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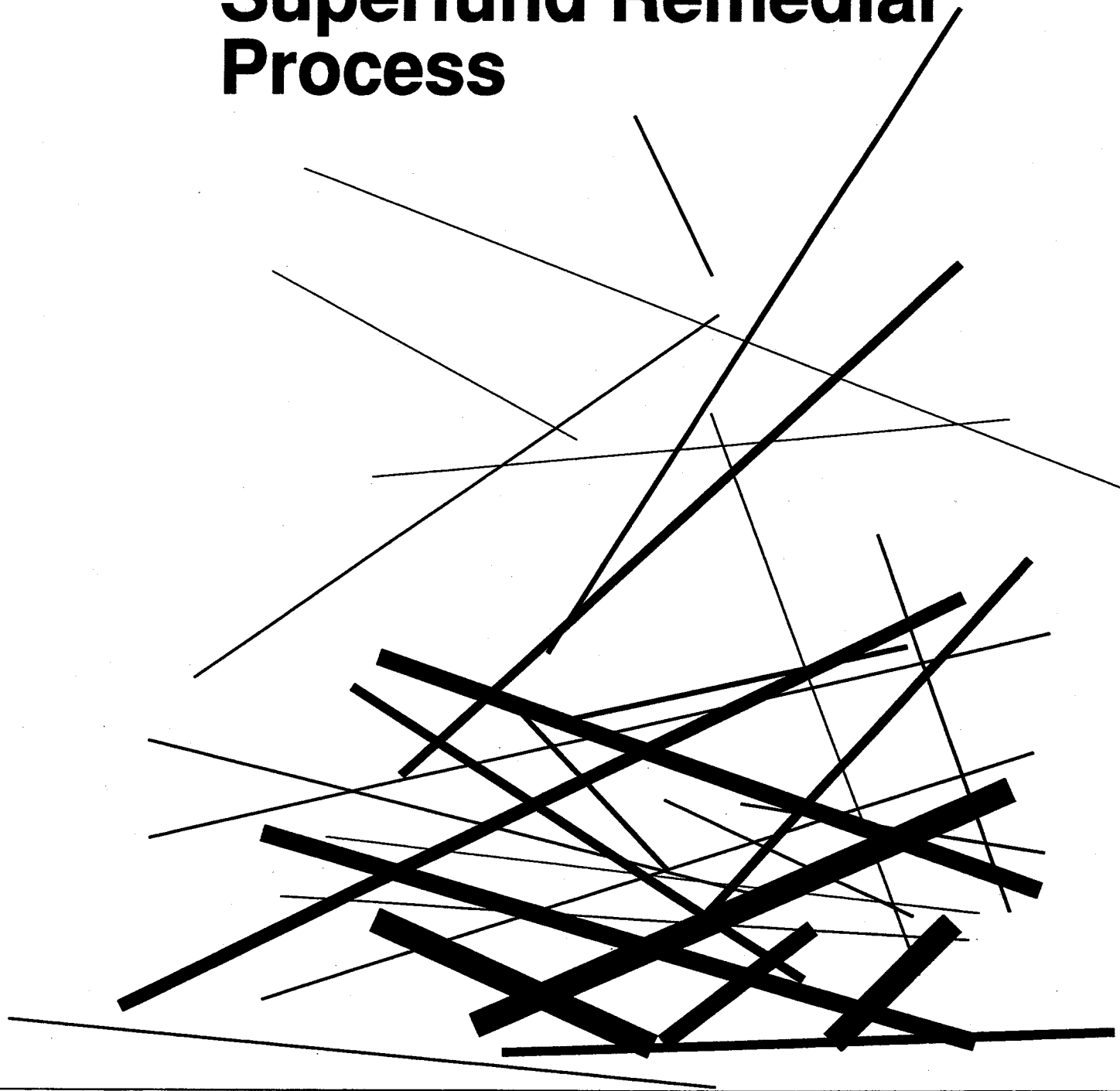
# Guidelines for Making Environmentally-Sound Decisions in the Superfund Remedial Process



# GUIDELINES FOR MAKING ENVIRONMENTALLY-SOUND DECISIONS IN THE SUPERFUND REMEDIAL PROCESS

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# Guidelines for Making Environmentally-Sound Decisions in the Superfund Remedial Process

## INTRODUCTION

In 1990, the Congress declared pollution prevention to be the national policy of the United States. The Pollution Prevention Act of 1990 states that

> "...pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner."

