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CERCLA Site Discharges to POTWs

Guidance Manual

Prepared by

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Office of Water

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Documents being prepared at the release of this guidance manual that may impact the information contained within include:

- The proposed "Procedures for Planning and Implementing Off-Site Response Actions" (40 CFR §300.440 upon promulgation)
- New Domestic Sewage Study Regulations (40 CFR §122 and 403 upon promulgation)
- The Proposed Sludge Regulations (40 CFR §503 upon promulgation)

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EXECUTIVE SUMMARY

6098-01

EXECUTIVE SUMMARY

The purpose of this guidance manual is to provide Feasibility Study (FS) writers, USEPA Remedial Project Managers (RPMs), state officials, and Publicly Owned Treatment Works (POTW) personnel with the current regulatory framework and technical and administrative guidance that is necessary to evaluate the remedial alternative of discharging wastes from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites to POTWs. This remedial alternative is to be evaluated and compared to other alternatives developed in the FS.

The POTW discharge alternative consists of discharging untreated or pretreated wastes to a POTW for treatment and disposal. Aqueous wastes from CERCLA sites can constitute a majority of waste treated during remedial clean-up efforts. These wastes can include groundwater, leachate, surface runoff, and other aqueous wastes.

Currently, there are few CERCLA sites with existing discharges to POTWs. However, at the sites that have negotiated and implemented a discharge to a POTW, the success is largely due to the parties involved possessing a good understanding of the regulatory requirements and performing a thorough technical and administrative evaluation of the remedial alternative.

USEPA's most comprehensive statement of policy concerning discharge of CERCLA wastes to a POTW was presented in a policy memorandum, "Discharge of Wastewater from CERCLA Sites into POTWs," dated April 15, 1986. The criteria outlined in the policy that must be considered for evaluating the feasibility of discharging CERCLA wastewater to a POTW are as follows:

- The pollutants in the discharged CERCLA wastewater must not pass through, interfere, contaminate sludge, or become hazardous to employees at the POTW.

- The POTW must have legal authority and enforcement mechanisms to ensure compliance with applicable pretreatment standards and requirements.

- The POTW should have a good record of compliance with its National Pollutant Discharge Elimination System (NPDES) permit and pretreatment program requirements.

- The potential for volatilization of the wastewater contaminants and the potential for groundwater contamination from transport of CERCLA wastewater or impoundment at the POTW must be considered.

- The CERCLA wastewater discharge must not violate water quality standards in the POTW's receiving waters, including the narrative standards of "no toxics in toxic amounts."

- The POTW must be knowledgeable of and in compliance with any applicable Resource Conservation and Recovery Act (RCRA) or other environmental statute requirements.

- The various costs of managing CERCLA wastewater, including all risks, liabilities, and permit fees, should be considered.

The "CERCLA Site Discharges to POTWs Guidance Manual" presents a stepwise approach to guide the manual user through a comprehensive evaluation of the discharge to a POTW remedial alternative, conforming to the USEPA April 15, 1986, Policy Memorandum. The manual is organized so that the user can systematically identify and review the various technical, administrative, and regulatory issues in order to screen the POTW discharge alternative. If after the initial screening of the alternative it appears plausible, sufficient information to perform a detailed evaluation of the POTW discharge alternative is included and/or referenced in the guidance manual.

The remainder of the Executive Summary is a general overview of the contents of each section of the guidance manual.

Section 1.0 - Introduction. The introduction states the purpose of the document and describes how the material in the guidance manual is organized to lead the user through a thorough and expedient evaluation of CERCLA site discharges to POTWs. Section 1.0 also provides an overview of the Remedial Investigation/Feasibility Study (RI/FS) process and discusses the important issues and criteria that must be considered during the remedial alternative evaluation, as well as issues related to compliance with Applicable or Relevant and Appropriate Requirements (ARARs).

In addition to the regulatory framework (NPDES and Pretreatment) established under the Clean Water Act (CWA), two USEPA policy statements require a POTW to comply with applicable regulations before accepting CERCLA wastewater. These policy statements (i.e., USEPA's Off-site Policy and USEPA's April 15, 1986, policy memorandum entitled, "Discharge of Wastewater from CERCLA Sites into POTWs") are also summarized in Section 1.0.

Sections 2.0 through 7.0 discuss the six steps of the process for analyzing the POTW discharge alternative. Figure ES-1 also shows major points discussed in each section.

Sections 8.0 through 10.0 provide additional information that will assist the RI/FS team during development and evaluation of the POTW discharge alternative.

Section 2.0 - Identify and Characterize CERCLA Wastewater Discharge. To identify and characterize a CERCLA discharge, the quantity and quality of the discharge must be estimated. Section 2.0 describes how to evaluate the site-specific CERCLA wastewater. Data collection and evaluation requirements, definition of the wastestream quality and quantity, and determination of whether the CERCLA wastestream is a RCRA hazardous waste are discussed in this section. If the waste is considered hazardous, it is subject to RCRA Subtitle C regulations, and additional constraints must be considered when determining whether the waste can be discharged to a POTW. These constraints may make it more difficult or impractical to discharge the CERCLA wastestream to a POTW. Therefore, it is important to determine early in the RI/FS process, with confirmation of the lead agency, whether the wastestream is a RCRA hazardous waste.

Section 3.0 - Identify Potential POTWs. Local POTWs that may be potential receptors for CERCLA wastewater need to be identified early in the FS process. Section 3.0 identifies some of the important technical and administrative criteria that should be used to identify potential POTWs. The economics of transporting the waste (i.e., by dedicated pipe, truck, rail, or sewer connection) to a POTW and the compliance history of a POTW will often serve as a first cut to identify acceptable treatment facilities.

SECTION 2:

Identify and Characterize CERCLA Wastewater Discharge

- Identify the site-specific CERCLA wastewater discharges
- Determine data requirements and collect data to fulfill these requirements
- Evaluate all available data to characterize wastewater
- Determine if the CERCLA wastewater is a RCRA hazardous waste

SECTION 3:

Identify Local POTWs

- Determine geographic area to be considered
- If CERCLA wastestream is a hazardous waste, determine if Domestic Sewage Exclusion is appliable. If not, determine Permit - by - Rule requirements
- Consider methods of transporting the wastestream to the POTW
- Identify potential POTWs and gather information about each facility

SECTION 4:

Involve POTW in the Evaluation Process and Screen POTWs

- Contact the POTW to determine if they are willing to accept a CERCLA wastestream
- Investigate the compliance status of the POTW
- Evaluate the POTW's ability to handle and properly treat the CERCLA wastestream
- Evaluate the current permits of the POTW and determine changes required and other permits needed
- Address and discuss the POTW's potential liability associated with accepting a CERCLA wastestream

SECTION 5:

Evaluate Pretreatment Requirements

- Pretreatment requirements (local limits) should prevent pass through, inhibition, and sludge contamination at the POTW
- Obtain or estimate the local limits enforced by the POTW to prevent pass through, inhibition and sludge contamination
- Compare CERCLA discharge characteristics to local limits to determine which contaminants require pretreatment

SECTION 6:

Identify and Screen Pretreatment Alternatives

- Identify possible pretreatment technologies
- Develope a pretreatment process train to properly pretreat the CERCLA wastestream

SECTION 7:

Detailed Analysis of the POTW Discharge Alternative

Evaluate the POTW discharge alternative using the following nine criteria:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of mobility, toxicity, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

FIGURE ES-1
PROCESS FOR EVALUATING CERCLA DISCHARGES TO POTWs

6098-01

The Domestic Sewage Exclusion (DSE) and the RCRA permit-by-rule requirements impact the feasibility of discharging to a POTW. If the CERCLA wastewater is a RCRA hazardous waste and it must be transported by truck, rail, or dedicated pipe to a POTW, the POTW is required to be a RCRA-permitted or RCRA permit-by-rule facility. However, if the wastewater is discharged into the sewer system, the DSE may exclude the POTW from the RCRA requirements. Instead, these wastes would be regulated under the CWA pretreatment program.

Section 4.0 - Involve POTWs in the Evaluation Process and Screen POTWs. This section emphasizes the importance of establishing contact with personnel associated with prospective POTWs early in the FS process. Once a line of communication has been established, prospective POTWs can be screened efficiently by asking if they are willing to accept the CERCLA wastewater, determining the compliance status of the POTW, and considering the technical and administrative feasibility of discharging the CERCLA wastewater to the POTW.

Section 5.0 - Evaluate Pretreatment Requirements. Another important step in evaluating the CERCLA discharge to a POTW is to determine whether the POTW can adequately treat the site wastewater or whether pretreatment is required. This step ensures that the site discharge will not violate the goals of the National Pretreatment Program by causing pass through, inhibition, or sludge contamination at the POTW. During this step, the POTW's pretreatment limits must be obtained for each pollutant contained in the CERCLA waste. If the POTW does not have limits for each pollutant in the CERCLA waste, the FS writer and the POTW can derive a conservative estimate of pretreatment limits. Section 5.0 also compares pretreatment limits to the CERCLA site discharge to evaluate whether pretreatment will be necessary.

Section 6.0 - Identify and Screen Pretreatment Alternatives. If it is determined that the CERCLA wastestream requires pretreatment before discharging to a POTW, Section 6.0 describes how to evaluate and select an appropriate pretreatment technology. Table 6-1 presents the application of various pretreatment technologies for the major classes of compounds. Pretreatment process trains are included for flow equalization and phase separation, metals treatment, organics treatment, and polishing and discharge. Section 6.0 also describes how the appropriate pretreatment technologies required to treat the CERCLA waste can be assembled into a pretreatment train.

Section 7.0 - Detailed Analysis of the POTW Discharge Alternative. The final phase of an FS is to perform a detailed analysis of the most promising remedial options that were identified during the development/screening of alternatives. If discharge to a POTW is being considered, the viability of treating a wastestream at the POTW needs to be evaluated.

As required in Section 300.430(e)(iii) of the National Contingency Plan, each remedial alternative must be evaluated against the following criteria: 1) overall protection of human health and the environment; 2) compliance with ARARs; 3) long-term effectiveness and permanence; 4) reduction of mobility, toxicity, or volume through treatment; 5) short-term effectiveness; 6) implementability; 7) cost; 8) state acceptance; 9) community acceptance. Factors that should be considered specifically for a POTW discharge with respect to each criterion are listed in Table 7-1.

Section 8.0 - Clean Water Act and the National Pretreatment Program. This section is a synopsis of the regulatory framework under which a POTW must operate. To date, specific regulations (i.e., categorical pretreatment standards) governing the discharge of CERCLA wastes to a POTW have not been promulgated. However, CERCLA wastes are treated as nondomestic wastestreams and, therefore, are subjected to the general pretreatment regulations promulgated under the CWA. Similar to other nondomestic wastestreams, a CERCLA wastewater discharge to a POTW may not be accepted if it will cause pass through, interference, or exceedance of the general pretreatment regulations, specific prohibitions, or local pretreatment limits or ordinances.

Section 8.0 presents a brief overview of the National Pretreatment Program, NPDES discharge permits, and other applicable requirements under the CWA. References for detailed discussion of these regulations are included in Section 8.0.

Section 9.0 - RCRA Requirements. RCRA hazardous waste is defined in this section. Two flow charts were developed to assist the manual user in determining whether the site-specific hazardous waste and/or contaminated groundwater requiring treatment is a RCRA waste. Exempted wastes are also described in Section 9.0.

Section 10.0 - Estimate Pretreatment Limits. In the event that pretreatment limits will have to be obtained to complete the initial screening and detailed analysis of the POTW discharge alternative, a conservative approach to estimate the limits is presented in Section 10.0. The procedure requires the FS writer, RPM, state official, and/or POTW authority to accumulate the applicable regulatory requirements to evaluate the acceptable concentrations that can volatilize, partition to the sludge, and/or pass through the POTW in the effluent.

A conservative mass balance approach that focuses on the three principal removal mechanisms (i.e., volatilization, partitioning to sludge, and biodegradation) is described to help the user evaluate the fate and estimate the limits for each contaminant in the CERCLA waste. Once the probable fate of each compound in the POTW has been determined, the impact to each removal mechanism must be evaluated to determine whether quality standards will be exceeded. If it is determined that water, sludge, and/or air quality standards will be exceeded by discharging CERCLA wastewater to the POTW, pretreatment of the CERCLA wastewater will be required. This mass balance process must be performed for each regulated pollutant detected in the CERCLA wastewater.

Section 11.0 - Hypothetical Case Studies. Three hypothetical case studies provide examples of how to evaluate the POTW discharge alternative using the approach presented in the guidance manual. The case studies were developed by assigning a wastestream from an actual CERCLA site, a hypothetical flow rate, and a USEPA region to three different FS writers with varying amounts of FS experience. With this information, each case study writer was free to choose a specific location of the site within the assigned USEPA region and begin to make contacts with the appropriate USEPA, state, and local POTW authorities.

Appendices - Appendices A and B present two USEPA policies that may be useful in evaluating a CERCLA site discharge to a POTW. The two policies are the USEPA off-site policy (USEPA, 1987f) and the USEPA policy on discharges from CERCLA sites to POTWs (USEPA, 1986a) (Appendices A and B, respectively).

Appendix C presents data generated from a number of published studies on the total percent removal of specific pollutants in biological treatment systems. The data, to be used primarily with Section 10, can be used to obtain an estimated overall percent removal of specific compounds.

SECTION 1
INTRODUCTION

1. INTRODUCTION

The POTW discharge alternative consists of discharging untreated or pretreated CERCLA aqueous wastes to a POTW for treatment and disposal. To more effectively develop and evaluate this alternative, the administrative and technical issues associated with discharging CERCLA wastewater to a POTW must be clearly identified.

1.1. THE REMEDIAL INVESTIGATION/FEASIBILITY (RI/FS) STUDY PROCESS

During an RI/FS, data defining site and waste characterisitcs are collected and evaluated, and specific site problems are identified (figure 1-1). Based on the site characteristics and the potential risks posed by the site, remedial alternatives are developed and screened as necessary to focus on the most promising options, and evaluated in detail during the FS.

The criteria used to evaluate alternatives are:

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

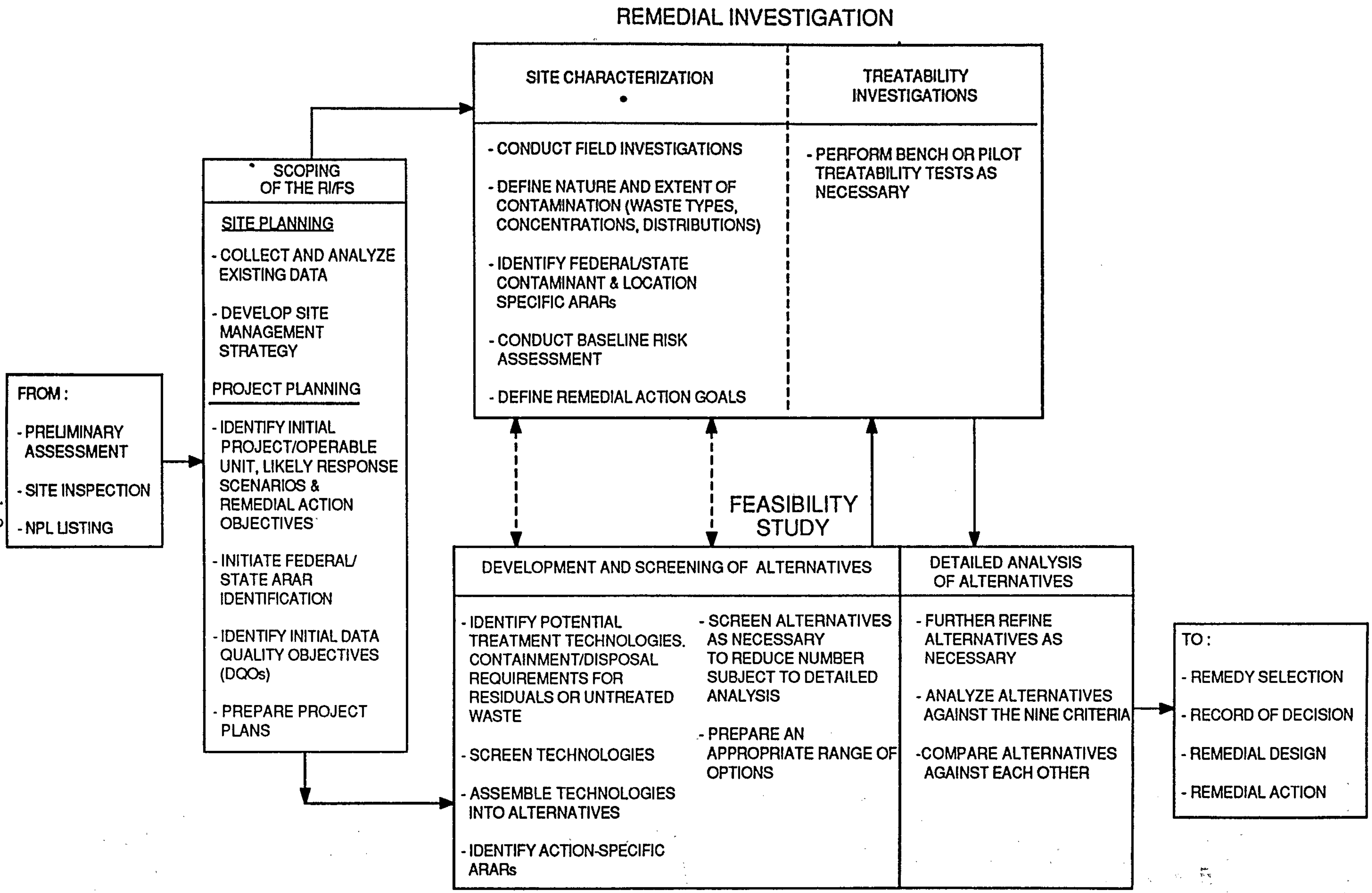
Once the RI/FS is complete, a proposed plan is prepared identifying EPA's preferred alternative and made available for public comment. Once comments have been received and considered, EPA documents the final selection in a Record of Decision (ROD). EPA is required under CERCLA to select remedies that are 1) protective of human health and the environment; 2) comply with state and federal requirements that are ARARs unless a waiver is justified; 3) is cost-effective; and 4) utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The development and evaluation of alternatives involving the discharge to a POTW may require additional coordination with agencies and POTW authorities, as well as the technical analyses to determine whether a POTW can accept the discharge.

1.2. POLICIES THAT APPLY TO THE POTW DISCHARGE ALTERNATIVE

Aqueous wastes from CERCLA sites can comprise a majority of waste treated during remedial clean-up efforts. This waste can include groundwater, leachate, surface runoff, and other aqueous wastes. In addition, the selected remedy may produce liquid wastestreams that require remediation. For example, incineration of soil or solid wastes produces scrubber effluent that must be treated or disposed.

Currently, aqueous wastes at many CERCLA sites are either treated on- or off-site at a Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal (TSD) facility.



SOURCE: USEPA RI/FS GUIDANCE (USEPA, 1988c)

FIGURE 1-1
PHASED RI/FS PROCESS

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However, another alternative for effective treatment of CERCLA wastewaters may be to discharge them to one of the 15,000 POTWs in the U.S. Because many POTWs have excess capacity and may be capable of treating some CERCLA wastewater discharges, such an alternative may be the most cost-effective method of disposal.

Before a CERCLA wastestream can be discharged to a POTW, many legal, technical, and administrative issues must be considered and evaluated. In addition to the requirements under federal environmental statutes, particularly the Clean Water Act (CWA), two USEPA policies affect the POTW discharge alternative: (1) USEPA's Procedures for Planning and Implementing Off-site Response Actions (40 CFR §300.440 upon promulgation), and (2) USEPA's policy memorandum entitled, "Discharge of Wastewater from CERCLA Sites into POTWs."

USEPA's Procedures for Planning and Implementing Off-site Response Actions (40 CFR §300.440 upon promulgation). USEPA has developed procedures that must be observed when a response action under CERCLA involves off-site management of CERCLA wastes. A discharge to a POTW is generally considered an off-site activity, even if CERCLA waste is discharged to a sewer located on-site (USEPA, 1988a). Therefore, USEPA's Procedures for Off-site Management of CERCLA Wastes (40 CFR §300.440 upon promulgation) would generally apply to a discharge of CERCLA waste to a POTW.

Prior to proposing 40 CFR §300.440, USEPA issued "Guidance on the Requirements for Selecting an Off-site Option in a Superfund Response Action" in January 1983. This first guidance required a facility inspection and that all major violations at the facility be corrected in order for the facility to receive CERCLA wastes from remedial or removal actions. In May 1985, USEPA issued "Procedures for Planning and Implementing Off-site Response Actions" (50 FR 45933), which detailed the criteria for evaluating the acceptability of facilities to receive CERCLA wastes.

In 1986, SARA affirmed USEPA's 1985 policy for off-site transfer of CERCLA waste. SARA Section 121(d)(3) provides that CERCLA hazardous substances, pollutants, or contaminants may only be transported to a facility operating in compliance with Sections 3004 and 3005 of RCRA and other applicable laws or regulations; Section 121(d)(3) also provided that releases must be eliminated or controlled at land disposal facilities in order for those facilities to receive CERCLA wastes. To implement this SARA requirement, USEPA issued revised procedures for implementing off-site response actions on November 13, 1987, and provided detailed procedures for issuing and reviewing unacceptability determinations.

On November 9, 1988, "Procedures for Planning and Implementing Off-site Response Actions" were issued as a proposed rule. The general requirements of the rule are similar to those of USEPA's previous off-site policy, and will supersede the policy when finalized. The final rule, expected to be issued in 1990, will amend the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR §300) by adding a new Section 300.440.

Generally, this policy requires that an off-site facility accepting the waste have no relevant violations, uncontrolled releases, or other environmental conditions that pose a significant threat to human health, welfare, or the environment, or otherwise affect the satisfactory operation of the facility. The purpose of the rule is to direct these wastes only to facilities determined to be environmentally sound and avoid having CERCLA wastes contribute to present or future environmental problems.

Specific criteria are used to determine whether a facility is acceptable to receive off-site transfers of CERCLA waste, and to ensure that the waste will be appropriately managed. The criteria generally apply to RCRA Subtitle C TSD facilities, and to other non-RCRA facilities. To the extent that POTWs have a RCRA permit-by-rule, they may be considered RCRA treatment facilities; non-RCRA POTWs are considered "other facilities." (See 40 CFR §300.440 upon promulgation.)

USEPA's Policy Memorandum - Discharges from CERCLA Sites to POTWs. In this USEPA memorandum, criteria are outlined that should be considered in the RI/FS process for evaluating the feasibility of discharging CERCLA wastewater to a POTW (USEPA, 1986a). These criteria were considered when developing the stepwise evaluation process discussed in Subsection 1.4. The criteria that must be considered and the sections of the manual that address them are as follows:

- The quantity and quality of the CERCLA wastewater (the constituents in the wastewater must not cause pass through or interference, including unacceptable sludge contamination or a hazard to employees at the POTW) (Sections 2.0 and 5.0)

- The ability (e.g., legal authority and enforcement mechanisms) of the POTW to ensure compliance with applicable pretreatment standards and requirements, including monitoring and reporting requirements (Subsections 4.2 and 8.1.4)

- The POTW's record of compliance with its National Pollutant Discharge Elimination System (NPDES) permit and pretreatment program requirements to determine whether the POTW is a suitable discharge option for CERCLA wastewater (Subsection 4.2)

- The potential for volatilization of the wastewater contaminants at the CERCLA site and POTW and its impact on air quality (Section 7.0)

- The potential for groundwater contamination from transport of CERCLA wastewater or impoundment at the POTW, and the need for groundwater monitoring (Section 7.0)

- The potential effect of the CERCLA wastewater on the POTW's discharge, as evaluated by continued compliance with the NPDES permit and by maintenance of water quality standards in the POTW's receiving waters, including the narrative standard of "no toxics in toxic amounts" (Section 5.0)

- The POTW's knowledge of and compliance with any applicable RCRA or other environmental statute requirements (RCRA permit-by-rule requirements may be triggered if the POTW receives CERCLA wastewaters classified as "hazardous wastes" without prior mixing with domestic sewage [e.g., direct delivery to the POTW by truck, rail, or dedicated pipe]. CERCLA wastewaters are not necessarily considered hazardous wastes; case-by-case determination has to be made.) (Subsection 4.2)

- The various costs of managing CERCLA wastewater, including all risks, liabilities, and permit fees (Section 7.0)

To date, few CERCLA sites have discharged wastestreams to POTWs for treatment. For some sites, USEPA selected a remedial alternative that included a CERCLA wastewater discharge to a POTW; however, it was not implemented because it was not sufficiently evaluated in the FS. The reason that these alternatives were not implemented is that prospective POTWs are frequently not involved in the FS evaluation process.

If a discharge is properly evaluated prior to remedy selection and necessary negotiations are conducted, the feasibility of discharging to a POTW can be accurately determined prior to final selection of the site remedial action (i.e., signing the ROD). The purpose of this manual is to guide FS writers, USEPA Remedial Project Managers (RPMs), state officials, and POTW officials in evaluating potential discharges to POTWs during an FS.

1.3. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The National Contingency Plan (NCP) (40 CFR §300.430[e]) and SARA Section 121(d)(2)(A) require that CERCLA remedial actions at least attain levels or standards of control that are legally applicable to the contaminant concerned, or are relevant and appropriate under the circumstances of the release. Therefore, the POTW discharge alternative must comply with ARARs, as defined in the following subsections.

1.3.1. Applicable Requirements

Applicable requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

1.3.2. Relevant and Appropriate Requirements

Relevant and appropriate requirements (RARs) are those environmental clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state law. While not independently applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, they do address problems or situations sufficiently similar to those encountered at the CERCLA site, and their use is well-suited to the particular site, and may be required under CERCLA. A requirement must be both relevant and appropriate to be a RAR.

Only substantive requirements of other laws are considered potential ARARs; permitting and other administrative requirements are not required for on-site CERCLA actions (see SARA 121[e][1]). Off-site actions must comply with all legally applicable requirements, both substantive and administrative, as well as USEPA's "Procedures for Planning and Implementing Off-site Response Actions" (40 CFR §300.440 upon promulgation). The concept of "relevant and appropriate" is not pertinent to off-site actions.

In general, a discharge to a POTW is considered an off-site activity. Therefore, CERCLA sites are required to comply with substantive and procedural requirements of applicable regulations. If a remedial alternative involves discharging CERCLA wastewater to a POTW, applicable regulations that regulate such a discharge must be identified and evaluated. The major applicable regulations that apply to discharges to POTWs involve regulations promulgated under the CWA and RCRA.

The CWA, as implemented through the NPDES permit program, regulates discharges of pollutants or a combination of pollutants to U.S. waters from any point source. It requires the establishment of a permit containing applicable standards and requirements to control the discharge of pollutants to U.S. waters. A discharge to a POTW is considered an indirect discharge. The General Pretreatment Regulations (40 CFR §403) and categorical pretreatment standards were developed by USEPA to control the discharge of pollutants into POTWs by categorical industrial users (e.g., leather tanning and metal finishing) and other nondomestic sources. The purpose of the pretreatment regulations and standards is to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the POTW. Local pretreatment programs developed by POTWs under the CWA are responsible for developing "local limits" on industrial user discharges to prevent pollutant pass through or interference, and for enforcing both local and national pretreatment standards and requirements.

RCRA deals with specific waste management activities. The Subtitle C requirements apply to hazardous waste management and regulate treatment, storage, and disposal of hazardous waste. RCRA requirements may be considered applicable when discharging RCRA hazardous waste to a POTW, and may determine how the waste must be handled (see Subsection 2.2.4 for discussion of whether CERCLA wastewater is a RCRA hazardous waste). The specific requirements of RCRA and CWA regulations and other ARARs are discussed in Sections 8.0 and 9.0, and throughout this guidance manual.

1.4. GUIDANCE MANUAL ORGANIZATION

Issues concerning the discharge of CERCLA wastestreams to POTWs must be carefully evaluated during the RI/FS. To facilitate this evaluation, a six-step process was developed to lead the FS writer through a thorough and expedient evaluation of CERCLA site discharges to POTWs. This process was developed considering the USEPA "Discharge of Wastewater from CERCLA Sites into POTWs" memorandum. The evaluation process and the respective sections that present each step are shown in Figure 1-2.

Sections 2.0 through 7.0 discuss the six steps of the process for analyzing the POTW discharge alternative. The remaining sections of the guidance manual provide additional information that will assist the RI/FS team during development and evaluation of the POTW discharge alternative.

