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DRAFT GUIDANCE ON SELECTING REMEDIES FOR SUPERFUND SITES WITH PCB CONTAMINATION

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Guidance on Selecting Remedies for Superfund Sites With PCB Contamination

1. Introduction

This document describes the Superfund approach to sites with PCB contamination. It provides the foundation for starting point cleanup levels in various media that may become contaminated and identifies other considerations important to ensuring protection of human health and the environment that these factors may not address. In addition, potential applicable or relavent and appropriate requirements and "to-be-considered" factors pertinent to Superfund sites with PCB contamination and their integration into the RI/FS, remedy development process are summarized.

1.1 Purpose

This guidance document explains how the RI/FS process specifically applies to the development, evaluation, and selection of remedial actions that address PCB contamination at Superfund sites. The principal objectives of this guidance are to:

- o Present the statutory basis and analytical framework statutory basis for formulating alternatives designed to address PCB contamination, explaining in particular the regulatory requirements and other criteria that shape choices for remediation;
- o Describe key considerations for developing remedial action goals for each contaminated media under various scenarios;
- o Outline options for achieving the remedial action goals and the associated ARARs;
- o Summarize the key information that should generally be considered in the detailed analysis of alternatives;
- o Discuss primary tradeoffs likely to occur in the remedy selection balancing conducted to determine he most appropriate solution;
- o Provide guidance on documenting remedies for PCB sites in the Record of Decision.

Technical aspects of the investigation, evaluation, and remediation are not discussed in detail here. However, pertinent references and, in some cases, summary information are provided.

This document has been prepared as a resource for EPA remedial project managers (RPMs) and State and other Federal Agency site managers responsible for Superfund sites involving PCBs, contractors responsible for conducting the field work and alternatives evaluation at these sites, and others involved in the oversight or implementation of response actions at these sites.

Although each Superfund site presents unique environmental conditions and potential human health problems, some general principles can be established for sites involving the same predominant chemical, in this case PCBs to streamline the RI/FS and remedy selection process. This can be accomplished by specifying ARARs and other factors that shape the primary options for remediating such sites, key information necessary to fully evaluate those options, and major tradeoffs likely to emerge in comparing them that are balanced to make the remedy selection. Consideration of the factors outlined in this document should lead to consistent alternatives development and evaluation at sites involving PCB contamination.

1.2 Background

Approximately 17 percent of the Superfund sites for which Records of Decision have been signed (81 as of 8/89) address PCB contamination. Preliminary assessment/site inspection data from sites on the National Priority List indicates that a similar percentage of these sites also involve PCBs. The remedy selection process for PCB sites is complicated for a number of reasons. From a regulatory point of view, there is an unusually high number of potentially applicable or relevant and appropriate requirements (ARARs) and pertinent "to-be-considered" guidelines for actions involving PCB wastes. PCBs are difficult to address technically due to their persistence and high toxicity. Finally a large number of process options are potentially effective for addressing PCBs and deserve consideration. The approach outlined in this document attempts to address all three aspects of PCB remediation.

1.3 Focus of This Document With Respect to Remedial Process

The Superfund remedial process begins with the identification of site problems during the preliminary assessment/site inspection, which is conducted before a site is listed on the National Priorities List: This process continues through site characterization in the RI and development, screening, and detailed analysis of remedial alternatives in the FS and culminates in the selection, implementation, and operation of a remedial action. Figure 1 shows the steps comprising the

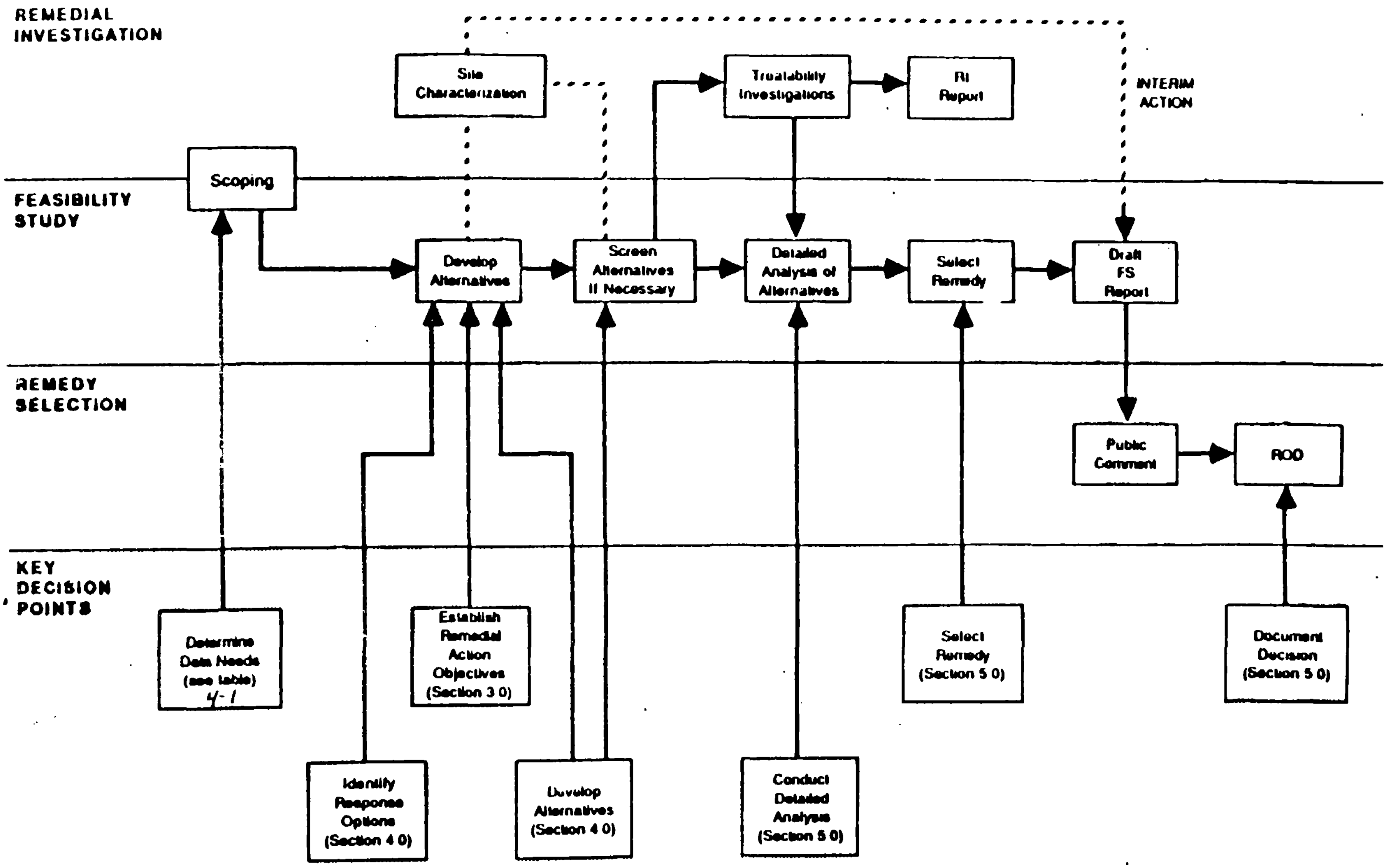

Figure 1-1 DECISION POINTS IN THE SUPERFUND PROCESS

Superfund RI/FS process. Arrows indicate key decisions specifically addressed in this document.

The various components of the remedial investigation are not specifically addressed in this document; however, initial reference material including tables outlining properties of PCBs, analytical methods available, and data collection needs/considerations for technologies used to address PCBs are provided. In addition, a general discussion on the assessment of PCB impact to ground water and evironmental considerations which may be pertinent in the risk assessment is provided.

The focus of this guidance is primarily on the feasibility study: development and screening of alternatives, detailed analysis of alternatives, and the consequent selection of remedy. The development of alternatives involves completing the following steps:

1. Identify response objectives including the anticipated use of the site once an alternative is implemented. The expected exposure scenarios are used to determine the appropriate concentration of PCBs that can remain at the site or the management controls that should be implemented to restrict access.

2. Identify general response actions such as excavation and treatment, containment, or insitu treatment. Each of these actions involves unique ARARs and TBCs specific to PCB contamination.

3. Identify process options for various response actions. Treatment options for PCBs include incineration, solvent extraction, KPEG, or other removal/destruction methods. Immobilization techniques may also be considered. Long term management controls appropriate for the material remaining on site should be noted.

4. Evaluate/screen process options to determine which are technically feasible for the site.

5. Combine feasible process options to formulate alternative remedial actions for detailed analysis.

This document provides general guidance on two primary aspects of the development of alternatives process that are considered and revised throughout the completion of the steps listed above:

- Determination of the appropriate concentration of PCBs that can remain at a site (cleanup level) under various site use scenarios. This is based on standard exposure and fate assumptions for direct contact. A qualitative consideration of potential migration to ground water and environmental impacts is included for site-specific assessment.

- Identification of options for addressing contaminated material and the implications, in terms of long term management controls, associated with these options. Remedial actions will fall into three general categories: overall reduction of PCB concentrations at the site (through removal or treatment) such that the site can be used without restrictions, complete containment of the PCBs present at the site with appropriate long term management controls and access restrictions, and a combination of these options in which concentrations are reduced through removal or treatment but the levels remaining still warrant some management controls.

For both evaluations, pertinent ARARs and TBCs are identified.

Finally, this document will discuss some of the unique factors associated with response actions at PCB-contaminated sites that might be considered under the detailed analysis of alternatives using the evaluation criteria outlined in the proposed NCP, indicate how these factors might be evaluated in selecting the site remedy, and outline the findings that should be documented for the selected remedy.

1.4 Organization of Document

The remainder of this document is divided into four sections and three attachments, summarized below.

Section 2 describes the potential ARARs and TBCs most commonly encountered at sites involving PCB contamination. This discussion has been included as a separate background section as because of the complexity of the regulatory framework.

Section 3 provides general guidelines for determining the appropriate concentrations to leave at the site. The primary factors affecting this determination are the medium that is contaminated, the exposure scenario for the site, and the extent and level of contamination that is to be addressed. Exposure scenarios may vary for different alternatives; i.e., incorporation of access restrictions and long-term management controls may allow a higher cleanup level.

Section 4 outlines the remediation options for addressing the material for which some active response is determined to be warranted. Options range from treatment that destroys the PCBs to long-term management controls that prevent exposure to PCBs. The regulatory implications of each option are discussed.

Section 5 summarizes the primary considerations associated with determining the appropriate response action for a PCB contaminated Superfund site in terms of the evaluation criteria used in the detailed analysis. Key tradeoffs among alternatives are noted. Finally, the findings specific to actions addressing PCBs that should be documented in the Record of Decision are presented.

Attachment 1 provides a summary of the Superfund sites involving PCBs for which RODs have been signed, including type of treatment chosen and clean-up levels specified.

Attachment 2 includes two case studies of Superfund site actions involving PCB contamination; Peppers Steel, FL where the remedy involved solidification and Wide Beach, NY where treatment using the KPEG process was selected.

Attachment 3 provides a list of the currently permitted PCB disposal companies and their addresses and phone numbers. It also includes a list of the Regional PCB disposal contacts and their phone numbers.

Attachment 4 provides examples of long term management controls implemented at several PCB Superfund sites where varying concentrations of PCBs were left on site.

2.0 Regulations and "To-Be-Considered" Guidelines Pertinent to PCB Contamination Sites

Actions taken at Superfund sites must meet the mandates of CERCLA as provided for in the NCP. This requires that remedies protect human health and the environment, comply with applicable or relevant and appropriate requirements, be cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, there is a preference for remedies that employ treatment that permanently and significantly reduce the mobiliby, toxicity, or volume of hazardous substances as a principal element. Although the basic Superfund approach to addressing PCB-contaminated sites is consistent with other regulations, this consistency must be documented to demonstrate that ARARs have been complies with. Primary ARARs for PCBs come from TSCA and RCRA.

TSCA requires that material contaminated with PCBs at concentrations of 50 ppm or greater must be incinerated or disposed of in a high temperature boiler. Liquids at concentrations less than 500 ppm and soils may also be treated by an alternate methods that achieves a level of performance equivalent to incineration. Soils may also be disposed of in a chemical waste landfill.

RCRA applies to PCBs when liquid waste contains PCBs at concentrations greater than 50 ppm or non-liquid waste contains total HOCs at concentrations greater than 1000 ppm. The land disposal restrictions require that this material be incinerated unless a treatability variance is obtained.

Other regulations that may apply or be relevant and appropriate when the site involves surface or ground water contamination include the CWA and SDWA.

2.1 Introduction

The primary regulation that governs actions at PCB-contaminated Superfund sites is, of course, the National Contingency Plan (NCP), which defines the framework for addressing the requirements of CERCLA. The provisions of the NCP form the basis for the guidance provided in this document and will not be discussed in detail here but will be discussed in each section as they form the basic structure for the approach. Basically, remedies selected at Superfund sites must:

- Protect of human health and the environment (CERCLA Section 121(b))
- Comply with the applicable or relevant and appropriate requirements (ARARs) of Federal and State laws (CERCLA Section 121 (d)(2)(A)) or justify a waiver (CERCLA Section 121 (d)(4))
- Be cost effective, taking into consideration short- and long-term costs (CERCLA Section 121(a))
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable (CERCLA Section 121(b))
- Satisfy the preference for remedies that employ treatment that permanently and significantly reduce the mobility, toxicity, or volume of hazardous substances as a principal element or an explanation of why treatment was not chosen must be provided in the ROD (CERCLA Section 121(b))

The nine evaluation criteria discussed in Section 5 are designed to elicit the appropriate information that will form the basis for demonstrating that these requirments have been satisfied. Because remedies must attain ARARs of other Federal laws and

State laws, some background and summary material on the ARARs that address PCB contamination is presented in this section.

ARARs for treating or managing PCB-contaminated material derive primarily from two regulations: the Toxic Substances Control Act (TSCA) PCB regulations and the Resource Conservation and Recovery Act (RCRA) land disposal restrictions. Where PCBs affect ground or surface water, the Safe Drinking Water Act (SDWA) and Clean Water Act (CWA) may provide potential ARARs for establishing cleanup levels; i.e., Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), and Water Quality Criteria (WQC). In addition, the PCB Spill Policy, which is not an ARAR but is codified in the Federal Register, should be considered when determining cleanup levels at a site. Other "to-be-considered" (TBC) information is provided by guidances developed by the Office of Toxic Substances to assist in implementing the PCB regulations.

2.2 TSCA PCB Regulations

The TSCA PCB regulations of importance to Superfund actions are found in 40 CFR Section 761.60 - 761.79, Subpart D: Storage and Disposal. They specify treatment and disposal requirements for PCBs based on their form and concentration. The disposal options for PCB-contaminated material are summarized in Table 2-1 and discussed in the following sections.

TSCA does not address PCBs at concentrations less than 50 ppm; however, PCBs cannot be diluted to escape TSCA requirements. Consequently, PCBs that have been deposited in the environment after the effective date of the regulation, February 17, 1978, are treated, for the purposes of determining disposal requirements, as if they were in the form and at the concentration of the original material. This specification was developed with the intent of eliminating the incentive responsible parties might have to dilute wastes in order to avoid regulation. Therefore, when the party responsible for initially depositing the PCBs is performing the necessary response actions, they must address the PCBs not as they are found in the environment, but as they were at the time of disposal. However, when the response action is conducted by Superfund, this same principle generally will not apply and the PCBs should be addressed at the concentration and form in which they exist at the time of the Superfund action. As long as Superfund maintains the lead in evaluating and implementing the remedial action, the contaminated material would be treated as it exists in the environment If the party responsible for spilling the PCBs takes on responsbility for clean-up, Superfund would defer to TSCA enforcement authority for specific requirements.

Table 2-1
REMEDIATION OPTIONS FOR PCB WASTE UNDER TSCA

PCB waste category	CFR Section	PCB concentration (ppm)	Incinerator (§761.70)	Chemical waste landfill (§761.75)	High efficiency boiler (§761.60)	Alternative method (§761.60(e))	Method approved by region	Drain, dispose as solid waste	Decontamination
Liquid PCB	761.60	≥500	X		X				
Liquids with flash point > 60° C	761.75	50-500	X	X	X	X			
Liquids with flash point < 60° C	761.75	50-500	X		X	X			
Other liquids that are also hazardous wastes	268.42(a)(1)	50-500	X		X	X			
Other liquids that are also hazardous wastes	268.42(a)(1)	≥500	X			X			
Nonliquids (soil, rags, debris)	761.60(a)(4)	≥50	X	X		X			
Dredged materials and municipal sewage sludge	761.60(a)(5)	≥50	X	X			X		
PCB transformers (drained and flushed)	761.60(b)(1)	NS[a]	X	X					
PCB capacitors[b]	761.60(b)(2)	≥500	X						
PCB capacitors	761.60(b)(4)	50-500	X	X					
PCB hydraulic machines	761.60(b)(3)	≥50						X[c,d]	
PCB contaminated electrical equipment (except capacitors)	761.60(b)(4)							X[e]	
Other PCB articles	761.60(b)(5)	≥500[f]	X	X[g]					
Other PCB articles	761.60(b)(5)	50-500						X[e]	
PCB containers	761.60(c)	≥500[f]	X	X[e]					X[h]
PCB containers	761.60(c)	<500						X[d]	X[h]
All other PCBs	761.60(a)	≥50	X			X			

[a] Not specified.

[b] Exemptions for some small capacitors.

[c] Must also be flushed if hydraulic fluid contains >1,000 ppm PCBs and flushing solvent disposed of in accordance with §761.60(a).

[d] Drained liquid must be disposed of in accordance with §761.60(a).