The idea of minimizing the amount of hazardous waste generated is not new in regulatory history. In 1986, with the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA), the Congress declared that "...wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible." The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 mandates the selection of remedial actions that utilize resource recovery technologies or permanent solutions to the maximum extent practicable. The Pollution Prevention Act codifies the evolution of this Nation's thinking concerning the best way to address the problems of environmental management.

Over the past several months, representatives from the Offices of Superfund and Program Management with a shared interest in pollution prevention have met to discuss its applicability to Superfund. The first issue that needed to be addressed was whether or not pollution prevention even applies to the Superfund program. Although the Pollution Prevention Act embodies an environmental management hierarchy, U.S. EPA defines pollution prevention as source reduction only. On first thought, one might conclude that since Superfund deals with waste that has already been generated, there is no opportunity for the pollution to be "prevented or reduced at the source." If, however, one thinks of the Superfund program itself as a generator of hazardous waste, opportunities for pollution prevention do present themselves. Actions can be taken during the course of the investigation and cleanup, be it Superfund or RCRA corrective action, that reduce the amount of waste generated. Fifty-five gallon drums could be cleaned and reconditioned, instead of landfilled. Solvents could be recycled instead of being incinerated. Treatment trains could be employed to reduce the volume of waste requiring final disposal. Whether it's called "pollution prevention", "waste minimization", or "waste reduction" (as we will

call it in this document), the goal of the authors is to promote a mind set that will result in less waste being generated during the investigation and cleanup process, and will encourage project managers to look for opportunities for making environmentally-sound decisions throughout the remedial process.

The purpose of the guidelines that follow is to help project managers identify, assess, and implement opportunities for limiting waste generation during the remedial process of the Superfund program. It may not be apparent at first where opportunities exist outside of selecting remedies that use resource recovery technologies, but waste reduction approaches can be applied to all waste generating activities. Although these guidelines are geared towards Superfund, similar situations exist during RCRA corrective action.

Waste reduction opportunities are identified in the following sections:

- Remedial Investigation - minimization of waste in the investigation and reporting processes

- Feasibility Study - incorporation of recycling, recovery technologies, and waste minimization in the alternatives array

- Early Actions and Presumptive Remedies - mitigation of future contamination through accelerating the remedial process

- Remedial Design/Remedial Action - minimization of waste generated during field work, and reusing on-site materials to the maximum extent practicable

- Enforcement Settlements - inclusion of pollution prevention conditions in enforcement documents

- Community Relations - educating the public about pollution prevention

Paper reduction opportunities are discussed in Attachment A, and may be used during any part of the remedial process. Technologies and their waste reduction advantages and disadvantages are discussed in detail in Attachment B. Specific examples of projects in Region V where waste reduction concepts are being utilized or considered are discussed in Attachment C. Attachment D includes examples of language which incorporates pollution prevention provisions into enforcement settlements. Keep in mind while reading these guidelines that the overall goals are to reduce, as appropriate, the need to treat or dispose of waste, and to conserve energy and resources.

## REMEDIAL INVESTIGATION ACTIVITIES AND WASTE REDUCTION

Scoping

The amount of generated waste and residuals that require treatment or disposal can be reduced through proper planning of all Remedial Investigation (RI) activities. It is during scoping, the first step in the RI process, where most of this planning occurs. In order to limit waste generation during the investigation, it is important to write sound waste reduction practices into the scoping documents, which typically include a work plan, a field sampling plan, and a quality assurance project plan (QAPP). Otherwise, these practices may be overlooked.

Additional deliverables developed during the scoping process usually include a health and safety plan and a community relations plan. The project team should remember to apply the paper reduction techniques discussed in Attachment A while developing all of the scoping documents. If the investigation is phased or broken into operable units, project managers can rely heavily on what has already been written for an earlier operable unit or phase by referencing plans rather than including or repeating them.