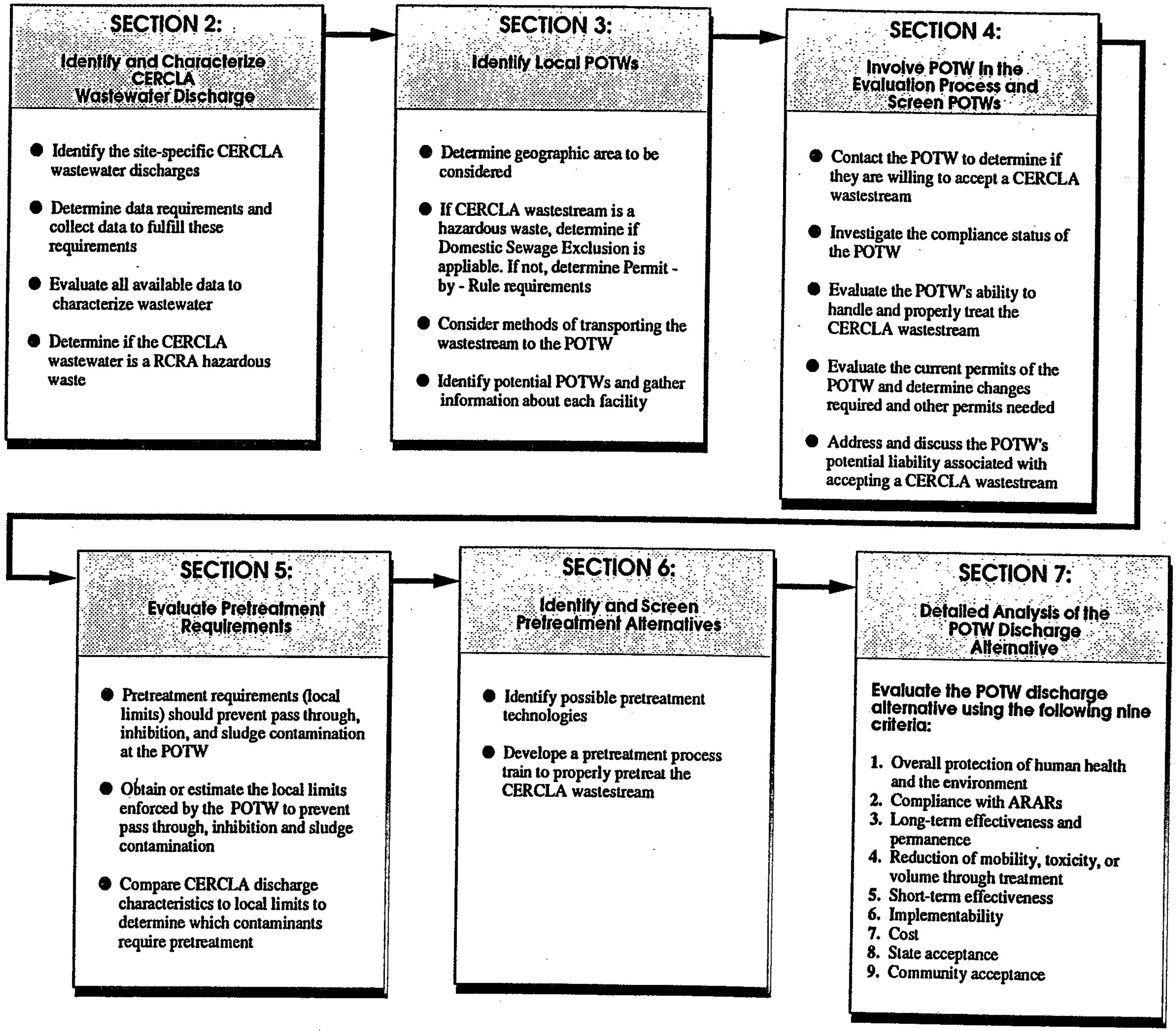

FIGURE 1-2
PROCESS FOR EVALUATING CERCLA DISCHARGES TO POTWs

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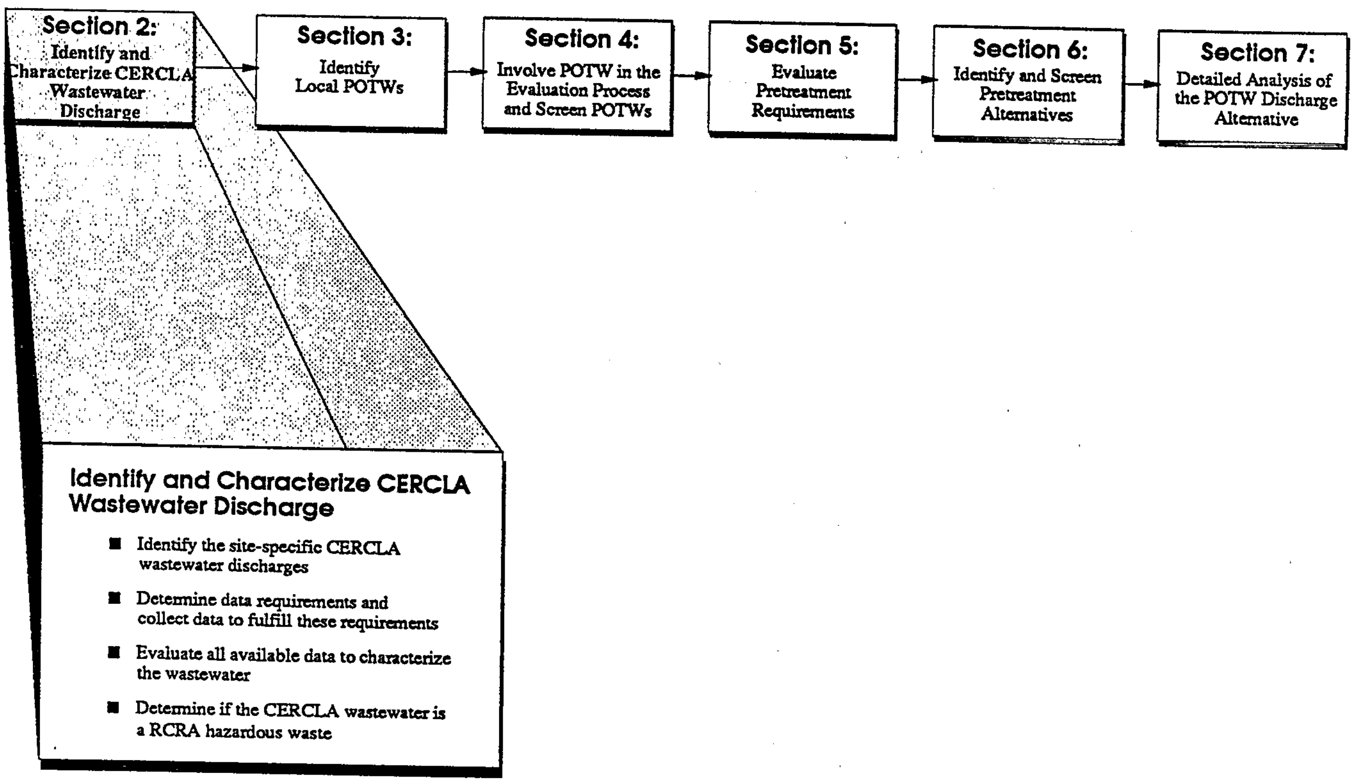
SECTION 2
IDENTIFY AND CHARACTERIZE CERCLA WASTEWATER DISCHARGE



2. IDENTIFY AND CHARACTERIZE CERCLA WASTEWATER DISCHARGE

Identification and characterization of a CERCLA wastewater discharge are the first steps of the evaluation process shown in Figure 1-1. In these steps, the FS writer will define the quantity and quality of the CERCLA discharge, as required by the USEPA memorandum concerning discharge to POTWs. After the wastestream is characterized, the FS writer should determine whether it is a RCRA hazardous waste. A RCRA hazardous waste is defined in Section 9.0.

2.1. IDENTIFY THE CERCLA WASTEWATER DISCHARGE

When scoping the RI/FS, the RI/FS team should identify wastewater streams that could be discharged from the CERCLA site to a POTW. Potential wastewater streams may include groundwater, leachate, surface runoff, or other aqueous wastes that exist on-site, or process streams generated by remedial activities. Examples of process wastestreams include scrubber effluent resulting from incineration of soil or solid waste; wastewater from soil-washing activities; and water used to decontaminate equipment after remedial activities.

CERCLA wastewaters originate from a wide variety of sources, and range from groundwater with low levels of contamination to heavily contaminated leachate and storage tank contents. The types of contaminants vary greatly among sites and wastestreams. Table 2-1 lists the 18 contaminants most commonly found at CERCLA sites, including chlorinated and aromatic organics, as well as metals. Table 2-2 lists the contaminants commonly found in 15 CERCLA site wastewaters during 1987-1988 sampling for the full Industrial Technology Division (ITD) list of 443 analytes.

2.2. CHARACTERIZE THE CERCLA WASTEWATER DISCHARGE

After the potential wastestream(s) is identified, the RI/FS team should characterize it in terms of quality and quantity. Characterization consists of the following steps:

- Identification of data requirements, considering data quality and analytical parameters
- Collection of necessary data
- Evaluation of data, including Applicable or Relevant and Appropriate Requirements (ARARs) analysis and risk assessment
- Characterization of wastestream quality and quantity using results of the data evaluation

These steps are discussed in the following subsections and shown in Figure 2-1.

2.2.1. Data Requirements

Selecting the level of data quality to be achieved and the analytical parameters to be investigated are critical first steps to characterizing a wastestream. In general, five levels of data quality are employed in the RI/FS process. The first level, field-screening data, uses portable monitoring equipment and provides the most rapid results; however, it is usually qualitative rather than quantitative. Field analysis data (the second level) are generated using mobile analytical instruments. Depending on the instruments and environmental conditions, field analysis data may be either qualitative or

TABLE 2-1

MOST COMMON CONTAMINANTS DETECTED AT CERCLA SITES

Trichloroethylene
Lead
Toluene
Chromium and Compounds
Benzene
Chloroform
Polychlorinated Biphenyls
1,1,1-Trichloroethane
Tetrachloroethene
Zinc and Compounds
Cadmium
Arsenic
Phenol
Xylene
Ethylbenzene
Copper and Compounds
1,2-Trans-Dichloroethylene
Methylene Chloride

NOTES:

These contaminants were detected in soil, water, and other media at more than 10 percent of the 888 CERCLA sites for which chemical data are available.

A more comprehensive table of contaminants detected at CERCLA sites, compiled in October 1986, is in "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990).

quantitative. The third, fourth, and fifth levels involve laboratory analysis, but differ in the analytical methods, quality control, and validation procedures used. The third level is laboratory analysis with less than Contract Laboratory Program (CLP) quality. The fourth level, CLP-Routine Analytical Services, is usually used for CERCLA sites and has more stringent quality control and validation procedures. The fifth level is CLP-Special Analytical Services for nonstandard analytical methods. Because the quality of the data determines its usefulness, the category of data quality required for an RI/FS should be carefully selected. "Data Quality Objectives for Remedial Response Activities" contains more guidance on data quality objectives (USEPA, 1987a).

Analytical parameters should also be carefully selected when determining data requirements. Under usual circumstances, CERCLA samples undergo analyses for those compounds on the Target Compound List (TCL). The TCL is a list of 152 volatile and semivolatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganics

TABLE 2-2

COMMON CONTAMINANTS IN CERCLA SITE WASTEWATER

ORGANIC CONTAMINANT	FREQUENCY
Trichloroethylene	10
Phenol	9
Acetone	9
Trans-1,2-Dichloroethylene	8
Benzoic Acid	8
Tetrachloroethylene	7
Toluene	7
Benzene	6
Hexanoic Acid	6
Chlorobenzene	6
INORGANIC CONTAMINANT	**FREQUENCY**
Zinc	14
Sodium	14
Manganese	14
Boron	14
Iron	14
Calcium	14
Barium	13
Aluminum	13
Magnesium	13
Titanium	12

NOTES:

These contaminants were commonly detected in the wastewaters (groundwater and/or leachate) of 14 CERCLA sites sampled for the USEPA Industrial Technology Division List of Analytes during a 1987-88 sampling program.

The complete list of compounds detected in the wastewaters of 14 CERCLA sites, the frequency of occurrence, and the concentration ranges detected is presented in "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990).

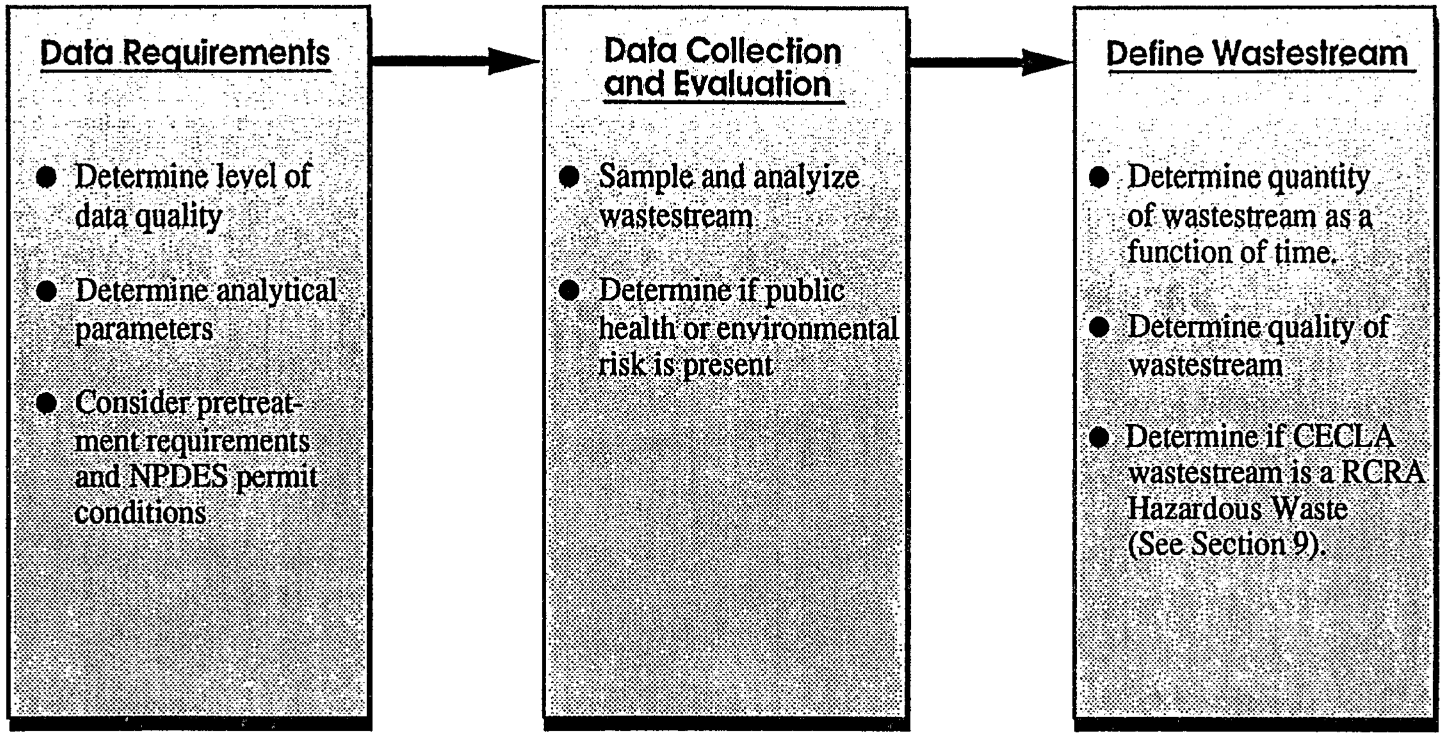


FIGURE 2-1
CHARACTERIZING THE CERCLA WASTEWATER DISCHARGE

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used in the CLP under CERCLA. In addition, POTWs usually require information about conventional and nonconventional pollutants in the wastestream (e.g., five-day biological oxygen demand [BOD], chemical oxygen demand [COD], total suspended solids [TSS], nitrite-nitrate, total Kjeldahl nitrogen, total phosphorus, oil and grease, total dissolved solids, color, total sulfides, and pH). Applicable pretreatment requirements and NPDES permit conditions should be reviewed while designing the analytical program.

2.2.2. Data Collection and Evaluation

After the data requirements are determined, samples of the wastestream should be collected and analyzed. The data should be validated and evaluated for precision, accuracy, representativeness, consistency, and completeness. In addition, for many CERCLA wastestreams (e.g., groundwater or surface water), the RI/FS team must determine whether the contaminants in the wastestream present a human health or environmental risk at the site. If the risk due to exposure to the wastestream is not considered significant, no remediation of the wastestream would be required. Risk evaluations would include study of the extent of contamination, determination of exposure pathways, assessment of risk, and determination of the need to remediate the wastestream.

2.2.3. Definition of Wastestream Quality and Quantity

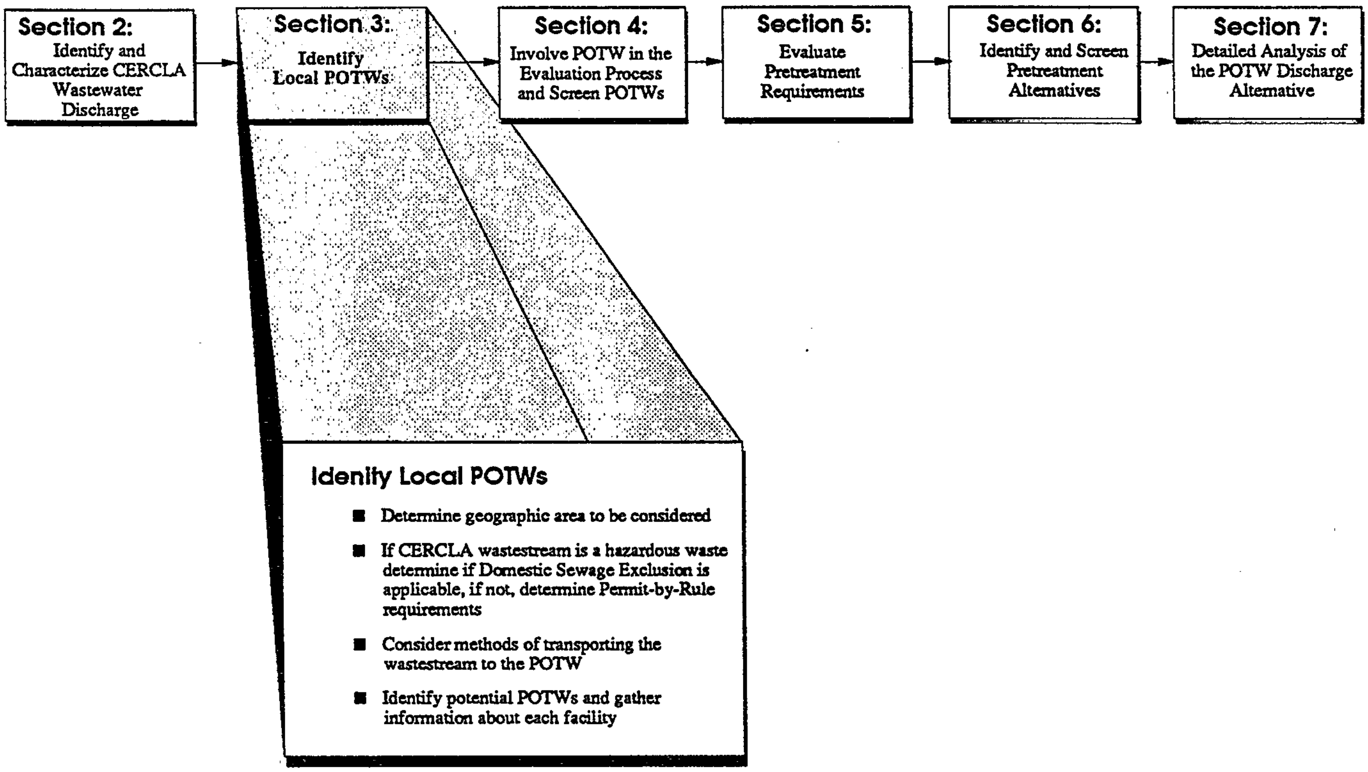
After the data evaluation is completed, the waste should be described in terms of quantity and quality. Quantity should be considered as a function of time (most POTWs will be interested in daily average and daily maximum flows and in batch discharges). Will the wastestream be generated as a result of a one-time removal action, or will it continue over time? If it will continue, for how long, and will the quantity and quality remain constant? To estimate quality, the RI/FS team should carefully consider all available data, and then use that which will be most representative of the future discharge.

When determining both quality and quantity, the RI/FS team should carefully evaluate the accuracy of the data. Accurate identification of specific compounds and concentrations of compounds detected is important when trying to determine whether the POTW is technically capable of handling and treating the waste. For example, if a POTW has only 0.1 million gallons per day (mgd) of available hydraulic capacity and a CERCLA site wants to discharge 0.075 mgd, the POTW would be hydraulically capable of accepting the discharge. However, if the CERCLA site discharge quantity is only estimated at 50 percent, that quantity could be as high as 0.12 mgd, which is greater than the POTW's available capacity. Similarly, a poor estimate of the CERCLA discharge water quality could cause biological interference in the POTW and cause the POTW to exceed its NPDES discharge limits.

2.2.4. Determine whether CERCLA Wastestream is a RCRA Hazardous Waste

After the quality and quantity of the CERCLA discharge have been adequately characterized, the RI/FS team (in conjunction with the lead agency) should determine whether the waste is a RCRA hazardous waste. If the waste is hazardous, it is subject to RCRA Subtitle C regulations, and additional constraints must be considered when determining whether the waste can be discharged to a POTW. These constraints may make it more difficult or impractical to discharge the CERCLA wastestream to a POTW. Therefore, it is important to determine early in the RI/FS process, with the lead agency's agreement, whether the wastestream is a RCRA hazardous waste. Section 9.0 provides guidance on determining whether a CERCLA site discharge is a RCRA hazardous waste.

SECTION 3
IDENTIFY LOCAL POTWs



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3. IDENTIFY LOCAL POTWs

During the RI/FS scoping and site characterization, local POTWs should be identified. The first step in identifying candidate POTWs is to determine the area that should be considered. After the area is determined, POTWs within it can be identified.

3.1. IDENTIFY THE AREA OF CONSIDERATION

There is no rule for determining an area within which POTWs will be considered; it must be determined on a site-by-site basis. Many factors can affect such a determination. For example, if few alternatives (other than disposal to the POTW) for remediating the wastestream are available, a greater area of consideration may be selected. Because selection of an area of consideration is site-specific, USEPA or another authorized agency should be involved with the selection.

Several factors should be considered when evaluating POTWs at most sites, including the following:

- If the CERCLA wastestream is considered a RCRA hazardous waste, does the Domestic Sewage Exclusion (DSE) apply to the discharge of that waste to a POTW?
- If the CERCLA wastestream is considered a RCRA hazardous waste and the DSE does not apply, does the POTW meet the RCRA permit-by-rule requirements?
- Is it technically and administratively feasible to pipe or truck the CERCLA wastestream to a local POTW?

These factors are discussed in the following subsections and a flowchart is presented in Figure 3-1 to show the evaluation process.

3.1.1. Applicability of the Domestic Sewage Exclusion

To determine the most feasible way to transport CERCLA waste to a POTW, the FS writer should consider whether the waste is regulated as a RCRA hazardous waste and, if so, whether the DSE would apply to the discharge of that waste to a POTW.

Under 40 CFR §261.4, the Domestic Sewage Exclusion, domestic sewage and any mixture of domestic sewage and other wastes that flow through a sewer system to a POTW for treatment are excluded from the definition of solid waste and, therefore, would not be considered a hazardous waste under RCRA. If a known RCRA hazardous waste is mixed with domestic sewage and this mixture flows through a sewer system to a POTW for treatment, the mixture is excluded from most RCRA requirements. This exclusion is known as the Domestic Sewage Exclusion.

While the DSE extends to most wastes that reach POTWs, it does not exempt wastes received within the POTW's property boundary by truck, rail, or dedicated pipeline. In addition, hazardous waste cannot simply be introduced to sewers outside the POTW property boundary; this would violate RCRA manifesting regulations. These regulations require that all hazardous waste must be transported to designated RCRA facilities (i.e., those with RCRA permits). Although DSE wastes are exempt from most RCRA requirements, they are subject to applicable pretreatment standards and requirements under the Clean Water Act (CWA) (see Section 8.0).

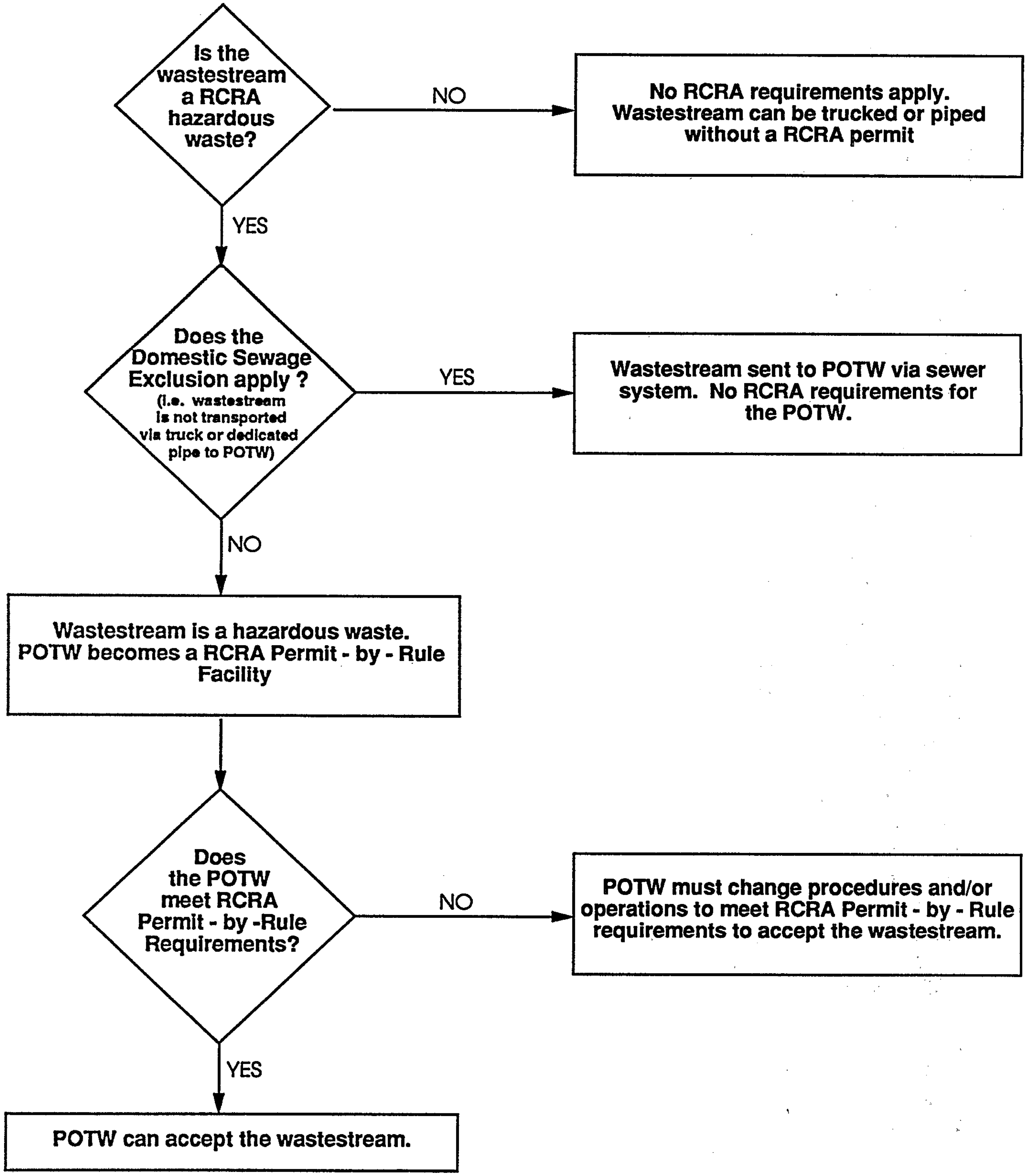

FIGURE 3-1
EVALUATING POTWs

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3.1.2. RCRA Permit-by-Rule Requirements for POTWs

If a POTW receives CERCLA wastewater that is classified as a RCRA hazardous waste and that waste is not covered by the DSE (i.e., direct delivery to the POTW by truck, rail, or dedicated pipe), the RCRA permit-by-rule requirements will be triggered. These requirements are summarized as follows:

- If a POTW is operating under an NPDES permit issued before November 8, 1984 (i.e., the date of enactment of the Hazardous and Solid Waste Amendments to RCRA), the following permit-by-rule requirements under 40 CFR §270.60(c) apply: (1) the POTW must currently have an NPDES permit; (2) the POTW must be in compliance with its NPDES permit; (3) the POTW must comply with RCRA regulations regarding an identification number, use of a manifest system, identification of manifest discrepancies, and reporting requirements; and (4) the waste received must meet all federal, state, and local pretreatment requirements that would apply to the waste if it were discharged through a sewer, pipe, or similar conveyance (i.e., the same pretreatment standards as if the DSE applied).

- If a POTW is operating under an NPDES permit issued or renewed after November 8, 1984, it must comply with the permit-by-rule requirements discussed in the preceding paragraph and corrective action requirements under 40 CFR §264.101.

Some POTWs identified as potential receivers of RCRA hazardous waste may be located so that the waste must be shipped to the POTW by truck, rail, or dedicated pipe and discharged. These POTWs may need to be ruled out as potential discharge options if they do not comply with the permit-by-rule requirements; or if they are not already a RCRA permit-by-rule facility and are not willing to comply with the additional requirements for such facilities.

Most POTWs are not RCRA permit-by-rule facilities because they receive no hazardous wastes by truck, rail, or dedicated pipe. Therefore, if the CERCLA wastestream is considered a RCRA hazardous waste, discharge to the POTW by such means would create new obligations for that POTW. The RI/FS team should consider this issue when determining whether transport by truck, rail, or dedicated pipe is feasible and in selecting a reasonable area of consideration.

3.1.3. Selection of an Appropriate Transport Technology

There is no rule for determining whether piping, trucking, or rail transport is the more appropriate way to transport a CERCLA wastestream to a POTW. However, several factors can greatly affect the cost of the transport technology, including the following:

- Area geology and topography
- Need to obtain rights-of-way for road or pipeline construction
- Wastestream quality characteristics (i.e., Is the stream a RCRA hazardous waste and will the DSE apply to the discharge of the waste to a sewer system?)
- Distance to the POTW or its existing sewer lines

- Volumes of the CERCLA wastewater
- Viscosity or percent solids of the CERCLA wastewater

Area geology should be considered; if bedrock is shallow, it may require removal prior to pipe placement. Also, topography would determine whether the liquid could flow by gravity or a pump would be necessary to force wastewater through the sewer line. If the piping needs to extend beyond property boundaries, or roads or rail lines must be built prior to waste transport, rights-of-way may be needed beforehand.

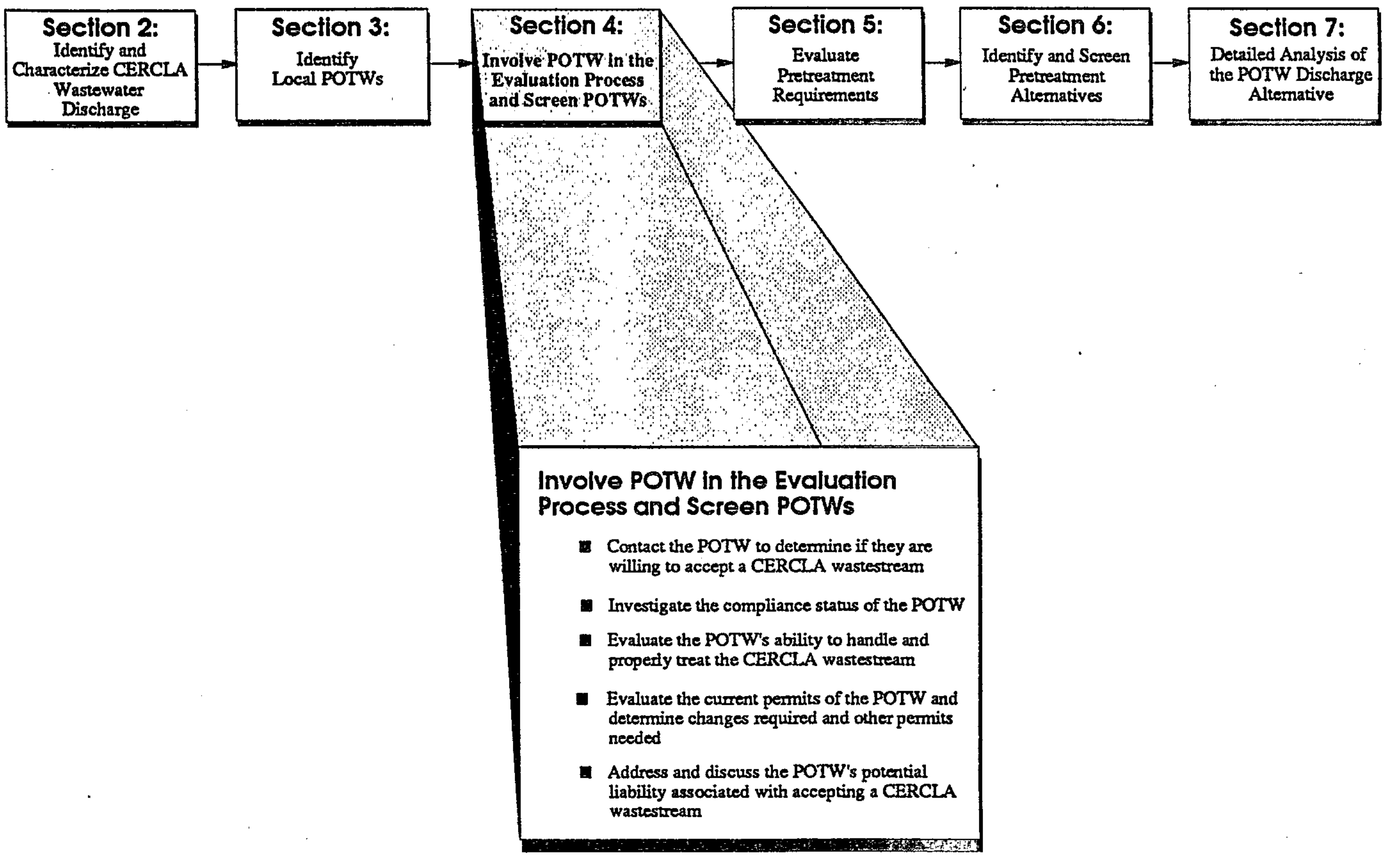
3.2. IDENTIFY POTENTIAL POTWs

After transport options have been considered, POTWs within the area should be identified. In addition, the authorities that administer the NPDES program in the appropriate states should be identified and contacted. This authority will either be the USEPA regional office or a state agency. States authorized to administer the NPDES and pretreatment programs within their jurisdiction are listed in "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990).