[e] Must be drained of all free-flowing liquid. The disposal of the drained electrical equipment and other PCB articles is not regulated by 40 CFR 761. All liquids must be disposed of in accordance with paragraph (a)(2) or (3) of §761.60 [in an incinerator (§761.70), chemical waste landfill (761.75), high efficiency boiler, or by an alternative method (§761.60(e)].

[f] Due to a typographical error, 40 CFR 761 (July 2, 1988, p. 180) erroneously states this value as 50 ppm (refer to Federal Register, 44, 31514-31568 (May 3, 1979) (USEPA).

[g] Drained of any free-flowing liquid and liquid incinerated in a §761.70 incinerator.

[h] Decontaminated in compliance with §761.79.

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2.2.1 Liquid PCBs at Concentrations Greater Than 500 ppm

Liquid PCBs at concentrations greater than 500 ppm must be disposed of in an incinerator which complies with 40 CFR 761.70 or in a high efficiency boiler which complies with 40 CFR 761.60.

2.2.2 Liquid PCBs at Concentrations Between 50 ppm and 500 ppm

Liquid PCBs at concentrations between 50 ppm and 500 ppm, can be disposed of in an incinerator or high efficiency boiler as described above, or in a facility that provides an alternative method of destroying PCBs that achieves a level of performance equivalent to incineration (equivalent method) approved under 40 CFR 761.60(e).

Liquids at these concentrations with a flash point greater than 60 degrees Centigrade (not considered ingnitable as defined in 761.75(b)(8)(iii)) other than mineral oil dielectric fluid, can also be disposed of in a chemical waste landfill which complies with 40 CFR 761.75. However, the following actions must be taken:

- o Bulk liquids must be pretreated and/or stabilized (e.g., chemically fixed, evaporated, mixed with dry inert absorbant) to reduce its liquid content or increase its solid content so that a non-flowing consistency is achieved.

- o Containers of liquid PCBs must be surrounded by an amount of inert sorbant material capable of absorbing all of the liquid contents of the container.

2.2.3 Non-Liquid PCBs at Concentrations Greater Than or Equal to 50 ppm

Soils/sludges contaminated with PCBs at concentrations greater than or equal to 50 ppm can be disposed of in an incinerator, treated by an equivalent method, or disposed of in a chemical waste landfill. Sludges are non-pumpable solids often found at the bottom of waste lagoons or settling ponds.

Dredged materials and municipal sewage treatment sludges that contain PCBs at concentrations greater than or equal to 50 ppm can also be disposed of by an alternate method approved by the Regional Administrator. It must be demonstrated that disposal in an incinerator or chemical waste landfill is not reasonable and appropriate, and that the alternate disposal method will provide adequate protection to health and the environment.

2.2.4 PCB Articles, Containers, Electrical Equipment

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PCB transformers and capacitors (by definition these contain 500 ppm PCB or greater) must be disposed of in an incinerator or a chemical waste landfill. However, special procedures must be followed for disposing transformers in chemical waste landfills and a special showing must be made for disposing capacitors in landfills. These are described in 40 CFR 761.60(b)

PCB-contaminated electrical equipment (this includes transformers and capacitors which contain PCBs between 50 ppm and 500 ppm) must be drained of all free flowing liquid. The liquid must be incinerated. The drained equipment is not covered under TSCA regulations.

PCB articles and containers with PCB concentrations greater than 500 ppm must be incinerated or disposed of in a chemical waste landfill provided all free flowing liquid is drained and incinerated. PCB articles and containers with PCB concentrations between 50 ppm and 500 ppm must be disposed of by draining all free flowing liquid and appropriately disposing of the liquid. The drained articles and containers can be disposed of as municipal solid waste.

2.2.5 Chemical Waste Landfill Requirements

The requirements of a chemical waste landfill are described in 40CRF Section 761.75 and outlined in Table 2-2. As indicated there are no capping requirements as the regulations were designed for operating landfills. Where Superfund sites will be closed with PCBs remaining in place or where PCB-contaminated material is excavated, treated, and re-disposed at concentrations that still pose a threat, capping consistent with RCRA closure is probably warranted. Also, some of the requirements specified under TSCA may not be appropriate for existing waste disposal sites like those addressed by Superfund. When this is the case, it may be appropriate to waive certain requirements, such as liners, under the waiver provision, 761.75(c)(4). Requirements may be waived when it can be demonstrated that operation of the landfill will not present an unreasonable risk of injury to health or the environment.

2.3 RCRA Regulations Addressing PCBs

Closure requirements described under RCRA are considered potentially applicable or relevant and appropriate at Superfund sites and will not be addressed in this section since they do not specifically apply to PCB contamination but apply to contaminated sites in general. Guidelines for long term management controls

Table 2-2

TSCA CHEMICAL WASTE LANDFILL REQUIREMENTS (40 CFR SECTION 761.75)

1. Located in thick, relatively impermeable formation such as large area clay pans, or:

   - On soil with high clay and silt content with the following parameters:
     - in-place soil thickness of four feet or compacted soil liner thickness of three feet
     - permeability equal to or less than 1×10^{-7}
     - percent soil passing No. 200 Sieve, greater than 30
     - liquid limit greater than 30
     - plasticity index greater than 15.

   - On a synthetic membrane liner (minimum thickness of 30 mils.) providing permeability equivalent to the soil described above including adequate soil underlining and soil cover to prevent excessive stress on or rupture of the liner.

2. A. Bottom of the landfill liner system or natural in-place soil barrier at least 50 feet from the historical high ground water table. Floodplains, shorelands, and ground water recharge areas shall be avoided and there shall be no hydraulic connection between the site and standing or flowing surface water.

   B. If the landfill is below the 100-year floodwater elevation, surface water diversion dikes should be constructed around the perimeter with a minimum height equal to two feet above the 100-year floodwater elevation.

   If the landfill is above the 100-year floodwater elevation, diversion structures capable of diverting all of the surface water runoff from 24-hour, 25-year storm.

3. Located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping.

4. Sampling of designated surface watercourses monthly during disposal activities and once every six months after disposal is completed.

5. Ground water monitoring at a minimum of three points (equally spaced on a line through the center of the landfill), sampling frequency determined on a site specific basis (not specified in reg.) samples analyzed for PCBs, pH, specific conductance, and chlorinated organics.

6. Leachate Collection System:

   A. Gravity flow drainfield installed above the liner (recommended for use when semi-solid or leachable solid wastes are placed in a lined pit excavated into a relatively unsaturated homogeneous layer of low permeable soil) or

   B. Gravity flow drainfield installed above the liner and above a secondary liner (recommended for use when semi-liquid or leachable solid wastes are placed in a lined pit excavated into relatively permeable soil) or

   C. Network of porous ceramic cups connected by hoses/tubing to a vacuum pump installed along the sides and under the bottom of the waste disposal facility liner (recommended for relatively permeable unsaturated soil immediately adjacent to the bottom and/or sides of the disposal facility)

7. Installation of a six foot woven mesh fence, wall, or similar device to prevent unauthorized persons and animals.

consistent with RCRA that are warranted under various closure scenarios are provided in section 3.1.3.

PCBs are addressed under RCRA in 40 CFR 268 which describes the prohibitions on land disposal of various hazardous wastes. Note that RCRA regulations only apply to waste that is considered hazardous under RCRA; i.e., listed in 40 CFR 261.3 or characteristic as described in 40 CFR 261.2. PCBs alone are not a RCRA hazardous waste; however, if the PCBs are mixed with a RCRA hazardous waste they may be subject to land disposal restrictions as summarized below.

PCBs are one of the constituents addressed by the land disposal restrictions under the California List Wastes. This subsection of wastes covers liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm and non-liquid hazardous wastes containing total concentrations of Halogenated Organic Compounds (HOCs) at concentrations greater than 1000 ppm. PCBs are included in the list of HOCs provided in the regulation. (Appendix III part 268)

2.3.1 Liquid Hazardous Waste With PCBs at 50 ppm or Greater

As described in 40 CFR 268.42(a)(1), liquid hazardous (RCRA listed or characteristic) wastes containing PCBs at concentrations greater than or equal to 500 ppm must be incinerated in a facility meeting the requirements of 40 CFR 761.70. Liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 ppm but less than 500 ppm must be incinerated or burned in a high efficiency boiler meeting the requirements of 40 CFR 761.60.

A method of treatment equivalent to the required treatment may also be used under a treatability variance procedure if the alternate treatment can achieve a level of performance equivalent to that achieved by the specified method as described in 40 CFR 268.42 (b).

2.3.2 Hazardous Waste With HOCs at 1000 ppm or Greater

Liquid and non-liquid hazardous wastes containing HOCs in total concentration greater than or equal to 1000 ppm must be incinerated in accordance with the requirement of 40 CFR 264 Subpart O.

Again, a method of treatment equivalent to the required treatment, under a treatability variance, may also be used.

Special considerations are pertinent for HOC waste that falls into the category of soil and debris from a CERCLA remedial

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action or RCRA Corrective Action. The land disposal restrictions for CERCLA soil and debris went into affect November 8, 1988; however, no standards for disposal were published at this time. Consequently soil and debris contaminated with hazardous waste is banned from land disposal unless it meets existing standards for the pure waste or qualifies for a treatability variance. Guidance levels were established to provide a consistent evaluation of whether treatment applied to CERCLA soil and debris qualifies for a treatability variance. For PCBs, residuals after treatment should contain .1 to 10 ppm PCBs for initial concentrations up to 100 ppm and above 100 ppm, treatment should achieve 90 to 99% reduction to qualify for a treatability variance.

Finally, hazardous wastes for which the treatment method is incineration (or where the treatment standard was based on incineration) are subject to a 2-year capacity extension from the time that the standard went into place. Wastes that qualify for a capacity extension can be disposed without meeting the treatment requirements; however, they must be disposed of in a facility that is in compliance with the minimum technology requirements established for landfills in section 3004(o) of RCRA. The capacity extension for California List wastes when they are present in CERCLA soil and debris extends until November 8, 1990.

2.4 Clean Water Act

The Clean Water Act establishes requirements and discharge limits for actions that affect surface water. Water Quality Criteria (WQC) indicating concentrations of concern for surface water based on human exposure through drinking the water and ingesting fish as well as concentrations of concern to aquatic life have been developed for many compounds. For PCBs, the WQC for chronic exposure through drinking water and fish ingestion is .000079 ppb based on an excess cancer risk of 10^{-6}. This assumes consumption of 6.5 grams of estuarine fish and shellfish products and 2 liters of water per day over a 70 year lifetime. The level is the same if consumption of water is excluded indicating a relative negligable impact due to this source.

Acute toxicity to freshwater aquatic life is estimated to only occur at concentrations above 2 ppb. Acute toxicity to saltwater aquatic life is estimated to only occur at concentrations above 10 ppb. The water quality criteria for chronic effects are .014 ppb and .03 ppb for fresh and saltwater aquatic life respecitively.

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These values are used as guides in the development of water quality standards for surface water that are enforced at the State level. The States may account for other factors in establishing these standards including physical, chemical, biological, and economic factors. The State standards are ARAR for surface water discharges and WQC may be ARAR when contamination at a site affects surface water.

2.5 Safe Drinking Water Act

Under the Safe Drinking Water Act (SDWA), Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) are established. MCLs are set at levels that reflect an excess cancer risk due to drinking 2 liters of water per day over a 70 year life of between 10^{-4} and 10^{-6}. They must be attained by public water supplies and are considered relavent and appropriate to ground water within the area of attainment that is potentially drinkable in its uncontaminated state. MCLGs are set at levels that would result in no known or anticipated adverse effects to human health over a lifetime. MCLGs may be relevant and appropriate when multiple pathways or contaminants increase risks at a site.

An MCL of .5 ppb was proposed for PCBs in May 1989. The MCLG is zero because PCBs are possible carcinogens. As a proposed MCL it is to be considered in determining the appropriate cleanup level for potentially drinkable ground water.

2.6 PCB Spill Cleanup Policy

This policy was codified in 40CFR 761.120 - 761.139 on April 2, 1987 to define the level of cleanup required for PCB spills occurring after May 4, 1988 (the effective data). Because it is not a regulation, it is not ARAR for Superfund; however, as a codified policy representing substantial scientific and technical evaluation it has been considered in developing the guidance cleanup levels discussed in section 3. A summary of the policy follows.

2.6.1 Low Concentration, Low Volume Spills All Areas

For spills of low concnetration PCBs (50 ppm to 500 ppm) involving less than one pound of PCBs, cleanup in accordance with procedural performance requirements is required. This consists of double wash rinse and cleanup of indoor residential surfaces to 10 micrograms (ug) per 100 square centimeters (cm2) analyzed by a wipe test, and excavation of all soils within the spill area plus a 1-foot lateral boundary of soil and other ground media and

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backfilling with clean (less than 1 ppm) soil. No confirmation sampling is required.

2.6.2 Non-Restricted Access Areas

For spills of 500 ppm or greater PCBs and spills of low-concentration PCBs of more than one pound PCBs by weight in non-restricted access areas, materials such as household furnishings and toys must be disposed of and soil and other similar materials must be cleaned up to 10 ppm PCBs provided that the minimum depth of excavation is 10 inches. In addition a cap of at least 10 inches of clean materials must be placed on top of the excavated area. Indoor and outdoor surfaces must be cleaned to 10 ug/100 cm2, but low contact outdoor surfaces may be cleaned to 100 ug/100 cm2 and encapsulated. Post clean-up sampling is required.

2.6.3 Industrial Areas

For spills of 500 ppm or greater PCBs and spills of low-concentration PCBs of more than one pound in industrial and other restricted access areas, cleanup of soil, sand, and gravel to 25 ppm PCBs is required. Indoor high contact and outdoor high contact surfaces must be cleaned to 10 ug/100 cm2. Indoor low contact surfaces may be cleaned to 10 ug/100 cm2 or to 100 ug/100 cm2 and encapsulated. Outdoor low contact surfaces may be cleaned to 100 ug/100 cm2. Post cleanup sampling is required.

2.6.4 Outdoor Electrical Substations

For spills of 500 ppm or greater PCBs and spills of low-concentration PCBs of more than one poind at an outdoor electrical substation, cleanup of solid materials such as soils to 25 ppm or to 50 ppm (with as sign posted) is required. All surfaces must be cleaned to 100 ug/100 cm2. Post cleanup sampling is required.

2.6.5 Special Situations

For particular situations, decontamination to site-specific requirements established by EPA Regional Offices is required. These situations are:

1. Spills that result in direct contamiantion of surface waters,

2. Spills that result in direct contamination of sewers or sewage treatment systems,

3. Spills that result in direct contamination of any private or public drinking water sources,

4. Spills which migrate to and contaminate surface waters, sewers, or drinking water supplies,

5. Spills that contaminate animal grazing land, and

6. Spills that contaminate vegetable gardens.

2.7 Guidances

Several documents have been produced that provide background information and guidance on complying with the regulations and policy described above. Pertinent information provided by some of the more important documents are described in this section. This material is also "to-be-considered" in developing remedies at Superfund sites.

2.7.1 Guidance Manual for Writers of PCB Disposal Permits for Alternate Technologies -- OTS

The most significant information in this document affecting actions taking place at Superfund sites is the discussion provided on evaluating the equivalency of technologies other than incineration. As described in section 2.2, most PCB-contaminated material can be treated by an alternate methodology provded that it can achieve a level of performance equivalent to an incinerator or a high efficiency boiler. The guidance manual indicates that an equivalent level of performance for an alternate method of treatment of PCB-contaminated material is demonstrated if it reduces the level of PCBs to less than 2 ppm measured in the treated residual. The residual can then be disposed of on site without further regualtion. Otherwise, the material must be treated as if it were contaminated at the original level (i.e. disposed on in a chemical waste landfill or incinerated).

This level was based on the practical limit of quanitification for PCBs in an organic matrix and consequently does not apply to aqueous or air emissions produced by the treatment process. Aqueous streams must contain less than 3 ppb PCBs. Releases to air must be less than 10 ug of PCBs per cubic meter.

2.7.2 Verification of PCB Spill Cleanup by Sampling and Analysis -- OTS

This document describes methods for sampling and analyzing PCBs in various media. It also includes basic sampling strategies, identification of sampling locations, and guidance on interpreting sampling results. This manual may be useful in developing sampling plans at Superfund sites and identifying appropriate methods for complicated sampling such as structures.

2.7.3 Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup -- OTS

This manual provides a step-by-step guidance for using hexagonal grid sampling primarily for determining if cleanup levels have been attained at the site. It discusses preparation of the sample design, collection, handling and preservation of the smaples taken, maintenance of quality assurance and quality contol, and documentaion of sampling procedures used. It is a companion to the guidance discussed in section 2.5.2 that discusses in more detail the rationale and techniques selected. The field manual addresses field sampling only and does not provide information on laboratory procedures. This guidance may be useful in specifying the appropriate sampling after or during remedial action to assess progress toward achieving cleanup goals.

2.7.4 Development of Advisory Levels for PCB Cleanup -- ORD

This document provides the basis for the cleanup levels developed in the PCB Spill Policy. It discusses the assumptions made in addressing the dermal contact, inhalation, and ingestion pathways and may provide useful information for completing risk assessments at Superfund sites. An update to the calculations made in this document to account for recent policy on standard ingestion assumptions and revised cancer potency factor for PCBs has been provided in a memorandum dated December 6, 1989 from Michael Callahan to Henry Longest.

2.7.5 Superfund Public Health Evaluation Manual -- OERR

This document describes the process for conducting risk assessments at Superfund sites. It is being revised at the time of this writing and one component of these revisions is to include a section on specific chemicals, including PCBs, for which analysis may not be straight forward.