The field sampling program developed during scoping should concentrate on collecting only the amount of data needed to sufficiently characterize the site, to assess risks posed by the site, and to evaluate the most practicable remedial actions for the site. Waste generation during field sampling may be minimized in the following ways: 1) an efficient sampling program, 2) limiting investigation-derived waste, and 3) minimization of decontamination events and activities. These ideas are discussed in more detail in the following paragraphs.

**An Efficient Sampling Program.** An efficient sampling program will take into account the evaluation of existing site data, and will be designed to minimize the number of samples collected.

Project managers should evaluate and use existing site data, such as data collected during the Preliminary Assessment/Site Inspection (PA/SI) process. The quality and quantity of the existing data may be adequate enough to make decisions at the site. Minimally, existing data should be used to focus the collection of additional samples.

The number of samples that will be collected and subsequently analyzed may be minimized to reduce the use of energy, money, water, and laboratory chemicals, while minimizing the volume of sample residuals which will require disposal. Project managers can use field screening methods to help strategically place and limit the number of samples collected. *Field Screening Methods Catalog - User's Guide* (September 1988, EPA/540/2-88/005) assists in identifying field screening methods applicable to specific site types. Statistical methods and guidance can be used to determine the minimum number of samples required to make decisions. The minimum number of samples required to adequately evaluate background chemical concentrations at a site should also be defined up front. Project

managers should work with the state to decide if regional background levels, or background concentrations determined for another site in the area, can be used at their site. Helpful references for designing a data collection program include *Guidance for Data Useability in Risk Assessment, Part A* (April 1992, PB92-963356) and the *Data Quality Objectives for Remedial Response Activities, Volumes 1 and 2* (March 1987, EPA/540/G-87/003,004).

**Limiting Investigation-Derived Waste.** Project managers should also strive to limit the generation of Investigation-Derived Wastes (IDW), such as development water, purge water, drilling mud, cuttings, materials from collection of samples, and personal protective equipment (PPE). If possible, IDW should be considered part of the site and should be managed with other wastes from the site, consistent with the final remedy. This will avoid the need for separate treatment and/or disposal options. If protective, avoid containerizing IDW and return it to its source. Some states may require that IDW be handled as solid waste once it is containerized even if it is found to be nonhazardous. Site managers may want to consider drilling methods and sampling techniques that generate little waste. Alternative drilling and subsurface sampling methods may include the use of small diameter (2-inch) boreholes, the use of drilling procedures that utilize air versus mud, as well as borehole testing methods such as cone penetrometer or hydropunch instead of coring. Site managers should also be careful to keep hazardous wastes separate from nonhazardous wastes in order to avoid cross-contamination. Additional ideas to minimize IDW can be found in the *Guide to Management of Investigation-Derived Waste* (January 1992, PB92-963353).

**Minimization of Decontamination Events and Activities.** The RI plans should specify field work support activities, especially decontamination procedures, that will limit the amount of waste created during the investigation. The project team should consider substituting less toxic, aqueous-based, or phosphate-free cleaners for solvent-based cleaners used for decontamination of equipment and clothing. The team should also plan to keep decontamination events and activities to a minimum. For example, the exclusion zone should be planned for convenience and to limit traffic between hot and clean zones to decrease decontamination events and activities. The field crew can use dedicated sampling equipment and containers to reduce the frequency of decontamination. Project managers should remember that these field support activities can also be applied to Remedial Design or Remedial Action field work.

Site Characterization

After scoping, the next step in the RI process is site characterization during which field sampling and laboratory analyses are initiated and conducted. This is when implementation of the waste reduction practices written into the scoping plans should begin. If field sampling is phased, the results of the initial sampling effort should be used to refine plans developed during scoping. During field work, implement the waste minimization procedures described above and use good housekeeping practices (e.g., prevent leaks and spills, avoid using excessive amounts of decontamination fluid and other materials).