The NPDES authority (state or federal) can help identify potential POTWs, and can provide additional information (e.g., the level of treatment, capacity, operating history, and collection system) that will be helpful for screening the POTWs (see Section 5.0). In addition, USEPA Headquarters generates a Quarterly Noncompliance Report, which includes a listing of the POTW facilities that are in significant noncompliance each quarter. This document does not list all the facilities that have violated daily maximum limits; therefore, it should not be relied upon as a complete compliance screening tool.

At this stage in the evaluation, the RI/FS team should compile a list of potential POTWs and the information available concerning each one.

SECTION 4
INVOLVE POTW IN THE EVALUATION PROCESS AND SCREEN POTWs



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4. INVOLVE POTW IN THE EVALUATION PROCESS AND SCREEN POTWs

Once potential POTWs have been identified, the RI/FS team should contact the municipal authority responsible for technical and administrative oversight of each POTW to gather specific information. This information will be used to screen the list of potential POTWs. The POTW screening process should consider the following information:

- Whether the POTW is willing to accept CERCLA discharges
- Compliance status of the POTW
- The technical feasibility of discharging the CERCLA wastewater to the POTW
- The administrative feasibility of discharging the CERCLA wastewater to the POTW

If possible, screening of POTWs should be conducted during the site characterization phase of the RI/FS process. POTW screening and involvement are discussed in the following subsections.

4.1. COMPLIANCE STATUS OF POTWs

One factor that should be considered in the initial screening of a POTW is its compliance status. USEPA regulations prohibit sending CERCLA wastewater to POTWs not in compliance with the Clean Water Act (CWA) and other applicable laws. Based on review of the POTW's compliance history, the POTW may be determined an unacceptable receptor of CERCLA wastewater. Two USEPA policies previously described discuss procedures for determining whether a POTW may accept CERCLA wastewater: (1) USEPA's Procedures for Planning and Implementing Off-site Response Actions (40 CFR §300.440 upon promulgation), and (2) USEPA's policy memorandum entitled, "Discharge of Wastewater from CERCLA Sites into POTWs."

40 CFR §300.440 (upon promulgation) describes procedures that must be observed when a CERCLA response action involves off-site management of CERCLA waste. The regulation prohibits the transfer of CERCLA wastewater to a POTW if USEPA has information indicating that there are releases from the POTW that pose a significant risk to health. Regional off-site coordinators have been established in each region to collect available information on the acceptability status of potential receiving facilities. In addition, criteria for evaluating whether to send CERCLA waste specifically to a POTW are discussed in a USEPA-issued memorandum entitled, "Discharge of Wastewater from CERCLA Sites into POTWs." This memorandum states that full compliance with all applicable requirements of CWA and RCRA is necessary (e.g., including monitoring and reporting requirements).

According to USEPA's policy memorandum, if the discharge of CERCLA wastes to a POTW is being considered, the following points pertaining to compliance status should be evaluated:

- The ability (e.g., legal authority and enforceable mechanisms) of the POTW to ensure compliance with applicable pretreatment standards and requirements, including monitoring and reporting requirements

- The POTW's record of compliance with its NPDES permit and pretreatment program requirements

- The POTW's knowledge of and compliance with any applicable RCRA requirements or other environmental statutes

- The potential for groundwater contamination from transport of CERCLA wastewater to an impoundment at the POTW

As stated in the memorandum, POTWs under consideration as potential receptors of CERCLA wastewaters may include those POTWs either with or without an approved pretreatment program. POTWs with an approved pretreatment program are required to have mechanisms necessary to ensure compliance by industrial users with applicable pretreatment standards and requirements. POTWs without an approved pretreatment program must be evaluated to determine whether sufficient mechanisms exist to enable the POTW to ensure compliance with national general pretreatment requirements, which prohibit discharges that would cause pass through or interference (i.e., develop, monitor compliance, and enforce local limits). (The pretreatment program requirements are discussed in more detail in Section 8.0.) Therefore, the POTW must clearly demonstrate that its operations are in compliance and that it will continue to operate in an environmentally sound manner.

If a POTW receives RCRA-defined hazardous waste in a case when the DSE would not apply, it is subject to RCRA permit-by-rule facility requirements. In accordance with the RCRA requirements, these facilities will be inspected as appropriate.

To determine the ability of a non-RCRA permit-by-rule POTW to accept CERCLA waste when the DSE does not apply, a compliance check may be performed during the FS by identifying the POTW's operations and responsibilities (e.g., direct discharges, sludge management and disposal, pretreatment enforcement, and hazardous waste treatment), and the regulations applicable to those activities. The checklist in Table 4-1, which should be used to determine a POTW's compliance status, includes a synopsis of potentially applicable requirements. Because USEPA routinely updates and modifies regulatory requirements for POTWs, the checklist should be considered only a preliminary tool for assessing POTW compliance, to be supplemented by a review of recent regulatory amendments. Answers to the compliance checklist questions may be ascertained through (1) interviews with the POTW personnel; (2) documents such as the facility's permit applications and permits; and (3) file reviews to determine compliance history at appropriate USEPA and state offices.

The RI/FS team should use the compliance checklist as a preliminary guide to determining whether a POTW is in compliance with applicable environmental laws. The lead agency should be involved in this determination, especially because many of the compliance issues are not clear cut and require interpretation.

4.2. TECHNICAL FEASIBILITY

In the first step, the POTW should be screened to determine whether it can technically accept the waste. This determination should be made using information gathered during contacts with the POTW, as well as information on the quantity and quality of the CERCLA wastestream. This step will serve as a screening step prior to further contact with the POTW. During this determination, the following questions should be considered:

- Is the POTW willing to accept the CERCLA discharge?

- Does the POTW have the hydraulic and organic load capacity to accept the CERCLA waste?

- Are the POTW's unit operations suitable for treatment of contaminants in the CERCLA wastestream?

- If the CERCLA wastestream will be discharged to a sewage collection system, is that system separate from or combined with the storm drain system, and will that system provide proper containment of the wastestream?

- Are there combined sewer overflows between the site and the POTW?

- Are the capacity and age of the sewer piping system adequate for the CERCLA discharge flow rate?

- Which sludge disposal processes are currently employed by the POTW?

- Is it likely that the POTW could treat the CERCLA wastestream for the duration required?

- Are there any other technical reasons why the POTW could not accept the CERCLA wastestream?

If the RI/FS team, USEPA Remedial Project Manager (RPM), and POTW authority believe the POTW is technically capable of accepting the CERCLA wastestream, the POTW should be retained for further consideration.

4.3. ADMINISTRATIVE FEASIBILITY

After a POTW is determined to be in compliance with its NPDES permit, capable of ensuring compliance with applicable pretreatment standards and requirements, and technically capable of accepting the waste, it should be screened to determine whether acceptance of the CERCLA waste is administratively feasible. Early in this preliminary evaluation process, the RI/FS team will have to determine whether the POTW is willing and able to accept the CERCLA wastestream. These negotiations should include the POTW authority and USEPA and/or state agency representatives, and the following information should be discussed with the POTW:

- A description of the CERCLA site history and wastestream characteristics

- A summary of the information about the POTW and POTW screening results to date

Based on this information, the POTW authority must determine whether it is willing to accept the CERCLA waste and, if so, whether there are any additional issues the POTW should resolve before further discussions. If a POTW is willing to accept CERCLA wastes, the FS writer may wish to include a member of its staff on the FS technical review committee.

During the screening of POTWs, several administrative issues must be considered, such as obtaining or changing permits, delays associated with the permitting process, restrictions imposed by local ordinances, and a POTW's unwillingness to accept CERCLA wastewater due to potential liabilities associated with it. These issues are discussed in the following subsections.

4.3.1. Permitting Process

POTWs are required to notify the regulatory agency issuing NPDES permits in its state of any new introduction of pollutants to the POTW by an indirect discharger (40 CFR §122.42[b]). If a CERCLA indirect discharge (to a POTW) contains a pollutant not previously limited in the POTW's NPDES permit, the NPDES permit may require modifications. Also, the POTW's pretreatment program may need to be revised to regulate the new pollutant or increased discharges of previously limited pollutants. If permitting changes are substantial, discharging to the POTW may be deemed inappropriate either because the POTW is unwilling to have the changes made to its permit or pretreatment program, or because the changes cannot be made in a timely manner.

4.3.2. Local Ordinances

Local ordinances should also be reviewed in evaluating the possibility for discharging CERCLA wastewaters to POTWs. An ordinance may permit only domestic discharges to the POTW. The town where the POTW is located may have contracts to accept waste only from specific neighboring towns. The municipality may restrict groundwater or surface water runoff. Restrictions should be identified and local officials contacted to determine whether the restrictions apply to the CERCLA discharge or whether a variance to the ordinance may be obtained.

4.3.3. Potential Liability Associated with Accepting CERCLA Wastes

Another major administrative issue is the liability associated with accepting CERCLA waste. Potential liabilities should be identified and discussed with the POTW during negotiations, and steps that may be taken to minimize potential liability.

Under CERCLA, Section 107, whenever there is a release or threatened release of a hazardous substance(s), the responsible parties can be held liable for the costs of cleanup of that release. Responsible parties may include current owners and operators of a facility, owners and operators of the facility at the time of the release, persons who transported the hazardous substances and selected the disposal facility, waste generators, and persons who arranged for disposal or treatment of the hazardous substances. However, "federally permitted releases" are not subject to such liabilities (CERCLA 107[j]).

In the proposed rule for "Reporting Exemptions for Federally Permitted Releases of Hazardous Substances" (Federal Register, July 1988), USEPA clarified this exemption for CERCLA release liability provisions. Under these proposed regulations, "federally permitted releases" would include the following:

- Discharges covered by an NPDES permit, permit application, or permit administrative record

- The introduction of any pollutant into a POTW when such pollutant is specified in and in compliance with pretreatment standards and a pretreatment program has been submitted to USEPA for approval

If a categorical pretreatment standard or a local limit were absent for a specific pollutant, discharge of that pollutant to a POTW would not be considered a "federally permitted release" and, therefore, would not be exempted from CERCLA liability or reporting provisions according to this proposed rule. Therefore, the POTW should identify all possible hazardous substances likely to be received and establish local limits for these substances. This will avoid the possibility of non-federally permitted releases and the associated liabilities.

In addition, to qualify for this exemption, the POTW must have a local pretreatment program approved by the approval authority or a state-implemented pretreatment program approved for the specific POTW. In addition to liability under CWA, a POTW would be subject to CERCLA reporting and liability provisions if its discharge of a hazardous substance violates its NPDES permit, as defined in CERCLA Section 102.

It should be made clear to the POTW accepting the waste that compliance with the requirements of the proposed rule (and final rule when issued) for reporting exemptions and compliance with the

NPDES permit terms and conditions may protect against liability. Additionally, the POTW may arrange with a potentially responsible party to cover any financial liability that may be incurred due to the POTW accepting a CERCLA wastestream.

4.3.4. Indemnification

Another administrative issue, which is related to liability and should be discussed with the POTW, is indemnification. SARA Section 119 authorizes indemnification from liability to response action contractors. However, under SARA Section 119(c)(5)(D), indemnification cannot be provided to facilities regulated under RCRA, including RCRA permit-by-rule POTWs.

POTWs not subject to RCRA regulations (i.e., POTWs without a RCRA permit or permit-by-rule) are not explicitly prohibited from USEPA indemnification authority under Section 119. However, according to the "USEPA Interim Guidance on Indemnification of Superfund Response Action Contractors under Section 119 of SARA" (USEPA, 1987e), USEPA has determined that an extension of indemnification to any POTW would not be consistent with Congressional intent in Section 119. Therefore, USEPA will not provide indemnification to POTWs under Section 119 authority.

After all potential POTWs have been screened and the appropriate ones contacted, the RI/FS team should compile a list of those able and willing to accept the waste, and issues that would require resolution.

TABLE 4-1

POTW COMPLIANCE CHECKLIST

(Consult Appropriate Regulations for Amendments and Additions to These Rules)

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
<u>Direct Discharges</u>		
1. Is the POTW in compliance with its NPDES permit, or has the POTW been reported in a recent Quarterly Noncompliance Report (QNCR)?	CWA - NPDES Regulations (40 CFR §122, 125)	If the POTW discharges wastewater into U.S. waters, an NPDES permit is required. Specific requirements include compliance with effluent limitations based on secondary treatment requirements and any water quality standards, establishment of a discharge monitoring system, and routine reporting of the discharge monitoring results.*
2. Is the POTW in compliance with state discharge requirements?	State Discharge Permit Programs	Some states have permit programs that are part of the NPDES system.
<u>Sludge Management/Hazardous Waste Management</u>		
3. If the POTW disposes of the sludge on land, does it violate standards for PCBs, cadmium, and pathogens in the sludge?	RCRA - Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR §257)	These criteria provide guidelines for sludge utilization and disposal under Section 405(d) of the CWA. To comply with Section 405(e), the owner/operator of a POTW must not violate these criteria when disposing of sludge on land. Standards have been promulgated for pathogens applied to the land surface or incorporated into the soil, and for cadmium and PCBs when applied to land used for production of food-chain crops.

* If a POTW is operating under an expired permit, the conditions of the permit normally continue in force until the effective date of a new permit. Most NPDES permits provide for such extensions, unless this would violate state law (in those states authorized to administer the NPDES program). Therefore, a CERCLA site could discharge to a POTW that has an expired permit, if the POTW has received an extension permissible under state law and is in compliance with the extended permit.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
3. (continued)		If the POTW operates its own solid waste disposal facility for sewage sludge disposal, the solid waste disposal facility must also meet the general environmental performance standards set forth in 40 CFR §257. These criteria currently include sewage sludges from POTWs. However, USEPA is currently developing specific standards for managing POTW sewage sludge (40 CFR §503) (see No. 20), and may amend Section 257 to exclude POTW sewage sludge from its requirements.
4. If the pollutants regulated by NESHAPS are present in the POTW's sludge, and the sludge is stored in piles, dried, and/or incinerated, do the air emissions violate the standards?	CAA - National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR §61)	Windblown particulates, mercury and beryllium, from sludge piles and stack emissions from sludge incinerators may be regulated by NESHAPS, depending on the pollutants present and processes involved.
5. If pollutants regulated by National Ambient Air Quality Standards (NAAQS) are present in the POTW's sludge, and the sludge is stored in waste piles and/or incinerated, do the air emissions violate the standards?	CAA - National Ambient Air Quality Standards (40 CFR §50)	EPA has promulgated NAAQS for six pollutants: particulate matter equal to or less than 10 microns particle size, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. These standards are national limitations on ambient concentration. Different requirements will be triggered depending on whether the source is located in an attainment or non-attainment area. The standards only apply to "major sources" (i.e., emits 250 or more tons of any regulated pollutant per year).

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
6. If the sludges contain PCBs greater than 50 ppm, are they properly disposed of?	TSCA - Storage and Disposal (40 CFR §761.60 - 761.79)	Incinerators burning sludges that contain PCBs in amounts greater than 50 parts per million (ppm) must be in compliance with specific design and operational requirements of TSCA.
7. If the POTW incinerates its sludge and is subject to the provisions of 40 CFR §60, Subpart 0, do the air emissions violate standards for particulate matter and/or opacity?	CAA - Standards of Performance for Sewage Treatment Plants, Standards for Particulate Matter (40 CFR §60.152)	These requirements apply to sewage sludge incinerators that combust wastes containing more than 10-percent sewage sludge (dry basis) or incinerators that charge more than 1,000 kg/day municipal sewage sludge (dry basis). Facilities under this description must have commenced construction or modification after June 11, 1973, to be subject to the requirements. A sewage sludge incinerator shall not discharge into the atmosphere particulate matter at a rate in excess of 0.65 grams/kg dry sludge input nor any gases which exhibit 20-percent opacity or greater.
8. If the POTW incinerates its sludge and is subject to No. 7, does it conduct the appropriate air monitoring?	CAS - Monitoring of Operations (40 CFR §60.153)	The owner or operator of a sludge incinerator subject to these provisions must conduct the appropriate monitoring.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
9. If the POTW dumps its sludge into ocean waters, does it violate any prohibitions, limits, or conditions set by its permit, or does it contain any of the constituents at certain concentrations prohibited from dumping?	MPRSA - Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials (40 CFR §227)	This regulation constitutes the criteria for the issuance of ocean disposal permits after consideration of the environmental effect of the proposed dumping operation. Specifically, materials containing the following constituents, other than trace contaminants, are prohibited from ocean dumping: organohalogen compounds, mercury and mercury compounds, cadmium and cadmium compounds, oil, and known or suspected carcinogens, mutagens, or teratogens. In addition, wastes may only be ocean dumped so as not to exceed the limiting permissible concentration (LPC).
	US Code - Title 33, Navigation and Navigable Waters (1989 Cumulative Annual Pocket Part, Section 1414b.)	Section 1414b, ocean dumping of sewage sludge and industrial waste prohibits the issuance of permits to dump sewage sludge at sea, except to persons who were authorized by a permit or court order. It also renders it unlawful to dump sewage sludge at sea by any person after December 31, 1991.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
10. Is the POTW sludge and/or wastewater considered a hazardous waste?	RCRA - Standards Applicable to Generators and Hazardous Wastes, Hazardous Waste Determination (40 CFR §262.11)	POTW sludge and/or wastewater may be RCRA hazardous waste if it exhibits a hazardous characteristic or is derived from the treatment of a mixture (see 40 CFR §261.3[a]2) of listed hazardous waste received by truck, rail, or dedicated pipe and other sewage or waste.
11. If the POTW generates hazardous wastes, does it have a USEPA identification number?	RCRA - USEPA Identification (40 CFR §262.12)	If the POTW produces hazardous wastes, including sludges that are hazardous, the POTW must notify USEPA of its activities and obtain a USEPA identification number.
12. Does the POTW properly manifest its hazardous waste?	RCRA - Manifest Requirements (40 CFR §262.20 - 262.23)	If hazardous waste is shipped off-site, the shipments must be accompanied by a uniform hazardous waste manifest. The manifest provides the mechanism for tracking hazardous wastes. A POTW must also complete manifests as the recipient of hazardous waste sent to it by truck, rail, or dedicated pipe. The procedures to follow in using the manifest are outlined in 40 CFR §262.22 and 262.23.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
13. Are hazardous wastes packaged in the manner prescribed for the specific material in accordance with Department of Transportation (DOT) and RCRA regulations?	RCRA - Pre-transport Requirements (40 CFR §262.30 - 262.34); DOT Regulations (49 CFR §171-179)	The POTW must assure that hazardous wastes are shipped in proper containers, are accurately marked and labeled, and the transporter is provided with the proper placards.
14. Are containers holding hazardous wastes labeled with the labels prescribed for the material as specified in DOT and RCRA regulations?	RCRA - Pre-transport Requirements (40 CFR §262.30 - 262.34); DOT Regulations (49 CFR §171-179)	The POTW must assure that hazardous wastes are shipped in proper containers, are accurately marked and labeled, and the transporter is provided with the proper placards.
15. Does the POTW accumulate hazardous wastes for 90 days or less before the waste is picked up by a licensed transporter? If not, does the POTW generate less than 1,000 kg/month of waste, transport it more than 200 miles, or have a RCRA storage permit?	RCRA - Pre-transport Requirements (40 CFR §262.30 - 262.34)	If the POTW accumulates 1,000 kg/month of hazardous wastes on-site for more than 90 days, the POTW is classified as a hazardous waste storage facility, and must comply with Sections 264, 265, and 270, and obtain a RCRA storage permit. (This could include a permit-by-rule under 40 CFR §270.60[c].) POTWs generating between 100 and 1,000 kg/month of waste can accumulate wastes for 180 or 270 days if waste must be transported more than 200 miles for treatment and disposal.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
16. Does the POTW properly dispose of the sludge classified as hazardous waste?	RCRA - Land Disposal Restrictions 40 CFR §268	If the hazardous sludge is land-disposed, it must be treated to the applicable treatment standard specified in the RCRA Land Disposal Restrictions prior to disposal.
17. Does the POTW comply with permit requirements for sludge use and disposal?	CWA - Establishing limitations, standards, and other permit conditions (40 CFR §122.44)	Regulations require that when there are no applicable standards for sewage sludge use or disposal, the permit shall include requirements developed on a case-by-case basis to protect public health and the environment from toxic pollutants in sewage sludge.
18. Does the POTW comply with permit requirements for sludge use and disposal?	CWA - USEPA-administered Permit Programs: NPDES (40 CFR §122)	Regulations that pertain to sludges are based on CWA Section 405(f), which requires that NPDES permits must include requirements to implement the sludge use and disposal standards (40 CFR §503), unless such requirements have been included in a permit issued under RCRA, SDWA, CAA, or MPRSA and an approved state sludge management program. Permits with requirements for sludge use or disposal will also be required for treatment works treating domestic sewage not subject to NPDES.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Sludge Mngmt/Hazardous Waste Mngmt (continued)		
19. (Compliance question to be determined upon finalization of sewage sludge technical standards.)	CWA - Conditions applicable to all permits (40 CFR §122.41)	Regulations require the POTW to comply with standards for sludge use or disposal even if the permit has not yet been modified to incorporate the regulatory requirement. The POTW must take all reasonable steps to minimize or prevent sludge use or disposal in violation of the permit. Test procedures may be specified under 40 CFR §503.
20. (Compliance question to be determined upon finalization of the proposed CWA sludge regulations.)	CWA - Sewage Sludge Technical Standards (40 CFR §503)	Proposed regulations set sludge technical standards for the use and disposal of nonhazardous sewage sludge. The proposed standards address the agricultural and nonagricultural land application, distribution, marketing, surface disposal, landfilling, and incineration of sewage sludge. They specify numerical limits or equations for calculating these limits for 28 pollutants based on public health and environmental criteria. In addition, these proposed regulations include management practices and other general requirements pertaining to use and disposal of sewage sludge.
21. (Compliance question to be determined upon finalization of the proposed RCRA - Solid Waste Disposal Criteria.)	RCRA - Solid Waste Disposal Facility Criteria (40 CFR §258)	Under proposed regulations, sewage sludge co-disposed with solid waste in municipal landfills would be regulated under a new 40 CFR §258. These regulations establish various management and operation requirements including numerical limitations in the form of groundwater protection standards.

TABLE 4-1

(continued)

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Pretreatment		
22. Is the POTW violating its NPDES permit and/or sludge use or disposal requirements as a result of an indirect discharge?	CWA - National Pretreatment Standards - Prohibited Discharges (40 CFR §403.5(c))	POTWs are required to develop "local limits" for indirect dischargers introducing pollutants into their receptor systems to prevent discharges of pollutants in amounts sufficient to interfere with or pass through the POTW. Discharges must not violate: - the POTW's NPDES permit - relevant sludge use or disposal requirements, thereby restricting the POTW's sludge use or disposal practices - the specific prohibition listed in 40 CFR §403.5(b) Enforcement of these prohibitions is a requirement of pretreatment program approval. Waste must be pretreated to a level that will not violate these prohibitions.
23. Do any industrial discharges violate categorical standards for discharges to the POTW?	CWA - Pretreatment Standards Categorical Standards (40 CFR §403.6)	Categorical Standards specify quantities or concentrations of pollutants or pollutant properties that may be discharged to a POTW by existing or new industrial users in specific industrial subcategories, which have been established as separate regulations under the appropriate subpart of 40 CFR Chapter I, Subchapter N. Violation of pretreatment standards may indicate POTW violation of requirements described in No. 25.

TABLE 4-1

(continued)

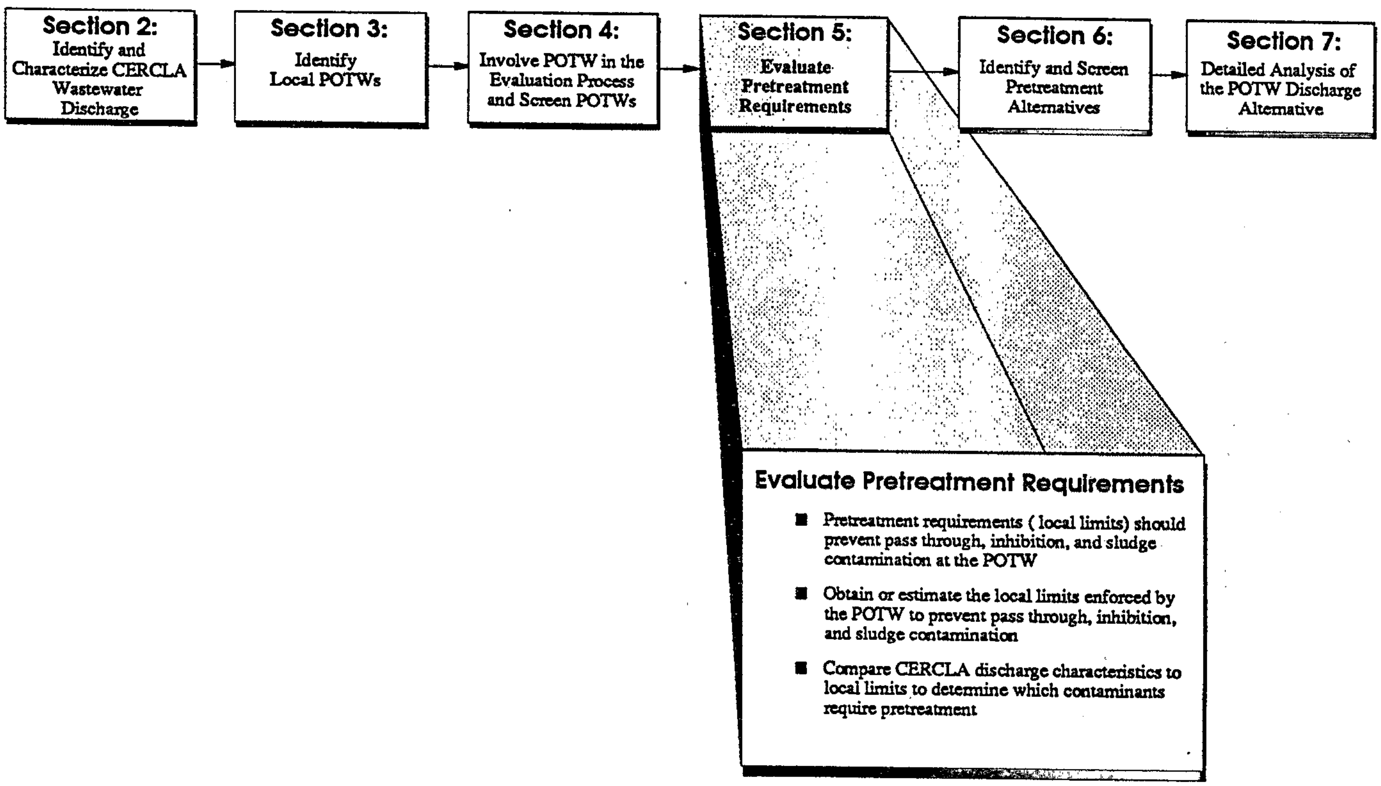
POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
<u>Pretreatment (continued)</u>		
24. If required to develop a Pretreatment Program, has the POTW developed the program by the appropriate deadline?	CWA - POTW Pretreatment Programs: Development by POTW (40 CFR §403.8)	Any POTW with a total design flow greater than 5 mgd that receives pollutants from industrial users which pass through or interfere with operations, or which are otherwise subject to national categorical pretreatment standards, must establish a Pretreatment Program, unless the NPDES state exercises its option to assume local responsibility. Other POTWs may also be required to establish Pretreatment Programs, upon an appropriate finding of need by USEPA or an authorized state agency. The deadline for program approval is July 1, 1983.
25. Has the POTW enforced the Pretreatment Program and properly implemented procedures to ensure compliance?	CWA - National Pretreatment Standards: Prohibited Discharges (40 CFR §403.5)	A POTW is required to develop a local pretreatment program and implement procedures to ensure compliance with the requirements of the Pretreatment Program, including identifying all nondomestic users of its system, identifying the character and volume of their discharges, notifying them of applicable standards, sampling industrial effluents, conducting inspections, and annually publishing the names of nondomestic users in significant violation of the Pretreatment Program.

POTW COMPLIANCE CHECKLIST

CONSIDERATION BEFORE DISCHARGING TO POTW	APPLICABLE REQUIREMENT	REQUIREMENT SYNOPSIS
Hazardous Waster Treatment		
26. If the POTW treats hazardous wastes, is it permitted under RCRA, and does it comply with the permit?	RCRA - Permit-by-Rule (40 CFR §270.60)	The owner or operator of a POTW that accepts hazardous waste for treatment is deemed to have and be in compliance with a RCRA permit-by-rule if it has an NPDES permit, is in compliance with the NPDES permit, meets RCRA reporting, manifest, and (for certain facilities) corrective action requirements. The hazardous waste received by the POTW meets all federal, state, and local requirements and, if applicable, the POTW complies with RCRA corrective action requirements.

