comparison to the remedial goals and objectives;
- Evaluation of the appropriateness of the remedy and its ability to meet the stated remedial goals and objectives stated in the ROD;
- Assessment of the potential for terminating the active remedy and moving to MNA or monitoring; and
- Assessment of the sustainability of the remedy. This could include things such as energy usage, carbon footprint, air emissions, wastes generated and disposed, and raw materials utilized.

Recommendation

The recommendations may include concepts such as the following:

- Changes necessary to more efficiently and effectively target the contamination;
- Modification or optimization of system processes;
- Applications of new technologies and risk assessment approaches;
- Improvements in reliability/run time of systems to reduce the frequency of site visits for O&M;
- Modifications to processes if data suggests a cost savings and net benefit to the environment;
- Modifications or replacement of equipment to reduce energy costs and associated emissions;
- Reduction in sampling frequency and locations. Use of alternate analytical methods. Substitution of field analysis for laboratory analysis;
- Opportunities to reduce raw materials usage; and
- Opportunities to increase recycling and reduce wastes generated.

Other Issues:

Authority

For privately funded cleanups, States may lack the authority to require changes based upon reviews of the remedies, particularly if a remedy is otherwise compliant with regulations, guidance, and the oversight document (consent order, voluntary agreement). If the State performs the review, sharing the results of a remedy review with a responsible party (RP) could result in implementation of its recommendations, particularly if a cost savings may be realized by the RP in the near or long term. Further, this can demonstrate good faith on the part of the State in satisfying environmental goals without necessarily driving the RP's costs higher.

Funding Greener Cleanup Recommendations

A periodic remedy review may result in recommendations which require capital costs to implement such as changing or downsizing equipment. Typically, subsequent to the completion of the remedial construction, limited funds are available to make capital purchases which are not associated with operation and maintenance. For example, EPA's guidance Directive on Paying for Remedy Repairs or Modifications during the State-Funded Period of Operation and Maintenance (O&M), OSWER 9375.2-12, April 26, 2007, is focused on protectiveness, not efficiency or sustainability improvements.

A present worth analysis using a realistic projection of the anticipated time that the remedy must operate may demonstrate that a capital investment is more cost effective than continuing operation without the modifications. If there is no net increase in the present worth, this may be justification for making the changes. Alternatively, money for the capital improvements may need to come from the O&M budget.

Change of Remedy

A remedy review may reveal that while the remedy is protective, it is possible to make improvements to the sustainability of the cleanup beyond that which can be achieved through optimization. Some possible conclusions of the review which relate to the remedy selection include:

- The selected remedy is not appropriate (e.g., net negative environmental benefit);
- The selected remedy will not reach the remedial goals;
- Newer and more sustainable technologies have been developed since the ROD was issued; and
- Sustainability was not considered at the time that the remedy was selected.

To implement recommendations based upon these conclusions, however, would require an amendment to, or change of, the remedy. In these cases, a change in remedy may be

appropriate. If the indications are compelling enough, it may be prudent to evaluate an amendment or remedy change. The CERCLA 5-Year Review process concludes at the statement on protectiveness. It is uncommon to change or amend a selected remedy which is found to still be protective. For State funded cleanups, issues such as funding and cost recovery come into play. Regulatory agencies generally cannot compel a change to a selected remedy for a privately funded cleanup if the remedy is protective of human health and the environment and compliant with the regulations, however, modifying or changing a remedy may be mutually beneficial.

If there are significant sustainability gains possible and the present worth costs are comparable to the existing remedy, it may be worth pursuing changing or amending the remedy. The recommendation to consider changing the remedy should be advanced along with supporting documentation including the results of the remedy review, an economic evaluation (e.g., present worth analysis), and other supporting information such as the net benefit to the environment, site-specific issues and community factors. Remedy change would proceed in accord with existing relevant guidance.

References

[1] Comprehensive Five-Year Review Guidance, EPA 540-R-01-007 (OSWER No. 9355.7-03B-P), June 2001

[2] Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites. EPA/OSWER Office of Superfund Remediation and Technology Innovation. Technology Primer: EPA 542-R-08-002. April 2008.

U.S. Code Title 42, Chapter 103, subchapter I, § 9621 Cleanup standards (c) Review