3.0 Cleanup Level Determination

This section describes for various scenarios, considerations pertinent to determining the appropriate level of PCBs that can be left in each media that is contaminated. For soils, starting point cleanup levels are set at .5 to 1 ppm for sites with unrestricted access based on achieving a 10^{-6} cancer risk level. Higher starting point values are suggested for sites where access is less frequent. Cleanup goals for ground water that is potentially drinkable should be the MCL. Cleanup levels associated with surface water should account for impacts to aquatic life and the food chain.

3.1 Soils

The concentration of PCBs in the soil that is appropriate to leave on site will depend primarily on the expected exposure scenario for the site; i.e., direct contact with the soil or limited contact through capping and access restrictions. This section has correspondingly been organized according to categories of sites differentiated by the expected direct contact that will occur. Other factors influencing the concentration to which soils should be excavated or treated include the impact the residual concentration will have on ground water and potential environmental impacts. Since these pathways are pertinent to all site categories and can at this time only be covered in a general way, they are discussed in seperate sections.

A summary of the guidelines discussed in this section is presented in Table 3-1.

TABLE 3-1
Recommended Soil Clean Levels -- Analytical Starting Point

Access To Site	PCB Cleanup Concentration (ppm)
Unrestricted	.5 - 1 ppm
Limited	10 - 25 ppm
Restricted	500 - 1000 ppm

3.1.1 Sites Where Access Will Be Unrestricted

The scenario under which the remedial action for the site will result in reducing contaminant concentrations to levels that are considered protective for unrestricted access and unlimited use will be an appropriate starting point for alternatives analysis at many sites. The concentration of PCBs that can remain on site without management will be based on standard assumptions for direct contact -- dermal, ingestion, and inhalation and should consider potential impact to ground water which is discussed in section 3.1.4. As part of the development of the clean up levels in the PCB Spill Cleanup Policy a detailed analysis of the direct contact pathways was performed by the EPA Office of Health Effects Analysis and can be found in their report entitled:

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Development of Advisory Levels for PCB Cleanup. This report was subsequently updated to account for revised cancer potency factor and ingestion assumptions by memorandum from Michael Callahan (December 6, 1988). This study estimates that a residual concentration of .5 ppm PCBs in the soil reflects an excess cancer risk of 10^{-6} for soil ingestion, inhalation, and dermal contact pathways. They also estimate that a 10 inch cover of clean soil will reduce the risk by approximately one order of magnitude; consequently, a concentration of 5 ppm with a 10 inch clean soil cover will result in an excess cancer risk of 10^{-6}.

There are several assumptions worth noting in the derivation of the concentrations noted above. These are tabulated below in Table 3-2 with an example risk calculation based on a residual soil concentration of 1 ppm.

For Superfund sites, the risk remaining after remediation should fall within the protective risk range of 10^{-4} to 10^{-7} with the starting point for analysis at 10^{-6} assuming no soil cover. When unrestricted access is assumed the direct contact analysis indicates that concentrations remaining should fall within the range of .05 ppm to 50 ppm with a starting point of .5 to 1 ppm. As noted above, these levels reflect direct exposure assumptions only and may not be appropriate where ground water or ecological habitats are potentially threatened. These levels are consistent with the guidance provided by the PCB Spill Cleanup Policy which recommends a 10 ppm cleanup level with a 10 inch cover to achieve a 10^{-6} risk level. Superfund would start analysis at approximately .5 to 1 ppm to achieve a 10^{-6} risk without a soil cover.

3.1.2 Sites Where Access Will Be Limited

Some Superfund sites may be located in areas where direct exposure assumptions are not appropriate. Under the PCB Spill Policy this category includes sites that are more than .1 km from residential/commercial areas or where access is limited by either man-made or natural barriers (e.g., fences or cliffs). For example, a site may be located in an industrial area or a very remote area where ingestion and inhalation exposures are more limited than a residential area. In these cases, a more appropriate cleanup level at which to start analysis may be 5 to 25 ppm. Even assuming exposure equivalent to that at unrestricted sites, these levels are still within the protective risk range (approximately 10^{-5}), and in fact will reflect a lower risk due to the reduced frequency of exposure expected at the site. This is consistent with the PCB Spill Cleanup Policy which recommends a cleanup level of 25 to 50 ppm for sites in industrial or other reduced access areas.

Table 3-2
PCB DIRECT CONTACT ASSUMPTIONS

INGESTION:

Soil ingestion rate 1 - 5 years	0.2 g/day
Soil ingestion rate 6 - 70 years	0.1 g/day
Body weight average over 1 - 5 years	10 kg
Body weight 6 - 70 years	70 kg
Absorption of PCBs from ingested soil	30%

Volatilization of PCBs from soil surface using average PCB concentration over first 20 inches assumed based on partitioning of PCBs between soil and air.

INHALATION:

Lifetime (70 year) inhalation rate	20 m^3/day
Lung absorption of inhaled PCBs	50%

DERMAL: [illegible]
[document] [illegible]
[illegible]

EXAMPLE CALCULATION:

At 1 ppm initial soil concentration

Average soil concentration over 10 inches and over 6 years = 0.545 ppm

Average soil concentration over 10 inches and over 70 years = 0.19 ppm

Corresponding concentration in air = 0.006 $\mu g/m^3$

Risk due to soil ingestion =
[(0.545 mg/kg)(0.2 g/day)(6 yr)(1/10 kg) +
(0.19 mg/kg)(0.1 g/day)(64 yr)(1/70 kg)] •
[(kg/1000 g)(1/70 yr)(7.7 kg-day/mg)(0.3)] = 2.7×10^{-6}

Risk due to inhalation =
(0.006 $\mu g/m^3$)(mg/1000 μg)(20 m3/day) •
(1/70 kg)(7.7 kg-day/mg)(0.5) = 6.66×10^{-6}

Risk due to dermal contact, 5% effect

Total risk = 9.3×10^{-6}

3.1.3 Sites Where Access Will Be Restricted

At some Superfund sites; e.g., sites where low concentration wastes are spread over a large area, the most practicable remedy may be to contain the contaminated material, preventing further migration, and restrict access to the site. Principle threats at the site should be reduced prior to containment. For PCBs this generally means that material with the highest concentrations of PCBs; i.e., greater than 500 to 1000 ppm depending on overall site concentrations, should be treated to reduce concentrations in the material that is to be managed over the long term.

The management controls that should be implemented at these sites will depend on the material that is to be contained and hydrogeological and meteorological factors associated with the site. Controls may include caps, liners, leachate collection systems, ground water monitoring, surface water controls, and site security. A general guide to appropriate controls under various site scenarios is provided in Table 3-3.

3.1.4 Assessing the Impact to Ground Water

There are many factors such as soil permeability, organic carbon content, and presence of organic colloids, which can influence PCB movement from soil into ground water and the situation is complicated by the low solubility of PCBs and the prevalence of their occurrence as solutes in oils. At this point the migration of PCBs to ground water can only be described qualitatively. Table 3-4 lists factors affecting migration for several PCBs.

PCBs are very immobile under conditions where the PCB concentration in the aqueous phase is controlled by the aqueous solubility of PCBs and transport is governed by partitioning between the water and soil. However, low solubility compounds like PCBs may migrate through facilited transport on colloidal particles or dissolved in more mobile substances such as oils in large enough volumes. Measurements of dissolved organic carbon (DOC) in leachate may help assess this movement. Concentrations of PCBs in water samples exceeding PCB water solubility indicate that PCBs are being solubilized by something other than water. PCBs in oils will be mobile if the oil itself is present in volumes large enough to move a significant distance from the source. If immiscible fluid flow is significant, PCB transport predictions must be based on immiscible fluid flow models.

Table 5-5

General Selection Criteria
Long-Term Management Controls
For Superfund Sites with PCB Management Actions *

Long-term Management Controls \ PCB Concentration (ppm)	5	20	50	500	1000	>1000
CAP DESIGN						
1. - Top Slope 2% - 12" Vegetated Soil	X	X				
2. - Top Slope 2% - 12" Vegetated Soil - 24" Cover Soil (K=8.5 x 10^{-7}cm/sec)			X			
3. - Top Slope 2% - 12" Sand (K=1 x 10^{-2}cm/sec) - FML 20 MIL (K=1 x 10^{-14} cm/sec) - 24" Clay (K=1 x 10^{-7}cm/sec) - 12" Cover Soil (K=3.7 x 10^{-4}cm/sec)				X	X	X
LEACHATE COLLECTION				X	X	X
LEAK DETECTION						X

* Based on Professional Judgement

Table 3-4
CHEMICAL AND PHYSICAL PROPERTIES OF PCBs

PCB	Molecular Weight	K_{ow}	Specific Gravity	Solubility in Water (mg/l)[a]	Vapor Pressure (mm Hg) at 25°C	Henry's Law Constant (atm-m^3/gmol)
PCB-1016 (Arochlor 1016)	257.9	24,000		0.42	4×10^{-4}	
PCB-1221	200.7	12,000	1.182	15.0	6.7×10^{-4}	
PCB-1232	232.2	35,000	1.266	1.45	4.06×10^{-3}	
PCB-1242	266.5	380,000	1.380	0.24	4.06×10^{-4}	5.73×10^{-4} [b]
PCB-1248	299.5	1,300,000	1.445	5.4×10^{-2}	4.94×10^{-4}	3.51×10^{-3} [b]
PCB-1254	328.4	1,070,000	1.538	1.2×10^{-2}	7.71×10^{-5}	8.37×10^{-3} [c]
PCB-1260	377.5	14,000,000	1.620	2.7×10^{-3}	4.05×10^{-5}	7.13×10^{-3} [c]
PCB-1262			1.646			
PCB-1268			1.810			
PCB-1270			1.947			
PCB-2565			1.727			
PCB-4465			1.712			
PCB-5442			1.434			
PCB-5460			1.740			
2,2',5,5'-Tetra-chlorobiphenyl				4.6×10^{-2}		
2,2',3,4,5-Penta-chlorobiphenyl				2.2×10^{-2}		

[a] Hutzinger et al., 1974, Monsanto Chemical Co., undated.
[b] MacKay and Leinonen, 1975.
[c] Hwang, 1982, and U.S. EPA, 1980c.

Bioaccumulation factor: 31,200 L/kg.

Soil-water partition coefficient (U.S. EPA, 1980a): 22 - 1938 L/kg.

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Generally, PCB soil cleanup levels based on direct contact assumptions will provide sufficient protection of ground water. However, if ground water is very shallow, oily compounds are or were present, or the unsaturated zone has a very low organic carbon content an estimation of the residual concentration that will not exceed levels found to be protective for ground water should be made.

3.2 Ground Water

If PCBs have contaminated potentially drinkable ground water, ground water response actions should be considered. As discussed above PCBs generally have low mobility but can be transported with oils in which they may be dissolved. A problem that arises is that once the immiscible fluid has been immobilized through capillary retention in the soil pore space (termed the residual saturation) then PCB transport is governed by the rate the PCBs dissolve from the oil into the water moving past the residually saturated oil. This is a very slow process with the residual saturation serving as a long term source of contamination. Emulsification of the residual oil, and PCB transport in micelles may also occur.

PCBs have also been found to migrate within aquifers sorbed to colloidal particles. This movement can be assessed through analyzing both filtered and unfiltered ground water samples for PCBs.

In both scenarios described above, PCBs can be found in ground water at levels that exceed health based concentrations. The proposed MCL for PCBs is .5 ppb reflecting a 10^{-4} excess cancer risk. These situations are also very difficult to address actively. In the first case, residual oil lodged in pore spaces continues to be a source of PCBs and are very difficult to remove through traditional pump and treat methods. In the case of PCBs present on particulates, the rate of removal through ground water extraction may be very limited and substantial amounts of clean water will be affected as it is pulled into the contaminated zone. Because of the technical impracticability of reducing concentrations to health based levels, remedies designed to prevent further migration of contaminants may be the only option.

3.3 Sediment

The cleanup level established for PCB-contaminated sediment may be based on direct contact threats using exposure assumptions specific to the site if the surface water is used for swimming. More often, the impact of PCB on aquatic life and consumers of aquatic life will drive the cleanup level. Interim criteria for sediment based on achieving and maintaining WQC in the surface water have been developed for several chemicals. The approach used to estimate these values is called the Equilibrium Partioning Approach (EP) which is based on two interrelated assumptions. First, that the interstitial water concentration of the contaminant is controlled by partitioning between the sediment and the water at contaminant concentrations well below saturation in both phases. Thus, the partitioning can be calculated from the quantity of the osrbent on the sediment and the appropriate sorption coefficient. For nonpolar organic contaminants, the primary sorbent is the organic carbon on the sediment; therefore, the partition coefficient is called the organic carbon normalized partition coefficient, K_{OC}. Second, the toxicity and the accumulation of the contaminant by benthic organisms is correlated to the interstitial, or pore water concentration and not directly to the total concentration of the contaminant on the sediment.

When the EP approach is used to estimate sediment quality criteria, chronic water quality criteria (WQC) are used to establish the "no-effect" concentration in the interstitial water. The interstitial water concentration (C_W) is then used with the partition coefficients (K_{OC}) and the following equation:

$$C_{sed} = K_{oc} * C_w$$

to calculate the concentration of the contaminant on the sediment (C_{sed}) that at equlibrium will result in this interstitial water concentration. This concentration on the sediment will be the numerical criteria value (SQC).

The interim sediment quality criteria for PCBs is shown in Table 3-3 along with the 95% confidence interval based on the variability of the partition coefficients used. This interval represents the range of concentrations within which there is 95% certainty that the sediment criteria would fall. The lower value of the confidence interval represents the concentration which with 97.5% certainty will result in protection from chronic effects or of uses depending on the WQC value used in the SQC derivation. The upper value of the confidence interval represents the concentration which with 97%% certainty will result in hazardous long-term impacts on the benthic fauna. Concentrations within the confidence intervals can be cnsidered either "safe" or hazardous with respect to that compound with certainties between 2.5 and 97%.

To determine if the sediment concentration of a nonpolar contaminant exceeds the sediment criteria values, the concentration of the contaminant and the organic carbon content of the sediment must both be known. Because the sediment criteria values are presented as normalized to organic carbon content (i.e., presented on a per organic carbon weight basis), the normalized sediment concentrations of the contaminants must be calculated. These normalized concentrations can then be directly compared with the interim values shown in Table 3-3.

TABLE 3-5
PCB Sediment Quality Criteria

	Sediment Quality Criteria (ug/gC)	
WQC - Freshwater	Mean	95% Confid. Int.
.014 ug/L	19.5	3.87 - 99.9
WQC - Saltwater		
.030 ug/L	41.8	8.29 - 214

3.4 Ecological Considerations

The occurrence of PCBs at Superfund sites often poses significant threat to wildlife. Mobility of PCBs into ground water, into air, and through biological vectors can result in adverse ecological impacts beyond the immediate boundaries of the site. It is important to consider interactive ecological processes relative to PCB contamination as part of the remedial investigation. This evaluation can provide insights into other avenues of human exposure in addition to ensuring protection of wildlife.

Assessments of PCB sites by the Department of the Interior have concluded that PCB concentrations of 1 - 2 ppm will be protective of wildlife such as migratory birds and that providing a soil cover over more highly contaminated areas can also mitigate threats to acceptable levels. However, the uncertainty regarding environmental impacts described below may warrant more in depth analysis at sites where this pathway may be of particular significance; e.g., sensitive species, high agricultural use.

It is important to note that, from a toxicological and ecological perspective, not all PCB congeners will have the same effects. Discrimination of congeners appears operative at many physical, chemical, and biological levels: primary source materials differ from environmental samples; toxicity values differ among congeners; persistence in the environment varies; and bioaccumulation potential varies among congeners and across trophic levels. Consequently, an established environmental concentration based on total PCB concentration (i.e., irrespective of the specific congeners) may show little relationship to biological phenomena (e.g., food chain contamination, toxicity, etc.).

Metabolism of PCBs can occur in a diverse group of organisms including bacteria, plants, and animals. (Fungi almost certainly possess similar capabilities.) For the most part the lesser chlorinated congeners are more readily subject to metabolism, whereas the penta-, hexa-, and heptachlorinated forms are quite recalcitrant. Metabolism should not be equated with degradation, because certain conversions are better thought of as modificantions of the parent compound; and in some cases the modified forms may become more toxic, more water-soluble, more bioavailable. To date the best evidence for degradation is demonstrated for certain bacteria which are capable of dechlorinating the lesser cholorinated congeners.

Toxicity symptoms are most clearly observed in animals. Usually the symptoms are sublethal. Chronic exposures lead to disrupted hormone balances, reproductive failure, teratomas, or carcinomas. Plants do not appear to exhibit detectable toxicity responses to PCBs.

Biological contamination may occur through a variety of routes. Aquatic organisms may incorporate PCBs from water, sediment, or food items. Subterranean animals, similarly accumulate PCBs via dermal contact and ingestion. Exposure scenarios in above-ground terrestrial populations additionally may occur via volatilization. The least understood features of food web contamination are those related to the uptake, fate and transport of PCB congeners in plants.

4.0 Options For Excavated Material

Treatment and disposal options for PCB contaminated material are governed by the type of material that is contaminated and the concentration of PCBs in the material that is to be disposed. There are several options available for contaminated non-liquid material, including some sludges, so more emphasis is given them in this section. PCB liquids will generally be incinerated. Aqueous PCB streams will be treated by traditional treatment systems such as carbon adsorption. (Sludges are defined as those using the paint filter test (Method 9095 in EPA Publication SW-846) and are treated the same as soils for the purposes of evaluating disposal options.