SECTION 5
EVALUATE PRETREATMENT REQUIREMENTS



5. EVALUATE PRETREATMENT REQUIREMENTS

The next step in evaluating the CERCLA discharge to a POTW is to determine whether pretreatment is required prior to discharging to a POTW. This step should be conducted during the development of alternatives phase of the RI/FS process. An accurate evaluation of the pretreatment requirements for the CERCLA discharge will help ensure that the National Pretreatment Program objectives are attained (i.e., that pass through, interference, and sludge contamination be prevented at the POTW). In addition, this evaluation is consistent with the USEPA policy memorandum concerning CERCLA discharges to POTWs. The memorandum requires that the quantity and quality of the CERCLA wastewater, including the possibility of pass through, interference, and sludge contamination, be evaluated. Also, it requires that the potential effect of the CERCLA wastewater on the POTW's discharge be evaluated.

The process for evaluating pretreatment requirements consists of two activities: (1) obtaining or estimating local limitations for the contaminants in the CERCLA discharge; and (2) comparing the CERCLA wastewater characteristics against the local limitations and prohibited discharge standards.

In order to avoid problems that could arise in treating highly concentrated wastestreams, it may be more practical to pretreat before discharging to a POTW.

5.1. OBTAIN OR ESTIMATE POTW'S LOCAL LIMITS

Local limits will serve as a basis for evaluating pretreatment requirements. Local limits are specific requirements developed and enforced by individual POTWs to prevent pass through and interference. Such limits may be required for the CERCLA wastestream contaminants because uniform federal standards establishing the required level of pretreatment for CERCLA wastes being discharged to a POTW are not currently available (i.e., categorical standards for CERCLA sites). Rather, these standards must be determined on a site-specific basis depending on the compounds present in the wastestream and their concentrations, the POTW characteristics, the body of water that will receive the discharge, POTW sludge disposal practices and requirements, and/or POTW NPDES permit requirements.

The POTW may have local limits for all the contaminants in the CERCLA discharge. However, it is more likely that the POTW will not have such limits for all contaminants or that existing limits may need to be changed based on the acceptance of the new discharge. If some local limits do not exist, they must be developed by the POTW, or estimated by the FS team so that pretreatment alternatives can be evaluated. However, if these limits are estimated and the POTW later agrees to accept the discharge, the POTW must develop the estimated limits into enforceable ones (see Section 8.0).

To determine whether local limits can be obtained from the POTW or must be estimated, the FS team must contact the POTW. Working with the POTW authority and/or the agency responsible for developing local limits, the team should evaluate the local limits that already exist for compounds detected in the CERCLA waste and determine whether others must be developed or estimated. The flow chart in Figure 5-1 identifies important points that should be addressed to evaluate local limits.

As shown in the flow chart, the simplest but most unlikely scenario would be that the POTW already has local limits developed for all compounds detected in the CERCLA waste and

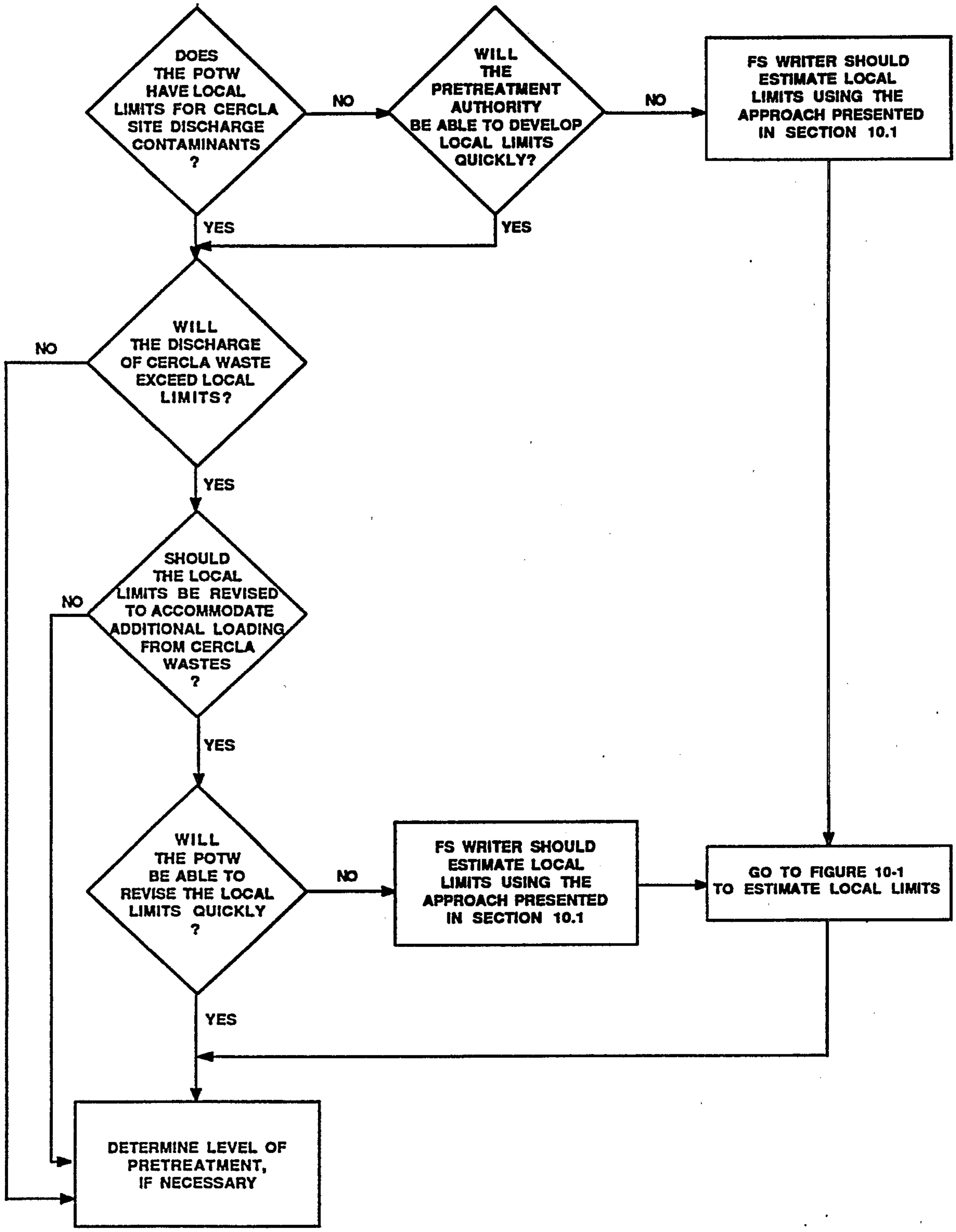


FIGURE 5-1
OBTAINING POTW LOCAL LIMITS

6094-01

that the addition of the CERCLA waste would not exceed the existing local limits. If this situation did occur, the FS writer could evaluate the pretreatment requirements quickly. However, if the CERCLA waste would be a significant portion of the POTW influent, it would be appropriate to reevaluate the current local limits.

In most instances, however, enforceable local limits will not exist for all compounds detected in the CERCLA wastes, and will have to be developed by the POTW or estimated by the FS team. If this is the case, it is important to get an estimate of the time required by the POTW to develop new local limits. Depending on staffing, laboratory capabilities, and treatment plant performance experience, some POTW authorities may be capable of developing acceptable local limits for a wide range of compounds in a reasonably short period.

If new or revised local limits are needed, the POTW should notify the NPDES regulatory agency. The earlier that this agency is notified, the greater the chance that revised NPDES limits and local limits will be developed by the time a decision must be made concerning remedial action. Several iterations to develop and agree on the acceptable limits should be expected. However, high priority may not necessarily be given to a CERCLA site clean-up effort, and several months could be required to develop local limits.

The time required by the POTW to develop local limits for compounds in the CERCLA waste will determine whether FS writers have to estimate local limits to evaluate pretreatment requirements. To estimate local limits, the FS team must conduct several activities:

- Collect and evaluate the pertinent regulatory criteria
- Calculate a mass balance for each compound detected in the CERCLA waste using treatability data
- Evaluate the impact each contaminant has on air emissions, treatment plant operations, sludge disposal, and effluent water quality
- Estimate local limits and the expected level of pretreatment necessary, at a minimum, to ensure continued compliance with NPDES permit limits and applicable air emission standards, avoid any exceedance of state water quality standards, and maintain acceptable levels of sludge quality

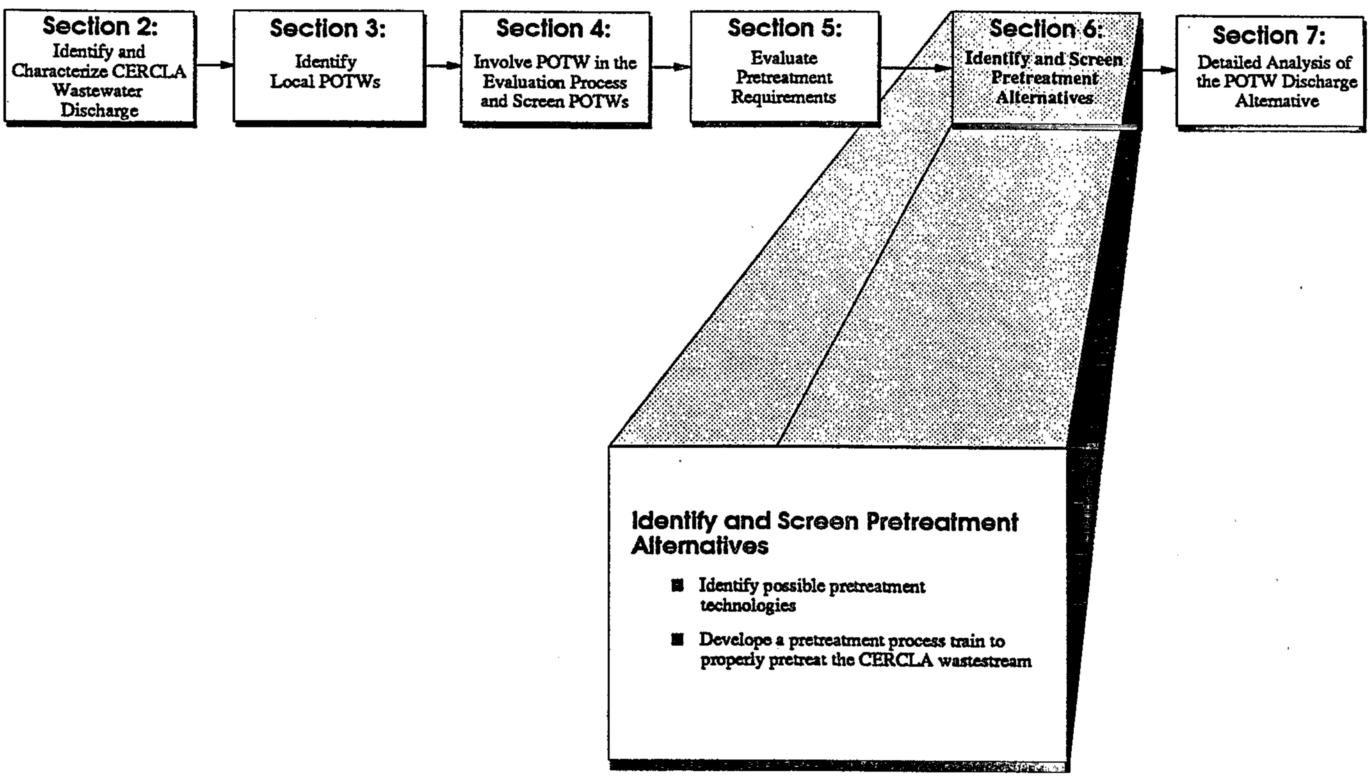
These activities and a method for estimating local limitations are discussed in Section 10.0.

5.2. COMPARE CERCLA DISCHARGE CHARACTERISTICS TO LOCAL LIMITS

After local limits have been obtained or estimated, they should be compared to CERCLA wastewater characteristics (i.e., contaminant concentrations and flow rate), as determined in Section 2.0. In addition, these characteristics should be evaluated considering General Pretreatment Regulations (see Subsection 8.1.2), which forbid the discharge of pollutants that cause fire or explosion hazard, corrosive structural damage, obstruction of flow, interference, or inhibition of biological activity due to excessive heat.

Based on these comparisons, the FS team should determine which contaminants, if any, require pretreatment, and the percent removal required for each contaminant. In addition, if local limits were estimated, the FS team, POTW, and appropriate authorities should develop and obtain approval of enforceable local limits and issue a mechanism of control for the contaminants in the CERCLA discharge (see Section 8.0).

SECTION 6
IDENTIFY AND SCREEN PRETREATMENT ALTERNATIVES



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6. IDENTIFY AND SCREEN PRETREATMENT ALTERNATIVES

At this point in the development of the discharge to a POTW alternative, the FS team has determined that a POTW is available to accept the wastewater, and has determined if pretreatment is required. This section describes the process for selecting and evaluating an appropriate pretreatment alternative. Various technologies are presented for pretreating the CERCLA site discharge, and a strategy is given on how to assemble the appropriate technologies into a treatment train. Detailed information for several technologies is available in the "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990) and other sources. This information can be used by the FS team to evaluate the pretreatment/discharge to POTW alternative.

Approaching this section, the FS writer should have certain information, including a complete description of the stream to be discharged (i.e., flow rates and chemical composition), and necessary treatment levels for key contaminants prior to acceptance at the POTW. This section is not intended to be an exhaustive review of available technologies or possible pretreatment trains; rather, it provides a simple approach to establishing a basic pretreatment train. Refinements of the train will be necessary based on a more detailed review of available technologies.

6.1. IDENTIFY PRETREATMENT TECHNOLOGIES

The technologies presented in this section were identified based on review of available demonstrated wastewater treatment technologies and a review of technologies that have been used for pretreatment of CERCLA discharges to POTWs. New technologies for treating wastewater are continually being developed, and the FS team is referred to technical journals and outside references for additional information on recent developments.

The technologies discussed in this section are a basic set of unit operations capable of pretreating a wide variety of wastestreams and contaminants, including most identified contaminants of concern. The technologies can be combined to form a complete train for many mixed wastestreams that might be expected from a CERCLA site.

The technologies covered briefly in this section can be grouped into the following three general categories:

<u>TREATMENT TECHNOLOGIES</u>

Aerobic Biological Treatment
Air- and Steam-stripping
Anaerobic Biological Treatment
Separation
Neutralization
Oxidation
Precipitation
Reduction

<u>SEPARATION TECHNOLOGIES</u>

Clarification
Filtration
Oil and Grease

<u>POLISHING TECHNOLOGIES</u>

Carbon Adsorption
Ion Exchange

These technologies are presented in Table 6-1 with information on how the technologies are used, which combinations of technologies are

TABLE 6-1
APPLICABILITY OF PRETREATMENT TECHNOLOGIES

PRETREATMENT TECHNOLOGY	PRIMARY USES	LOCATION IN TREATMENT TRAIN	AMMONIA	pH	BOD	COD	CYANIDES	OIL & GREASE	SUSPENDED SOLIDS	METALS & ELEMENTS	DIOXINS/FURANS	VOLATILES	ACID EXTRACTABLE	NEUTRAL EXTRACTABLE	BASE EXTRACTABLE	ORGANOHALIDES	CARBAMATES	ORGANOPHOSPHORUS	HERBICIDES
Oil and Grease Separation	Organic Phase Removal Large Particle Sedimentation	First step in train, combined with settling, flow equalization	--	--	--	--	--	P	P	--	--	--	--	--	--	--	--	--	--
Oxidation	Oxidizing Metals Oxidizing Organics	Prior to Precipitation Prior to Biological Treatment	V	--	S	S	P	--	--	V	V	V	P	V	--	P	P	P	P
Reduction	Reducing Metals	Prior to Precipitation	--	--	--	--	--	--	--	V	--	--	--	--	--	V	--	--	--
Precipitation	Dissolved Metals Removals	Following Oxidation/Reduction Prior to Clarification/Filtration	--	--	--	--	P	--	--	V	V	V	P	V	--	P	P	P	P
Clarification	Settles Suspended Solids Concentrates Organic Sludges	Following Precipitation Following Aerobic Biological Treatment	--	--	S	S	--	--	P	--	--	--	S	S	S	S	S	S	S
Filtration	Removes Suspended Solids	As an early step in train Following Precipitation/Clarification Following Biological/Precipitation Prior to Air-stripping Prior to Polishing w/Carbon or Ion Exchange	--	--	S	S	--	--	P	S	--	--	--	--	--	--	--	--	--

P = Primary method of treatment for the class

S = Support technology, for treatment of chemicals in this class

V = Treatment effectiveness varies for compounds within class

-- = Not Applicable or insufficient data available for compounds in this class

TABLE 6-1
(continued)
APPLICABILITY OF PRETREATMENT TECHNOLOGIES

PRETREATMENT TECHNOLOGY	PRIMARY USES	LOCATION IN TREATMENT TRAIN	AMMONIA	pH	BOD	COD	CYANIDES	OIL & GREASE	SUSPENDED SOLIDS	METALS & ELEMENTS	DIOXINS/FURANS	VOLATILES	ACID EXTRACTABLE	NEUTRAL EXTRACTABLE	BASE EXTRACTABLE	ORGANOHALIDES	CARBAMATES	ORGANOPHOSPHORUS	HERBICIDES
Air- or Steam-stripping	Remove VOCs	Prior to Carbon Adsorption Prior to Biological Treatment	P	--	--	--	--	--	--	--	--	P	--	--	--	--	--	--	--
Anaerobic Biological	Degrades High-strength Organics	Prior to Aerobic Biological	--	--	P	P	--	--	--	--	--	P	V	V	V	V	V	V	V
Aerobic Biological	Degrades Organics	Following Anaerobic Biological Following Oxidation Prior to Carbon Adsorption	P	--	P	P	--	--	--	--	--	V	V	V	V	V	V	V	V
Carbon Adsorption	Removes Organics Removes Some Metals	Polishing step at end of train Following other organic treatments/Filtration Prior to ion exchange	--	--	--	--	--	--	--	V	P	V	P	P	P	P	P	P	P
Ion Exchange	Removes Trace Metals	Polishing step at end of train Following carbon adsorption	P	--	S	S	--	--	--	P	--	--	--	--	--	--	--	--	--
Neutralization	Adjusts pH	Prior to ion exchange, carbon Prior to precipitation Final step prior to discharge	--	P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

P = Primary method of treatment for the class

S = Support technology, for treatment of chemicals in this class

V = Treatment effectiveness varies for compounds within class

-- = Not Applicable or insufficient data available for compounds in this class most frequently used, and the applicability of each technology to the classes of contaminants. Table 6-1 should be considered when combining technologies into process trains capable of pretreating discharges from CERCLA sites.

6.2. ASSEMBLE ALTERNATIVE PROCESS TRAIN PRETREATMENT

This subsection discusses an approach to assembling a process train for pretreatment of a CERCLA discharge. The approach presented in the following paragraphs, one of many possible approaches to development of a process train, is designed to aid in selection of the basic unit operations necessary to treat a wastestream.

The remainder of this subsection consists of four decision flow charts that will enable the FS team to assemble a treatment train. The flow charts are arranged in the following order: (1) Flow Equalization and Phase Separation, (2) Metals Removal, (3) Organics Removal, and (4) Polishing and Discharge.

Each flow chart deals with a specific segment of an overall pretreatment train. After each step in the flow chart, the concentrations in the stream must be recalculated. Data for this recalculation can be obtained through treatability tests, or from data available in the literature. For this subsection, it is assumed that the FS team has such data available. If the data are not available, the information in Table 6-1 provides a rough indication of the effectiveness of each technology. This information can be expanded upon during detailed evaluation of the alternative.

6.2.1. Flow Equalization and Phase Separation

The first segment of the pretreatment process involves screening and equalization of solids followed by the removal of any nonaqueous liquid. As described in Figure 6-1, one or more operations may be required to accomplish these steps. Coarse screens may be used to remove large solids; sedimentation and grit removal will remove smaller solids. Flow equalization is necessary when the concentration or flow rate of a stream varies over time, as might occur with intermittent pumping of groundwater or leachate. Organic nonaqueous phase liquids may be removed using a settling step for heavy fractions, or an oil and grease separator for lighter fractions. These preliminary steps may be accomplished in a single settling chamber or in a series of chambers.

If solids removal, oil and grease removal, or flow equalization achieves the necessary pretreatment levels, the stream may be discharged. If dissolved organic or inorganic constituents are of concern, the stream requires further pretreatment.

6.2.2. Metals Removal

The next segment in the pretreatment process addresses dissolved metals. Dissolved metals can be removed by forming insoluble precipitates that can be flocculated and settled or filtered from the solution (Figure 6-2). The types of chemicals used for precipitation are highly specific to the individual wastestream. In some cases, metal species need to be oxidized or reduced before precipitation.

The pretreatment process train consists of reduction or oxidation, precipitation/flocculation, and filtration and/or clarification. Removal rates for each metal species can be calculated from bench-test results. In some cases, a second precipitation operation, using different pH and chemical dosages, is necessary to achieve acceptable removal of all metallic species present. After precipitation, residual metals can be removed during the polishing phase, if necessary.

6.2.3. Organics Removal

The third segment of the pretreatment process involves removal or treatment of organics (Figure 6-3). Air- or steam-stripping is used to remove the volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs) are treated using a combination of oxidation and/or biological treatments. The effectiveness of biological treatment is highly compound-specific.

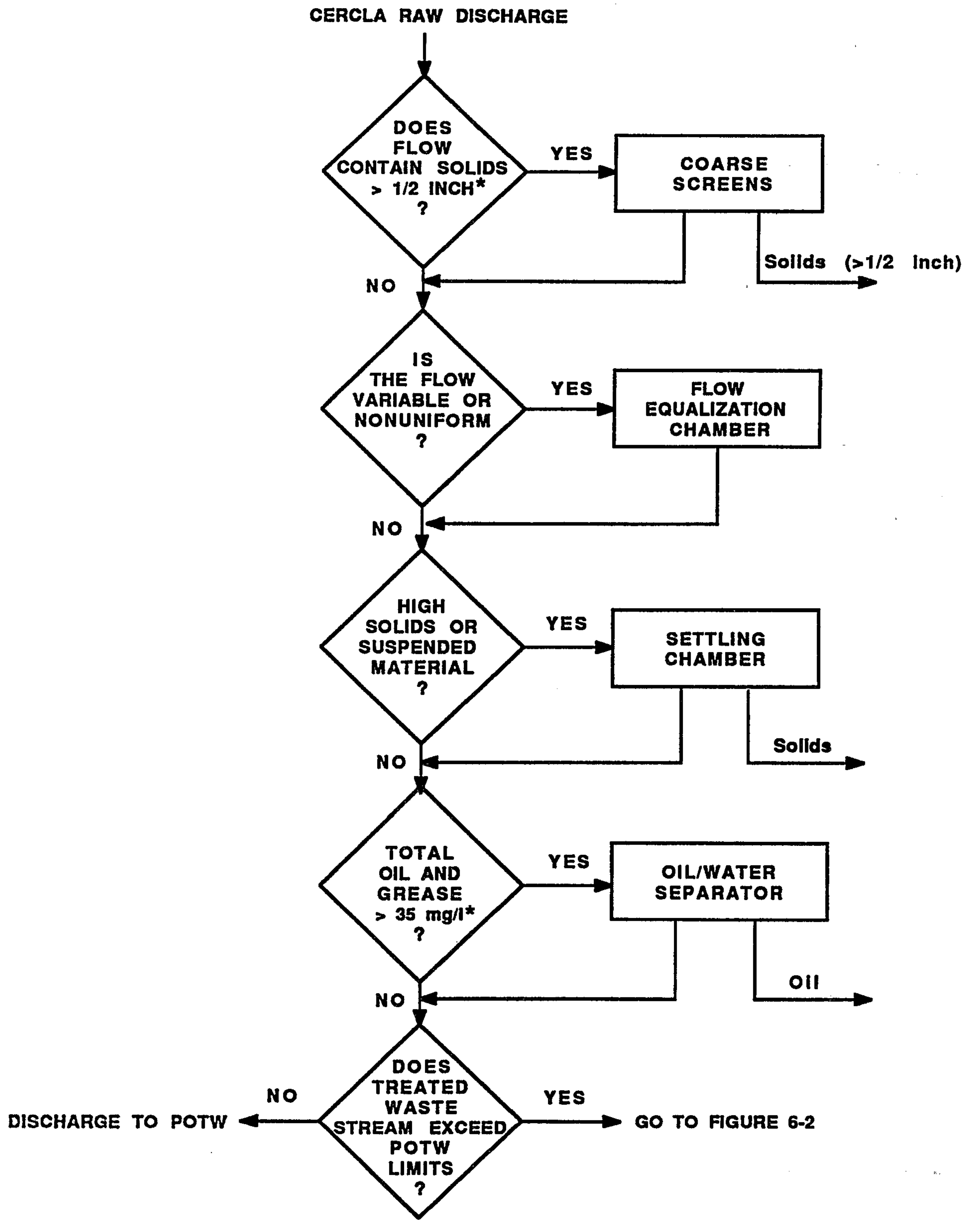
6.2.4. Polishing and Discharge

Following the treatment segments for metals and organics, additional treatment may be necessary to meet the pretreatment levels established by the POTW or otherwise deemed necessary by the FS writer. This manual discusses two polishing processes: carbon adsorption for organics and ion exchange for metals. Following these polishing steps, final pH adjustment may be necessary before discharge. These processes are presented in Figure 6-4. Both carbon adsorption and ion exchange are somewhat compound-specific. With proper design considerations, both technologies have been applied successfully to reduce trace contaminant levels.

After identifying the appropriate technologies from each of the four flow charts, the FS writer can assemble a complete pretreatment alternative. As a first approximation, the train can be assembled in the order the technologies were identified in the flow charts.

The order of unit processes in the treatment train is highly site-specific. Factors such as type of contamination, size of the site, and availability of materials will affect the final design. The process can be made more efficient by optimizing the design and order of technologies used for pretreatment.

Once the treatment train has been developed, the entire alternative can be evaluated using information gathered during discussions with the POTW authority and more detailed information on treatment technologies contained in other references.



* INDICATES LIMITS ARE BASED ON BEST PROFESSIONAL JUDGEMENT

FIGURE 6-1
PRETREATMENT PROCESS TRAIN
FLOW EQUALIZATION AND PHASE SEPARATION

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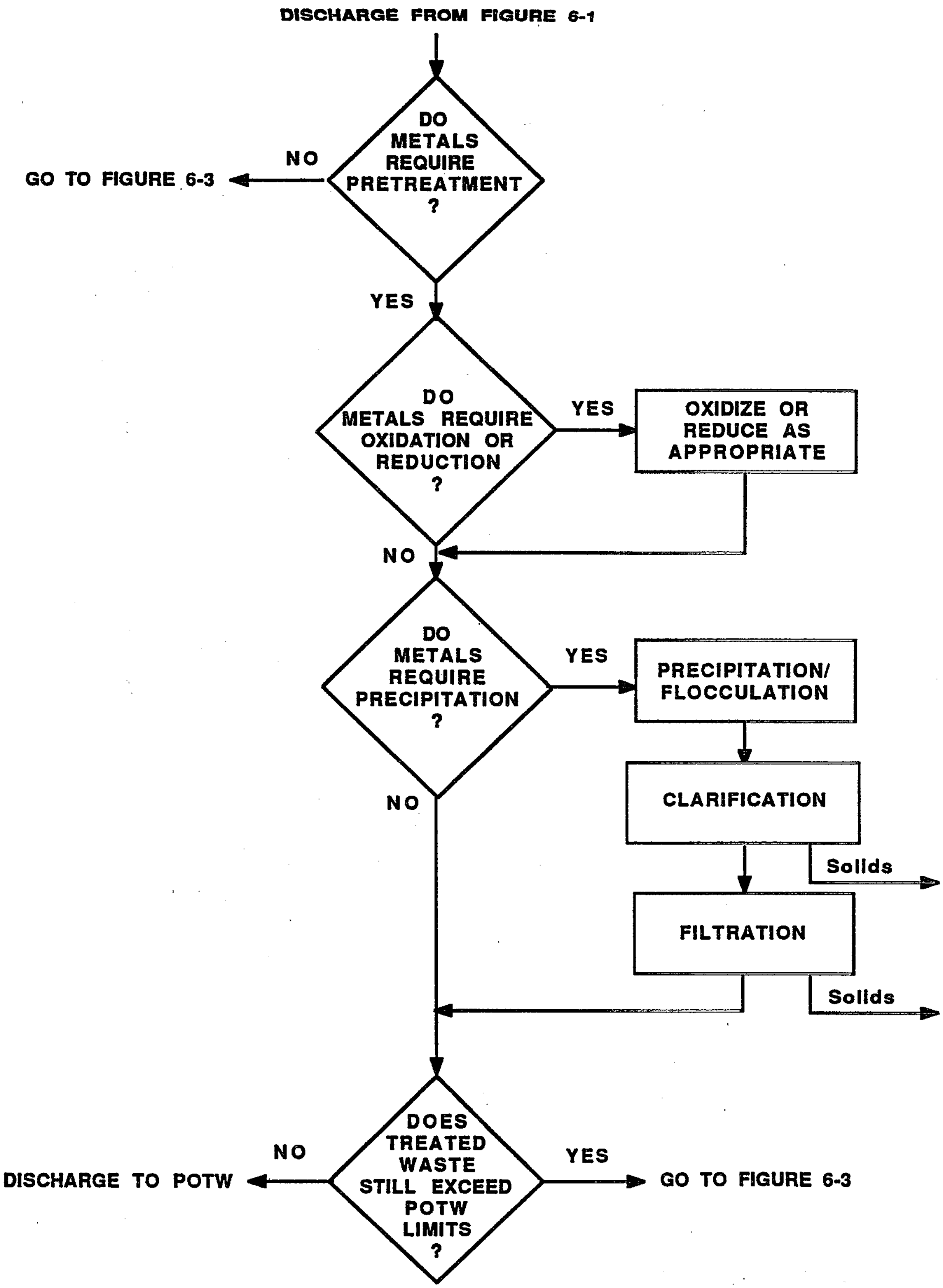