## FEASIBILITY STUDY ACTIVITIES AND WASTE REDUCTION

Feasibility Study Report

The RI is generally followed by a Feasibility Study (FS) in which remedial alternatives are developed and evaluated. It is important to identify and retain reuse/recycle technologies during the technology identification and screening steps of the FS. The best potential for waste reduction in the Superfund remedial process may be the "refining" of Superfund wastes to recover a product that can be reused or recycled. SARA's mandate is to select remedial actions that utilize permanent solutions and alternative treatment technologies or (emphasis added) resource recovery technologies to the maximum extent practicable. The tendency in Superfund, to date, has been to select remedies involving treatment. To incorporate waste reduction into our decision making, consider retaining resource recovery or recycling when assembling technologies into alternatives and performing the detailed analysis. When reuse or recycle alternatives are impracticable, consider and retain alternatives that reduce the volume of waste and/or minimize residuals, and do not simply transfer contaminants from one medium to another.

These guidelines, in part, are intended to be used for incorporating waste reduction procedures into the remedy selection process. The feasibility of including waste reduction practices as part of any recommended alternative will, of course, be subject to the statutory requirements of CERCLA/SARA and the evaluation criteria established in the National Contingency Plan (NCP).

Technologies

Technologies to consider during the FS, and their environmental benefits, are described in Attachment B. Examples of technologies and sites where these technologies are being or have been used or explored include:

- Resource recovery/recycling
  - Solvent recovery at removals
  - Recycling or smelting of drums and containers (Laskin Poplar Oil)
  - Metals recovery (Arrowhead)
  - Waste oils and hazardous waste burned as fuel, e.g., BTU recovery in a Boilers and Industrial Furnaces (BIF) unit (St. Louis River)
  - Methane recovery from landfills
  - Product recovery, e.g., free oil off water table (Koch Refinery)

- Volume reduction
  - Soil washing (Macgillis & Gibbs)
  - Particle separation (GLNPO studies)
  - Solvent extraction (Fields Brook)
  - Ground water applications, e.g., SPB membrane filtration

- ♦ Chemical alternation/neutralization
  - · Chemical dechlorination, e.g., APEG, KPEG

- ♦ Thermal treatment
  - · Incineration (Laskin Poplar Oil)
  - · Low temperature thermal desorption (OMC)
  - · Boilers and Industrial Furnaces

- ♦ In-situ remediation
  - · Soil vapor extraction (Verona, Seymour)
  - · Bioremediation (Seymour)

Attachment C contains specific Region V examples of Superfund projects that have utilized or have considered some of these technologies.

Since this document is intended to be primer on waste reduction opportunities in the Superfund remedial process, it simplifies and summarizes technical discussions about technologies. A good source of detailed technical information about these technologies is *Innovative Treatment Technologies, Overview and Guide to Information Sources* (October 1991, EPA/540/9-91/002). Within the Waste Minimization, Destruction, and Disposal Research Division of the U.S. EPA-ORD Risk Reduction Engineering Laboratory (RREL) in Cincinnati, Ohio, is a branch dedicated to pollution prevention research. This branch, along with the Office of Solid Waste of U.S. EPA Headquarters, was recently involved in the production of the *Facility Pollution Prevention Guide* (May 1992, EPA/600/R-92/008). The Guide, along with its predecessor, the *Waste Minimization Opportunity Assessment Manual* (July 1988, EPA/625/7-88/003), guides the reader through the decision making process of applying waste minimization and source reduction concepts to various processes. Although developed primarily with industry in mind, these concepts can be part of the evaluation of technologies and treatment train options during the alternatives screening process. For more information on this document, or to identify any research efforts that may help with a particular waste stream, contact Lisa Brown of the Process Engineering Section at (513) 569-7634. The *Facility Pollution Prevention Guide* is planned to be updated every three years and can be ordered from CERI by calling (513) 569-7562.

Treatability Studies

Treatability studies are conducted to provide additional information for evaluating technologies, or to reduce cost and performance uncertainties for treatment alternatives. Treatability studies will generally include the following steps: 1) preparing a work plan for the bench or pilot studies, 2) performing field sampling, bench, and/or pilot testing, and 3) evaluating data and preparing a brief report. Project managers should try to apply paper reduction techniques when developing treatability study documents, by using existing site plans, including QAPPs, to the maximum extent possible. Site managers should strive to conserve resources, including internal resources. A treatability study QAPP will often not

require review and approval by the Quality Assurance Section if the testing performed during the treatability study is related only to the engineering or operating parameters of a cleanup method. Project managers should also try to limit sampling and waste generation during the study. These and other waste reduction practices should be specified in any treatability study plans to ensure these practices are implemented.