There are three primary options for non-liquid PCBs at concentrations of 50 ppm or greater (there is no seperate consideration given to PCBs at concentrations greater than 500 ppm):

1. Incineration
2. Treatment equivalent to incineration
3. Disposal in a chemical waste landfill.

There is more flexibility in the requirements for disposal of PCB contaminated dredged material.

A list of permitted PCB disposal facilities including incinerators, equivalent treatment processes, and chemical waste landfills in provided in Attachment 3.

4.1 Incineration

Incineration, covered in 40CFR761.70, should achieve the equivalent of 6 9's destruction removal efficiency. This is indicated by the requirement that mass air emissions from the incinerator shall not be greater than .001 g PCB/kg of PCB contaminated material.

4.2 Alternative Treatment

In addition to incineration, there are several other technologies that result in the destruction or removal of PCBs in contaminated soil. These methods can be used with no long term management of treatment residuals if they can be shown to achieve a level of performance equivalent to incineration, as required in 40CFR761.60(e). As described in guidance, this determination can be made by demonstrating that the treatment residuals contain less than or equal to 2 ppm PCBs using a total waste analysis. When a remedial action alternative for a Superfund site involves use of a technology that can achieve substantial reductions but residual concentrations exceed 2 ppm, the alternative should include long term management controls as outlined in Table 3-3. This will not be considered equivalent treatment but will be treated as closure of an existing hazardous waste unit consistent with the RCRA and TSCA framework.

A brief discussion of some of the pertinent considerations for several alternative treatment technologies that address PCBs follows. The evaluations described below provide the substantive considerations pertinent to treatment of PCBs on Superfund sites. When material is transported off-site for treatment, the treatment facility must be permitted under TSCA. Table 4-1 summarizes important considerations and consequences associated with the use of the various technologies that should be accounted for in developing and evaluating alternative remedial actions.

Chemical Dechlorination (KPEG)

Table 4-1
PCB TREATMENT METHODS AND APPLICATION CONSEQUENCES

Methods	Considerations/Consequences
Incineration	• Cost • Residual disposal (ash, scrubber water) • Public resistance
Biological Treatment	• Efficiency • By-products • Treatment time • Not proven effective for all PCB congeners
Solidification	• Volatilization • Leachability • Physical strength • Life of composite's integrity
Vitrification	• Cost • Volatilization • Leachability • Soil denaturation
KPEG (Potassium Polyethylene Glycolate)	• Cost (varies with reagent recycleability)* • Efficiency (varies with Arochlor type) • Aqueous wastes must be dewatered either as a pre-step or in a reactor
Solvent Washing/Extraction	• Volatilization of solvent • Solvent recovery
Critical Fluid Extraction	• Inability of solvent to extract all PCBs • Several extraction steps • Solvent residual remains in extracted soil • Extracts require destruction via other methods
Granular Activated Carbon	• Removal efficiency in soil has not been established • Spent carbon requires treatment/disposal

* Cost for KPEG treatment is still being determined, however, preliminary results of the Guam Pilot facility indicate cost will be approximately 25% of incineration (incineration costs are approximately $1,700 per ton).

that will require subsequent treatment, generally incineration. Often the solvent can be recovered by taking advantage of certain properties of the solvent being used. Aliphatic amines (e.g., triethylamine [TEA]), used in the Basic Extractive Sludge Treatment (B.E.S.T.), exhibit inverse miscibility. Below 15 degrees C, TEA can simultaneously solvate oils and water. Above this temperature, water becomes immiscible and separates from the oil and solvent. Consequently, a process can be designed to remove water and organics at low temperatures, seperate the water from the organic phase at higher temperatures, and recover most of the solvent through distillation. The high concentration PCB stream is then incinerated.

A similar process, called critical fluid extraction, involves taking advantage of increased solvent properties of certain gases (e.g., propane) when they are heated and compressed to their "critical point." Once the PCBs have been extracted the pressure can be reduced allowing the solvent to vaporize. The solvent can be recovered and the remaining PCBs sent to an incinerator.

Treatability tests run to date have indicated that there is probably a limit to the percentage reduction (on the order of 99.5%) achievable with these processes. Although repeat applications can increase the reductions obtained, it may not be cost effective for sites where there are large volumes of material at very high concentrations.

Vitrification

Vitrification involves the use of high power electrical current (approximately 4 MW) transmitted into the soil by large electrodes which transform the treated material into a pyrolyzed mass. Organic contaminants are destroyed and inorganic contaminants are bound up in the glass-like mass that is created. Since this process is often performed in-situ without disturbing the contaminated material, the requirements of TSCA would not be applicable. However, it is often advantageous to consolidate contaminated material into one area for purposes of applying the process in which cases TSCA requirements would apply for PCBs at concentrations greater than 50 ppm. Because the process would result in pyrolosis of the PCBs it can be considered equivalent to incineration and no long term management would be warranted.

Solidification/Stabilization

The terms solidification and stabilization are sometimes used interchangeably, however, subtle differences should be recognized. Solidification implies hardening or encapsulation to prevent leaching, whereas stabilization implies a chemical reaction or bonding to prevent leaching. Solidification of PCBs

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Chemical reagents prepared from polyethylene glycols and potassium hydroxide have been demonstrated to dechlorinate PCBs through a nucleophilic substitution process. Studies have shown that the products of the reaction are non-toxic, non-mutagenic, and non-bioaccumulative; however, some process may result in an increased mobility of any residual PCBs. Treatability studies in Guam and at the Wide Beach Superfund Site in New York have shown that PCB concentrations can be reduced to less than 2 ppm. However, variable waste streams will result in varying efficiencies and systems must be monitored carefully to ensure that sufficient reaction time is allowed.

This technology can achieve performance levels that are considered equivalent to incineration; however, treatability studies will generally be required to demonstrate that the concentration reductions can be achieved on a consistent basis for the material that is to be treated. In some cases, cost effective use of the KPEG process will result in substantial reductions of PCB concentrations, but the residual levels may still be above 2 ppm.

Biological Treatment

Some work has been done on the use of microbes to degrade PCBs either through enhancing conditions for existing microbes or mixing the contaminated material with engineered microbes. The use of this process requires detailed treatability studies to ensure that the specific PCB congeners present will be degraded and that the byproducts of the degradation process will not be toxic. For in-situ application, it is possible that extensive aeration and nutrient addition to the subsurface will increase the mobility of PCBs through transport on particulates which should be considered when potential ground water contamination is a concern.

In-situ application does not trigger TSCA requirements and the primary consideration should be attainment of cleanup levels established for the site based on the evaluation of factors described in section 3. Biological processes involving the excavation of contaminated material for treatment in a bioreactor that can be shown to achieve residual concentrations of less than or equal to 2 ppm PCBs can be considered equivalent treatment. Treatment residuals can be re-deposited on site without long term management controls as long as treatment byproducts have been found to be safe.

Solvent Washing/Extraction

Solvent washing/extraction involves removing PCBs from the contamited soil and concentrating them in a residual side stream can be accomplished by use of pozzolons such as cement or lime. Encapsulation, rather than bonding, occurs to prevent leaching of the PCBs. There is some evidence in the literature that the excess hydroxides are substituted on the biphenyl ring resuting in a dechlorination reaction. The dechlorinated product would probably be less toxic than the parent molecule. The extent of the dechlorination process is not known. Stabilization may be accomplished using a modified clay or other binder to bond to the PCB preventing leaching of the PCBs even under extreme environmental conditions. This product will probably be stable over time because of the binding, but no changes in the parent molecules are expected.

When the stabilized/solidified material is analyzed by standard methods used to quantify PCB levels in soils and the results indicate PCB concentrations are below 2 ppm, the mobility of the PCBs has been effectively destroyed to the extent necessary to demonstrate equivalency to incineration. Standard analytical methods for PCBs are given in Table 4-2. [Need to add description of how solidified material would be analyzed] Since PCBs will probably be detected at levels more representative of what is in the solidified/stabilized material, long term management controls as outlined in Table 3-3 should be incorporated into the alternative.

4.3 Dredged Material

A special allowance is made under TSCA for dredged material and municipal sewage treatment sludges in section 761.60(a)(5)(iii). If, based on technical, environmental, and economic considerations, it can be shown that disposal in an incinerator or chemical waste landfill is not reasonable or appropriate and that an alternative disposal method will provide adequate protection to health and the environment, this alternate disposal method will meet the substantive requirements of TSCA. Since these showings are integral components of any remedy selected at a Superfund site, Superfund actions involving PCB-contaminated dredged material will generally be consistent with TSCA.

4.4 RCRA Hacardous Waste

As noted in section 2.3.2, special consideration must be given to PCB-contaminated soil that also contains material considered hazardous under RCRA. Soil containing constituents that make it hazardous under RCRA that is excavated for the purpose of treatment or disposal must be treated consistent with the land disposal restrictions prior to placement. This means that the treatment method must be applied or specified concentration levels attained for the waste contained in the soil or a

Table 4-2
ANALYTICAL METHODS FOR PCBs

Matrix	Method	GC	GC / MS	Detection Limit	Quantification Limit
Oil	Bellar and Lichtenberg	yes		less than 2 ppm	greater than 2 ppm
	ASTM 04059	yes		less than 2 ppm	greater than 2 ppm
Water/Soil/ Sediment	Method 680		yes		
	Method 8080	yes		0.1 - 0.5 ppb	Water greater than 3 ppb Soil/Sediment greater than 2 ppm
Water	EPA Method 505 (Microextraction)	yes		0.1 - 0.5 ppb	greater than 3 ppb
	Perchlorination			0.1 - 0.5 ppb	
	Method 680		yes		
	Method 608	yes		0.1 - 0.5 ppb	greater than 3 ppb
Air	NIOSH Method 5503 Florosil sorbent, hexane extraction, GC/ECD	yes			

treatability variance invoked. For soil and debris from CERCLA sites, treatment level guidelines for constituents found in RCRA hazardous waste have been developed and should be used as a guide in determining the reductions in contaminant levels that should be attained by alternative treatment methods. PCBs are not considered hazardous under RCRA since they are addressed under the TSCA regulations; however, land disposal restrictions do address PCBs under the California List Waste provisions. If the concentration of halogenated organic compounds exceeds 1000 ppm, the land disposal restrictions associated with California List Waste become applicable. A list of compounds regulated under the category of halogenated organic compounds is provided in 40 CFR part 268 Appendix III. PCBs are included on this list. Soil with HOCs exceeding 1000 ppm must be incinerated or treated under a treatability variance. Under a treatability variance, treatment should achieve residual HOC concentrations consistent with the levels specified for a treatability variance for Superfund soil and debris (June 1, 1988 memo from Henry Longest and Sylvia Lowrance). For PCBs concentrations must be reduced to .1 - 10 ppm for concentrations up to 100 ppm, and percent reductions of 90 - 99.9% must be achieved for higher concentrations. If solidification is used the levels specified apply to leachate obtained from application of the Toxicity Characteristic Leaching Procedure (TCLP). The implications of the land disposal restrictions vary somewhat depending on whether the waste present is a listed waste or a characteristic waste.

If the soil contains a listed hazardous waste, once treatment consistent with the land disposal restrictions; i.e., specified treatment or concentration reductions consistent with the levels provided in the treatability variance guidelines for soil and debris is employed, the residual after treatment must be disposed in a landfill that meets the requirements of a RCRA Subtitle C Landfill. If the concentration of PCBs remaining still exceeds 2 ppm, the landfill should also be consistent with a chemical waste landfill described under TSCA. As discussed in Section 3.1.3, if the site is closed consistent with closure for a Subtitle C landfill this will also be consistent with the long term management controls associated with a chemical waste landfill.

If the soil contains material that makes it hazardous because of a characteristic; e.g., leachate concentrations exceed levels specified in 40CFR 261.24, the soil should be treated to remove the characteristic. Once the characteristic has been removed, the waste is no longer hazardous and Subtitle C landfill requirements would not be applicable. However, long term management controls consistent with the guidelines given in Section 3.1.3 should be employed. Also, the treatment requirements for a California List waste may still be applicable if HOC concentrations exceed 1000 ppm and should be addressed as described above.

4.5 Example Options Analysis -- Contaminated Soil

Table 4-3 outlines the ARARs that may have to be addressed for wastes with different constituents including those that will make the waste hazardous because either a listed waste is present or the material exhibits a hazardous characteristic. [add flow chart of options from ARAR conference call summary]

5.0 Analysis of Alternatives and Selection of Remedy

It will generally be appropriate to develop a range of alternatives for sites with PCB contamination, including alternatives that involve treatment of the primary threats using methods described in section 4 or more innovative methods and alternatives that involve long term management of wastes consistent with the framework provided in section 3. As described in the Guidance on Conducting Remedial Investigations/Feasibility Studies Under CERCLA, alternatives are screened on the basis of effectiveness, implementability, and cost. Those alternatives that are retained are analyzed in detail against nine evaluation criteria.

5.1 Evaluation Criteria

Alternatives retained for detailed analysis are evaluated on the basis of the following criteria:

- o Overall protection of human health and the environment
- o Compliance with ARARs
- o Long-term effectiveness and permanence
- o Reduction of toxicity, mobility, or volume through treatment
- o Short-term effectiveness
- o Implementability
- o Cost
- o State acceptance
- o Community acceptance

The sections that follow will discuss in turn the first seven of these criteria and the special considerations that may be appropriate when PCB contamination is to be addressed. State and community acceptance are important criteria but are generally handled no differently for PCB sites than they are for other contaminated sites. PCBs do, however, tend to draw more attention than other typical contaminants.

5.1.1 Overall Protection of Human Health and the Environment

Table 4-3
EXAMPLE PCB COMPLIANCE SCENARIOS FOR CONTAMINATED SOIL

Waste Type and Concentration	Restriction(s) in Effect	Compliance Options to Meet Restrictions *
PCBs > 50 ppm	TSCA	• Dispose of in chemical waste landfill; • Incinerate; <u>or</u> • Use equivalent treatment to 2 ppm
PCBs > 50 ppm, RCRA listed waste, and HOCs < 1,000ppm [in this case PCBs not covered by RCRA]	TSCA	• Must also be consistent with chemical waste landfill if final PCB concentration exceeds 2 ppm
	RCRA LDRs	• Treat to LDR treatment standard for listed waste; <u>or</u> • Obtain an equivalent treatment method petition; <u>or</u> • Obtain a treatability variance (soil and debris concentration levels as TBC); <u>and</u> • Dispose of according to Subtitle C restrictions
PCBs > 50 ppm, RCRA listed waste, and HOCs > 1,000 mg/kg	TSCA	• Dispose of in chemical waste landfill if final PCB concentration exceeds 2 ppm
	RCRA LDRs	• Treat to LDR PCB (i.e., incinerate) and listed waste treatment standard; <u>or</u> • Obtain an equivalent treatment method petition; <u>or</u> • Treat to treatability variance levels for Superfund soil and debris; <u>and</u> • Dispose of according to Subtitle C restrictions
PCBs > 50 ppm, RCRA EP characteristic metal waste, and HOCs < 1,000 mg/kg	TSCA	• Dispose of in chemical waste landfill if final PCB concentration exceeds 2 ppm
	RCRA LDRs	• Solidify to remove characteristic
PCBs > 50 ppm, RCRA EP characteristic metal waste, and HOCs > 1,000 ppm	TSCA	• Dispose of in chemical waste landfill if PCB concentration exceeds 2 ppm
	RCRA LDRs	• Incinerate to LDR treatment standard for HOCs, solidify ash; <u>or</u> • Treat by equivalent method, solidify; <u>or</u> • Treat to treatability variance levels for PCBs in soil and debris, solidify residuals; <u>or</u> • Solidify to remove characteristic -- waste no longer RCRA hazardous

* If both TSCA and RCRA landfill requirements apply, comply with the most stringent.

Overall protection of human health and the environment is achieved by eliminating, reducing, or controlling site risks posed through each pathway. As covered in section 3, this includes direct contact risks, potential migration to ground water, and potential risks to ecosystems. Often alternatives will involve a combination of methods (e.g., treatment and containment) to achieve protection. In general, remedies for PCB sites will involve reducing high concentrations of PCBs through treatment and long-term managment of materials remaining. The method of protection used to control exposure through each pathway should be described under this criterion.

5.1.2 Compliance With ARARs

As outlined in section 2, the primary ARARs that will be encountered at PCB sites derive from the RCRA and the TSCA, and for actions involving PCB contaminated ground water and/or surface water, the SDWA and the CWA.

Since RCRA closure requirements are generally relevant and appropriate at Superfund sites even when a hazardous waste is not involved, a discussion of the measures taken at the site for the alternative being considered that are consistent with the RCRA requirements is warranted.

TSCA is applicable for any alternatives involving movement of material with 50 ppm or greater PCBs and compliance with the substantive requirements must be addressed. For alternatives that do not achieve the standards specified for treatment of PCBs under TSCA, consistency with long term management controls associated with a chemical waste landfill must be demonstrated. Consistency may be achieved by complying with the specified landfill requirements or meeting the substantive findings to support a waiver as provided in the TSCA regulations.

Although the the PCB Spill Policy is not ARAR, it is an important TBC. A discussion of the relation between the cleanup levels selected and the cleanup levels in the Spill Policy for alternatives involving no or minimal long term management controls is usually warranted.

Because PCBs adhere strongly to soil, it may be impracticable to reduce concentrations in the ground water to the proposed MCL level of .5 ppb for sites where PCBs have migrated to the saturated zone. PCBs adsorbed to particulates can be removed in extraction wells; however, they will be drawn through the aquifer very slowly. A waiver from State standards or the MCL once it becomes final may be warranted for sites where ground water restoration time frames are estimated to be very long or where cleanup cannot be achieved throughout the entire area of attainment. Interim remedies to assess the practicability of extraction or other techniques may be worthwhile to determine the feasibility of achieving drinking water levels or at a minimum, reducing risks to the extent practicable.