FIGURE 6-2
PRETREATMENT PROCESS TRAIN
METALS TREATMENT

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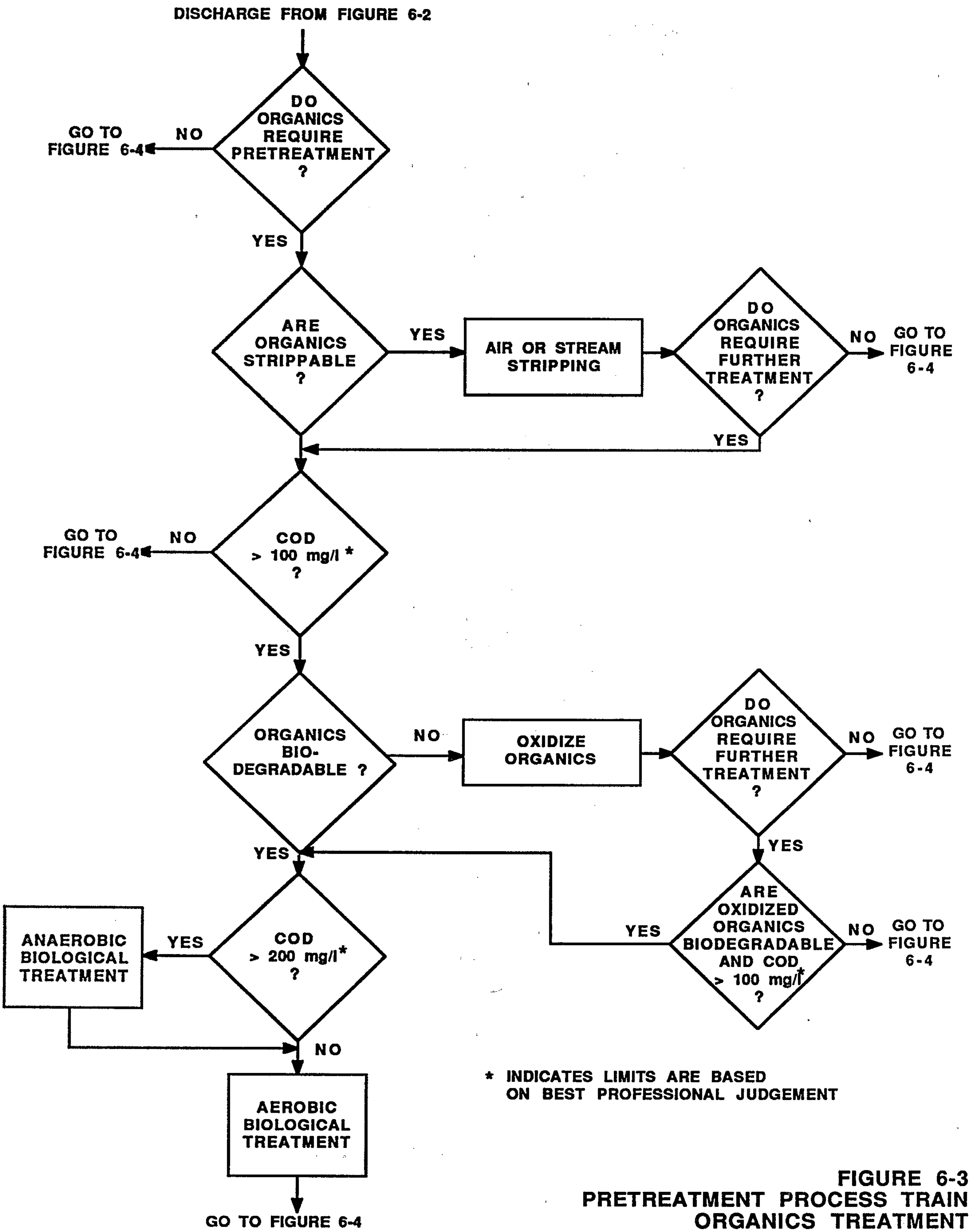

FIGURE 6-3
PRETREATMENT PROCESS TRAIN
ORGANICS TREATMENT

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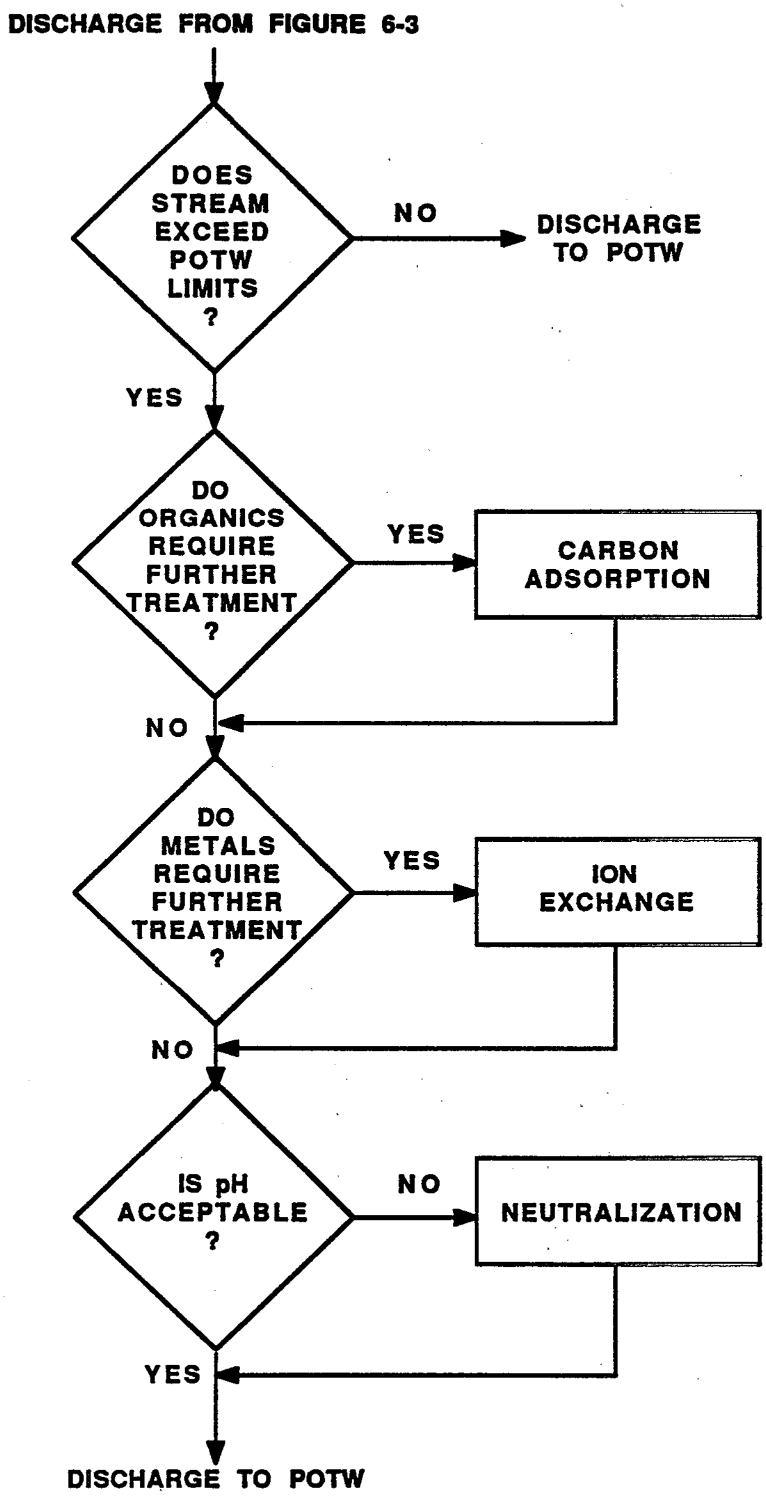

FIGURE 6-4
PRETREATMENT PROCESS TRAIN POLISHING AND DISCHARGE

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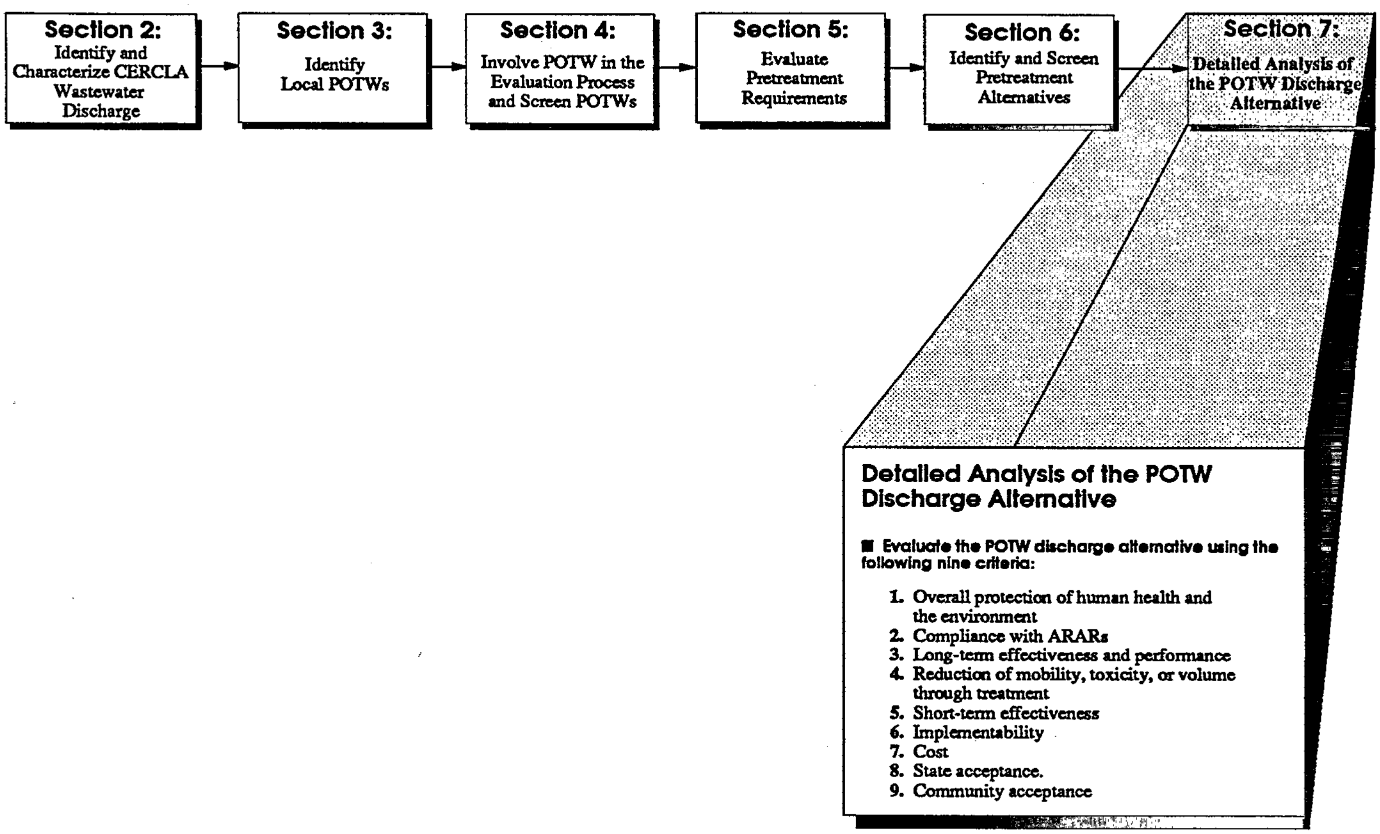
SECTION 7
DETAILED ANALYSIS OF THE POTW DISCHARGE ALTERNATIVE



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7. DETAILED ANALYSIS OF THE POTW DISCHARGE ALTERNATIVE

The identification of the preferred alternative and the remedy selection decision are based on an evaluation of the major tradeoffs among the alternatives in terms of the following nine evaluation criteria:

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

Remedial alternatives must be protective of human health and the environment and comply with ARARs (or justify a waiver) in order to be eligible for selection. These are the two threshold criteria.

The tradeoffs, identified in the detailed analysis, are balanced among alternatives with respect to long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, and cost. This initial balancing determines preliminary conclusions as to the maximum extent to which permanent solutions and treatment can be practicably utilized in a cost-effective manner.

The preferred alternative in the proposed plan is the alternative that is protective of human health and the environment, is ARAR-compliant, and affords the best combination of attributes. State and community acceptance are factored into a final balancing in which the remedy and the extent of permanent solutions and treatment practicable for the site are determined.

The detailed analysis of an alternative involving discharge to a POTW will usually focus on three of the nine criteria:

- Reduction of toxicity, mobility, or volume through treatment - under this factor the on-site pretreatment of the material ultimately to be discharged should be described
- Short-term effectiveness - the potential adverse impacts of transporting the wastewater to the POTW and the timing of the remedial action
- Cost - costs of discharging to the POTW should be compared to those of other alternatives

Generally, because the POTW discharge is to an off-site facility, the remaining six criteria would be addressed in the development and screening of remedial alternatives (i.e., in evaluating the compliance status and ability of the POTW to receive the CERCLA waste, etc.).

The following factors, as required by the USEPA memorandum concerning CERCLA discharges to POTWs, are considered initially during the development and screening of remedial alternatives and are carried forward into the detailed analysis as necessary:

- The quantity and quality of the CERCLA wastewater and its compatibility with the POTW
- The ability of the POTW to ensure compliance with applicable pretreatment standards and requirements, including monitoring and reporting requirements
- The POTW's record of compliance with its NPDES permit and pretreatment program requirements to determine whether the POTW is a suitable disposal site for the wastewater
- The potential for volatilization of the wastewater at the CERCLA site and POTW and its impact on air quality
- The potential for groundwater contamination from transport of CERCLA wastewater or impoundment at the POTW, and the need for groundwater monitoring
- The potential effect of the CERCLA wastewaters on the POTW's discharge as evaluated by maintenance of water quality standards in the POTW's receiving waters, including the narrative standard of "no toxics in toxic amounts"
- The POTW's knowledge of and compliance with any applicable RCRA requirements or requirements of other environmental statutes
- The various costs of managing CERCLA wastewater, including all risks, liabilities, and permit fees

Elaboration on the nine criteria and how they relate to the anlysis of the POTW discharge, both in the development and screening of remedial alternatives and in the detailed analysis, are summarized in Table 7-1.

7.1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

This criterion assesses whether each alternative meets the requirement for protection of human health and the environment. Basic guidance for this criteria is provided in a two manual set entitled "Risk Assessment Guidance for Superfund" (USEPA, 1989c). Volume I, "Human Health Evaluation Manual," provides guidance for health risk assessment. Volume II, "Environmenal Evaluation Manual," provides guidance for ecological assessment at Superfund sites. Attainment of chemical- and location-specific ARARs is addressed, when appropriate. Adverse effects associated with construction and operation of each remedial alternative are described in terms of direct effects (e.g., loss of habitat) or indirect effects (e.g., increased erosion and sedimentation). Inevitable effects are distinguished from reversible effects, where appropriate. Measures to mitigate adverse effects are also discussed herein.

Additionally, USEPA developed a risk-based methodology for evaluating the feasibility and risk associated with discharging a CERCLA waste to a POTW. This methodology is described in "Feasibility and Risks Associated with Discharge of Superfund Wastes to POTWs" (USEPA, 1988b).

TABLE 7-1

SUMMARY OF CRITERIA FOR ANALYSIS OF THE DISCHARGE TO POTW ALTERNATIVE

CRITERIA	FACTORS TO CONSIDER
Overall Protection of Human Health and the Environment	– What is the potential for short- or long-term health effects to the public and the environment if the alternative is implemented?
	– Will the alternative meet pretreatment and NPDES requirements? See Subsections 4.3.1 and 8.2.
Compliance with ARARs	– Will the pretreatment identified meet pretreatment standards and local limits? See Section 5.0.
	– Can the POTW ensure compliance with applicable pretreatment requirements? See Section 5.0.
	– If the POTW accepts the discharge, will the POTW meet its NPDES discharge requirements? See Subsections 4.3.1 and 8.2.
	– If the POTW accepts the discharge, will the POTW discharge be in compliance with state water quality standards? See Subsection 4.3.
	– If the POTW accepts the discharge, will the POTW meet its sewage sludge disposal requirements? See Subsections 4.1 and 4.2.
	– Is the POTW in compliance with RCRA permit-by-rule requirements? See Subsection 3.1.2.
	– Will the alternative meet the requirements of RCRA? In particular, is the wastestream considered a RCRA hazardous waste? If so, will the DSE apply? See Subsections 2.2.4 and 3.1.1 and Section 9.0.
	– Will the alternative meet other action- and location-specific requirements? See Subsections 1.3 and 7.2.
Long-term Effectiveness and Permanence	– After the alternative is implemented, how much risk will still be posed if receptors are exposed to the wastestream? See Subsection 7.3.
	– What types of long-term management will be required for the pretreatment and storage systems? See Subsection 7.3.
	– How reliable are the system components?
	– Is it likely that the POTW could treat the CERCLA wastestream for the time duration required? See Section 4.0.
	– Will contaminants pass through the POTW? See Section 5.0.

TABLE 7-1

(continued)

SUMMARY OF CRITERIA FOR ANALYSIS OF THE DISCHARGE TO POTW ALTERNATIVE

CRITERIA	FACTORS TO CONSIDER
Reduction of Mobility, Toxicity, or Volume Through Treatment	– Are the pretreatment technologies or the POTW unit operations innovative technologies, which reduce mobility, toxicity, or volume?
	– How much will the alternative reduce the mobility, toxicity, or volume of pollutants? See Subsection 7.4.
	– What residuals will result from the process? How will they be treated and/or disposed?
Short-term Effectiveness	– What risks will be posed to workers, the community, or the environment as a result of constructing the systems involved in the alternative? See Subsection 7.5.
	– How long will it take to implement the alternative?
	– What is the potential that human or environmental receptors will be exposed to the wastestream during on-site storage or off-site transport and disposal? See Subsections 3.1.3 and 7.5.
	– What is the potential that the pretreatment system will not be adequately effective? See Section 5.0.
	– How long must the system operate?
	– Will operation of collection or extraction systems and the pretreatment systems cause adverse environmental impacts? What is the cost of mitigating these impacts?
Implementability	
Technical Feasibility	– Is the transport technology (i.e., piping or trucking) feasible? See Subsection 3.1.3.
	– Are the POTWs' unit operations suitable for contaminant treatment? See Subsection 4.2.
	– If the wastestream will be discharged to a sewage collection system, is that system separate from or combined with the storm drain system? Are there combined sewer overflows between the site and the POTW? See Subsection 4.2.
Demonstrated Performance	– Has the pretreatment system been proven on the contaminants at the site? See Subsection 4.2.
	– Is the POTW effective on site contaminants? See Subsection 4.2.
Support Requirements	– What sludge disposal processes are currently employed by the POTW? Are they adequate? What other support requirements would be necessary? See Subsections 4.1 and 4.2.

SUMMARY OF CRITERIA FOR ANALYSIS OF THE DISCHARGE TO POTW ALTERNATIVE

CRITERIA	FACTORS TO CONSIDER
Implementability (continued)	
Availability	– Does the POTW have the hydraulic capacity to accept the wastestream? See Subsection 4.2.
	– Are pretreatment systems available? See Subsection 4.2.
Installation	– Are the collection, storage, or pretreatment systems difficult to construct? See Subsection 6.0.
	– How long will construction of these systems take?
Permitting and Legal Constraints	– Will the POTW agree to accept the waste? See Section 4.0.
	– Would the POTW need additional permits or changes in current permits? See Subsection 4.3.
	– Is the POTW in compliance with its NPDES permits and pretreatment program requirements? See Subsections 3.2 and 4.1.
	– Can the POTW ensure compliance of the CERCLA site with applicable pretreatment standards and requirements? See Section 4.0 and Subsection 4.1.
	– Is the POTW regulated by any local ordinances that limit the waste types they may accept? If so, does the ordinance affect the CERCLA discharge? See Subsection 4.2.
	– Is the POTW's discharge in compliance with state water quality standards and applicable sludge use and disposal requirements? See Subsections 4.1 and 4.2.
Cost	– What are the capital costs of this alternative?
	– What are the long-term O&M costs of this alternative (including O&M of the pretreatment system and site sewers, fees or user charges for the POTW, and monitoring and reporting costs?)
	– What is the net present-worth cost of this alternative?
	– How do these costs compare to the costs of other alternatives?
State and Community Acceptance	– Is the state or community expected to support or oppose the alternative? See Subsections 7.8 and 7.9.

The USEPA document uses a risk-based evaluation to evaluate the impact of a CERCLA site discharge to a POTW in the absence of environmental guidelines for the POTW effluent, air emissions, and sludge disposal. The wastes are assessed on the basis of three exposure pathways: volatilization, pass through, and sludge quality. The risks associated with each exposure pathway are evaluated using a two-tiered approach. In Tier I, a simple screening model consisting of worst-case assumptions is applied to evaluate maximum probable risk impacts associated with each pathway. If the risks associated with Tier I analyses are inconsequential, then no further analyses are performed. If the Tier I model reveals the potential for significant exposures, then Tier 2 assumptions are applied. In Tier 2, more realistic assumptions are made, plant-specific data are used, and more complex models are employed. The risk assessor actually evaluating a POTW as a remedial alternative could consult the USEPA document for a more detailed discussion.

7.2. COMPLIANCE WITH ARARs

This evaluation criterion is used to determine how each alternative complies with applicable or relevant and appropriate federal and state requirements, as defined in SARA Section 121. The detailed analysis summarizes which requirements are applicable or relevant and appropriate to an alternative, and describes how the alternative meets those requirements. The three general categories of ARARs (i.e., chemical-, location-, and action-specific) are discussed for each alternative along with the alternative's compliance with appropriate criteria, advisories, and guidance. RARs are not pertinent to evaluations of off-site response actions.

7.3. LONG-TERM EFFECTIVENESS AND PERMANENCE

The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The following components of the criterion should be addressed for each alternative:

- Magnitude of remaining risk. This factor assesses the residual risk remaining from untreated waste or treatment residuals at the conclusion of remedial activities. The potential for this risk may be measured by numerical standards such as cancer risk levels or the volume or concentration of contaminants in waste, media, or treatment residuals remaining on-site. Characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their toxicity, mobility, and propensity to bioaccumulate.

- Adequacy of controls. This factor assesses the adequacy and suitability of controls (if any) that are used to manage treatment residuals or untreated wastes remaining at the site. It may include an assessment of institutional controls to determine whether they are sufficient to ensure that any exposure to human and environmental receptors is within protective levels.

- Reliability of controls. This factor addresses the long-term reliability of management controls for providing continued protection from residuals. It includes (1) the assessment of the potential need to replace technical components of the alternative; (2) the potential exposure pathway; and (3) the risks posed if the remedial action needs replacement. USEPA has developed a risk-based methodology for evaluating the feasibility and risk associated with discharging CERCLA site wastewater to a POTW. This methodology is presented in the USEPA document, "Feasibility and Risks Associated with Discharge of Superfund Wastes to POTWs" (USEPA, 1988b).

7.4. REDUCTION OF MOBILITY, TOXICITY, OR VOLUME THROUGH TREATMENT

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce mobility, toxicity, or volume of hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

This evaluation focuses on the following specific factors for a particular remedial alternative:

- The treatment processes, the remedies they will employ, and the materials they will treat
- The amount of hazardous materials that will be destroyed or treated, including how principal threats will be addressed
- The degree of expected reduction in mobility, toxicity, or volume measured as a percentage of reduction (or order of magnitude)
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment

7.5. SHORT-TERM EFFECTIVENESS

This evaluation criterion addresses effects of the alternative during the construction and implementation phase until remedial action objectives are achieved. Under this criterion, alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The following components of this criterion are addressed for each alternative:

- Protection of the community during remedial actions. This aspect of short-term effectiveness addresses any risk that results from implementation of the proposed remedial action.
- Protection of workers during remedial actions. This factor assesses threats that may be posed to workers and the effectiveness and reliability of protective measures that could be taken.
- Environmental impacts. This factor addresses the potential adverse environmental impacts that may result from implementation of an alternative and evaluates how effective available mitigation measures would be in preventing or reducing the impacts.
- Time until remedial action objectives are achieved. This factor includes an estimate of the time required to achieve protection for either the entire site or individual elements associated with specific site areas or threats.

7.6. IMPLEMENTABILITY

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. This criterion involves analysis of the following factors.

Technical Feasibility

- Construction and operation. This relates to the technical difficulties and unknowns associated with a technology.
- Reliability of technology. This focuses on the ability of a technology to meet specified process efficiencies or performance goals. The likelihood that technical problems will lead to schedule delays is considered as well.
- Ease of undertaking additional remedial action. This includes a discussion of which (if any) future remedial actions may need to be undertaken and how difficult it would be to implement such additional actions.
- Monitoring considerations. This addresses the ability to monitor the effectiveness of the remedy and includes an evaluation of the risks of exposure if monitoring is insufficient to detect a system failure.

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies (e.g., obtaining permits for off-site activities or rights-of-way for construction)

Availability of Services and Materials

- Availability of adequate off-site treatment, storage capacity, and disposal services
- Availability of necessary equipment, specialists, and provisions to ensure any necessary additional resources
- Timing of the availability of technologies under consideration
- Availability of services and materials, plus the potential for obtaining competitive bids, which may be particularly important for innovative technologies

7.7. COST

In the analysis of each remedial alternative, the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988c) requires that cost estimates include the following five principal elements:

- Capital costs
- Operation and maintenance (O&M) costs
- Five-year review costs
- Present-worth analysis
- Potential future remedial action costs

Capital costs consist of direct (construction) and indirect (nonconstruction and overhead) costs. Typically, capital costs include those expenditures initially incurred to develop, construct, and implement a remedial action. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Direct capital costs include construction, equipment, land and site development, buildings and utilities (including sewer construction), and disposal.

Indirect costs include expenditures for engineering, financial, and other services that are not part of actual installation activities but are required to complete remedial alternatives. Indirect capital costs may include engineering expenses, start-up costs, legal fees and license/permit costs, health and safety costs, and contingency allowances.

Controls and costs associated with protecting workers on-site during remedial action are difficult to quantify and vary with site-specific conditions. Some important health and safety cost components likely to impact total remedial costs are decontamination, emergency preparedness, hazard assessment, insurance, manpower inefficiencies, medical services/surveillance, personal protection, personnel training, recordkeeping, and site security.

O&M costs refer to expenditures associated with long-term power and equipment requirements and long-term post-construction costs (e.g., equipment replacement costs, sewer use charges, and permit fees) required to effectively operate and maintain the remedial action throughout its useful life.

CERCLA as amended, Section 121(c), states that a five-year review of a remedial action is required if that remedial action results in hazardous contaminants remaining on-site. Additional costs associated with the five-year review should be considered.

A present-worth analysis evaluates the expenditures that occur over different time periods by discounting all future costs to a common base year. Present-worth analysis allows remedial alternatives to be compared on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life.

7.8. STATE ACCEPTANCE

This assessment evaluates technical and administrative issues and concerns the state may have regarding each alternative. Comments provided by the state during the FS should be evaluated and discussed in the Record of Decision (ROD) and the responsiveness summary. Additional information is provided in the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988c).

7.9. COMMUNITY ACCEPTANCE

This assessment incorporates public input into the analysis of alternatives. Formal public comments are provided during the 21-day public comment period on the RI/FS report and proposed plan. Specific public concerns or comments should be addressed in the ROD and responsiveness summary. Additional information is provided in the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988c).

7.10. SUMMARY EVALUATION

Following detailed analysis, the results should be summarized and compared considering the following factors used by USEPA during remedy selection in the ROD process:

- Protection of human health and the environment
- Attainment of federal and state human health and environmental requirements identified for the site
- Cost-effectiveness
- Use of permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable

Additional information is provided in the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988c).

SECTION 8
CLEAN WATER ACT AND THE NATIONAL PRETREATMENT PROGRAM

8. CLEAN WATER ACT AND THE NATIONAL PRETREATMENT PROGRAM

To date, specific national categorical pretreatment standards governing the discharge of CERCLA wastes to a POTW have not been promulgated. As a result, CERCLA wastes are treated as nondomestic wastestreams, and are subject to the general pretreatment regulations promulgated under the Clean Water Act (CWA) and to any more stringent local or state requirements. Similar to other nondomestic wastestreams, a CERCLA wastewater discharge to a POTW will not be accepted if it will cause contaminant pass through, interference with the POTW operation, violations of the general pretreatment regulations, or violations of local pretreatment limits or ordinances.

It is not the intent of this section to present an exhaustive listing of all the regulations that may pertain to CERCLA waste discharge to a POTW, but rather to familiarize the FS writer with the major components of the National Pretreatment and NPDES programs. References for a detailed discussion of the National Pretreatment Program include the "Guidance Manual on the Development and Implementation of Local Discharge Limits under the Pretreatment Program" (USEPA, 1987i) and "CERCLA Compliance with Other Laws Manual (Draft)" (USEPA, 1988a). The NPDES requirements are discussed in the "Training Manual for NPDES Permit Writers" (USEPA, 1987c). Other useful documents include "Guidance for Implementing RCRA Permit-by-Rule Requirements at POTWs" (USEPA, 1987g), "Guidance Manual for the Identification of Hazardous Wastes Delivered to POTWs by Truck, Rail or Dedicated Pipe" (USEPA, 1987j), "RCRA Information on Hazardous Wastes for Publicly Owned Treatment Works" (USEPA, 1985), and "Overview of Selected USEPA Regulations and Guidance Affecting POTW Management" (USEPA, 1989b). These references were used to develop the information presented in the following subsections.

8.1. NATIONAL PRETREATMENT PROGRAM

The National Pretreatment Program, authorized under CWA Section 307(b), was established to regulate the introduction of pollutants from nondomestic sources into POTWs. The goal of the program is to protect POTWs and the environment from damage that may occur when hazardous, toxic, or other nondomestic wastes are discharged into a sewer system. The discharges targeted for regulation include those that (1) will interfere with the operation of a POTW, including interference with its sludge use or disposal; (2) will pass through the POTW; or (3) are otherwise incompatible with the POTW. The pretreatment program is implemented primarily through approved local programs administered by POTWs. The National Pretreatment Program consists of two elements that interact to accomplish the objectives of the program:

- National Categorical Standards
- General Pretreatment Regulations

The controls imposed by national categorical standards and general pretreatment regulations are described in the following subsections. Greater emphasis is placed on the discussion of local limits because of the flexibility in developing specifically tailored local limits by POTWs on a case-by-case basis.

8.1.1. National Categorical Standards

The national categorical standards are technology-based effluent limits developed by

USEPA to provide standard limits on the introduction into POTWs of wastes generated by particular categories of industry (e.g., leather tanning and metal finishing). Categorical standards have not been developed for CERCLA sites.

8.1.2. General Pretreatment Regulations

The general pretreatment regulations are intended to address site-specific problems at POTWs, and to apply a broader baseline level of control to all industrial users discharging to any POTW. These regulations apply whether or not the water has been generated by a particular industrial category. The general treatment regulations consist of general prohibitions, specific prohibitions, and local limits.

General Prohibitions. The general prohibitions of the pretreatment regulations (40 CFR §403.5[a]) are national prohibitions applicable to nondomestic uses that control the introduction of contaminants into POTWs to accomplish the following:

- Prevent interference with the operation (including sludge management) of a POTW
- Prevent pass through of contaminants through the POTW

The term "interference" means a discharge that, alone or in conjunction with discharges from other sources, inhibits or disrupts a POTW, its treatment processes or operations, or its sludge processes, use, or disposal, causing a violation of its NPDES permit or other requirements. "Pass through" is any discharge to a POTW in quantities or concentrations that, alone or in conjunction with discharges from other sources, causes a violation of any requirement of the POTW's NPDES permit (e.g., a pollutant "passes through" the POTW to surface waters without sufficient treatment to comply with discharge limits).