Treatability studies provide a great opportunity to focus on treatment trains which minimize residuals and do not simply transfer pollutants to other media. Treatability studies also allow investigation/refinement of environmentally-beneficial technologies, e.g., technologies which conserve energy or other resources.

## EARLY ACTIONS AND PRESUMPTIVE REMEDIES

At any point during the RI/FS, the project manager should evaluate the potential for early actions and/or presumptive remedies. One of the most environmentally-beneficial tasks that can be performed at Superfund remedial sites is an early action remedy. For example, any early action ground water removal and treatment remedy will reduce the amount of ground water that comes into contact with the contaminated plume. Early action removal of source materials that are grossly contaminated, followed by a cleanup of any material with a residual risk, reduces the potential for further migration of highly contaminated media.

Currently, U.S. EPA is working on incorporating presumptive remedies into the Superfund process. Presumptive remedies will streamline, and hopefully shorten, the RI/FS process by using past experience to focus on the most likely remedies for specific types of sites (e.g., wood preserving facilities, landfills). Streamlining the RI/FS process will enable remedial action to be initiated relatively quickly. Quick action controls the migration potential of the contaminated media earlier; consequently, a lesser volume of media becomes affected by the contamination. For example, a cap is usually a component of a presumptive remedy for a municipal landfill site. Evaluating the need for and installing a landfill cap early in the site assessment and cleanup process would prevent the vertical infiltration of surface water into the landfill. Hence, less leachate would be created and less ground water would become contaminated.

Of course, these activities make good sense from a project management standpoint. These guidelines reemphasize the need to take early action at Superfund remedial sites in an effort to minimize the amount of contaminated media that needs to be remediated.

## REMEDIAL DESIGN/REMEDIAL ACTION ACTIVITIES AND WASTE REDUCTION

Remedial Design (RD) activities involve the preparation and review of the bid specifications and the specific Remedial Action (RA) contractor plans (if any) as outlined in the specifications. Paper consumption and EPA resources can be reduced by requiring less than

four design packages (30%, 60%, 90%, and final). This decision will be based on the scope and complexity of the RA.

Waste reduction activities discussed for the RI field work may be applicable throughout the remedial process. These activities include prudent management of purge water and drilling mud. Also, careful selection and minimization of decontamination fluids should be continued from the RI phase into the RA.

Site managers may also want to consider using available on-site soils and materials to the maximum extent possible during the RA for backfilling or material handling purposes. This allows for reuse of soil and/or debris and negates the need to pay for extra materials and transportation from off-site sources. However, project managers should be cautioned that if the soil used as backfill is mixed with a restricted RCRA hazardous waste, the backfilling might constitute "disposal" and may trigger the RCRA Land Disposal Restrictions.

## RECYCLING/REUSE AND PURCHASE OF RECYCLED MATERIALS

Opportunities for recycling or material reuse exist throughout the remedial process. For example, fifty-five gallon drums are often needed only temporarily on-site, for collecting purge water, PPE, etc. Once the drums are no longer needed, consideration should be given to reusing them for a later phase of the work, to using them at another site, or to sending them to a drum recycler/reconditioner instead of to a landfill. Another idea is to set up bins on-site for collecting employees' paper, cans, bottles, newspapers, etc., for recycling. Other environmentally-beneficial options, such as purchasing recycled materials (e.g., reconditioned drums), will become apparent as recycling and reuse is emphasized. Project managers should recognize that the Federal Government is the nation's largest consumer, and as such, they can help stimulate the market by purchasing items made of recycled materials.

Recycling or reusing site debris during the remedial action should be considered. Both large rocks found during excavation and debris could be decontaminated and used for backfill, as appropriate. Decontaminated metal debris could be recycled. The project manager may need to work closely with the PRPs and possible recyclers to encourage the reuse of site materials. Once field work begins, more site specific waste reduction and recycling opportunities will reveal themselves.