5.1.3 Long Term Effectiveness and Permanence

Long term effectiveness and permanence addresses how well a remedy maintains protection of human health and the environment after remedial action objectives have been met. Alternatives that involve the removal or destruction of PCBs to the extent that no access restrictions are necessary to for protection of human health and the environment provide the greatest long term effectiveness and permanence. The uncertainty associated with achieving cleanup levels for the treatment methods considered may distinguish alternatives with respect to this criteria. Alternatives that limit the mobility of PCBs through treatment such as solidification/stabilization afford less long term effectiveness and permanence than alternatives that permanently destroy the PCBs. Although solidification in combination with managment controls can be very reliable. Generally, alternatives relying solely on long term management controls such as caps, liners, and leachate collection systems to provide protection have the lowest long term effectiveness and permanence. Many alternatives will involve combinations of treatment and containment and will consequently fall at various points on the scale depending on the volume and concentration of residuals remaining on site.

5.1.4 Reduction of Toxicity, Mobility, or Volume

The anticipated performance of treatment technologies used in the alternatives is evaluated under this criterion. Alternatives that do not involve treatment achieve no reduction of toxicity, mobility, or volume and should not be addressed under this criterion. Alternatives that use treatment methods that have a high certainty of achieving substantial reductions of PCBs have the greatest reduction of toxicity. Alternatives that treat the majority of the contaminated material through these processes achieve the greatest reduction in volume. Alternatives that utilize methods to encapsulate or chemically stabilize PCBs achieve reduction of mobility; however, most of these processes also increase the volume of contaminated material and this must be considered.

5.1.5 Short Term Effectiveness

The effectiveness of alternatives in protecting human health and the environment during construction and implementation is assessed under short-term effectiveness. This criteria encompassess concerns about short-term impacts as well as the length of time required to implement the alternatives. Factors such as cross-media impacts, the need to transport contaminated material through populated areas, and potential disruption of ecosystems may be pertinent. Because PCBs do volatilize, remedies involving excavation will create short term risks through the inhalation pathway. For actions involving large volumes of highly contaminated material this risk may be substantial.

5.1.6 Implementability

The technical and administrative feasibility of alternatives as well as the availability of needed goods and services are evaluated to assess the alternative's implementability. Many of the treatment methods for PCBs require construction of the treatment system on-site since commercial systems for such techniques as KPEG and solvent washing are not readily available. Other methods, such as bioremediation, require extensive study before their effectiveness can be fully assessed. This reduces the implementability of the alternative. Offsite treatment and disposal facilities must be permitted under TSCA and usually under RCRA as well if other contaminants are present. This may affect the implementability of alternatives that require PCB material be taken offsite. Finally, the implementability of alternatives involving long term management and limitations on site access to provide protection may be limited by the site location; e.g., flood plain, residential area.

5.1.7 Cost

Capital and operation and maintenance costs are evaluated for each alternative. These costs include design and construction costs, remedial action operating costs, other capital and short-term costs, costs associated with maintenance, and costs of performance evaluations, including monitoring. All costs are calculated on a present worth basis.

5.2 Selection of Remedy

The remedy selected for the site should provide the best balance of tradeoffs among alternatives with respect to the nine evaluation criteria. First, it should be confirmed that all alternatives provide adequate protection of human health and the environment and either attain or exceed all of their ARARs or provide grounds for invoking a waiver of an ARAR. Some of the key tradeoffs for sites with PCB contamination include:

o Alternatives that offer a high degree of long term effectiveness and permanence and reduction of toxicity, mobility, or volume, such as incineration, generally involve high costs. Short term effectiveness may be low since risks may increase during implementation due to the need to excavate and possibly transport contaminated material, resulting in cross-media impacts.

o Alternatives that utilize innovative methods, often less costly than incineration, to reduce toxicity, mobility, or volume are often more difficult to implement due to the need for treatability studies and to construct treatment facilities onsite. In addition, the treatment levels achievable and the long term effectiveness and permanence may be less certain.

o Alternatives that involve stabilization to reduce the mobility of PCBs and limit cross-media impacts that may result from incineration (particularly important when other contaminants such as volatile metals are present) at a lower cost than other treatment methods, have higher uncertainty over the long term and may provide minimal advantages in long term effectiveness over alternatives that contain the waste in place.

o Alternatives that simply contain PCBs do not utilize treatment to reduce toxicity, mobility, or volume of the waste, have lower long term effectiveness and permanence than alternatives involving treatment, but are generally less costly, easy to implement, and have minimal short term impacts.

The relative trade-offs based on these considerations will vary depending on site specific considerations discussed in earlier sections; i.e., concentration and volume of PCBs, site location, and presence of other contaminants.

5.3 Documentation

Typically, a ROD for a PCB-contaminated sites should include the following unique components in addition to the standard site characterization and FS summary information described in the Guidance on Preparing Superfund Decision Documents:

o Remediation goals defined in the FS. For the selected remedy, the ROD should describe:

- Cleanup levels above which PCB-contaminated material will be excavated. A comparison of the levels selected to PCB Spill Policy levels and explanation of why they differ may be warranted.

- Treatment levels to which the selected remedy will reduce PCB concentrations prior to re-depositing residuals onsite or in a landfill. The consistency of these levels with the TSCA requirements.

o A description of technical aspects of the remedy, such as the following:

- Treatment process, including the disposition of all effluent streams and residuals.

- Time frame for completing the remedy and controls that will be implemented during this time to ensure protection of human health and the environment.

- Long term management actions or site controls that will be implemented to contain or limit access to PCBs remaining on site. The consistency with RCRA closure and TSCA chemical waste landfill measures, and necessary TSCA waivers, should be indicated.

SUMMARY REPORT OF FY82 FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
** REGION 01							
* Cannon Engineering/Plymouth, MA (03/31/88) (F) Decontamination of all structures and debris with offsite disposal; excavation of contaminated soils with onsite thermal aeration; excavation of PCB contaminated soils and offsite incineration and disposal; restrict ground water use; ground water monitoring.	$3,400,000 Present Worth	RD: (SCAP): 89/4 RA: (SCAP): 91/4	Not Provided	Not Provided	Not Provided	Not Provided	Incineration selected.
* Ottati & Goss, NH (01/16/87) (S) Excavation of PCB contaminated soil and sediment with concentrations above 20 ppm and destruction of contaminants by incineration following test burn. RCRA delisting evaluation to be conducted for ash residuals. Aeration of other contaminated soils, including PCB soil with concentrations less than 20 ppm. Pilot study to be conducted to demonstrate the aeration process at a [illegible] of $175,000.	$6,055,000 Present Worth	RD: (SCAP): 89/2, subsequent RD start pending trial; RA: (SCAP): 91/4.	Not Provided	143 ppm	1 ppm Sediment, 20 ppm Soil	14,000 cubic yards	EPA feels that the recommended health-based excavation criteria of 20 ppm are appropriate for this site and are consistent with EPA draft guidance (Development of Advisory Levels for PCB Cleanup). Soil aeration will be consistent with RCRA requirements achieving 1 ppm for sediments with less than 20 ppm PCBs.
[illegible]'s Salvage Yard, ME (05/30/89) (F) [illegible]ion and offsite incineration of [illegible] cubic yards of > 50 ppm PCB [illegible]inated soil with offsite disposal of ash; excavation and onsite solvent	$3,420,000 Capital Cost	RD: (SCAP): [illegible] RA:	Not Provided	1.92 ppm	1 ppm	2,200 cubic yards	Incineration for PCB concentrations above 50 ppm. Solvent extraction for PCB concentrations between 5 ppm to 50 ppm. Replace and cover

SU Y REPORT OF FY82-FY88 RECORDS OF DECISION (1)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
extraction of 5-50 ppm PCB contaminated soil with collection of treatment waters in onsite storage tanks and treatment by carbon adsorption and disposal (unspecified) of carbon filters and water, offsite incineration and disposal of PCB oil by-products, and onsite backfilling of treated soils; consolidation of 500 cubic yards of 1-5 ppm PCB soil into excavated areas and cover with < 1 ppm PCB soil; extraction and onsite treatment of contaminated ground water using filtration and carbon adsorption with reinjection of treated water and disposal of carbon residuals (unspecified); offsite disposal of debris affecting remediation activities; O&M.							for PCBs below 5 ppm.
* Re-Solve, MA (09/24/87) (F) Dechlorination (KPEG) (potassium polyethylene glycol) rapidly dechlorinates aromatic halides. Similar process to soil washing with a reagent soil contacting step followed by a multi-step heat treatment and water rinse process. Bench-scale test proven to reduce PCB contaminated soil from 3000 ppm to 1 ppm. New facility to be completed in spring 1988. This treatment attains all ARARs, is cost-effective, uses treatment to MEP and reduces TMV.	$17,038,000 Present Worth	RD: (SCAP): 90/4 RA: (SCAP): 93/1	Not Provided	10-3000 ppm	1 ppm Sediment, 25 ppm Soil	22,500 cubic yards	Incineration not selected due to limited facilities (availability) and length of implementation time.

[redacted]

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
* Rose Township Dump, MA (09/23/88) (RP) Excavation of 15,000 cubic yards of soil and sediment > 13 ppm PCBs and onsite incineration and disposal; recovery of subsurface free product with offsite thermal destruction and disposal; extraction of ground water and treatment using air stripping and carbon adsorption with discharge to the aquifer; installation of a bedrock extraction well; O&M.	$4,450,000 Present Worth	RD: (SCAP): 90/3 RA: (SCAP): 91/3	Not Provided	Not Provided	13 ppm	15,000 cubic yards	Incineration selected.
* Sullivan's Ledge, MA (06/29/89) (F) Excavation of 24,200 cubic yards of contaminated soil and 1,900 cubic yards of contaminated sediment with dewatering and onsite solidification and disposal; excavation, clearing, and onsite and offsite disposal of debris; capping of eleven of the twelve acre site; extraction and onsite treatment of contaminated ground water by passive and active techniques which include oxidation/filtration for metals and ultraviolet/ozonation for organics (or air stripping and carbon adsorption), dewatering and concentration of metals and disposal in an appropriate facility pending testing, and onsite discharge of	$10,000,000 Present Worth	RD: (SCAP): 91/1 RA: (SCAP): 92/4	Not Provided	18-2400 ppm	10 ppm (soils), 1 ppm (seds)	24,200 cy (soil), 1,900 cy (seds)	Selected remedy is cost effective considering long-term effectiveness and the significant reduction of mobility equivalent to other treatment alternatives (i.e., incineration). Available at less cost, with less problems regarding implementation.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
treated water to surface water or to a secondary treatment plant; diversion and lining of surface water; ground water institutional controls; O&M.							
** REGION 02							
* Bridgeport Rental & Oil, NJ (12/31/84) (F)							
Excavation and onsite incineration of oily waste, sediment and sludge using a pyrotech mobile incinerator.	$35,050,000 Present Worth	RD: (SCAP): 88/2 RA: (SCAP): 92/4	Not Provided	>500 ppm	Not Provided	60,000 cubic yards	Incineration selected.
* Burnt Fly Bog, NJ (09/29/88) (S)							
Excavation of contaminated materials and offsite disposal; containment of contaminated soil in westerly wetlands; construction of a security fence and access road; treatability studies.	$6,100,000 Present Worth	RD: (SCAP): 90/2 RA: (SCAP): 91/2	Not Provided	8.4-232 ppm	5 ppm (soils)	62,000 cy (soil) 1,400 cy (seds)	Contamination found in the downstream area, while significant enough to pose a threat in the stream, is at sufficiently low concentration that treatment is not warranted. At this low concentration, EPA feels that containment in a RCRA or TSCA permitted facility would be protective, and treatment technically difficult and unwarranted. Treatability studies will determine the most appropriate remedy for the westerly wetlands.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
* Chemical Control, NJ (09/23/87) (F) In situ fixation (drill large diameter soil borings, inject chemical fixating material and mix with soil). Treatability studies will be conducted during remedial design. "Fixation is considered a permanent solution and is least expensive."	$7,280,000 Capital Cost	RD: (SCAP): 91/2 RA: (SCAP): 93/1	1242 1254 1260	ND-6 ppm	Not Provided	18,000 cubic yards	Incineration is more expensive than the selected alternative and does little to further reduce risk at the site.
* Clothier Disposal, NY (12/28/88) (S) Cover contaminated soil with one foot of clean soil; installation of rip rap to prevent soil erosion; long-term ground water, surface water, air and sediment monitoring; institutional controls including land use and deed restrictions.	$500,000 Present Worth	RD: (SCAP): 89/3 RA: (SCAP): 90/4	1242	2.7 ppm	1 ppm	2,500 cubic yards	EPA determined that the risk levels associated with the residual contamination was minimal and within the range considered acceptable for SF remedies. The selected remedy provides additional protection by reducing the threat of contact and ingestion through capping.
* Hooker/Hyde Park, NY (11/26/85) (FE) Extraction and onsite phase separation of non aqueous phase liquids (NAPL) from ground water followed by destruction using incineration.	$17,000,000 Total Cost	RD: (SCAP): 86/4 RA: (SCAP): 92/1	1248	3000 ppm	Not Provided	Not Provided	Incineration selected.
* Kin Buc Landfill, NJ (09/30/88) (RP) Extraction of ground water and aqueous	$16,635,000	RD: (SCAP): 90/2	Not	50 ppm (max)	Not	400,000 cy	It would be difficult for a single

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
phase leachate and onsite treatment using carbon adsorption and aerobic/anaerobic biodegradation treatment with onsite residual discharge to surface water; collection and offsite incineration of oily phase leachate; installation of a slurry wall and cap with periodic monitoring; O&M.	Present Worth	RA: (SCAP): 93/1	Provided		Provided	> 50ppm 4,205,000 cy < 50ppm	incinerator facility to dedicat itself to handling such a large volume of hazardous waste. Eve an incinerator dedicated itself disposing Kin-Buc wastes, it is estimated that it would take 35 years to complete incineration.
* Ludlow Sand & Gravel, NY (09/30/88) (FE) Excavation of 10,000 cubic yards of contaminated soil and sediment and onsite consolidation and disposal with cap; collection of leachate using either a passive drain system or an active extraction well system and dewatering of contaminated leachate and ground water onsite with onsite discharge of effluent to surface water or offsite discharge; implementation of upgradient ground water controls, if necessary; deed restrictions; multimedia monitoring.	$3,727,000-$14,548,900 Present Worth	RD: (SCAP): 91/1 RA: (SCAP): 93/2	Not Provided	2-482 ppm	10 ppm	10,000 cubic yards	Thermal treatment (incineration was not expected to offer significant increases in protectiveness to public health the environment or short-term effectiveness or long-term effectiveness for the increased cost.
Swope Oil & Chemical, NJ (09/27/85) (F) Excavation and offsite incineration of hot spots".	$3,134,683 Total Cost	RD: (SCAP): 88/4 RA: (SCAP): 90/4	1242 1248 1254 1260	5-500 ppm	5 ppm	145 cubic yards	Total site contamination not incinerated due to cost.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs) SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
Wide Beach Development, NY (09/30/85) (S) onduct pilot study on KPEG (potassium olyethylene glycol) treatment to etermine effectiveness in neutralizing the PCB contaminated soil (pilot cost $500,000). The process is similar to wastewater treatment units. Mix ontaminated soils with potassium-based eagent, heat to 100 degrees Celcius for wo hours followed by water washes and eparation. Soil moisture is the major pediment to in situ PCB soil chemical eatment (must maintain 2-3% moisture ontent). Pilot study to determine sign parameters, operation temperatures retention time. "Treatment results ultimate destruction of contaminants, ids hazards of transport and is more t effective than disposal."	$9,295,000 Present Worth	RD: (SCAP): 89/2 RA: (SCAP): 91/1	1254	0.05-1026 ppm	10 ppm	22,300 cubic yards	Incineration not retained as a viable alternative through preliminary screening.
ork Oil, NY (02/09/88) (F) vation and dewatering of PCB minated soil and sediments with dification treatment in a mobile te unit. Contaminated soil and ments will be blended in mixing tanks fixing additives to permanently lize the wastes. The stabilized al will be tested to verify its eachability and then disposed	$6,500,000 Capital Cost	RD: (SCAP): 91/1 RA: (SCAP): 93/2	1248 1254 1260	0.001-210 ppm	10 ppm Soil 0.0001 ppm Ground Water	30,000 cubic yards 25,000 gallons	Incineration was not selected because further treatment of the residual ash following thermal destruction may be needed to fuse the high concentration of metals found onsite into the residual ash in a non-hazardous form.