Specific Prohibitions. The specific prohibitions (40 CFR §403.5[b]) are national prohibitions that apply to all nondomestic users and protect against pollutant discharges causing the following:

- A fire or explosion hazard in the sewers or POTWs
- Corrosive structural damage to the POTW (pollutants with a pH lower than 5.0)
- Obstruction of flow in the sewer system
- Interference due to the pollutant's high concentration or flow rate
- An increase in temperature of wastewater entering the POTW which inhibits biological activity resulting in interference

Local Limits. The third segment of the prohibited discharge standards are local limits. "Local limits" are specific requirements (including, for example, specific prohibitions or limits on pollutants or pollutant parameters) developed and enforced by individual POTWs to implement the national general and specific prohibitions. They are federally enforceable under Section 403.5(d). The development of these limits will ensure that pretreatment standards protect both the local POTW and the environment.

States and localities may also impose more stringent requirements on dischargers. These additional requirements may be based on state pretreatment regulations or local ordinances.

8.1.3. Development of Local Limits or Other State or Local Discharge Requirements

POTWs that are required under 40 CFR §403 to have pretreatment programs or those that experience pass through and interference problems must develop and enforce local limits. In a few cases, states are responsible for administering pretreatment programs and developing local limits for particular POTWs. Development of local limits requires site-specific data to identify pollutants of concern that may be discharged in quantities sufficient to cause POTW or environmental problems. Briefly, the process used to develop local limits requires a review of plant operations and environmental criteria. During this process, the sources, character, and volume of contaminants in the POTW influent, effluent, and sludge are evaluated, and a technical approach for developing the limits is selected and implemented. Detailed descriptions of methods to develop local limits are in the "Guidance Manual on the Development and Implementation of Local Discharge Limits under the Pretreatment Program" (USEPA, 1987i). An abbreviated discussion of developing local limits is presented in Section 10.0.

Local limits are dynamic and POTWs should review and revise the limits periodically to respond to changes in federal or state regulations, environmental protection criteria, plant design and operational criteria, or the nature of the industrial or other nondomestic contributions to the POTW influent.

Specific examples of potential changes that may require the POTW authority or other responsible regulatory agency to derive new local limits include the following:

- Changes in NPDES permit limits
- Changes in water quality standards, including toxicity requirements
- Changes in sludge disposal standards or POTW sludge disposal methods
- Modifications to the treatment plant, causing changes in the process removal efficiencies and tolerance to inhibition from pollutants
- Availability of additional site-specific data pertaining to pollutant removal efficiencies and/or process inhibition
- Introduction of new or additional industrial wastes (or CERCLA wastewaters) into the POTW

A POTW's local limits must, at a minimum, be based on meeting the statutory and regulatory requirements expressed in the CWA and General Pretreatment Regulations and any applicable state and local requirements. Because individual NPDES permit conditions, sludge disposal practices, and state and local requirements vary among POTWs, various concerns must potentially be addressed through local limits. The types of concerns that a POTW will likely be required to address as a result of federal, state, or local requirements include water quality protection, sludge quality protection, operational problems, worker health and safety, and air emissions.

8.1.4. Discharge Control Mechanism

Under the proposed Domestic Sewage Study (DSS) rule (40 CFR §112 and 403), POTWs that have pretreatment programs would be required to issue permits or equivalent individual control mechanisms for each significant industrial user.

The mechanisms must contain the following components:

- Statement of duration - five years or less
- Statement of nontransferability of the permit without prior notification to the POTW
- Applicable effluent limits based on general pretreatment in 40 CFR §403, national categorical pretreatment standards, local limits, and applicable state law
- Applicable self-monitoring, sampling, reporting, and recordkeeping requirements, including sampling location, sampling frequency, and sample type
- Notification requirements for slug discharges as defined in 40 CFR §403.5(b)
- Statement of applicable civil and criminal penalties for violation of pretreatment standards and requirements and, where required, any applicable compliance schedules

Compliance Schedules/Reporting Requirements. Under 40 CFR §403.8(f)(1)(iv), the POTW with an approved pretreatment program must also have the authority to require (1) the development of a compliance schedule by each industrial user for the installation of technology required to meet applicable pretreatment standards and requirements; and (2) the submission of all notices and self-monitoring reports from dischargers as are necessary to assess and assure compliance by industries with pretreatment standards and requirements. The POTW is likely to require some type of self-monitoring program for the CERCLA site discharge, with submission of results to the POTW.

8.2. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Control of point sources of water pollution is implemented through the National Pollutant Discharge Elimination System (NPDES), which was established under the CWA. The NPDES program requires dischargers to obtain permits specifying the permissible concentration or level of contaminants in the effluent. USEPA and the states use the NPDES permitting system to control point sources and thereby help attain and maintain ambient water quality standards for their surface water bodies. Every POTW must apply for and obtain an NPDES permit which includes limits that control the pollutants that may be discharged in its effluent.

8.2.1. Ambient Water Quality Standards

States are responsible for setting water quality standards for the waters within their borders. Two types of standards are used: narrative standards such as "no toxics in toxic amounts," and numerical standards. These standards designate the uses of specific water bodies and the associated numeric or narrative criteria applicable to these waters which are to be maintained via effluent limits set in permits. USEPA reviews and approves the state standards, in accordance with regulations specified in 40 CFR §131.

When setting standards, states must consider toxic pollutants listed pursuant to Section 307 of the CWA to determine whether:

- The discharge or presence of any pollutant on the list could interfere with the designated uses of the water body.

- USEPA has published numeric criteria for those pollutants under Section 304(a) of the CWA.

If both of these conditions are met, the state must adopt specific numeric criteria for those pollutants; otherwise, adopt a procedure to derive a numeric limit from a narrative criterion to protect the designated uses of the water body. Depending on the state's evaluation of local conditions, its numeric pollutant criteria may be more or less stringent than USEPA criteria. In cases where the state determines that a specific toxic pollutant could interfere with a water body's designated uses but USEPA has not yet published numeric criteria, the state must adopt pollutant criteria based on biological monitoring or assessment methods.

8.2.2. Controlling Effluent Toxicity

Reducing effluent toxicity may be considerably more difficult than treating conventional pollutants. Not only are there hundreds of toxic chemicals that may be discharged to receiving waters, but analysis of these chemicals is sometimes difficult. In addition, it is difficult to predict the toxicity of chemical mixtures.

In response to these difficulties, USEPA has placed considerable emphasis on a water quality-based approach to NPDES permitting, while also requiring that all applicable technology-based requirements be met. In its 1984 "Policy for the Development of Water-quality-based Permit Limitations for Toxic Pollutants" (49 FR 9016), USEPA recommended the use of biological testing of effluents in conjunction with other data to establish NPDES permit conditions.

In addition to meeting the technology-based requirements of secondary treatment, POTWs must meet any more stringent water-quality-based limits imposed by the permitting authority. In some cases, local limits for industrial users of the POTWs may need to be developed to ensure attainment and maintenance of water-quality-based limits established in POTW permits.

Effluent toxicity can be managed in some cases by chemical-specific effluent analysis and control (e.g., removing residual chlorine in the effluent). Frequently, however, biological monitoring is needed to identify the interactive effects of toxic pollutants in the discharge. This is known as Whole Effluent Toxicity Monitoring. USEPA and the states will develop NPDES permit limits based on whole effluent toxicity where it is an appropriate control parameter.

SECTION 9
RCRA REQUIREMENTS

6098-01

9. RCRA REQUIREMENTS

Whether a CERCLA site wastewater is a RCRA hazardous waste and whether the Domestic Sewage Exclusion (DSE) applies will affect the feasibility of discharge to a POTW and the method of wastewater transport.

Under RCRA regulations, a material must be a solid waste to be a hazardous waste. According to 40 CFR §261, "Identification and Listing of Hazardous Waste," the term "solid waste" includes virtually all physical forms of discarded material (i.e., solids, liquids, semisolids, or contained gaseous substances) that are abandoned, recycled, or "inherently waste-like." A material is abandoned if it is disposed of, burned, or incinerated. Materials that are stored, treated, or accumulated before or instead of being disposed of, burned, or incinerated are considered abandoned. A material is also a solid waste if it is recycled in a manner constituting disposal by burning for energy recovery, reclamation, or speculative accumulation. Finally, material is inherently wastelike if USEPA so defines it by regulation (40 CFR §261.2[d]). Any material meeting this description that is not excluded under 40 CFR §261.4(c) is a solid waste. The most significant exemption from the definition of solid waste for purposes of assessing the CERCLA site discharge to a POTW is the DSE. The DSE exempts domestic sewage or any mixture of domestic sewage, and other wastes, that pass through a sewer system to a POTW for treatment from consideration as solid waste (40 CFR §261.4[a][1]). This exclusion does not apply to wastes received within the POTW's property boundary by truck, rail, or dedicated pipe (see Subsection 3.1.1).

Additionally, residual products from the treatment of hazardous waste are themselves hazardous wastes (40 CFR §261.3(c)(2)). However, if the waste prior to treatment was hazardous solely by characteristic and the treatment rendered a residual that did not exhibit any of the characteristics of hazardous, then that residual is not a hazardous waste (40 CFR §261.3 (d)(1).

If a waste is considered a solid waste under RCRA, it may also be a RCRA hazardous waste. To determine whether a solid waste is a RCRA hazardous waste, the RI/FS team can conduct several steps. These steps are shown in Figures 9-1 and 9-2, and discussed in the following subsections.

9.1. DETERMINE WHETHER THE WASTE IS SPECIFICALLY LISTED

If a solid waste has not been exempted, the second step is to determine whether the waste is listed as a hazardous waste in Subpart D of 40 CFR §261. If a waste appears on any of the lists, it is a regulated hazardous waste, regardless of its concentration or whether it displays hazardous waste characteristics. The listed wastes are subcategorized into the following four separate categories.

Hazardous Wastes from Nonspecific Sources. These wastes are generated by activities that are not specific to a particular industry or process. For example, spent degreasing solvents are listed as hazardous wastes. Wastes listed in this manner appear on the "F" list.

Hazardous Wastes from Specific Sources. These include wastes generated by a specific product process in a particular industry, such as emission control dust or sludge from secondary lead smelting. These wastes appear on the "K" list.

Acutely Hazardous Commercial Chemical Products, Off-specification Species, Container Residues, and Spill Residues. These wastes are acutely hazardous and include discarded chemical

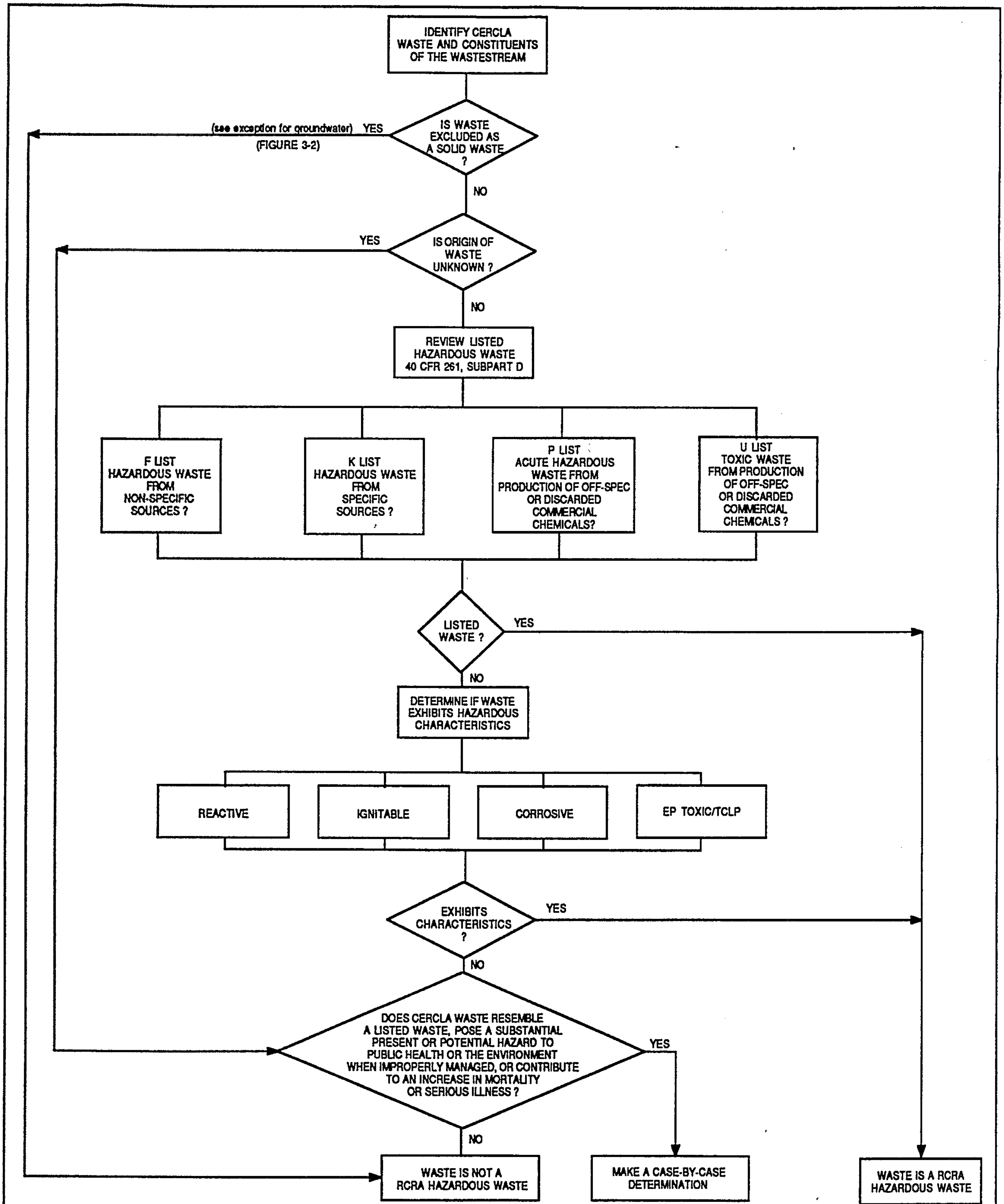

FIGURE 9-1
DETERMINATION OF RCRA HAZARDOUS WASTE STATUS

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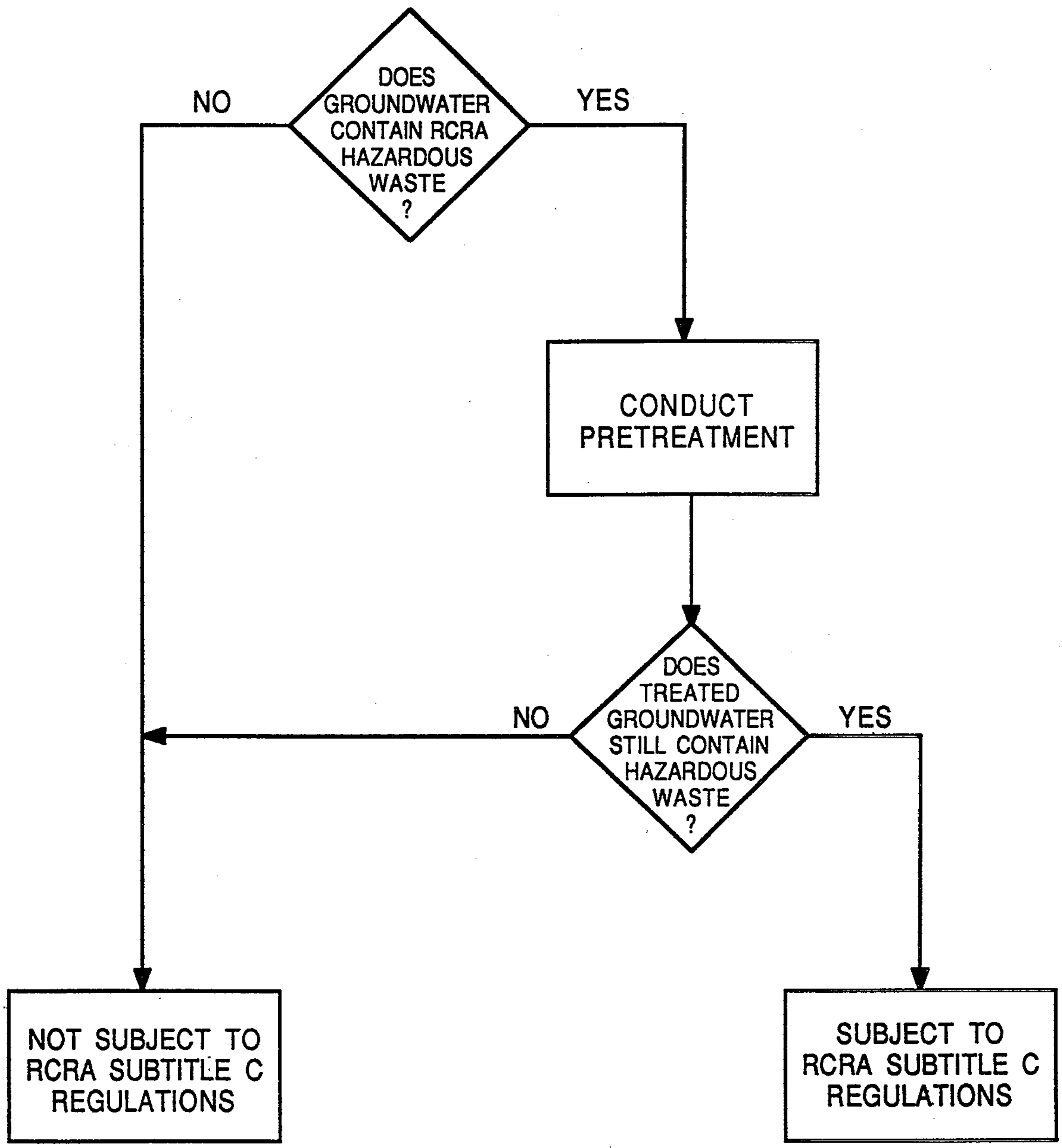

FIGURE 9-2
DETERMINATION OF GROUNDWATER AS RCRA HAZARDOUS WASTE

6098-01

products manufactured or formulated for commercial or manufacturing use, which consist of the commercially pure grade of the chemical, any technical grades of the chemical produced or marketed, and all formulations in which the chemical is the sole active ingredient. These wastes were listed to account for all acutely toxic chemical products that are sometimes discarded in pure or diluted form. Wastes listed in this manner appear on the "P" list.

Toxic Commercial Chemical Products, Off-specification Species, Container Residues, and Spill Residues. Substances may be listed as hazardous because they are chronically toxic or they exhibit one or more characteristics of hazardous waste (i.e., ignitability, corrosivity, reactivity, or Extraction Procedure [EP] toxicity/Toxic Characteristic Leaching Procedure (TCLP)). These wastes include chemical products manufactured or formulated for commercial or manufacturing use, and which consist of the commercially pure grade of the chemical, any technical grades of the chemical produced or marketed, and all formulations in which the chemical is the sole active ingredient. Wastes listed in this manner appear on the "U" list.

9.2. DETERMINE WHETHER THE WASTE EXHIBITS HAZARDOUS CHARACTERISTICS

As shown in the preceding definitions, determining whether a waste is listed often requires knowing its source. However, at a CERCLA site, the source of the waste is often unknown, especially when there may have been many contributors to the contamination. If the source of the waste is unknown, it cannot be determined if the waste is listed; therefore, it would be considered "nonlisted." Nonlisted wastes are still covered by RCRA if they possess one of the four hazardous waste characteristics. Therefore, the third step is to determine whether the waste exhibits ignitability, corrosivity, reactivity, or EP toxicity. The properties of waste exhibiting any or all of these characteristics are defined in 40 CFR §261.20-261.24.

9.3. DETERMINE WHETHER THE WASTE IS A MIXTURE

Finally, if the waste is composed of a mixture of a listed hazardous waste and other waste, it is also treated as a hazardous waste, unless (1) the listed hazardous waste in the mixture was listed solely because it exhibits a hazardous characteristic and the mixture does not exhibit that characteristic; or (2) the mixture consists of certain specified hazardous wastes and wastewater (the discharge of which is subject to regulation under the CWA). To qualify under the second exemption, the concentrations must not exceed the concentrations specified in 40 CFR §261.3(a)(2)(iv).

A mixture including a nonlisted hazardous waste and a solid waste will be deemed hazardous only if the entire mixture exhibits one of the four hazardous waste characteristics.

9.4. DERIVED-FROM RULE

The derived-from rule (40 CFR §261.3(c)(2)) states that any solid waste derived from the treatment, storage, or disposal of a listed RCRA hazardous waste is itself a listed hazardous waste (regardless of the concentration of hazardous constituents). For example, ash and scrubber water from the incineration of a listed waste are hazardous wastes on the basis of the derived-from rule. Solid wastes derived from a characteristic hazardous waste are hazardous wastes only if they exhibit a characteristic.

9.5. GROUNDWATER AND UNKNOWN ORIGIN EXCEPTIONS TO RCRA

There are two exceptions to the rules set forth in 40 CFR §261. These exceptions pertain to the RCRA regulatory status of (1) groundwater contaminated with hazardous waste leachate, and (2) CERCLA waste of unknown origin.

Groundwater. Under 40 CFR §261, groundwater contained in the aquifer is not considered a solid waste, because it is not "discarded" in the sense of being abandoned, recycled, or inherently wastelike, as those terms are defined in the regulations. Therefore, contaminated groundwater cannot be considered a hazardous waste under the mixture rule, because a hazardous waste must be mixed with a solid waste to form a hazardous waste mixture. However, according to a USEPA memorandum, groundwater contaminated with hazardous waste leachate is subject to RCRA Subtitle C regulations because the groundwater contains hazardous waste (USEPA, 1986c). The memorandum also states that if, as a result of treatment, the groundwater no longer contains hazardous waste, the groundwater would not be subject to the hazardous waste rules. The determination of the treatment level for groundwater so as to "no longer contain" hazardous waste must be made on a case-by-case basis, depending on factors such as health-based levels and analytical detection levels. A contained-in waste does not have to be delisted; it only has to "no longer contain" the hazardous waste.

Unknown Origin. A waste is hazardous under RCRA if it is a listed waste or if it exhibits hazardous waste characteristics. If the waste does not exhibit any of the characteristics and is located at a CERCLA site where the origin of the waste is unknown, a positive determination of its regulatory status cannot be made. It is not necessary to presume that a CERCLA hazardous substance is a RCRA hazardous waste unless there is affirmative evidence to support such a finding. It is appropriate to use "reasonable efforts" to determine whether a substance is a RCRA listed or characteristic waste. (Current data collection efforts during CERCLA removal and remedial site investigations should be sufficient for this purpose.) For listed hazardous wastes, if manifests or labels are not available, this evaluation likely will require fairly specific information about the waste (e.g., source, prior use, and process type) that is "reasonably ascertainable" within the scope of a CERCLA investigation. Such information may be obtained from facility business records or from an examination of the processes used at the facility. For characteristic wastes, site managers may rely on the results of the tests described in 40 CFR §261.21 - 261.24 for each characteristic or on knowledge of the properties of the substance.

SECTION 10
ESTIMATE PRETREATMENT LIMITS

10. ESTIMATE PRETREATMENT LIMITS

A stepwise approach can be used to estimate appropriate pretreatment limits. These limits can then be used to calculate the level of pretreatment required at the CERCLA site. Detailed guidance on setting POTW local limits is provided in the "Guidance Manual on the Development and Implementation of Local Discharge Limits Under the Pretreatment Program" (USEPA, 1987i).

10.1. ESTIMATE LIMITS

Figure 10-1 outlines the procedures the FS writer should follow to predict the fate and potential impacts of the CERCLA waste in a POTW. First, the FS writer needs to compile the regulatory requirements discussed in Subsection 4.2. This includes all Applicable or Relevant and Appropriate Requirements (ARARs) for the sludge, air emissions, worker health and safety, treatment system protection, and effluent water quality for the specific POTW. The POTW authority or regulatory agency should be asked to supply the FS writer with a comprehensive list of the specific ARARs for the POTW. These should include effluent, sludge disposal, air emission requirements, and any existing limitations on non-domestic discharges.

While estimating local limits, the FS writer should conservatively estimate the treatability of compounds in the CERCLA waste, and their potential to impact the various removal processes in the treatment system. To obtain this estimate, the anticipated average flow rate and pollutant concentrations discharged from the CERCLA site should be added to the POTW's existing low flow and high pollutant concentrations. The new resulting combined influent can then be used to estimate the various potential impacts to the treatment system operations, sludge disposal, air emissions, and effluent water quality. Considerable dilution of the CERCLA waste will often result when it is discharged to the POTW. However, because dilution alone will not be considered an acceptable treatment mechanism, analysis of the fate of the contaminants in the wastestream will be required.

10.1.1. Evaluate Biological Inhibition

The low flow to the POTW usually represents a worst-case scenario for evaluating the impact of discharging CERCLA wastes to a POTW. At low flow there is less dilution of pollutants in the POTW. During the evaluations, the first concern is to address the potential for biological inhibition in the treatment system. POTW interference can be caused by a wide variety of chemical, biological, and physical factors. Studies reported in the literature discussing chemical interference (i.e., inhibition) range from research done in the laboratory to studies of actual treatment plant operations. A substantial amount of work has been done to determine the concentrations of different compounds that will cause inhibition in various biological treatment systems (USEPA, 1979; USEPA, 1981a; Russell et al., 1983; Wetzel and Murphy, 1986; and USEPA, 1987d). The following biological inhibition summary is from the "Guidance Manual for Preventing Interference at POTWs" (USEPA, 1987h).

The most important conditions that affect biological inhibition are as follows:

- The nature and strength of the inhibiting agent
- Biomass characteristics
- pH
- Temperature
- Synergism/antagonism

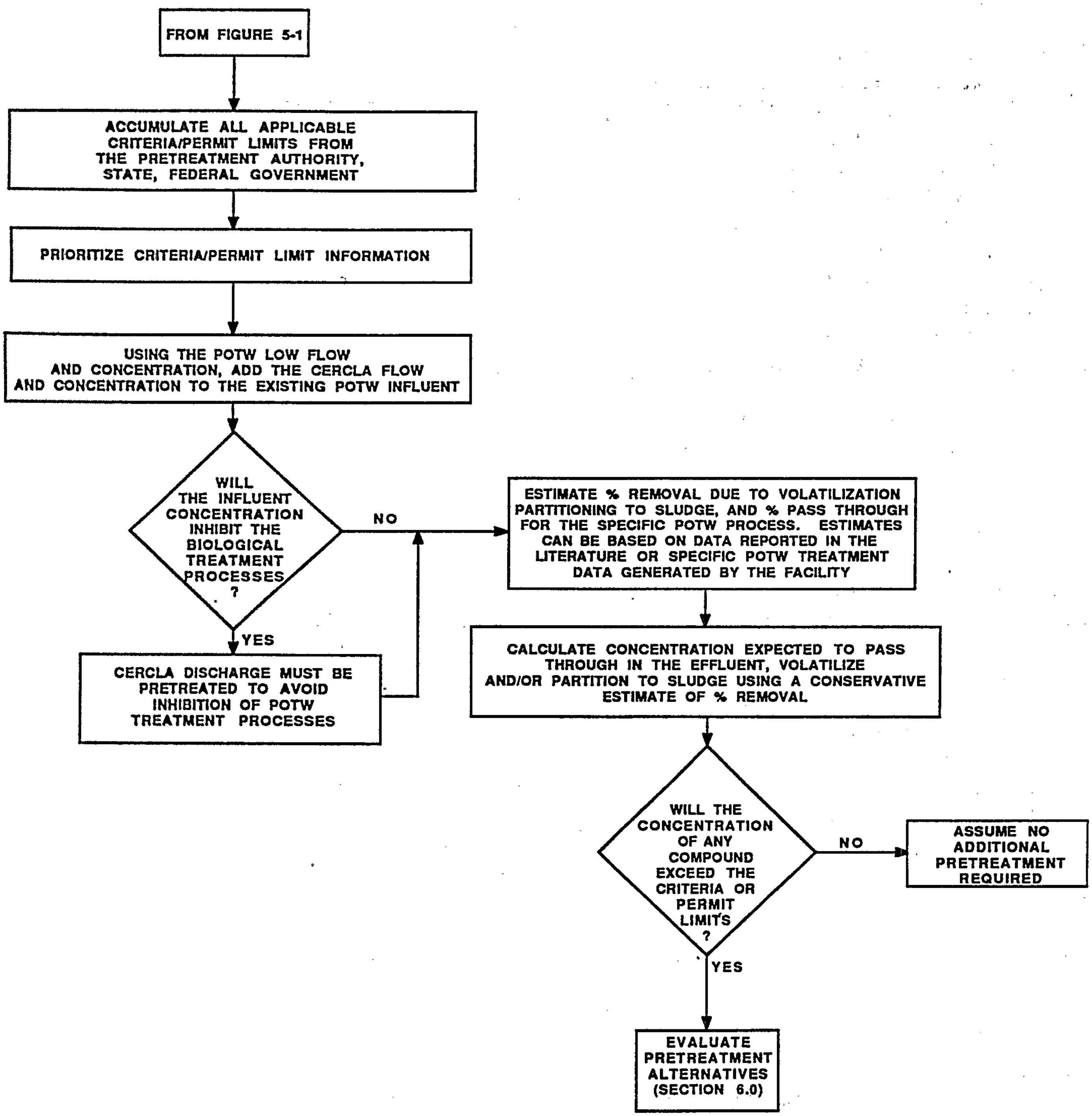

FIGURE 10-1
ESTIMATING POTW LOCAL LIMITS

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- Acclimation

Diverse biomass population characteristics in various biological treatment plants will result in significant variations in the inhibitory concentration levels of pollutants. The pH plays a particularly important role in metal-caused inhibition because the solubility of metal ions is directly related to pH. When metals are in the soluble state, they are the most toxic to microorganisms. Synergism (i.e., the increase in the inhibitory effect of one substance by the presence of another) is most important when considering combinations of metals. Toxic organics do not exhibit this effect as often as metals. On the other hand, some compounds are antagonistic toward each other, decreasing the inhibitory effect of either compound alone.

Substances that cause interference/inhibition problems can be divided into three groups: (1) conventional pollutants, (2) metals and other inorganics, and (3) organic compounds.

Conventional Pollutants. Conventional pollutants consist of commonly measured parameters, such as BOD, TSS, pH, and oil and grease. Interference/inhibition problems result from exceeding the peak mass loadings specified by the plant design. Such "shock loadings" (i.e., slug loadings) of conventional pollutants are a common cause of permit violations resulting from oxygen transfer limits, insufficient biodegradation, and solids carryover. Oil and grease are normal constituents of domestic wastewater which, if present in elevated concentrations, can interfere with normal waste treatment by preventing biological floc from settling properly, limiting oxygen transfer, and disrupting mechanical equipment operation. The pH and temperature of wastewater can also cause interference if either too high, too low, or widely fluctuating.