## ENFORCEMENT

Enforcement activities are an important part of every Superfund site. U.S. EPA encourages meaningful PRP participation during the investigation and cleanup of sites. This is accomplished by negotiating with the PRP an Administrative Order or Consent Decree, which will generally contain the scope of the activities to be performed, oversight roles and

responsibilities, and the enforcement options that may be exercised in the event of noncompliance.

Project managers should be creative and encourage the inclusion of pollution prevention conditions in the Agency's enforcement settlements, including settlements with Federal facilities. For example, project managers could require in the order/decree the implementation of some of the paper reduction techniques discussed in Attachment A.

The project manager may also suggest that the PRP submit, obtain U.S. EPA approval for, and undertake an environmentally-beneficial project or a supplemental environmental project in exchange for a reduction in the amount of an assessed penalty. Supplemental environmental projects have to meet certain criteria described in Agency policy regarding the kinds of projects that are appropriate for penalty reduction, situations under which they should be considered, and the amount by which the penalty demand can be reduced. The policy describes five specific categories of projects the Agency will consider as supplemental environmental projects in a settlement: pollution prevention, pollution reduction, environmental restoration, environmental auditing, and public awareness. It may be possible to undertake a supplemental environmental project at the Superfund site itself, especially if the site is an operating facility or there is a chance to create or restore a wetland on an abandoned part of the site. Alternatively, PRPs often own or operate other facilities where such projects may be undertaken.

While supplemental environmental projects in lieu of civil penalties are common with respect to RCRA settlement documents, this approach is not commonly employed in Superfund. These projects have the potential to provide useful environmental benefits, but will require close coordination within the Agency and with other interested parties. Examples of language which specifically incorporates pollution prevention provisions into enforcement settlements are provided in Attachment D. For more information, contact your site attorney, Terry Branigan at 353-4737 or Jacqueline Kline at 886-7167 in ORC, or Susan Swales at 353-4775 in RCRA.

## COMMUNITY RELATIONS

One of the strengths of the Superfund program is in its accessibility to the public. Perhaps more than with any other program in the Agency, the Superfund program provides opportunities to educate and to disseminate information to the public.

At those points in the remedial process where community relations activities occur, the project manager should emphasize those aspects of an investigative activity or a remedy selection that have waste reduction merits. The project manager may accomplish this by informing the Community Relations Coordinator of these merits, documenting them in proposed plans and fact sheets, and pointing them out during public meetings. Doing so may

increase the public's acceptance of a chosen remedy and enhance cooperation between the public, the state agency, U.S. EPA, and PRPs.

Education is also an important element of Superfund's outreach. Project managers could use public meetings as opportunities to inform citizens about what they can do, on a personal level, to prevent pollution. Placing pamphlets, facts sheets, and other educational materials about pollution prevention on a table near the entrance to the meeting room is an easy and effective way to disseminate information. This information can be either general in nature or tied to the type of contamination at the site. For example, at a site where petroleum contamination is a problem, the project manager may provide information on recycling used motor oil. Check frequently with the Office of Public Affairs for handouts; new fact sheets are always being developed.

## CONCLUSION

The goal of the Superfund Program is to clean up uncontrolled hazardous waste sites and to prevent the further release of contaminants that pose unacceptable human health and ecological risks. The RI/FS phase of the cleanup process involves determining the nature and extent of contamination at a site and the development of alternatives for the remediation of the contamination. With appropriate foresight and planning, the work that is done during the RI/FS can be performed so as to reduce the release of hazardous substances into the environment by incorporating waste reduction principles and practices into the process.

The opportunities available for limiting the environmental impacts of RI activities, as suggested in these guidelines, are intended to facilitate the reduction of waste materials and administrative paper generated during the investigation. Site scoping can be an effective means of minimizing investigation-derived waste by limiting the amount of sampling performed, incorporating existing data to focus sample collection, and using field screening methods. Sample collection procedures that limit the amount of material collected, and good housekeeping practices are additional tools for minimizing waste generation.

Remedial alternatives that minimize or eliminate the amount of residual waste material should be fully explored during the FS. The treatment technologies outlined in these guidelines represent a few of the approaches that may be taken to accomplish waste reduction goals.