[redacted]

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
onsite. Installation of deep ground water drawdown wells and shallow dewatering wells to collect the sinking contaminant plume and oil during excavation. Extracted ground water will be treated onsite and discharged in accordance with NY State NPDES requirements. The proposed ground water treatment system would consist of an oil skimmer and oil/water separator that would concentrate the PCB-laden oils floating on the ground water. Water from the separator would be discharged into a modular water treatment unit and offsite treatment of PCB-contaminated tank oils and additional oils collected at the site will be performed. Cleaning and demolition of the empty storage tanks also will be required. Treatability studies will be conducted to determine the effectiveness of the solidification process and the optimal treatment system for ground water,							
** REGION 03							
* Delaware Sand & Gravel, DE (04/22/88) (FE)							
Excavation of PCB-contaminated soil to a level where leachate released to the ground water no longer poses an unacceptable long-term carcinogenic risk	$18,250,000 Total Cost	RD: (SCAP): 90/2 RA: (SCAP): 9' 6	Not Provided	0.097-49 ppm	Not Provided	29,722 cubic yards	Incineration selected.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
(Drum Disposal Area), or to a depth of approximately 5 feet (Ridge Area). Temporary onsite storage followed by onsite mobile incineration of excavated soil and waste. The type of incinerator will be determined via engineering evaluation and treatability studies during the remedial design. Residual ash will be analyzed and disposed onsite.							
* Douglassville Disposal, PA (06/24/88) (S) removal, transportation, and offsite incineration of liquid and sludge tank aste. Decontamination of tanks, piping, rocessing equipment, and building aterials designated for salvage or reuse o a level not to exceed 100 ug/100 quare centimeters PCBs on the surface etermined by a wipe sampling. Offsite isposal of building rubble, concrete, asphalt, and other materials that cannot be decontaminated to less than 50 ppm PCBs and treatment (dewatering or incineration) of generated decontamination fluids, as appropriate depending on type and degree of contamination.	$4,050,000 Capital Cost	RD: (SCAP): 89/3 RA: (SCAP): 91/1	1260	1.5-6400 ppm	Not Provided	200,000 gallons	Incineration selected.
* Douglassville Disposal, PA (06/30/89) (S) Excavation and onsite thermal treatment	$39,280,670	RD: (SCAP): 90/3	Not	552-1889 ppm	Not	48,400	Incineration selected.

[redacted]

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

• SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
of 68,400 cubic yards of contaminated soils, sludges and sediments with solidification and onsite disposal of ash residuals; installation of soil covers in lesser contaminated source areas; deed restrictions.	$53,619,000 Capital Cost	RA: (SCAP): 91/4	Provided		Provided	cubic yards	
• Fike Chemical, WV (09/29/88) (F) Excavation and removal of tanks and drums with offsite incineration and disposal; onsite stabilization and/or offsite disposal of asbestos; temporary onsite storage of sodium metals; drainage and onsite treatment of lagoon sludge using ion exchange or chemical oxydation and wastewater using granulated activated carbon with offsite residual discharge to surface water.	$13,130,000 Present Worth	RD: (SCAP): 89/2 RA: (SCAP): 90/1	Not Provided	Not Provided	Not Provided	Not Provided	Incineration selected.
• M.W. Manufacturing, PA (03/31/89) (F) Excavation of 875 cubic yards of contaminated waste and soil followed by offsite incineration at a RCRA permitted facility; incinerator ash will be disposed offsite at a RCRA landfill.	$2,061,000 Capital Cost	RD: (SCAP): 89/4 RA: (SCAP): 90/1	Not Provided	1-54 ppm	Not Provided	875 cubic yards	Incineration selected.
• Ordinance Works Disposal, WV (03/31/88) (FE) Onsite mobile incineration and containment of excavated soils and	$6,718,000 Present Worth	RD: (SCAP): 91/2 RA: (SCAP): 93/4	1016 1260	229 ppm	5 ppm	Not Provided	Incineration selected.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
sediments in the areas of concern. A trial burn will be necessary to determine performance and scrubbers and/or baghouses may be required to control particulate and residual chemical constituents. Ash generated from the incineration process will be stored in water-tight bins and tested for EP toxicity. The ash that is not EP toxic may be disposed in the onsite inactive landfill, and ash that tests positive for EP toxicity will be disposed at an offsite RCRA facility. A multi-layer RCRA cap will be placed on the inactive landfill. "Onsite treatment using thermal oxidation is well-suited for this site. The materials are fairly homogeneous... capacity of 100 cubic yards/day would complete the project in 5 to 7 months.							
** REGION 04							
* Airco Carbide, KY (06/24/88) (RP) Extraction of ground water and onsite treatment using air stripping, carbon adsorption, and oil/water separation with discharge of treated water offsite to surface water; imposition of deed restrictions; excavation and deposition of contaminated surface soils in former	$6,090,000 Present Worth	RD: (SCAP): 89/3 RA: (SCAP): 91/4	Not Provided	4 ppm (seds)	Not Provided	5,000 cubic yards	Public health risks from soil exposure would be reduced to within target risk range through use of RCRA cap.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
burn pit area and cap; construction of organic vapor recovery system; construction of flood plain protection dike; installation of a leachate extraction system and upgrade existing clay cap.							
* Amnicola Dump, TN (03/30/89) (F) Excavation and separation of 600 cubic yards of contaminated surface soil and debris; onsite treatment of 400 cubic yards of soils using solidification/fixation with disposal onsite; contaminated debris will disposed of offsite; O&M.	$640,000 Present Worth	RD: (SCAP): 90/1 RA: (SCAP): 90/2	Not Provided	17 ppm	Not Provided	Not Provided	Exposure risk level determined to be in the 10-4 to 10-7. PCBs not addressed with respect to the selected remedy.
* Geiger/C&M Oil, SC (06/01/87) (F) Excavation and onsite thermal treatment of soil to remove organics. Solidification/stabilization of thermally treated soil following treatability studies.	$7,700,000 Present Worth	RD: (SCAP): 89/2 RA: (SCAP): 91/4	1254	4 ppm	1 ppm	11,300 cubic yards	Incineration selected.
* Goodrich, B.F. Chemical Group, KY (06/24/88) (RP) Extraction of ground water and treatment using air stripping, carbon adsorption, and oil/water separation with discharge of treated water to surface water; imposition of deed restrictions;	$6,090,000 Present Worth	RD: (SCAP): 89/3 RA: (SCAP): 91/4	Not Provided	4 ppm (seds)	Not Provided	5,000 cy (soil, seds)	Public health risks from soil exposure will be reduced to within target risk range through the use of a RCRA cap.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
excavation and placement of the contaminated surface soils in former burn pit area and cap; construction of an organic vapor recovery system; construction of a flood protection dike; installation of a leachate extraction system and upgrade existing landfill clay cap; O&M.							
* Mowbray Engineering, AL (09/25/86) (F) Excavation of soils contaminated above 25 ppm PCBs and either on- or offsite incineration or onsite stabilization/solidification of these soils. Infrared incineration is the preferred option, however, operating parameters (i.e., cost and ability of incineration to meet requirements of a TSCA permit) are not fully known for this technology and must be specified during design. This method allows for complete destruction of PCBs in soil, resulting in maximum risk reduction. The infrared incinerator operates without the intake air and fuel requirements associated with rotary kiln. Consequently, air handling stacks and scrubbers can be reduced and air emissions from fuel burning can be eliminated. Should actual experience with this type of unit prove unsatisfactory, the contaminated soils	$750,000 Capital Cost	RD: No RD date; removal action will be conducted to implement ROD; solidification was chosen as the selected action. RA: (SCAP): 87/4	1260	ND-1500 ppm	25 ppm	4,800 cubic yards	Incineration preferred in ROD, however, Regional Coordinator stated that solidification was selected by the removal program.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
will be stabilized/solidified onsite.							
* Pepper's Steel & Alloy, FL (03/12/86) (FE)							
Solidification of PCB contaminated soils with a cement type mixture and onsite placement of residuals. Proven process in bench-scale tests to reduce dissolution and diffusion rates and therefore reduce exposure. Primary concern is long-term integrity of matrix. A similar PCB and metal fixation treatment was performed successfully in Florida. The fill fixed with a similar blend passed the engineering performance and leaching criteria.	$5,212,000 Present Worth	RD: (SCAP): 87/1 RA: (SCAP): 89/3	Not Provided	1.0-2700 ppm	1 ppm	48,000 cubic yards	Incineration was not selected [illegible] to serious environmental disadvantages (2-16% of lead escapes into the aquifer), inavailability of incinerators, complexity of waste matrix, ti[illegible] intensive remedy, costly, and requires additional waste handl[illegible]
** REGION 05							
* Belvidere Municipal Landfill #1, IL (06/30/88) (S)							
Soils in the drum disposal area will be resampled and those containing greater than 50 ppm PCBs will either be excavated and incinerated offsite (40 CFR 761.70) or left in place (40 CFR 761.75) and capped with a soil cover. Soils contaminated with less than 50 ppm PCBs will be consolidated with the landfill material prior to capping.	$5,617,000 Present Worth	RD: (SCAP): 90/1 RA: (SCAP): 92/3	1242 1254 1260	9-51000 ppm	50 ppm	Not Provided	Incineration selected for soils containing greater than 50 ppm PCBs.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
* Bowers Landfill, OH (03/31/89) (RP) Capping; management of surface debris; erosion control and monitoring of ground water; O&M.	$4,267,500 Present Worth	RD: (SCAP): 90/4 RA: (SCAP): 92/1	1242 1248 1254	2.3-36 ppm	Not Provided	Not Provided	Covering landfill significantly reduces risk of ingestion.
* Fields Brook, OH (09/30/86) (F) Excavation of contaminated sediment with temporary storage, dewatering, test burns and onsite thermal treatment followed by onsite disposal of ash in a RCRA/TSCA landfill, unless determined to be non hazardous. (Considering offsite RCRA and TSCA incinerators, onsite rotary kiln, advanced electric reactor and onsite mobile incinerators.)	$12,260,000 Capital Cost	RD: (SCAP): 91/3 RA: (SCAP): 94/1	Not Provided	ND-518 ppm	50 ppm	16,000 cubic yards	Incineration selected.
* Fort Wayne Reduction, IN (08/26/88) (F) Excavation of the western portion of the site for removal of 4,600 buried intact drums and incineration of the drum contents onsite or offsite. Reconsolidation of excavated soils/wastes onsite followed by hybrid closure consisting of a compacted, continuous soil cover over the western portion of the site.	$10,020,000 Present Worth	RD: (SCAP): 91/3 RA: (SCAP): 91/4	Not Provided	<0.34-14.2 ppm	10 ppm	230,000 gallons	Incineration selected for drum contents; incineration not selected for contaminated soil due to high costs.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERAT[ION] WAS NOT SELECTED
* LaSalle Electrical Utilities, IL (03/30/88) (F) Excavation and mobile onsite incineration of PCB contaminated soils and stream sediments with concentrations above 5 and 10 ppm with subsequent ash analysis to determine final disposal location. High pressure flushing and mechanical cleaning of sewer lines, and collection and treatment (to be detailed during design, but will include phase separation, filtration, and air stripping) of ground water containing PCBs at concentrations above 1 ppb. Concentrations in excess of 150 ug/100 square centimeters were identified, through wipe samples, on all structures. Due to the magnitude of the problem, demolition and offsite disposal was selected to remediate the threats.	$34,495,180 Present Worth	RD: (SCAP): 89/2 RA: (SCAP): 93/2	1248 1254	0.38-17000 ppm	5 ppm (surface) 10 ppm (subsoils)	23,500 cubic yards	Incineration selected.
* Laskin/Poplar Oil, OH (08/09/84) (F) Excavation and offsite incineration of PCB contaminated waste water and oils.	$1,043,000 Total Cost	RD: (SCAP): 86/2 RA: (SCAP): 92/4	Not Provided	50-500 ppm	Not Provided	250,000 gallons	Incineration selected.
* Laskin/Poplar Oil, OH (09/30/87) (F) Excavation and incineration of oils, sludges and highly contaminated soils and offsite disposal of ash residuals.	$4,377,500 Present Worth	RD: (SCAP): 89/3 RA: (SCAP): 92/2	1221 1242 1254 1260	0.054-144 ppm	1-6 ppm	71,100 cubic yards	Incineration selected.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
* Laskin/Poplar Oil, OH (06/29/89) (S) Thermal destruction of contaminated soils, ash and debris with onsite disposal of ash if delisted or offsite disposal at a RCRA hazardous waste landfill; demolition and thermal destruction or decontamination of dioxin contaminated structures, if these structures cannot be decontaminated then contain in a concrete vault onsite and cap for temporary storage; drain retention and freshwater ponds with discharge to surface water and treatment as necessary; construct a multi-layer cap over soils exceeding performance levels; dewater site by natural ground water flow to surface water; conduct ground and surface water monitoring; land use restrictions; O&M.	$11,000,000 Capital Cost	RD: (SCAP): 91/2 RA: (SCAP): 92/4	Not Provided	Not Provided	Not Provided	5,000 cubic yards	Incineration selected.
* Miami County Incinerator, OH (06/30/89) (F) Excavation and consolidation of ash wastes and contaminated soils with disposal in north or south landfill and capping of north and south landfill; vapor extraction, vapor phase carbon treatment or equivalent, catalytic oxidation, or other appropriate treatment of exhaust; pump and treat ground water	$1,700,000-$3,500,000 Present Worth	RD: (SCAP): 92/1 RA: (SCAP): 92/2	Not Provided	Not Provided	Background Levels	22,000 cubic yards	Treatment depends on analysis of residual ash pile.

Table 6-1
SUPERFUND SITE SUMMARY

Superfund Site (ROD Date)	Initial Source & Problem	Disposition	Initial PCB Concentration Range (ppm)	Final PCB Concentration (ppm)	Geologic/Hydrogeologic Conditions	Cover Design	Bottom Liners	Leachate Collection/Removal and Leak Detection
1. Ottati and Goss, Kingston, NH (1/16/87)	• Buried drums, sludge	• Excavate • Off-site incineration • Cap • Aeration • Extract and treat groundwater	143 (soil)	20 (soil)	• Groundwater: 0-2 feet below surface • Geology: glacial tills; bedrock	9 inches top soil	• None	• Groundwater wells planned for pump and treatment
2. Re-Solve, MA, North Dartmouth, MA (7/24/87)	• Waste oil spread on dirt roads • Solvent reclamation facility	• Excavate • Cap • On-site treatment (dechlorination) • Wetland restoration • Extract and treat groundwater	15-52,000	25 (soil)	• Groundwater: 50-60 feet below surface • Geology: sand, gravel, till, bedrock	• Regraded and grassed	• None	• Groundwater wells planned for pump and treatment
3. Chemical Control, Elizabeth, NJ (9/23/87)	• Variety of waste in drums	• In-situ fixation • Debris removal • Storm sewer repair • Secure site (fence)	0-6	0-6	• Groundwater: 1-3 feet below surface • Geology: sand/gravel silty sand; till; bedrock	• 1-3 foot gravel layer	• None • Natural impermeable clays	• None
4. Wide Beach, Brant, NY (9/30/85)	• Waste oil spread on dirt roads	• Excavation • Chemical treatment	0.05-1026	10	• Geology: silty sand/gravel, silty/clay, fractured shale	• None (not feasible - residential community)	• None	None
5. York Oil, Moira, NY (2/5/88)		• Excavate • Stabilize • Off-site incineration • Extract and treat groundwater	.1-210		• Groundwater: 30 feet below surface • Geology: glacial bedrock	• None (stabilization process leaves treated soils impermeable)	• None • Natural impermeable clays	• Groundwater wells planned for pump and treatment

Table 6-1.
(Continued)

Superfund Site (ROD Date)	Initial Source & Problem	Disposition	Initial PCB Concentration Range (ppm)	Final PCB Concentration (ppm)	Geologic/ Hydrogeologic Conditions	Cover Design	Bottom Liners	Leachate Collection/ Removal and Leak Detection
6. Mowbray Engineering, AL ([illegible]/86)	• 3 acre swamp • Transformer repair plant	• Close cover • Excavate • Stabilize	• N.D.-62 • (soil)	• 25	• Groundwater: 10 feet below surface • Geology: sandy; clay, rock; limestone	• 2 feet compacted clay, 2 feet vegetative layer 2 feet sand, synthetic liner	• None	• None
7. Pepper's Steel & Alloys Medley, FL (3/12/86)	• 30 acres trash	• Excavate • Stabilize • Off-site incineration • Cap • Extract and treat groundwater	• 1.5-760 (soil)	• 1	• Groundwater: 5-6 feet below surface • Geology: fill; peat; limestone	• 12 inches crushed limestone	• None	• Down gradient groundwater wells planned for pump and treatment
8. Belvidere Landfill Belvidere, IL (6/10/88)	• Landfill • Drum disposal	• Excavate • Off-site incineration • Landfill • Cap • Extract and treat groundwater • Secure site	• 9-51,000	• 50	• Groundwater: 7 feet below surface • Geology: sand; gravel; bedrock	• RCRA cover	• None	• Groundwater wells planned for pump and treatment
9. Fort Wayne Fort Wayne, IN (8/2[illegible]/88)	• Dumping area • Recycling plant	• Excavate • On-site incineration • Cap • Containment wall • Extract and treat groundwater • Secure site	• 0.34-14.2	• 10	• Groundwater: 10-15 feet below surface • Geology: outwash sands and gravels; lake clays, silts and fines	• 2 feet clay and 6 inches vegetative layer	• None	• Groundwater wells planned for pump and treatment

Table 4-1
(Continued)

...nd Site ...rial	Initial Source & Problem	Disposition	Initial PCB Concentration Range (ppm)	Final PCB Concentration (ppm)	Geologic/ Hydrogeologic Conditions	Cover Design	Bottom Liners	Leachate Collection/ Removal and Leak Detection
...h Limited ...by, IA ...[illegible])	• 7.3 acre lagoon	• In-situ biological treatment • Stabilize	• N.D.-610	• 23	• Groundwater: less than 50 feet below surface • Geology: topsoil, clay	• None	• None • Natural impermeable clay	• Groundwater wells may be planned for pump and treatment
...[illegible] Bay/ ...[illegible] ..., WA ...[illegible])	• Scrap yard	• Excavate • Stabilize • Cap • Re-grade	• 0-106	• 1	• Groundwater: 8-17 feet below surface • Geology: fill; sand, clay	• 2 inches sealed asphalt	• None	• Groundwater monitoring system proposed
...[illegible] Side and ...lle, ID ...81)	• Transformers, capacitors • Scrap yard	• Excavate • Stabilize • Cap		• 10-25	• Groundwater: 20 feet below surface	• Low permeability or RCRA cap	• Low permeability clay added to existing aquitard • Stabilized material to serve as liner	• None