When discharging CERCLA wastes to a POTW, it is important to consider how the waste will contribute to the concentrations of various conventional pollutants. For example, compounds that are highly biodegradable increase BOD loadings to the POTW, thereby placing an increased demand on the treatment system. This may or may not be the case when considering compounds in which the major removal mechanism is volatilization or partitioning to sludge.

Metals and Other Inorganics. Research efforts studying the impact of heavy metals on biological treatment exceed those for all other classes of compounds. Many of the insoluble metals and metal salts that enter a POTW settle out during primary or secondary clarification, impacting sludge disposal alternatives. The soluble fractions of metals can upset the secondary treatment processes. Table 10-1 presents the ranges of metal and other inorganic pollutant concentrations inhibiting biological processes. The value ranges reflect differences in the pH, solubility, and definition of inhibition used by researchers reporting the results. In general, the lower end of the range refers to concentrations inhibiting unacclimated systems, while the upper end of the range corresponds to acclimated biological processes.

Organic Compounds. The amount of information available on the impacts of organic contaminants is small compared to metals, due in large part to the number of compounds of interest, as well as the sophisticated analytical equipment required to measure these organics. Table 10-2 presents the ranges of concentrations for toxic organic compounds that inhibit biological systems. However, data for specific compounds are limited.

If the addition of the CERCLA contaminants to the POTW influent is suspected of causing biological interference, then the CERCLA waste must be pretreated. Individual compounds in the CERCLA waste should be evaluated to determine the concentration at which biological inhibition may occur. Treatability studies can also be

TABLE 10-1
BIOLOGICAL INHIBITION THRESHOLD
INORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]
AMMONIA	480	U	5				1500-8000 (T)	U	5
	>480	U	4				1500-3000	U	4
ARSENIC	0.1	U	1,2,5				1.6 (S)	U	1
	0.04-0.4	U	4				1.5	U	2
							1.6 (T)	U	5
							0.1-1	U	4
BORON	0.05-10	U	4				2	U	4
CADMIUM	1-10	U	1	5.2	U	2	0.02 (S)	U	1,2
	1	U	2	5.2	B	5	<20 (T)	U	1
	0.5-10	U	4	5-9	U	4	0.02-1	U	4
CALCIUM	2500	U	4						
CHLORIDE				180	U	5	20000	U	4
CHROMIUM (TOT)	1-100	P	5	0.25-1.9	U	5	1.5-50	U	4
	0.1-20	U	4	0.25-1	U	4			
CHROMIUM (III)	15-50	U	1				50-500 (S)	U	1
	10	U	2				130 (T)	U	1
							50	U	2

TABLE 10-1
(continued)
BIOLOGICAL INHIBITION THRESHOLD
INORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]
CHROMIUM (VI)	1-10	U	1	0.25	U	1,2	5-50 (S)	U	1
	1	U	2	1-10	U	5	110 (T)	U	1
							5	U	2
COPPER	1	U	1,2	0.05	U	1	40 (T)	U	1
	1	P	5	0.48	U	2	1-10 (S)	U	1
	0.1-1	U	4	0.05-0.5	U	4	0.5	U	2
							0.5-100	U	4
CYANIDE	0.1-5	U	1	0.34-0.5	U	1	4 (S)	U	1
	0.1	U	2	0.34	U	2	1-2 (S)	U	1
	5	F	5	0.3-20	U	4	4	U	2
	0.05-20	U	4				4-100 (T)	U	5
							0.10-4	U	4
IRON	5-500	U	4				5	U	4
LEAD	1-5	U	1	0.5	U	1,2	340 (T)	U	1
	0.1	U	2	0.5-1.7	U	4	50-250	U	4
	10-100	B	5						
	0.1-10	U	4						
MAGNESIUM				50	U	4	1000	U	4

TABLE 10-1
(continued)
BIOLOGICAL INHIBITION THRESHOLD
INORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]
MANGANESE	10	U	4						
MERCURY	0.1-1	U	1	2-12.5	U	4	13-65 (S)	U	1
	0.1	U	2				1365	U	2
	0.1-5	U	4				1400	U	4
MERCURY (II)	2.5	B	5						
NICKEL	1-2.5	U	1	0.25-0.5	U	1	10 (T)	U	1
	1	U	2	0.25	U	2	10	U	2
	5	P	5	5	P	5	136 (T)	U	5
	1-5	U	4	0.25-5	U	4	2-200	U	4
SILVER	0.25-5	U	1	0.25	U	4			
	5	U	2						
	0.03-5	U	4						
SODIUM							3500	U	4
SULFATE							500-1000 (T)	U	5
SULFIDE	25-30	U	5				50-100	U	4
	>50	U	4				50-100(T)	U	5
TIN							9	U	4
VANADIUM	20	U	4						

TABLE 10-1
(continued)
BIOLOGICAL INHIBITION THRESHOLD
INORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]	CONCENTRATION RANGE (ppm)[1]	SCALE[2]	REF[3]
ZINC	0.3-5	U	1	0.08-0.5	U	1	5-20 (S)	U	1
	0.03	U	2	0.03	U	2	400 (T)	U	1
	5-10	P	5	0.01-1	U	4	1.5	U	2
	0.30-20	U	4				1-10	U	4

NOTES:

[1] Reference did not distinguish between total or soluble pollutant inhibition levels unless otherwise indicated; (T)-Total, (S)-Soluble

[2] (U)-Unknown, (B)-Bench top, (P)-Pilot plant, (F)-Full scale

[3] References:

1. Anthony and Breimhurst, 1981
2. Russell, Cain, and Jenkins, 1983
3. Tabak, Quave, Mashni, and Barth, 1981
4. USEPA, 1987h
5. USEPA, 1987i

TABLE 10-2
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]
1,1,1-TRICHLOROETHANE	+NI AT 10	B	3						
	360*	B	6						
1,1,2,2-TETRACHLOROETHANE	NI AT 201	U	2				20	U	2
1,1,2-TRICHLOROETHANE	NI AT 5	B	3						
	440*	B	6						
1,1-DICHLOROETHANE	NI AT 10	B	3						
1,1-DICHLOROETHENE	NI AT 10	U	2						
1,2,4-TRICHLOROBENZENE	NI AT 6	B	3						
1,2-DICHLOROBENZENE	5	B	3				0.23-3.8 (T)	B	5
							0.23++	U	2
1,2-DICHLORETHANE	NI AT 258	U	2				1	U	2
1,2-DICHLOROPROPANE	NI AT 182	U	2						
	520*	B	6						
1,2-DIPHENYLHYDRAZINE	5	B	3						
1,2-TRANS-DICHLOROETHENE	NI AT 10	B	3						
1,3-CYCLOPENTADIENE,1,2,3,4,5,5-HEXACHLORO	NI AT 10	B	3						
1,3-DICHLOROBENZENE	5	B	3						
1,4-DICHLOROBENZENE	5	B	3				1.4++	U	2

TABLE 10-2
(continued)
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]
1,4-DICHLOROBENZENE							1.4-5.3 (T)	B	5
2,4,6-TRICHLOROPHENOL	50	U	2						
	50-100	B	5						
2,4-DICHLOROPHENOL	64	U	1	64	U	1			
	NI AT 75	U	2						
2,4-DIMETHYLPHENOL	40-200	U	1						
	NI AT 10	B	3						
	190*	B	6						
2,4-DINITROPHENOL	1	B	3	150	U	2			
	110*	B	6						
2,4-DINITROTOLUENE	5	B	3						
2,6-DINITROTOLUENE	5	B	3						
2-CHLOROETHYL VINYL ETHER	NI AT 10	B	3						
2-CHLORONAPHTHALENE	NI AT 10	B	3						
2-CHLOROPHENOL	20-200	U	1						
	NI AT 10	B	3						
2-NITROPHENOL	NI AT 10	B	3						
2-PROPENAL	NI AT 62	U	2						

TABLE 10-2
(continued)
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]
2-PROPENENITRILE	NI AT 152	U	2				5 (S)	U	1
							5	U	2
4-NITROPHENOL	NI AT 10	B	3						
	72*	B	6						
ACENAPHTHENE	NI AT 10	B	3						
ACENAPHTHYLENE	NI AT 10	B	3						
ANTHRACENE	500	U	2						
	500	B	5						
BENZENE	100-500	U	1						
	125	U	2						
	125-500	B	5						
BENZIDINE	500	U	1				5 (S)	U	1
	5	U	2				5	U	2
BIS(2-CHLOROETHYL) ETHER	NI AT 10	B	3						
BIS(2-CHLOROISOPROPYL) ETHER	NI AT 10	B	3						
BIS(2-ETHYLHEXYL) PHTHALATE	NI AT 10	B	3						
BROMODICHLOROMETHANE	NI AT 10	B	3						
BUTYL BENZYL PHTHALATE	NI AT 10	B	3						

TABLE 10-2
(continued)
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]
CHLOROBENZENE	140*	B	6				0.96++	U	2
							0.96-3 (T)	B	5
CHLOROFORM	NI AT 10	B	3	10	U	2	10-16 (S)	U	1
	500*	B	6				1	U	2
							5-16 (T)	B	5
CHLOROMETHANE	NI AT 180	U	2				3.3	U	2
							3.3-536.4 (T)	P	5
CHRYSENE	NI AT 5	B	3						
DI-N-OCTYL PHTHALATE	NI AT 16.3	U	2						
DIBROMOCHLOROMETHANE	NI AT 10	B	3						
DIETHYL PHTHALATE	NI AT 10	B	3						
ETHYLBENZENE	200	U	1						
	NI AT 10	B	3						
FLUORANTHENE	NI AT 5	B	3						
FLUORENE	NI AT 10	B	3						
HEXACHLOROBENZENE	5	B	3						
HEXACHLOROBUTADIENE	NI AT 10	B	3						
HEXACHLOROETHANE	NI AT 10	B	3						
ISOPHORONE	NI AT 15.4	U	2						

TABLE 10-2
(continued)
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

	ACTIVATED SLUDGE			NITRIFICATION			ANAEROBIC DIGESTION		
COMPOUND	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]	CONC RANGE (ppm)[1]	SCALE[2]	REF[3]
METHYLENE CHLORIDE							100	U	2
N-NITROSODIPHENYLAMINE	NI AT 10	B	3						
NAPHTHALENE	500	U	1,2						
	500	B	5						
NITROBENZENE	30-500	U	1						
	500	U	2,5						
PCB - 1016	NI AT 1	U	2						
PCB - 1221	NI AT 1	U	2						
PCB - 1232	NI AT 10	B	3						
PCB - 1242	NI AT 1	U	2						
PCB - 1254	NI AT 1	U	2						
PENTACHLOROPHENOL	50	U	1				0.4 (S)	U	1
	0.95	U	2				0.2	U	2
	75-150	B	5				0.2-1.8 (T)	B	5
	2.6*	B	6						
PHENANTHRENE	500	U	2						
	500	B	5						
PHENOL	50-200	U	1	4-10	U	1			
	200	U	2,5	4	U	2			

TABLE 10-2
(continued)
BIOLOGICAL INHIBITION THRESHOLD
ORGANIC COMPOUNDS

COMPOUND	ACTIVATED SLUDGE CONC RANGE (ppm)[1]	ACTIVATED SLUDGE SCALE[2]	ACTIVATED SLUDGE REF[3]	NITRIFICATION CONC RANGE (ppm)[1]	NITRIFICATION SCALE[2]	NITRIFICATION REF[3]	ANAEROBIC DIGESTION CONC RANGE (ppm)[1]	ANAEROBIC DIGESTION SCALE[2]	ANAEROBIC DIGESTION REF[3]
PHENOL	2.6*	B	6						
PYRENE	NI AT 5	B	3						
TETRACHLOROETHENE	NI AT 10	B	3				20	U	2
TETRACHLOROMETHANE	NI AT 10	B	3				10-20 (S)	U	1
							2.9	U	2
							2.9-159.4 (T)	B	5
TOLUENE	200	U	1						
	NI AT 35	U	2						
TRIBROMOMETHANE	NI AT 10	B	3						
TRICHLOROETHENE	NI AT 10	B	3				20 (S)	U	1
							20	U	2
							1-20 (T)	B	5
TRICHLOROFLUOROMETHANE	NI AT 10	B	3				0.7	U	2

NOTES: [1]Reference did not distinguish total or soluble pollutant inhibition levels unless otherwise indicated; (T)-Total, (S)-Soluble
[2](U)-Unknown, (B)-Bench top, (P)-Pilot plant, (F)-Full Scale
[3]References:
1. Anthony and Breimhurst, 1981
2. Russell, Cain, and Jenkins, 1983
3. Tabak, Quave, Mashni, and Barth, 1981
4. USEPA, 1987i
5. USEPA, 1987h
6. Volskay and Grady, 1988

* Concentration reducing oxygen consumption by 50% of control
\+ NI-no inhibition at tested concentration

performed to test for the actual biological inhibition concentrations.

10.1.2. Calculate Mass Balance

Once the biological inhibition concentrations of contaminants in the CERCLA waste have been estimated, the next step is to calculate a mass balance for each compound in the CERCLA waste. The purpose of the mass balance is to calculate the general treatment efficiency of the POTW and identify which POTW removal mechanisms will be impacted by the removal of each constituent from the CERCLA wastestream.

The level of treatment that can be anticipated in a POTW for each contaminant varies widely. This level is a function of the type of treatment process and treatment efficiency at the POTW, the physical and chemical properties of the pollutant, and the mixtures and concentrations of the contaminants in the POTW influent. The three principal toxic removal mechanisms in a conventional wastewater treatment facility are stripping, partitioning (sorption) to the solids and biomass, and biodegradation. The great majority of "fate in a POTW" research has focused on the priority pollutants. Much of the reported data shows inconsistencies in removal efficiencies, which is a result of the various treatment unit processes used at POTWs; the scale of the treatment process; the combinations of compounds in the wastestreams and the antagonistic/synergistic reactions occurring within the POTW; the degree of acclimation at the plant receiving the waste; the ranges of concentrations detected in the influents; and the inconsistencies in sampling, handling, and analytical techniques. Despite the anomalies in the treatability data for some compounds, certain compounds have predictable fates in conventional biological treatment processes; conservative estimates of their fates can be made.

Several options are available to estimate a mass balance in a POTW, including the following:

- Use of specific POTW treatability data and/or data from POTW-specific bench-scale treatability studies
- Use of published treatability data to calculate a mass balance for each compound detected in the wastestream
- Use of computer models
- Where actual or published treatability data are not available, comparison of removals of compounds to similar physical/chemical data for which published removal data are available
- Use of the most conservative approach, assuming that 100 percent of each compound ends up in the air, effluent, and sludge

POTW Treatability Data. There is no substitute for actual POTW-specific treatability data. This is the most desirable method for developing a mass balance, and it should be used when the information is available. However, any local limits developed solely by POTW treatability experience should still be discussed with the NPDES regulatory agency to confirm acceptance. Situations will arise in which the loading deemed acceptable by the POTW will not be permitted by the regulatory agency. In most cases, actual POTW treatability data will not be available for all the compounds and ranges of concentrations detected in CERCLA wastes.

If the POTW has not conducted treatability studies in the past, treatability studies could be performed by the POTW authority, or the FS writer in conjunction with the POTW authority, to test specific biological response to compounds in the CERCLA waste. These tests would also indicate the removal mechanism for the contaminants present in the wastewater and expose problems that may be encountered when treating the waste during full-scale system operation.

Published Treatability Data. The second alternative is to estimate a mass balance based on published treatability data. In recent years, major monitoring efforts have been performed to measure the fate of contaminants in conventional biological treatment systems. Research conducted at the bench-, pilot-, and field-scale levels has attempted to quantify the removal efficiency of many priority pollutants in various conventional biological treatment systems. Attempts have also been made to measure the percentages volatilized, partitioned to sludge, and biodegraded; these attempts have been met with varying degrees of success. Appendix C summarizes treatability data for many compounds.

Computer Models. Computer software packages are available to help POTW authorities and regulatory agencies develop local limits. USEPA has released a computer program called "PRELIM," which is intended to facilitate the development of pretreatment programs and numeric limits by simulating the methodology and calculations normally used in this limit-setting process (USEPA, 1987i). The program is designed to accept POTW-specific data, and USEPA strongly encourages POTWs to develop and use data specific to its plant and receiving environment. However, PRELIM also contains several data bases to which the user can default if the POTW-specific data are not readily available. PRELIM is written for local limitation development for industrial wastes, but can be modified for various wastestreams. A list of other computer software packages is included in the "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990).

Comparison of Compounds. Where removal information is not available for a specific compound, it is possible to estimate a mass balance by comparing it to another similar compound. This can be accomplished by looking at the physical/chemical constants and the compound classes (see Subsections 10.2 and 10.3, respectively), and locating similar compounds for which mass balance information is available.

The Conservative Approach. If all else fails and there is no accurate way to estimate the mass balance, then a conservative approach should be used. It is assumed that 100 percent of the compound volatilizes, 100 percent partitions to the sludge, and 100 percent passes through the POTW and into the effluent. This approach ensures that, regardless of the fate of a compound, the worst possible case has been used for comparison to standards and that the POTW and the environment will be protected.

10.1.2.1. Calculate Concentration in POTW Effluent

The first step in calculating a mass balance is to sum the pollutant loading from the CERCLA site with the existing loading in the POTW influent. With this information, the user can calculate the mass loading of each contaminant to the POTW per day (mass/day). Appendix C presents the mean percent removal of compounds in conventional biological wastewater treatment systems for chlorinated and nonchlorinated systems. Because a greater percent removal of organic compounds is expected as influent concentration increases, the total percent removal data for each data set are broken down into ranges of influent concentrations.

Data exist for approximately 160 compounds. Care should be taken when using treatability data from Appendix C to observe the number of samples (N) collected and used to calculate the mean percent removal.

Compounds with No Treatability Data. Total percent removal may have to be estimated for compounds for which there are no treatability data. This can be done by comparing the physical/chemical properties of these compounds to others with similar properties and for which treatability data are available. The mean total percent removal calculated for certain compounds based on just one or two data points should also be compared to compounds with similar properties that have more extensive treatability information available. Physical/chemical properties and compound classification are discussed in Subsections 10.2 and 10.3, respectively.

10.1.2.2. Calculate Concentration in Air Emissions and Sludge

The next step in the mass balance calculation is to estimate the amount of each compound that will be air-stripped and partitioned to sludge in the POTW. Appendix C presents tables showing the mean percent volatilization and partitioning to sludge that will occur for a limited number of compounds. In each instance, when calculating total percent removal in the POTW and percentages volatilized and partitioned to sludge, the value present in Appendix C should be used in the mass balance calculation.

10.1.2.3. Calculate Amount Biodegraded

The purpose of estimating a mass balance is not to account for 100 percent of each compound in the CERCLA waste, but rather to develop an understanding of which compounds will have the greatest impact on the removal mechanisms, and to identify these limiting compounds so that pretreatment alternatives can be assessed. The residual in the mass balance could be used to estimate the percent biodegradation; however, this has proven to be an inaccurate evaluation in many cases. Therefore, the relative biodegradability of many of the compounds (i.e., rapid, moderate, slow, and resistant) is presented in Table 10-3.

10.1.3. Evaluate Permit Limit/Criteria Compliance

Once the relative concentrations of each CERCLA compound predicted to volatilize, partition to the sludge, or pass through the POTW untreated have been determined, the pertinent permit limits and other criteria must be assessed to determine whether the POTW will be in compliance.

Comprehensive guidelines regulating air emissions, sludge loading, and effluent concentrations are not likely to be available for all compounds. Therefore, it will be necessary to request guidelines from the appropriate regulatory agency or to develop environmental guidelines.

The NPDES regulatory agency will have the ultimate responsibility for approving the level of pretreatment required before discharging the CERCLA waste to the POTW.

Compounds not treated by the POTW, as measured by total percent removal, can be assumed to pass through the POTW. The concentration of each compound in the POTW effluent (estimated in Subsection 10.1.2) should be compared to the NPDES permit limits. If NPDES permit limits do not exist for each compound, federal or state ambient water quality standards and criteria should be checked.

To date, only limited guidance for acceptable air emissions from POTWs is available. In the absence of criteria, the user can identify and estimate the area of all closed spaces within the POTW treatment facility if volatilization is expected to be a problem. The greatest volatile organic compound (VOC) losses within the POTW will occur in an area where there is turbulence (e.g., weirs and aeration tanks). The concentration of VOCs in each closed space should be estimated given the mass loading to air (i.e., percent removal due to volatilization times influent flow times concentration) and the ventilation rate in the closed space. If the POTW

TABLE 10-3
BIODEGRADABILITY OF COMPOUNDS

REGULATORY NAME	AEROBIC SYSTEM	ANAEROBIC SYSTEM
MISCELLANEOUS		
Cyanides (soluble salts and complexes) NOS	M	
PCB		
PCB-1016	S	
PCB-1221	M	
PCB-1232	M	
PCB-1242	S	
PCB-1248	O	
PCB-1254	O	
PCB-1260	O	
PESTICIDES (HERBICIDES)		
DNBP \ Dinoseb \ 2-sec-butyl-4,6-dinitrophenol	S	
PESTICIDES (ORGANOHALIDES)		
Endrin		M
Aldrin		M
Dieldrin	O	
4,4′-DDD/Benzene	O	
1,1′-(2,2-dichlorethylidene)bis [4-chloro-4,4′-DDE/Benzene]	O	
1,1′-(dichlorethylidine)bis[4-chloro-4,4′-DDT/Benzene]	O	
1,1′-(2,2,2-trichloroethylidene)bis [4-chloro-Chlordane]	O	
Captan		R
Methoxychlor	S	M
Chlorobenzilate \ Ethyl-4,4′-dichlorobenzilate	S	M
6,9-Methano-2,3,4-benzodioxathiepin, 6,7-Camphechlor	O	M
PESTICIDES (ORGANOPHOSPHORUS)		
Naled \ Dibrom	S	S
Phorate \ Thimet		R
Disulfoton		R
Parathion \ Parathion, ethyl		R
Methyl parathion \ Parathion-methyl \ Metaphos		R

NOTES: R = rapid M = moderate S = slow O = resistant

SOURCE: USEPA, 1987i

TABLE 10-3
(continued)
BIODEGRADABILITY OF COMPOUNDS

REGULATORY NAME	AEROBIC SYSTEM	ANAEROBIC SYSTEM
SEMIVOLATILES (ACIDS)		
2,4,6-Trichlorophenol	M	M
2,4-Dichlorophenol	M	M
2,4-Dimethylphenol	R	R
2,4-Dinitrophenol	R	
2-Chlorophenol	R	R
Pentachlorophenol	M	S
Phenol	R	R
Resorcinol	R	R
SEMIVOLATILES (BASES)		
1,4-Dichlorobenzene	S	
2,6-Dinitrotoluene	S	
2-Chloronaphthalene	R	
3,3′-Dichlorobenzidine	O	
Benzenamine	R	R
Benzidine	S	
N-Nitrosodimethylamine	S	
Nitrobenzene	R	R
Pyridine	M	
SEMIVOLATILES (NEUTRAL)		
1,2,4-Trichlorobenzene	S	
1,2-Dichlorobenzene	S	
1,3-Dichlorobenzene	S	
4-Bromophenyl phenyl ether	S	
Acenaphthylene	M	M
Benzo(a)anthracene	S	
Benzo(a)pyrene	S	
Benzo(b)fluoranthene	S	
Benzo(ghi)perylene	S	
Butyl benzyl phthalate	R	R
Chrysene	S	
Di-n-octyl phthalate	M	M
Dibenzo(a,h)anthracene	S	
Diethyl phthalate	R	R
Hexachlorobenzene	S	
Hexachlorobutadiene	S	S

NOTES: R = rapid M = moderate S = slow O = resistant

SOURCE: USEPA, 1987i

TABLE 10-3
(continued)
BIODEGRADABILITY OF COMPOUNDS

REGULATORY NAME	AEROBIC SYSTEM	ANAEROBIC SYSTEM
SEMIVOLATILES (NEUTRALS) (continued)		
Hexachloroethane	S	S
Naphthalene	M	M
bis(2-Chloroethoxy)methane	R	R
bis(2-Chloroethyl)ether	R	
bis(2-Chloroisopropyl)ether	R	
bis(2-Ethylhexyl)phthalate	M	M
VOLATILES		
1,1,1,2-Tetrachloroethane	S	
1,1,1-Trichloroethane	R	
1,1,2,2-Tetrachloroethane	S	
1,1,2-Trichloroethane	S	
1,1-Dichloroethane	M	M
1,2,3-Trichloropropane	S	
1,2-Dichloroethane	M	
1,2-Dichloropropane	S	
2-Picoline	S	
2-Propenenitrile	R	R
Benzene	M	M
Bromomethane	M	
Carbon disulfide	M	M
Chlorobenzene	M	M
Chloroethane	S	S
Chloroform	M	S
Chloromethane	M	M
Dibromochloromethane	O	
Dibromomethane	S	S
Ethylbenzene	R	R
Isobutyl alcohol	R	M
Methylene chloride	R	M
Tetrachloroethene	M	
Tetrachloromethane	M	M
Toluene	R	R
Tribromomethane	S	
Trichloroethene	M	S
Trichlorofluoromethane	M	
Vinyl chloride	M	M
trans-1,2-Dichloroethene	M	M

NOTES: R = rapid M = moderate S = slow O = resistant

SOURCE: USEPA, 1987i

is in a National Ambient Air Quality Standard (NAAQS) nonattainment area for ozone, additional restrictions may be imposed for VOC discharges to the POTW.

Sludge disposal criteria are often available in state guidelines and may vary among states. Criteria regulating sludge disposal options for several compounds are outlined in the checklist described in Subsection 4.2. Many of the criteria are based on federal standards and apply to a wide range of compounds and concentrations. The proposed rule for "Standards for the Disposal of Sewage Sludge" (40 CFR §503) includes specific numerical limits or equations for calculating these limits for 28 pollutants in one or more use or disposal methods. In addition, the proposed rule for Solid Waste Disposal Facility Criteria (40 CFR §258) establishes numerical limits (in the form of Groundwater Protection Standards) for sewage sludge codisposed with municipal solid waste. It should be noted that 40 CFR §503 is currently a proposal, and limits will be developed on a case-by-case basis using existing regulatory framework and guidance. Additional information can be found in, "Guidance for Writing Case-by-Case Permit Requirements for Municipal Sewage Sludge" (USEPA, 1988d).

10.1.4. Calculate CERCLA Site Discharge Limits

After the mass balance and criteria comparison are complete, the remaining task is to calculate acceptable CERCLA site discharge limits. The steps necessary to develop the CERCLA site discharge limits are as follows.

Calculate acceptable POTW influent loading. This is done by back calculating the influent concentration/mass using the percent removals and the criteria exceeded (e.g., if the criterion for the POTW effluent is 12 parts per billion [ppb] and the total percent removal is 40 percent, the acceptable influent concentration is 20 ppb; or, if the acceptable mass loading to air is 1 kilogram per day [kg/day] and the percent volatilized is 20 percent, then the acceptable influent loading is 5 kg/day). Mass-based (kg/day or lbs/day) acceptable influent loadings should be calculated.

If a compound exceeds criteria for more than one medium, the acceptable POTW influent loading should be calculated for each medium and the lowest value should be used.

Subtract the existing loading to the POTW from the acceptable loading. This will give the remainder available for allocation. A portion of the available allocation should be reserved for future industrial growth; the remainder can be allocated to the CERCLA site. An accurate characteristic of existing loadings to the POTW from industrial and domestic sources is essential. The existing loadings plus the anticipated loadings from the CERCLA discharges and any safety factors, must not exceed the maximum allowable loading.

Calculate the POTW discharge limits concentrations. This is done by dividing the mass loading allocated to the CERCLA site by the CERCLA site flow.

The new estimated pretreatment local limits can now be used to select pretreatment technologies for the site.

10.1.5. Toxicity Reduction Evaluation

The FS writer may also consider the toxicity of the CERCLA wastewater especially if the POTW has Whole Effluent Toxicity testing requirements in its NPDES permit. If the CERCLA site discharge is likely to cause the POTW to fail its effluent toxicity testing criteria, a toxicity reduction study can be performed. The USEPA document, "Toxicity Reduction Evaluation Protocol for Municipal Wastewater Treatment Plants" outlines a method to reduce toxicity to meet applicable NPDES permit limits (USEPA, 1989a). The evaluation first looks at possible in-plant sources of toxicity. If plant performance is not the principal cause of toxicity, the toxicity reduction evaluation (TRE) proceeds to toxicity identification evaluation (TIE). TIE protocol is performed in three phases: toxicity characterization, toxicity identification, and toxicity confirmation. During the evaluation, batch-testing is performed on the site waste mixed with the POTW wastewater to evaluate the toxicity of the CERCLA site wastewater. The causes of the toxicity are then identified using specific test methods and confirmed through additional toxicity tests. The FS writer is referred to the TRE protocol manual for a more thorough description of the procedures.

10.2. PHYSICAL/CHEMICAL PROPERTIES

The physical and chemical properties most often used to predict the fate of contaminants in wastewater treatment include the Henry's Law constant, the octanol/water partition coefficient, and the water solubility. The potential for a compound to biodegrade is another property crucial in predicting fate. Although a considerable amount of work has been done to substantiate a compound's affinity for biodegradation, it is impossible to predict the exact amount of biodegradation that will occur during biological treatment. In most mass balance equations, biodegradation is estimated as the residual, or the percent of the compound not accounted for after considering percentages volatilized, partitioned to the sludge, and untreated and passing through in the effluent.

Henry's Law constants, octanol/water partition coefficients, solubilities in water, and molecular weights for the ITD list of analytes are included in the "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990).

The physical and chemical properties of a specific compound can be used as an important reference when treatability data are not available. The fate of compounds sharing similar physical and chemical properties can be compared so that the treatability and the potential impact to the POTW effluent, sludge, and air emissions can be estimated for compounds for which there is no treatability information. Comparison of compounds based solely on physical and chemical properties can be misleading, and should be used only in the preliminary assessment to determine which removal mechanisms may be most heavily impacted. Drawing conclusions from a compound's physical and chemical properties should not be used as a replacement for actual data or treatability studies.

A general discussion of the important physical and chemical properties used to characterize the fate of contaminants in a POTW follows. This information was summarized from the "Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works" (USEPA, 1986b).

10.2.1. Henry's Law Constant

The Henry's Law constant, which is the ratio of a substance's vapor pressure to its water solubility, is used to relate the air and aqueous concentrations of a volatile substance at equilibrium. It is an appropriate means for estimating releases to air or the ability of a chemical to be stripped or removed from contaminated water. The higher the Henry's Law constant of a substance, the more likely it is to migrate from water to air. Compounds with Henry's Law constants greater than 10^{-3} atm m^3/mole have been shown in the literature to be easily stripped. The most common formula given for Henry's Law constant is as follows:

$$H = Pv/Cs$$

where:

H = Henry's Law constant (atm m^3/mole)

Pv = compound's vapor pressure in air (atm)

Cs = compound's soluble concentration in water (mole/m^3)

A pollutant's affinity to adsorb onto biomass or to biodegrade will have an effect on the amount of material stripped during conventional treatment. These two variables may greatly control the total amount of volatilization, particularly at low concentrations, and should be considered when estimating the ability to be stripped of compounds in a POTW.