As discussed earlier, the implementation of early actions at Superfund sites helps control the spread of contaminants because less contaminated material will ultimately need to be removed and/or treated. Consequently, less energy is needed to treat the material, and the amount of treatment residuals produced is reduced. In addition, presumptive remedies can allow the agency to streamline the Superfund evaluation and cleanup process, thereby improving consistency, reducing costs, and increasing the speed with which sites are cleaned up.

The RD/RA phase of a cleanup project offers opportunities for waste reduction similar to those identified for the RI. These include such considerations as focusing on prudent field activities and decontamination procedures, minimizing document reviews, and implementing other appropriate paper reduction techniques.

Emphasis placed on the waste reduction aspects of the remedial process may also facilitate PRP cooperation, particularly if it offers cost-savings, shorter implementation times, and/or the potential for eliminating or significantly reducing hazardous residuals during a cleanup, for which the PRPs would, otherwise, still be held liable. Specific pollution prevention requirements can be incorporated into consent decrees or other enforcement documents, both in relation to implementation of paper reduction techniques and to actual on- or off-site activities.

There is a move in this country to shift the emphasis of environmental protection away from end-of-pipe controls to pollution prevention. Although U.S. EPA's working definition of pollution prevention is source reduction only, the pollution prevention "philosophy" can embrace much more than that. The purpose of this document is to introduce the pollution prevention philosophy to those involved in cleanups - both in Superfund and RCRA. The method used to accomplish this is by providing examples of specific waste reduction activities that can be implemented within the Superfund remedial process. This is not intended to be an exhaustive list. The hope is that once the pollution prevention philosophy has been embraced, project managers will identify other opportunities for making environmentally-sound decisions. Set up a recycling corner in the trailer on-site; restore wetlands; or plant trees to help offset, even in the slightest way, global climate change.

The principles of waste reduction are such that they should complement the project manager's goals of accomplishing site cleanup in the quickest, most efficient, and most cost-effective manner possible. Understanding these principles, and incorporating them into a site management plan, will benefit the project manager, the public, and the environment.

**Attachment A**

## PAPER REDUCTION TECHNIQUES

There are several ways the Office of Superfund can reduce the amount of paper used throughout the entire Superfund process. Some examples of paper reduction are as follows:

- Use double-sided pages

On August 15, 1989, Charles Grizzle, then the Assistant Administrator of U.S. EPA, made two-sided copies the Agency policy. Project managers should request that our contractors and the Potentially Responsible Parties (PRPs) also utilize double-sided pages in all submittals. For the PRP these conditions could be placed in enforcement orders. For EPA contractors, the contracts or Statements of Work (SOWs) could identify these requirements.

- Use binders and replacement pages

Project managers could require the use of binders and replacement pages in response to Agency comments rather than an entirely new submission of the revised document. As stated above, these requirements could be placed in enforcement orders for PRPs and contracts or SOWs for contractors.

- Use of report addenda

Additional phases of a project may utilize addenda to available documents such as the FSP, QAPP, and Health and Safety Plan rather than creating a new document. The addenda must only identify where the document differs from the original and what additions were made.

- Encourage the use of recycled paper

Executive Order #12780, signed by President Bush on October 31, 1991, requires the Federal Government, as the Nation's largest single consumer, to encourage the development of economically efficient markets for products manufactured with recycled materials.

- Reference Standard Operating Procedures (SOPs)

The documents which support the Work Plan, such as the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP), could reference standard protocols for field and analytical activities rather than copying the actual procedure and attaching it to the document.

- Pass information on computer disks

The site-specific QAPP, for example, can be written from the model QAPP, which is available on a computer disk. In addition, the RPM can review the site-specific QAPP on disk and the revisions can be submitted on disk. Therefore, only the final approved version would need to be printed on paper.

In addition, field data could be submitted on a computer disk rather than as hard copies.

- Reduce distribution list

Our distribution list requires the production of several copies of most of our documents in draft and final stage. This subject is being investigated by a Quality Action Team (QAT), which will evaluate who needs specific documents for review and at what stage of the process, so that the minimum number of copies can be made.

**Attachment B**

# TREATMENT TECHNOLOGIES AND THEIR WASTE REDUCTION ADVANTAGES AND DISADVANTAGES