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
with discharge to POTW with pretreatment if necessary; alternate water supply.							
* Midco I, IN (06/30/89) (RP) Excavation and onsite treatment of 12,400 cubic yards of contaminated soil and waste and 1,200 cubic yards of contaminated sediments by a combination of vapor extraction and solidification/stabilization followed by onsite disposal; installation and operation of a ground water pumping system to intercept contaminated ground water followed by reinjection into a deep well; installation of RCRA cap; O&M.	$8,294,000-$9,094,000 Capital Cost	RD: (SCAP): 91/1 RA: (SCAP): 93/1	1242 1254 1248	44 mg/kg (max)	Not Provided	12,400 cubic yards	Incineration is more expensive the selected alternative and dc little to further reduce risk e the site.
* Midco II, IN (06/30/89) (RP) Excavation and onsite treatment of 35,000 cubic yards of contaminated soil and waste, and 500 cubic yards of sediments by solidification/stabilization followed by onsite disposal of the solidified waste; installation and operation of a pumping system to intercept contaminated ground water followed by discharge to a deep injection well; installation of RCRA cap; O&M.	$10,755,400-$11,755,400 Capital Cost	RD: (SCAP): 91/1 RA: (SCAP): 93/4	Not Provided	<50 mg/kg	Not Provided	35,500 cubic yards	Incineration is more expensive t! the selected alternative and does little to further reduce risk at the site.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs) SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATIC WAS NOT SELECTED
* Ninth Avenue Dump, IN (09/20/88) (F) Containment of the oil layer by constructing a soil-bentonite slurry wall extending into the clay layer 30 feet below the surface. The containment barrier will encircle and prevent migration of contaminants in waste, soils, and ground water. Extracted oil and ground water within the containment area will be processed separately through a two-pump system in each of several central extraction wells. Treatment of ground water to 1.0E-06 carcinogenic risk level and discharge into a ground water recharge system. Contaminated oil will be stored in an onsite tank located within a secondary containment structure meeting RCRA and TSCA tank storage requirements. Cleanup levels specified in the TSCA PCB Spill Cleanup Policy may not be met because PCB contaminated oil adsorbed to soils will not be addressed under this operable unit.	$1,960,000 Capital Cost	RD: (SCAP): 90/3 RA: (SCAP): 92/1	1248 1254 1260	5.7-1500 ppm	Not Provided	250,000-700,000 gallons	Incineration not selected beca the oil layer is contaminated chlorinated dibenzo-dioxins as as PCBs and it may be difficult find a commercial incinerator willing to accept dioxin contaminated waste, and a mobil incinerator may not be cost effective.
* Ninth Avenue Dump, IN (06/30/89) (F) Excavation of 36,000 cubic yards of oil contaminated waste and fill, debris, and sediments from on- and offsite surface water bodies followed by onsite thermal destruction in a mobile incinerator;	$22,209,000 Present Worth	RD: (SCAP): 91/3 RA: (SCAP): 93/4	Not Provided	Not Provided	Not Provided	36,000 cubic yards	Incineration selected.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
extraction, treatment (unspecified) and reinjection of contaminated ground water inside slurry wall to promote soil flushing; discharge of a small quantity of ground water outside slurry wall to compensate for infiltration; capping; O&M.							
* Outboard Marine/Johnson, IL (05/15/84) (F)							
Dredge, dewater and fixate the four contaminated "hot spots" containing PCB contaminated soil and sediments with offsite disposal. Total amount of PCBs is estimated to be 771,200 pounds.	$13,890,000 Capital Cost	RD: (SCAP): 85/3 RA: (SCAP): 91/4	Not Provided	50-155000 ppm	50 ppm	222,400 cubic yards	Fund balancing used to waive applicable laws. Incineration not retained as a viable alternative through preliminary screening.
* Outboard Marine/Johnson, MI (03/31/89) (F)							
Construction of three containment cells to hold contaminated soil and sediment; excavation of sediments contaminated with > 500 ppm PCB and soils > 10,000 ppm PCBs for onsite thermal or chemical extraction, or an effective alternative treatment, the treated sediments and soil will be placed in the containment cells, which will be lined and capped; extracted PCB will be disposed of offsite; dredge water will be treated by sand filtration and carbon adsorption with discharge to an offsite sanitary sewer or onsite.	$19,000,000 Present Worth	RD: (SCAP): 90/2 RA: (SCAP): 91/4	Not Provided	52-710000 ppm	Not Provided	Not Provided	Remedy reduces migration of contaminants to Lake Michigan. Extracted PCBs removed offsite for destruction.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATIC WAS NOT SELECTED
* Summit National Liquid Disposal, OH (06/30/88) (F) Excavation and onsite mobile incineration of PCB contaminated soils and sediments and buried drums and tanks including their contents with disposal of incinerated residual in an onsite RCRA landfill. Pre-burn tests will be equired to demonstrate the type of hermal destruction to be employed at the ite.	$25,000,000 Present Worth	RD: (SCAP): 90/2 RA: (SCAP): 95/3	Not Provided	Not Provided	Not Provided	32,000 cubic yards 88,000 gallons	Incineration selected.
Wedzeb, IN (06/30/89) (F) pproximately 600 feet of sanitary sewer ipeline will be hydraulically jetted and acuum pumped to remove the resulting ater and sediment loosened from the ipeline walls; filtration of water to emove PCB contaminated sediments; onitoring of the water and refiltering, if necessary with discharge to a POTW; approximately 2 barrels of sediment and 20 barrels of RI generated waste will be analyzed, > 50 ppm PCB levels will be treated by offsite incineration and levels < 50 ppm PCB will be disposed offsite at a EPA approved site.	$24,500 Present Worth	RD: (SCAP): 91/2 RA: (SCAP): 93/3	Not Provided	1-370 ppm(seds)	10 ppm	Not Provided	Incineration for PCB concentratic above 50 ppm, offsite land dispos for PCB concentrations below 50 ppm.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
** REGION 06							
* French Limited, TX (03/24/88) (F) In-situ biodegradation of sludges and contaminated soils using indigenous bacteria with aeration of the lagoon waste to enhance the degradation process. Residues from the treatment process will be stabilized to prevent migration of PCB's to the upper aquifer and disposed onsite.	$47,000,000 Present Worth	RD: (SCAP): 90/1 RA: (SCAP): 95/2	Not Provided	ND-616 ppm	23 ppm	149,000 cubic yards	Incineration is more expensive t the selected alternative and doe little to further reduce risk at the site.
* Hardage/Criner, OK (11/14/86) (FE) Extraction of surface and ground water with separation of NAPL followed by offsite incineration of organic liquids with offsite disposal of ash residuals or onsite incineration with onsite disposal of solid ash residuals and either recycle or treat (unspecified) and offsite discharge of residual liquids. Onsite phisiochemical treatment (unspecified) of inorganic liquids with offsite discharge to surface water or POTW, or offsite treatment at commercial treatment facility or offsite disposal via deep well injection. Onsite treatment of soils and debris by one or more of the following: chemical neutralization, solidification, dewatering, chemical	$68,000,000 Present Worth	RD: currently negotiating with PRP, (SCAP): 89/1; RA: (SCAP): assuming RP judgement 92/4	1260	>50 ppm	Not Provided	175,000 cubic yards	Determine incineration selection during remedial design.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

• SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
oxidation/reduction, air stripping. Rotary kiln incineration bench-scale test to be conducted for moisture content and reactions of soil/fluid combinations and if successful, conduct pilot study and emissions testing.							
• MOTCO, TX (03/15/85) (F)							
Excavation and offsite incineration of PCB liquid organics at a permitted TSCA facility.	$35,300 Capital Cost	RD: (SCAP): 86/4 RA: (SCAP): 94/1	Not Provided	ND-100 ppm	Not Provided	18,000 cubic yards	Incineration selected.
• Sheridan Disposal Services, TX (12/29/88) (RP)							
Excavation and onsite biotreatment of all sludges, debris, floating oil and emulsion, and soils containing >25 ppm of PCBs; residuals, reduced to <50 ppm PCBs, will be stabilized onsite, returned to the pond and capped; if the residuals are >50 ppm PCBs, the pond will be a RCRA compliant landfill; installation of a flexible spur jetty river bank erosion control system; decontamination and disposal of all onsite tanks and processing equipment with onsite treatment (unspecified) or offsite disposal depending on contents; treatment of storm and waste water streams to remove solids, metal and organics with discharge to surface water; institutional	$28,346,000 Capital Cost	RD: (SCAP): 91/1 RA: (SCAP): Not Available	Not Provided	223 ppm (max)	25 ppm	44,000 cubic yards	Bioremediation significantly reduces mobility, toxicity and volume and essentially eliminates the source of contamination to the ground water. Incineration is mechanically complex, using highly specialized equipment and operators and would have required approved offsite disposal of ash. Bioremediation is also the less expensive remedy.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERAT WAS NOT SELECTED
controls.							
* Sol Lynn/Industrial Transformers, TX (03/25/88) (F) Excavation and treatment of contaminated soil with an alkali metal polyethylene glycolate (APEG) reagent in a batch reactor to dechlorinate PCBs to a concentration of 25 ppm. This treatment changes the chemical composition of PCBs by chemically reacting with the chlorine atoms until they are completely dechlorinated. The process yields polyglycol byproducts that are non-toxic. Pretreatment, if necessary, and discharge of liquid byproducts of treatment into a publicly owned treatment works facility. Feasibility testing will be conducted during the design phase.	$2,200,000 Present Worth	RD: (SCAP): 90/4 RA :(SCAP): 93/2	Not Provided	ND-350 ppm	25 ppm	2,400 cubic yards	Incineration not selected b it is not cost-effective an additional protection would provided by this treatment.
* Sol Lynn/Industrial Transformers, TX (09/23/88) (S) Extraction of 12 million gallons of ground water and onsite treatment using air stripping and granulated activated carbon (emissions) with either reinjection or offsite discharge of treated water to sanitary sewer; air emissions, residual water and ground water monitoring; O&M.	$2,200,000 Present Worth	RD: (SCAP): 90/3 RA: (SCAP): 94/2	Not Provided	ND-350 ppm	Not Provided	2,400 cubic yards	Incineration not addressed as alternative.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
** REGION 07							
* Findett, MO (12/28/88) (F) Installation of ground water extraction wells for hydraulic control, and treatment using air stripping with residual analysis prior to discharge to a sewage treatment plant; removal of contaminated soils for offsite disposal or treatment.	$1,883,000 Capital Cost	RD: (SCAP): 89/2 RA: (SCAP): 91/3	Not Provided	5600 ppm (max)	Not Provided	Not Provided	Incineration may be selected, depending on concentration levels.
** REGION 09							
* Lorentz Barrel & Drum, CA (09/28/88) (FE) Extraction of PCB contaminated ground water and onsite treatment using a packaged ozone-UV system to treat PCB's to a level below the detection limit of 0.065 ppb. The treated effluent will be released onsite to a storm sewer. Prior to UV-ozone treatment, the groundwater will be pumped to an equilization tank that will provide roughly 30 minutes of storage and will dampen any short-term variations in flow rates or contaminant concentrations. The ozone-UV treatment method utilizes ozone's strong oxidizing capacity with UV light's additional energy to provide considerable amounts of free radicals and excited state species	$3,238,000 Present Worth	RD: (SCAP): 90/1 RA: (SCAP): 91/4	1221 1242 1254 1260	ND-6.4 ppm	0.065 ppb	Not Provided	Incineration was not discussed as a treatment alternative in the ROD.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
capable of effectively destroying the contaminants present. The ozonated wastewater will then be subjected to high intensity UV light in a packaged treatment vessel. The residence time of the water in the ozone-UV unit is 40 minutes. The wastewater is treated using an oxidant dosage of 75 mg/l of ozone plus 25 mg/l of hydrogen peroxide and contaminant destruction occurs inside the treatment vessel. EPA and other agencies have supported treatability studies showing that UV-ozone treatment is effective for permanent destruction of VOC's and PCB's/pesticides in wastewater and ground water.							
* MGM Brakes, CA (09/29/88) (FE) Excavation of PCB-contaminated soil with concentrations above 10 ppm, construction of a staging area with transportation and offsite disposal of soil without prior treatment. Extraction and treatment of wastewater from dewatering in a mobile treatment system to remove sediments and PCBs and discharge of treated water onsite or in a publicly owned treatment works. Soil containing >50 ppm PCBs will be transported to a Class I TSCA-permitted disposal facility; soil containing 10-50 ppm PCBs will be	$5,369,300 Present Worth	RD: (SCAP): 90/4 RA: (SCAP): 91/4	Not Provided	1-4500 ppm	10 ppm	13,510 cubic yards	Incineration was not selected because of community opposition and limited availability of incinerators.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
transported to a Class II CA DOHS-permitted facility. Demolition of processing building, crushing of the concrete slab and excavation of the underlying soil contaminated with >10 ppm PCBs followed by transportation and offsite disposal of the contaminated concrete in an appropriate disposal facility.							
** REGION 10							
* Commencement Bay/NTF, WA (12/30/87) (FE). Excavation and stabilization of PCB contaminated soils exceeding 1.0E-06 life-time cancer risk (1 ppm PCBs). Drainage, removal and stabilization of ponded water and sediments with onsite disposal of treatment residuals and asphalt capping of the entire stabilized matrix. These actions will comply with 40 CFR 761.60-79. Laboratory experiments will be performed to ensure that the stabilization process effectively immobilizes contaminants. Following this, a larger scale pilot study will be conducted. The process involves excavation and pulverization of soils, followed by mixing silicate polymers, cement and pond water with the soils. The proportions will be determined by the	$3,400,000 Present Worth	RD: (SCAP): 91/1 RA: (SCAP): 92/1	Not Provided	ND-204 ppm	1 ppm Soil 2 ug/l Ponded Water	45,000 cubic yards	Incineration not selected as a viable alternative through a preliminary feasibility study due to high cost.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
laboratory studies. The reagent composition is formulated to provide a high-strength surface.							
* Pacific Hide & Fur Recycling, ID (06/28/88) (RP)							
Excavation of contaminated soil to a depth of 1.5 feet with processing and fixation of soils in a solidified matrix. A pilot study is necessary to determine the extent of contaminated material that can be processed and the optimum mix of binding agents (silt and scrap material are the primary concerns as well as dust control during excavation). Strength tests, leachability tests, and durability tests will also be performed during the pilot study. The process entails excavation, reduction of size (to approximately two inches), and mixing with cement, lime, or fly ash and possibly a proprietary binding ingredient. Followed by mixing with an agent and water, the slurry will be poured into depressions where it will harden. A >3 foot soil cap will be placed over the solidified masses. Onsite containment of contaminated soils if fixation found to be not viable through a pilot study; this alternative will comply with 40 CFR 761.75 and .60. Large material which cannot be reduced in	$1,890,000 Present Worth	RD: (SCAP): 89/4 RA: (SCAP): 91/4	Not Provided	Not Provided	25 ppm (restricted) 10 ppm (non-restricted)	8,200 cubic yards	Incineration not selected as a viable alternative through preliminary screening due to difficulty of implementation.

SUMMARY REPORT OF FY82-FY88 RECORDS OF DECISION (RODs)
SELECTING TREATMENT TO REMEDIATE PCB CONTAMINATED MEDIA

* SITE NAME, STATE (ROD SIGN DATE) (LEAD) COMPONENTS OF THE SELECTED TREATMENT	TREATMENT COSTS	RD/RA STATUS AND COMPLETION DATES	AROCHLORS	PRE-TREATMENT CONCENTRATION	EXCAVATION LEVELS	ESTIMATED VOLUME	RATIONALE WHY INCINERATION WAS NOT SELECTED
size will be steam cleaned and tested for contamination. Upon satisfactory cleanup, on- or offsite disposal of these items will be performed. The decontamination water will be used as the water source for this fixation process.							
* Queen City Farms, WA (10/24/85) (FE) Phase separation of sludge with solidification and liquid stabilization. Offsite disposal of contaminated soil.	$3,439,000 Total Cost	RD: (SCAP): 87/1 RA: (SCAP): 87/1	1260	125 ppm	Not Provided	5,200 cubic yards	Incineration not selected due to cost, limited incinerator capacity and difficulty in transportation.
* Western Processing/Phase II, WA (09/25/85) (F) Conduct bench-scale tests using in-situ solidification/stabilization; if successful, conduct pilot studies. No further description of process provided.	$18,100,000 Present Worth	RD: (SCAP): 88/4 RA: Not Available.	Not Provided	58-1128 ppm	Offsite 2 ppm, Onsite 50 ppm	10,650 cubic yards	Incineration not retained as a viable alternative through preliminary screening.

Attachment 2

SITE NAME: Wide Beach, NY

SITE DESCRIPTION: The Wide Beach Development site is located in a small lakeside community in Brant, New York, approximately 48 km south of Buffalo. The Development covers 22 hectares, 16 of which are developed for residential use. The site is bordered on the west by Lake Erie, on the south by wetlands and on the east and north by residential and agricultural property. Between 1968-1978, 155 cubic meters (approximately 744 barrels) of waste oil, some containing polychlorinated biphenyls (PCBs) was applied to the local roadways for dust control by the Wide Beach Homeowners Association. In 1980 the installation of a sewer line resulted in excavation of highly contaminated soils and surplus soil was then used to fill in several yards and a nearby grove of trees.

The Erie County Department of Environmental Planning investigated a complaint in 1981 of odors coming from a nearby woods. They discovered 19 drums in the woods and two contained PCB-contaminated waste oil. Alerted to a potential problem subsequent investigatory sampling revealed the presence of PCBs in dust, soil, vacuum cleaner dust, and water samples from private wells.

In 1985 the EPA performed an action to protect the public from the immediate concern until implementation of a long term measure. The action involved the paving of roadways and drainage ditches, decontamination of homes by rug shampooing, vacuuming, and replacement of air conditioner and furnace filters and protection of individual private wells by installation of particulate filters.

WASTE DESCRIPTION : The primary contaminant at the Wide Beach site is PCBs, found over the majority of the site in all environmental media. The most significant contaminations were found in the sewer trench wells, soils adjacent to the roadways and wetlands sediments. Maximum PCB concentrations from the following areas were:

- drainage ditch samples - 1,026 ppm;
- yards and open lot samples - 600 ppm;
- unpaved driveway samples - 390 ppm;
- roadway samples - 226 ppm;
- sediment samples from marsh area - 126 ppm

The concentration of PCBs in one catch basin sample was 5,300 ppm. Investigations revealed that one of eight monitoring wells, and all six sewer trench wells were contaminated with PCBs. Drinking water sampling studies discovered PCB contamination in 21 of 60 residential wells, however the level of contamination was low ranging from 0.06 ug/l to 4.56 ug/l.

PATHWAYS OF CONCERN : The primary pathway of concern is through the ingestion of PCB contaminated soils. Additional potential concerns involve the environmental impact of contamination on the surrounding marshlands.

TREATMENT TECHNOLOGY SELECTED : The recommended remedial alternative involves the excavation of contaminated soils > 10 ppm PCBs, onsite chemical treatment to destroy PCBs and soil residual replacement. The recommended treatment will involve removing [illegible] cubic meters of soil from the roadway, 8,500 cubic meters from the drainage ditches, 1,500 cubic meters from unpaved driveways and 13,000 cubic meters from back and front yards. The chemical treatment for the 28,600 cubic yards of contaminated soil consists of a two step procedure. First, PCB molecules are extracted from the soils using solvents. The solvents are then treated with Potassium PolyethyleneGlycol (KPEG), to remove chlorine atoms from the PCB molecule. This slurry is then pumped to a rotary kiln where the mixture is maintained at a soil moisture content of 2-3 percent for four to eight hours at a temperature of 140 degrees Celsius while the dechlorination reaction takes place. This stage is followed by several water washes, and solids separation. The soils will be replaced onsite after the PCB contaminated matrix is treated to 2 ppm.

EQUIVALENT TREATMENT : TSCA PCB regulations were identified as being the most applicable and relevant guidelines for the cleanup and disposal of PCBs in soils at the Wide Beach Development site. Regulations in the TSCA Spill Cleanup Policy (Part 761.120-135), effective May 4, 1987, provide guidance on types of spills covered and the specific cleanup requirements for different concentration spills. PCB spills at Wide Beach, however, occurred before the effective date of this policy. According to the spill regulations, prior spills are subject to decontamination requirements established at the discretion of EPA regional offices. Therefore, the cleanup and disposal of PCBs at this site is not subject to the specific constraints of PCB policy as codified in Part 761.125, but to determinations made by the Regional Administrator. The selected remedy is, nevertheless, consistent with the intent of this policy.

Disposal regulations for PCBs in soils are found in TSCA regulation 761.60 (a) (4) which requires that soils containing PCBs at concentrations greater than 50 ppm be destroyed by incineration or disposed in a chemical waste landfill. Incineration was rejected as an option during the remedial investigation and was not documented in the Record of Decision. Offsite landfilling of the PCB soils was rejected due to concerns of excessive cost, dust release during excavation and possible exposure risks during transport. Due to the concerns expressed above, other disposal techniques were investigated for utilization at this site. TSCA 761.60 (e) provides for the approval of alternative methods to PCB incineration which achieve an equivalent level of performance and do not present an unreasonable risk of injury to health or the environment.

Guidance on the level of performance required of alternative methods of incineration can be found in than Office of Toxic Substances document entitled "Draft Guidelines For Permit Applications and Demonstration Test Plans For PCB Disposal By Non-Thermal Alternative Methods" published on August 21, 1986. Specifically, on pages 2-6 the interpretation reads that "for processes which destroy PCBs in contaminated liquids, the agency has generally required the applicant to show that the concentration of any individual PCB congener in the product (decontaminated) liquid is not more than 2 ppm." Pilot treatability studies were performed for the selected remedy to assess the effectiveness of potassium polyethylene glycol in dechlorinating the PCBs, and to determine important design parameters for the reaction vessel such as physical dimensions, operation temperatures and detention time. The results from a pilot study revealed a reduction from 260 ppm in soil to under 2 ppm in the treated residual thus meeting the level of performance requirements under TSCA.

SITE NAME: Pepper's Steel and Alloys, Florida.

SITE DESCRIPTION: The site occupies 30-acres in Medley, Florida, approximately 10 miles northwest of Miami overlying the Biscayne Aquifer. This aquifer is used as a sole source drinking water supply for a large population. This location has been the site of a variety of businesses including the manufacture of batteries and fiberglass boats, repair of trucks and heavy equipment and an automobile scrap operation. Batteries, underground storage tanks, transformers, discarded oil tanks and other miscellaneous debris have accumulated as a result of disposal from past and present operations at the site. Contaminants have been identified within the soil, sediments and ground water.

WASTE DESCRIPTION: The contaminants of concern are polychlorinated biphenyls (PCBs), organic compounds and metals such as lead, arsenic, cadmium, chromium, copper, manganese, mercury, zinc and antimony. The quantities and concentrations of the primary contaminants are:

- PCBs - 48,000 cubic yards of soil at 1.4 ppm to 760 ppm,
  12,000 gallons of free oils with concentrations up to 2,700 ppm;
- Lead - 21,500 cubic yards of soil at 1,100 ppm to 98,000 ppm;
- Arsenic - 9,000 cubic yards of soil at concentrations greater than 5 ppm.

PATHWAYS OF CONCERN : Of significant concern is ground water transport of PCBs and lead to private wells and lead intake due to ingestion from direct contact with local soils. Air particulate matter containing PCBs provides a possible inhalation exposure pathway to onsite workers and offsite to neighboring residents.

TREATMENT TECHNOLOGY SELECTED: The recommended remedial alternative involves the excavation of PCB contaminated soils > 1 ppm and solidifying with a cement-fly ash mixture followed by onsite placement. The solidified mass will be replaced onsite approximately 4-5 feet above ground water level. Soils contaminated with > 1000 ppm lead or > 5 ppm arsenic will be excavated and chemically fixed (stabilized), thus reducing dissolution and diffusion rates. Free oils contaminated with PCBs will be treated offsite at a Toxics Substances Control Act (TSCA) approved incinerator. The offsite disposal of the free oils is cost-effective, implementable and satisfies the disposal requirements of TSCA Part 761.60 (a).

EQUIVALENT TREATMENT: TSCA PCB regulations were identified as being the applicable and relevant guidelines for the cleanup and disposal of PCBs in soils at Pepper's Steel. Regulations in the TSCA Spill Cleanup Policy (Part 761.120-135), effective May 4, 1987, provide guidance on types of spills covered and the specific cleanup requirements for different concentration spills. PCB spills at Pepper's Steel, however, took place during a period between 1960 and the early 1980's, before the effective date of this policy. According to the policy, prior spills are subject to decontamination requirements established at the discretion of EPA regional offices. Therefore, the cleanup and disposal of PCBs at this site are not subject to the specific constraints of PCB spill cleanup as codified in Part 761.125, but rather to determinations made by the Regional Administrator. Though this remedial action is not subject to the spill policy, since PCB contaminated soil with concentrations > 1 ppm will be solidified, the action is consistent with the TSCA PCB Spill Cleanup Policy (761.125) which recommends a 10 ppm cleanup level for a site with nonrestricted access.

Disposal regulations for PCBs in soils are found in TSCA regulation 761.60 (a) (4) which requires that soils containing PCBs at concentrations greater than 50 ppm be destroyed by incineration or disposed in a chemical waste landfill. Incineration was deemed unacceptable due to the high metal content in the contaminated soils. The volatilization of the metals would result in significant air discharges even with the implementation of air control mechanisms on the incinerator. Depending on the air control method used, scrubber waters or bag house filters contaminated with metals, and metals in the incinerated ash would require appropriate disposal. Additionally, the remedial project manager stated that the complexity of the waste matrix, the cost and the additional requirements of handling made the selection of incineration unacceptable. Offsite disposal in a chemical waste landfill was also eliminated as an option due to high cost, inhalation risks and concerns of offsite transportation of the material.

Due to the concerns expressed above, other disposal techniques were investigated for utilization at this site. TSCA 761.60 (e) provides for the approval of alternative methods to PCB incineration which achieve a level of performance equivalent to incineration and do not present an unreasonable risk of injury to health or the environment. In a similar manner, under TSCA 761.75 (c) (4) an owner of a chemical waste landfill may seek a waiver from one or more of the landfill requirements if they can prove their operation does not present an unreasonable risk of injury to health or the environment.

The selected remedial action is consistent with both TSCA incineration and chemical waste landfill policies on risk of injury to health or the environment. The primary concern with the fixation method is the long term integrity of the fixed mass related to near surface ground water or infiltrating rainwater which may contribute to migration of the contaminants. To assess this risk EPA performed treatability studies on the solidified mix to define performance standards. Extensive leach testing was performed to verify the integrity of the solidified matrix and these tests included Toxic Characteristic Leaching Procedure (TCLP), Extraction Procedure (EP) Toxicity, diffusion potential (ANS 16-1) and negligible mass transfer (MCC-1). Fate and modeling were used to establish ground water action levels to monitor for failure of the technology. Parameters for the treatability studies were set using the Water Quality Criteria Standard (0.079 ng/l PCBs in water) for PCBs at the property line several hundred feet from the solidified mass. Using ground water modeling, a level of 7 ppb PCB in leachate from the solidified mass was established as the maximum allowable concentration which would yield an acceptable risk at the receptor. Results from the treatability studies all indicated concentrations of PCBs in leachate of less than 1 ppb. As an additional protective measure the solidified mass will be covered with a 12-inch layer of crushed limestone to further eliminate the threat of water infiltration.

Treatability studies also provided evidence that this method achieved a level of performance equivalent to incineration. Guidance on the level of performance required of alternative methods of incineration can be found in an Office of Toxic Substances document entitled "Draft Guidelines For Permit Applications and Demonstration Test Plans For PCB Disposal by Non-Thermal Alternative Methods" published on August 21, 1986. Specifically, on pages 2-6 the interpretation reads that "For processes which destroy PCBs in contaminated liquids, the agency has generally required the applicant to show that the concentration of any individual PCB congener in the product (decontaminated) liquid is no more than 2 ppm."

Bench scale treatability studies were also performed to address the concern of possible formation of toxic end products through this type of chemical treatment. The Ames test was used in this bench scale study and revealed no mutagenic effects with the soil, indicating that the residuals are non-toxic. The results of both KPEG bench scale and pilot treatability studies showed that PCB concentrations of 2 ppm or lower can be achieved successfully without the formation of hazardous end products, which eliminates the primary concerns with this treatment.

The selected treatment destroys PCBs in contaminated soils thus eliminating the potential risks identified in the risk assessment (i.e., direct contact threats). KPEG also provides protection through permanent and significant reduction of toxicity, mobility and volume of the waste, and complies with all relevant and appropriate requirements set forth in TSCA. Since this method has achieved a level of performance equivalent to incineration and has been shown through pilot studies to be protective of human health and the environment, it is an acceptable alternative to incineration.

Attachment E

SEP 12 1988

PCB DISPOSAL COMPANIES
COMMERCIALLY PERMITTED

* - Permitted to operate in all ten EPA Regions

COMPANY	ADDRESS	PHONE #	
INCINERATOR			
ENSCO	P.O. Box 1957 El Dorado, AR 71730	501-223-4160	
ENSCO	P.O. Box 8513 Little Rock, AR 72215-8513	501-223-4100	*
General Electric	100 Woodlawn Ave. Pittsfield, MA 01201	413-494-3729	
Pyrochem/Aptus	P.O. Box 907 Coffeyville, KS	316-251-6380	
Rollins	P.O. Box 609 Deer Park, TX 77536	713-479-6001	
SCA Chemical Services	11700 South Stony Island Ave. Chicago, IL 60617	312-646-5700	
ALTERNATE THERMAL			
Ecova Corporation	12790 Merit Drive Suite 220, Lock Box 145 Dallas, Texas 75251	214-404-7540	*
GA Technologies, Incorporated	P.O. Box 85608 San Diego, CA 92138	619-455-2517	*
J.M. Huber Corporation	P.O. Box 2831 Borger, TX 79007	806-274-6331	
CHEMICAL			
American Mobile Oil Purification Co.	233 Broadway, 17th Floor New York, NY 10279	212-267-7073	*
Chemical Waste Management	1550 Balmer Road Model City, NY 14107	716-754-8231	
Exceltech, Inc.	41638 Christy Street Fremont, CA 94538	415-659-0404	
General Electric	One River Road Schenectady, NY 12345	518-385-3134	

National Oil Processing/Aptus	P.O. Box 1062 Coffeyville, KS 67337	800-345-6573	
Niagara Mohawk Power Corporation	300 Erie Boulevard West Syracuse, NY 13202	315-474-1511	
PPM, Inc.	1875 Forge Street Tucker, GA 30084	404-934-0902	*
Sun Environmental, Inc.	1700 Gateway Blvd. S.E. Canton, OH 44707	216-452-0837	*
T & R Electric Supply Company, Inc.	Box 180 Colman, SD 57017	800-843-7994	
Transformer Consultants	P.O. Box 4724 Akron, OH 44310	800-321-9580	*
Trinity Chemical Co. Inc.	6405 Metcalf, Cloverleaf 3 Suite 313 Shawnee Mission, KS 66202	913-831-2290	

PHYSICAL SEPARATION

ENSCO	1015 Louisiana Street Little Rock, AR 72202	501-223-4100	*
National Electric/ Aptus	P.O. Box 935 Coffeyville, KS 67337	800-345-6573	
Quadrex HPS, Inc.	1940 N.W. 67th Place Gainesville, FL 32606	904-373-6066	*
Unison Transformer Services, Inc.	P.O. Box 1076 Henderson, KY 42420	800-544-0030	

BIOLOGICAL

Detox Industries, Inc.	12919 Dairy Ashford Sugar Land, TX 77478	713-240-0892	

CHEMICAL WASTE LANDFILLS

Casmalia Resources	559 San Ysidro Road P.O. Box 5275 Santa Barbara, CA 93150	805-937-8449
CECOS International	56th St. & Niagara Falls Boulevard Niagara Falls, NY 14302	716-282-2676
CECOS International	5092 Aber Road Williamsburg, OH 45176	513-720-6114
Chemical Waste Management	Alabama Inc. Box 55 Emelle, AL 35459	205-652-9721
Chemical Waste Management	Box 471 Kettleman City, CA 93239	209-386-9711
Chem-Security Systems Incorporated	Star Route Arlington, OR 98712	503-454-2777
Envirosafe Services Inc. of Idaho	P.O. Box 417 Boise, ID 83701	208-384-1500
SCA Chemical Services	Box 200 Model City, NY 14107	716-754-8231
U.S. Ecology, Inc.	Box 578 Beatty, NV 89003	702-553-2203
U.S. Pollution Control, Inc.	Grayback Mountain Knolls, UT 84074	405-528-8371

OCT 21 1988

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Region I
(Connecticut, Maine, Massachusetts, Rhode Island, Vermont)

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Environmental Protection Agency, Region I
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Boston, Massachusetts 02203
(617) 565-3279, FTS 835-3279

Region II
(New Jersey, New York, Puerto Rico, Virgin Islands)

John Brogard
Air and Waste Management Division
Environmental Protection Agency, Region II
26 Federal Plaza
New York, New York 10278
(212) 264-8682, FTS 264-8682

Dan Kraft
FTS 340-6669
[illegible]

Region III
(Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)

Edward Cohen (3HW40)
Hazardous Waste Management Division
Environmental Protection Agency, Region III
841 Chestnut Street
Philadelphia, Pennsylvania 19107
(215) 597-7668, FTS 597-7668

Region IV
(Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)

Robert Stryker, PCB Coordinator
Connie Jones
Pesticides and Toxic Substances Branch
Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 347-3864, FTS 257-3864

<u>Region V</u>
(Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)

Sheldon Simon
Pesticides and Toxic Substances Branch (5S-PTSB-7)
Environmental Protection Agency, Region V
230 South Dearborn Street
Chicago, Illinois 60604
(312) 353-1428, FTS 886-6087

<u>Region VI</u>
(Arkansas, Louisiana, New Mexico, Oklahoma, Texas)

Jim Sales
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Environmental Protection Agency, Region VI
Allied Bank Tower
1445 Ross Avenue
Dallas, Texas 75202-2733
(214) 655-6719, FTS 255-6719

Donna Mullins
FTS 255-7244

<u>Region VII</u>
(Iowa, Kansas, Missouri, Nebraska)

Leo Alderman, PCB Coordinator
Gary Bertram
Toxic and Pesticides Branch
Environmental Protection Agency, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101
(913) 236-2835, FTS 757-2835

<u>Region VIII</u>
(Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)

Kay Modi
Toxic Substances Branch
Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 1300
Denver, Colorado 80202-2413
(303) 293-1442, FTS 564-1442

Region IX

(Arizona, California, Hawaii, Nevada, American Samoa, Guam)

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Region X

(Alaska, Idaho, Oregon, Washington)

Cathy Massimino (HW-114)
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