10.2.2. Octanol/Water Partition Coefficient

The octanol/water partition coefficient (K_{OW}) is a measure of a compound's tendency to concentrate either in the organic phases or in water at equilibrium. The octanol/water partition coefficient is a widely used tool for evaluating water solubility and the subsequent potential for sorption of organic compounds onto particulates and biomass. K_{OW} is often expressed as a logarithm to the base 10, or Log K_{OW}. In general, compounds that have Log K_{OW} values greater than 3.5 are significantly hydrophobic and adsorptive on solid organic matter, such as mixed liquor volatile suspended solids (MLVSS) or sludge. Compounds that have Log K_{OW} values less than 3.5 are more likely to be removed through biodegradation or, in the case of a more volatile pollutant, through air-stripping. Due to their adsorptive nature, compounds with a high Log K_{OW} also may be expected to concentrate in sludge. In addition, the presence of other compounds, electrolytes, oils and greases, and sorbents may also greatly affect the rate and total amount of adsorption that will occur in sludge.

10.2.3. Water Solubility

Water solubility is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. Solubility of an inorganic species can vary widely, depending on temperature, pH, Eh (i.e., oxidation/reduction potential), and the types and concentrations of complex species present. Soluble chemicals tend to be more readily biodegradable than those with low solubility (Lyman et al., 1982). Solubility, along with several other factors, can also affect volatilization from water. In general, high solubility is associated with lower volatilization rates (Menzer and Nelson, 1980). Highly soluble compounds are usually less strongly adsorbed to organic material and, therefore, may be more susceptible to pass through the treatment system if not biodegradable.

10.2.4. Biodegradation

Biodegradation plays a substantial and sometimes controlling role in the ultimate fate of the VOCs in conventional wastewater treatment, especially VOCs of moderate volatility. The extent of biological oxidation depends on the ease of biodegradation of the compound, availability of co-metabolites serving as food for the biota, and the concentration of biologically active solids (e.g., MLVSS and oxygen), as well as the degree of acclimation of the MLVSS.

The rate of biodegradation can be influenced by the availability of oxygen, a compound's extent of halogenation, and biochemical oxidation. In a well-aerated system, air-stripping may be the dominant removal mechanism for compounds such as benzene and toluene, which biodegrade to some degree under normal aeration conditions. The degree of halogenation influences the relative biodegradability of the compound, in that the more halogens in a chemical compound by weight, the less biodegradation will occur. Biochemical oxidation is highest for organic priority pollutants with low Log K_{OW} values (less than 3.5). In addition, air-stripping has been shown to compete with biodegradation as a removal mechanism in activated sludge treatment for some compounds that have relatively high Henry's Law constants (e.g., benzene, toluene, ethylbenzene, and chlorobenzene).

Among the three mechanisms (i.e., biodegradation, sorption, and volatilization), the dominant removal route at any one time will depend on the relative rates of aeration. The removal mechanisms are affected critically by the plant design and flow, air-to-liquid rates, and the concentration and activity of MLVSS. These factors are critically dependent on how well the facility is run, and the distribution, characteristics, and concentrations of the pollutants in wastewater. If the treatment system is acclimated to the pollutants in the plant influent, biodegradation may be a more effective removal mechanism for biodegradable compounds. In unacclimated treatment systems, removal of many organics by volatilization and sorption to solids and biomass may be more significant than in acclimated systems. Dissolved salts also affect all three removal mechanisms associated with biological treatment systems. Factors such as surface tension, interstitial tension, viscosity, and diffusion also must be considered in ultimate environmental fate analysis.

10.3. COMPOUND CLASSIFICATION

The compounds described in this section are the 443 compounds included in the USEPA Office of Water Industrial Technology Division (ITD) list of analytes (USEPA, 1987b). For the purposes of this guidance manual, the compounds were categorized into one of the following seven classes:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Pesticides and herbicides
- Polychlorinated biphenyls (PCBs)
- Dioxins and dibenzofurans
- Elements
- Miscellaneous

The compounds were categorized based on various physical properties (e.g., solubility and volatility), as well as similarities in chemical structure. Another major factor considered in the compound classification is the USEPA analytical method used to quantify the chemical. The "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA, 1990) classifies each compound by Regulatory Name (except for pesticides, which are listed by Common Name). The Regulatory Name is not always the familiar compound name reported; therefore, the compounds are also sorted by Chemical Abstract System (CAS) Number and Common Name to help locate the specific compounds of interest. The comprehensive listing of compounds in SARA Title III, Section 313, is also recommended for identifying compound synonyms and CAS numbers.

The general discussion presented in this section concerning the compound classification relates to pure compounds. The synergistic and antagonistic effects of mixtures of compounds is likely to significantly alter their inherent physical/chemical properties, but the magnitude of these alterations is difficult to predict. For example, the presence of organic solvents in a wastewater stream will greatly enhance the solubility of compounds such as PCBs. For treatability purposes, bench- or pilot-scale evaluation is helpful.

10.3.1. Volatile Organic Compounds

VOCs consist of organic liquids and gases, which are generally amenable to analysis by purging from the sample with an inert gas and analyzing the purged compounds via gas chromatography (GC). A total of 63 VOCs is included in this class. Most compounds classified as volatile have a molecular weight less than 250, a Henry's Law constant greater than $4x10^{-6}$ atm m^3/mole, solubility in water ranging from completely miscible to less than 1 mg/L, and log K_{OW} partition coefficients ranging from less than zero to occasionally greater than 3.

Groups of compounds within this class include aromatics, halogenated aliphatics, halogenated aromatics, alcohols, ketones, aldehydes, and a group of miscellaneous compounds (Table 10-4). The groups can be further categorized by their purge efficiency. The range in volatility as expressed by Henry's Law constants and solubilities indicates that the purge efficiency for these compounds ranges from near zero to 100 percent. In general, halogenated compounds are very purgeable, while oxygenated ones are poorly purged. Therefore, the alcohols, ketones, and aldehydes are considered poorly purged, while the aromatics, halogenated aromatics, and halogenated aliphatics purge well. Conversely, the poorly purged compounds are an excellent food source for biodegradation.

10.3.2. Semivolatile Organic Compounds

The class of 175 SVOCs consists primarily of those organic compounds not elsewhere categorized and not amenable to analysis by purging from the sample. Instead, various extractions are performed, and the extracts are concentrated and then analyzed via GC. This class is further subdivided into groups based on whether the compounds are extracted from the sample under acid, base, or neutral conditions. There are 24 acid-extractable, 40 base-extractable, and 111 neutral-extractable organic compounds. The neutral-extractable SVOCs are commonly analyzed in conjunction with the base-extractables.

The acid-extractable organics are primarily phenolics and, while biodegradable, are more likely to adsorb to organic sludges. Biodegradability decreases with increasing halogenation. The water solubility ranges from less than 1 to approximately 93,000 mg/L. Molecular weights generally range between 90 and 270. Henry's Law constants are mostly less than 10^{-5} atm m^3/mole. Log K_{OW} ranges from less than 1 to 5.

The base-extractable organics characteristically contain nitrogen. Most are more biodegradable than other extractable organics. Molecular weights range from approximately 70 to over 270. Solubility in water may be less than 1 to over 2,000 mg/L. Henry's Law constants are typically less than 10^{-6} atm m/mole and decrease to 10^{-11} atm m^3/mole; however, a few compounds, notably dichlorobenzene, are reported at 10^{-3} atm m^3/mole. The dichlorobenzenes may also be determined analytically with the volatile fraction, if desired.

Data for log K_{OW} are scarce and apparently range from near zero to 8 (but more typically 2 to 8), indicating a propensity to adsorb on organic solids.

The neutral-extractable organics, the largest group of extractable organics, contain aromatics, polynuclear aromatics, heterocyclics, and long-chain aliphatics; all may be halogenated or otherwise substituted. Of the extractable fraction, the neutral extractables are the most refractory in regard to biodegradation. Molecular weights range from 75 to 400. Solubility in water is generally low, typically less than 100 mg/L, but ranges up to approximately 900 mg/L. Henry's Law constants are typically less than 10^{-5} atm m^3/mole, with a range of 10^{-2} to 10^{-9} atm m^3/mole.

10.3.3. Pesticides and Herbicides

There are 88 compounds in the pesticides and herbicides classification, including 35 organo-halide, 41 organo-phosphorus, 10 carbamate, and 2 nitrophenolic compounds. Analytically, the pesticides and herbicides are determined in a fashion similar to SVOCs (i.e., extract, concentrate, and analyze using GC). The nitrophenolics and phenoxyacetic acids are considered exclusively herbicides; the others may function as pesticides or herbicides. The carbamate (i.e., containing nitrogen) and organo-phosphorus (i.e., containing phosphorus) compounds both hydrolyze rapidly in water to

TABLE 10-4

VOLATILE ORGANIC COMPOUND SUBCLASSES

ALCOHOLS

2-Propen-1-o1
Isobutyl alcohol

ALDEHYDES

2-Butenal
2-Propenal

AROMATICS

Benzene
Ethylbenzene
Styrene
Toluene
o + p xylene

HALOGENATED ALIPHATICS

1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2,3-Trichloropropane
1,2-Dibromoethane
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropane
3-Chloro-1-propane
1,4-Dichloro-2-butene (mixture of cis and trans)
2-Chloro-1,3-butadiene
Bromodichloromethane
Bromomethane
Chloroethane
Chloroform
Chloromethane
Dibromochloromethane
Dibromomethane
Dichloroiodomethane
Iodomethane

HALOGENATED ALIPHATICS (continued)

Methylene chloride
Tetrachloroethene
Tetrachloromethane
Total xylenes
Tribromomethane
Trichloroethene
Trichlorofluoromethane
Vinyl chloride
cis-1,3-Dichloropropene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
trans-1,4-Dichloro-2-butene

HALOGENATED AROMATICS

1-Bromo-2-chlorobenzene
1-Bromo-3-chlorobenzene
Chlorobenzene

KETONES

2-Butanone
2-Hexanone
2-Propanone
4-Methyl-2-pentanone

MISCELLANEOUS

1,4-Dioxane
2-Chloroethylvinyl ether
Carbon disulfide
Diethyl ether
Ethyl methacrylate
Methyl methacrylate
Vinyl acetate

NITROGEN COMPOUNDS

2-Picoline
2-Propenenitrile
2-Propenenitrile-2-methyl-chloroacetonitrile
Ethyl cyanide

alcohols. They function as pesticides through cholinesterase inhibition. These compounds are typically high in molecular weight (i.e., 200 to 500). The pesticides are low in water solubility (generally less than 100 mg/L), while the herbicides are soluble in water up to 1,000 mg/L.

10.3.4. Polychlorinated Biphenyls

Seven PCB mixtures (also known as Aroclors) are included in the PCB classification. The mixtures are differentiated by the amount of chlorine in the Aroclor. The last two digits of the Aroclor number denote the percentage of chlorine (except PCB-1016, which is 41 percent chlorine). PCBs were widely used for various applications due to their extremely good thermal and chemical stability; production was banned in 1976. Analytically, PCBs are determined via extraction and GC.

Except for PCB-1232, the solubility of these mixtures in water is less than 0.6 mg/L. PCBs are very hydrophobic and are most likely to be found adsorbed to organic solids. Log K_{ow} ranges between 4 and 7, and published Henry's Law constants are 10^{-3} to 10^{-4} atm m^3/mole; biodegradability is very low.

10.3.5. Dioxins and Dibenzofurans

These compounds are characterized by two benzene rings linked by either one (furans) or two (dioxins) oxygen molecules. The rings may undergo chlorine substitution at up to eight locations, creating families of compounds (e.g., there are 22 possible tetrachlorodibenzodioxins). Molecular weights exceed 300. Dioxins and furans are very hydrophobic, with solubilities in many cases less than 1 mg/L and log K_{ow} greater than 6. Therefore, these compounds are expected to be found adsorbed to the organic solids.

10.3.6. Elements

Seventy elements, primarily metals, are identified on the ITD list of analytes. The elements may be divided into two separate subcategories in reference to their natural state in solution: cations and anions. Cations are positively charged, while anions are negatively charged.

These identified elements form predominantly inorganic compounds, but are included in some organic compounds as well. Metals generally combine to form insoluble salts and concentrate in the sludges.

10.3.7. Miscellaneous

The miscellaneous class includes the remaining 29 analytes on the ITD list of analytes. Most are useful in controlling treatment processes or as indicators, and are commonly referred to as the conventional contaminants in biological treatment systems (i.e., BOD, COD, and TSS). Several others classified as miscellaneous are used to characterize a solid waste for disposal.

SECTION 11
HYPOTHETICAL CASE STUDIES

11. HYPOTHETICAL CASE STUDIES

Three hypothetical case studies were developed to guide FS writers, regulatory agencies, and POTW authorities through the process of evaluating the potential for discharging CERCLA wastes to a POTW. In most cases, evaluation of the POTW discharge alternative will be complicated by many technical and administrative requirements and concerns. Therefore, it is essential to perform a preliminary screening of the POTW alternative. The purpose of the initial screening is to identify the site-specific technical and administrative issues that will influence the outcome of the evaluation. It is important to identify and understand these issues early in the evaluation of the remedial alternatives to determine whether a full-scale detailed evaluation of the POTW alternative is warranted. There will be cases where the POTW discharge alternative can be ruled out early in the FS process; an example of this is included in the case studies.

The case studies describe the preliminary screenings of the POTW discharge alternative for three unique wastestreams. Each assessment closely follows the stepwise approach for evaluating the discharge of CERCLA waste to a POTW, as presented in this guidance manual. Each case study highlights the important technical and administrative issues raised during the course of the evaluation. With the examples and information presented in the case studies, FS writers, regulatory officials, and POTW authorities will become more familiar with many of the important technical and administrative issues involved and will be able to apply this information to perform a preliminary screening of the POTW alternative.

The case studies were designed using actual analytical data obtained from four CERCLA sites. Initially, each case study writer was given a data set and a hypothetical flow volume and rate, and was told what state the CERCLA site was in. Three USEPA regions were selected for the case studies to take into account any regional differences in administrative requirements. Given the background information, the case study writers identified and contacted the appropriate location of the hypothetical CERCLA site. State and USEPA officials were instrumental in helping the case study writer to gather information concerning actual POTW authorities that were operating in the designated area.

The case studies were organized to follow the procedures for evaluating the discharge of CERCLA wastes to a POTW, as presented in this guidance manual. To assist the guidance manual user, each case study is prefaced with a summary of the contents of the case study (i.e., wastestream characteristics, specific technical/administrative issues, and results of the evaluation). Therefore, the guidance manual user can screen the case studies and determine which case study presents the most relevant information useful to his/her own evaluation.

11.1. CASE STUDY #1

Case Study #1 evaluates the remedial alternative of discharging a finite quantity of liquid waste from a lagoon to a POTW. The lagoon is 0.5 acre in area; the depth of liquid waste averages approximately 4 feet. Field investigations during the RI determined that the lagoon was lined; therefore, the only on-site waste requiring treatment was the approximately 650,000 gallons of liquid in the lagoon. Samples from the lagoon that were collected for analysis revealed elevated concentrations of many organics (i.e., benzoic acid, acetone, chloroform, phenol, and toluene) and inorganics (i.e., aluminum, cadmium, magnesium, and manganese).

Five POTWs within a 10-mile radius of the site were identified for the feasibility screening evaluation. A sewer line was not present at the site. Therefore, Case Study #1 emphasizes administrative issues and concerns associated with obtaining permits to truck or pipe liquid waste to a POTW. A complete evaluation of treatability of the liquid waste in a POTW that employs activated sludge is also included in Case Study #1.

11.1.1. Identify and Characterize CERCLA Wastewater Discharge

The CERCLA wastestream is liquid waste contained in a half-acre lagoon. Approximate volume of wastewater requiring treatment is 650,000 gallons. Analytical work from the RI phase identified concentrations of contaminants in the lagoon (Table 11-1). The waste fails TCLP tests for cadmium, and contains several compounds in excess of the Maximum Contaminant Levels (MCLs). The RI risk assessment indicated the lagoon waste is a hazard to human health and the environment.

Lagoon contents are classified as solid waste because they have been discarded and abandoned (40 CFR 261.2). Under RCRA regulations, the lagoon waste is classified as hazardous because it fails TCLP testing and cannot be excluded from regulation under 40 CFR §261.4(b). Hazardous Waste No. D006 is assigned to the lagoon, corresponding to cadmium (i.e., the contaminant causing it to be hazardous [40 CFR §261.24]).

11.1.2. Identify Potential Local POTWs

The site is not located near any POTW sewer lines; therefore, liquid waste will have to be taken to a local POTW using trucks or dedicated pipe. For the purpose of this evaluation, a pumping rate of 5,000 gallons per day (gpd) will be used to assess pumping and/or hauling costs associated with transporting the wastestream to the POTW. POTWs located within a 10-mile radius of the lagoon were identified, and will be evaluated as potential receptors of the piped or trucked liquid waste.

The USEPA regional Water Management Division was contacted for assistance in locating POTWs and making contact with POTW authorities (i.e., within the 10-mile radius chosen for initial screening of the POTW discharge alternative). The USEPA Pretreatment Coordinator recommended two POTW Authorities (i.e., POTW Authorities A and B), which operate a total of five plants in the area.

11.1.3. Involve POTW in Evaluation Process and Screen POTWs

USEPA personnel emphasized the importance of involving all concerned parties early in the evaluation process to arrive at a suitable treatment scheme. Both POTW authorities were contacted to determine if the POTWs were willing to accept a CERCLA discharge, to obtain information about technical capabilities (e.g., capacity and unit operations), and to determine compliance status of the POTWs. The state was then notified about POTWs being considered. Useful information for screening POTWs was obtained from these initial contacts.

11.1.3.1. Determine Compliance Status

The compliance status of the five POTWs identified within the 10-mile radius was checked using the compliance checklist (see Subsection 4.2) and by telephoning the Regional Off-site Coordinator. POTW Authority A administers three treatment plants (i.e., POTWs 1, 2, and 3); each is currently in compliance with applicable permits and regulations. POTW Authority B administers two treatment plants (i.e., POTWs 4 and 5). POTW 5 is currently in violation of its NPDES permit; therefore, it was eliminated from consideration as a potential waste receiver. POTW 4 is in compliance with applicable permits and regulations. POTWs 3, 4, and 5 participate in the National Pretreatment Program. None of the POTWs is currently a RCRA permit-by-rule facility (see Subsection 3.1.2). There was no information on any of the facilities indicating a significant potential for contamination of

TABLE 11-1

CASE STUDY #1

CONCENTRATIONS OF POLLUTANTS DETECTED IN CERCLA SITE WASTESTREAM

POLLUTANTS	CONCENTRATION (µg/L)
Organics	
1,1,2,2-Tetrachloroethane	3,040
1,2-Dichloroethane	1,450
2,4-Dichlorophenol	10,000
2,6-Dichlorophenol	10,000
Acetone	68,580
Benzene	3,740
Benzoic Acid	4,050,000
Benzyl Alcohol	10,000
Chlorobenzene	3,100
Chloroform	12,600
Chloromethane	16,100
Ethylbenzene	2,690
Methylene Chloride	5,340
Phenol	2,090,000
Tetrachloroethene	3,470
Toluene	14,200
Trans-1,2-dichloroethene	1,720
Trichloroethene	4,150
Herbicides/Pesticides	
Dieldrin	42
Lindane	75
Metals	
Aluminum	5,530
Antimony	200
Arsenic	40
Cyanide	28
Cadmium	2,820
Calcium	1,080,000
Copper	52
Iron	1,230,000

TABLE 11-1

(continued)

CASE STUDY #1

CONCENTRATIONS OF POLLUTANTS DETECTED IN CERCLA SITE WASTESTREAM

POLLUTANTS	CONCENTRATION (μg/L)
Metals (continued)	
Magnesium	306,000
Manganese	14,400
Nickel	2,270
Selenium	20
Sodium	4,020,000
Thallium	20
Zinc	830
Lead	1,550
Phosphorus	169,000
Potassium	840,000

μg/L = micrograms per liter

groundwater from impoundment of the CERCLA wastewater.

To be eligible to receive the hazardous lagoon waste by either truck, rail, or dedicated pipe, a POTW must comply with its NPDES and other permits, and RCRA reporting and manifest requirements (40 CFR §270.60). Remedial activities at the lagoon site would need to comply with the substantive requirements of the RCRA standards for hazardous waste generators (40 CFR §262) and transporters (40 CFR §263).

11.1.3.2. Consider Technical Feasibility

A screening table was prepared to evaluate technical feasibility of the five POTWs (Table 11-2). Of the three POTWs in the Authority A district, only POTW 3 treats industrial waste. POTW 3 uses activated sludge secondary treatment and incinerates its sludge. POTWs 1 and 2 are low-flow primary treatment plants, and were excluded from consideration because their unit operations were unsuitable for treatment.

The POTW closest to the site is POTW 4, administered by POTW Authority B. This plant uses activated sludge secondary treatment and landspreads sludge. POTW 4 has sufficient excess capacity to treat lagoon waste over the five to six months it is expected to be discharged. Therefore, based on technical feasibility, POTWs 1 and 2 were excluded as potential receptors.

TABLE 11-2

CASE STUDY #1

EVALUATION OF TECHNICAL FEASIBILITY OF

CERCLA WASTESTREAM DISCHARGE TO IDENTIFIED POTWs

CRITERIA	POTWS				
	1	2	3	4	5
Does the POTW have hydraulic capacity to handle additional CERCLA wastestream flow?	Yes	No	Yes	Yes	No
Are unit operations suitable for treatment of contaminants in the CERCLA wastestream?	No	No	Yes	Yes	Yes
Is there a domestic sanitary sewer piping system running from the CERCLA site to the POTW?	No	No	No	No	No
Distance from CERCLA site to POTW? (miles)	6.0	3.0	5.0	0.5	7.0
POTW's sludge disposal process?	Landfill	Landfill	Incinerate	Landspread	Incinerate
Could the POTW treat the CERCLA wastestream for the time duration required?	Yes	No	Yes	Yes	No

11.1.3.3. Consider Administrative Feasibility

The reaction of POTW Authority A to potentially accepting the lagoon waste varied. Acceptance of the waste was not summarily refused; however, the waste originates in the Authority B district; therefore, Authority A believes the waste is the primary responsibility of Authority B. Authority A expressed a strong disinterest in meeting RCRA permit-by-rule requirements if the lagoon waste were trucked or piped from the site to be treated by

Authority A. POTW 3 was excluded from further consideration because administrative obstacles were encountered during negotiations with Authority A.

As a result of accepting several industrial wastestreams, local limits for industrial discharges to POTW 4 were recently developed for metals, cyanide, oil and grease, and several organics. The POTW 4 operator stressed that these limits apply to all dischargers to the plant.

The NPDES authority developed NPDES limits for all the CERCLA site contaminants not currently limited in the POTW's NPDES permit. Additionally, the POTW officially developed local limits for all compounds in the CERCLA waste before the CERCLA site discharge was implemented. In addition to creating limits, developing NPDES and local limits helped reduce the POTW's long-term liability.

Developing discharge limits for the lagoon waste would be an iterative process based on several technical and administrative factors. The following factors would have significant impact on the decision to truck or pipe the lagoon waste to a POTW: (1) water quality standards for the receiving body of water, and other regulations; (2) NPDES permit limits; (3) treatability characteristics of the POTW; (4) potential for pretreatment of the lagoon waste; (5) associated costs of pretreatment and trucking or piping to the POTW; (6) liability for accepting the waste; and (7) political pressure.

The POTW 4 operator expressed a willingness to accept the waste if he were relieved of liability issues. Under SARA Section 119(c)(5)(D), indemnification from liability to response action contractors cannot be provided to facilities regulated under RCRA (including RCRA permit-by-rule POTWs). The POTW 4 operator subsequently decided to meet the RCRA permit-by-rule requirements during the CERCLA site discharge.

Many issues that will ultimately determine the outcome of a POTW discharge alternative are administrative and political, and cannot be predicted in the initial screening of the POTW alternative. However, for the purpose of completing Case Study #1, the FS writer assumed that POTW 4 will comply with the RCRA permit-by-rule regulations and, therefore, is capable of accepting the waste via truck or dedicated pipe.

11.1.4. Obtain/Estimate POTW Local Limits

11.1.4.1. Obtain Local Limits

The FS team requested a copy of POTW 4 local limits on discharges, NPDES permit limits, and sludge disposal permit limits. The operator indicated that local limits on organics were derived from the USEPA Toxicity Characteristic Leaching Procedure proposed regulatory levels (Federal Register, 1986). Because of the relatively small volume and short duration of the wastestream discharge, the operator indicated that no influent limits would be placed on conventional and nonconventional pollutants, except for oil and grease. Local limits for metals would be imposed as for other discharges to the plant. The operator stated that sludge from POTW 4 is not considered a hazardous waste; therefore, it does not need to be disposed of as such. Sludge samples are routinely analyzed for metals and TCLP. The operator explained that discharge limits for metals are imposed on industrial users to ensure metal loading does not impact sludge quality. Table 11-3 shows the treatment process currently employed at POTW 4.

11.1.4.2. Estimate Local Limits

After state and USEPA officials conditionally approved the operator's initial assessment of the CERCLA wastestream discharge requirements, the FS team prepared summary tables to identify and assess the fate and treatability of compounds in the wastestream at POTW 4 requiring pretreatment.

TABLE 11-3

CASE STUDY #1

TREATMENT PROCESS AT POTW 4

TREATMENT PROCESS	TREATMENT METHODS
Screening	Bar Rack
Grit Removal	Grit Chamber
Pretreatment	None
Primary Settling	Clarified
Intermediate Treatment	None
Activated Sludge	Conventional
Filters	None
Disinfection	Chlorine Gas
Sludge Digestion	Anaerobic
Sludge Disposal	Land Spreading

After studying information from this document and POTW-specific inhibition data, the FS writers determined that pollutant concentrations in the wastestream were not sufficiently high to cause biological inhibition of POTW treatment processes.

Table 11-4 presents mass balance information for compounds in the CERCLA wastestream. The purpose of mass balance is to calculate general POTW treatment efficiency and to identify POTW removal mechanisms (i.e., partitioning to sludge and volatilization) impacted by constituent removal from the CERCLA wastestream. POTW-specific treatability data were not available for all contaminants in the lagoon; therefore, liquid waste, total removal, volatilization, and partitioning percentages were compiled from treatability data in Subsection 10.2 and other POTW treatability data.

Table 11-5 summarizes the treatability of the CERCLA wastestream at POTW 4 and identifies compounds that require pretreatment. For compounds with local limits, pretreatment decisions were straightforward. For compounds without specifically regulated discharge concentrations, the pretreat-or-discharge decision was made by calculating effects of CERCLA discharge on the quality of POTW influent and effluent. Predicted POTW effluent concentrations were compared to effluent limits, including existing permit limits, Ambient Water Quality Criteria (AWQC), and drinking water standards to determine whether compounds in the CERCLA wastestream will be effectively treated at the POTW or whether pretreatment will be required.

The FS team's mass balance and treatability tables were examined by USEPA, state, and POTW officials. After negotiations, the groups tentatively agreed on the list of compounds requiring pretreatment (see Table 11-5).

TABLE 11-4
CASE STUDY #1
MASS BALANCE FOR CERCLA WASTESTREAM CONTAMINANTS AT POTW 4

POLLUTANT	SITE CONTAMINANT CONCENTRATION (mg/L)	CALCULATED CONTAMINANT LOAD (g/day)[1]	% REMOVAL*	% TO AIR	MASS TO AIR (g/day)	% TO SLUDGE	MASS TO SLUDGE (g/day)	MASS TO EFFLUENT (g/day)
Organics								
1,1,2,2-Tetrachloroethane	3.04	NC						
1,2-Dichloroethane	1.45	27.4	60 M	45	12.3	4	1.1	16.5
2,4-Dichlorophenol	10.00	189	96 M	0	0	8	15.1	7.6
2,6-Dichlorophenol	10.00	189	96 M[2]	0[2]	0	8[2]	15.1	7.6
Acetone (2-Propanone)	68.58	1298	95 M[3]	1	13.0	10	129.8	64.9
Benzene	3.74	NC						
Benzoic Acid	4050.00	76,650	ND	ND		ND		
Benzyl Alcohol	10.00	189	ND	ND		ND		
Chlorobenzene	3.10	NC						
Chloroform	12.60	NC						
Chloromethane	16.13	304.9	82 M	86	262.2	1	0	54.9
Ethylbenzene	2.69	50.9	42 M	24	12.2	0	0	29.5
Methylene Chloride	5.34	NC						
Phenol	2090.00	NC						
Tetrachloroethene	3.47	NC						
Toluene	14.20	NC						
Trans-1,2-dichloroethene	1.72	32.5	42 M	63	20.5	49	15.9	18.8

See notes, p.11-10

TABLE 11-4
(continued)
CASE STUDY #1
MASS BALANCE FOR CERCLA WASTESTREAM CONTAMINANTS AT POTW 4

POLLUTANT	SITE CONTAMINANT CONCENTRATION (mg/L)	CALCULATED CONTAMINANT LOAD (g/day)[1]	% REMOVAL*	% TO AIR	MASS TO AIR (g/day)	% TO SLUDGE	MASS TO SLUDGE (g/day)	MASS TO EFFLUENT (g/day)
Trichloroethene	4.15	NC						
Herbicides/Pesticides								
Dieldrin	0.04	0.8	32 M[5]	0[5]	0	9[5]	0.07	0.5
Lindane	0.08	NC						
Metals/Elements								
Aluminum	5.53	104.7	90 M[6]	0	0	90	94.2	10.5
Antimony	0.20	3.8	17 M	0	0	90	3.4	3.2
Arsenic	0.04	NC						
Cyanide	0.03	NC						
Cadmium	2.82	NC						
Calcium	1080.00	20440.0	4 M[6]	0	0	90	18396.0	19622.4
Copper	0.05	NC						
Iron	1230.00	23280.0	81 M[7]	0	0	90	20952.0	4423.2
Magnesium	306.00	5791.0	0 M[6]	0	0	90	5211.9	5791.0
[illegible]	14.40	272.5	38 M[8]	0	0	90	245.2	169
[illegible]	2.27	NC						
Selenium	0.02	0.4	0 M	0	0	90	0.4	0.4

See notes, p.11-10

TABLE 11-4
(continued)
CASE STUDY #1
MASS BALANCE FOR CERCLA WASTESTREAM CONTAMINANTS AT POTW 4

POLLUTANT	SITE CONTAMINANT CONCENTRATION (mg/L)	CALCULATED CONTAMINANT LOAD (g/day)[1]	% REMOVAL*	% TO AIR	MASS TO AIR (g/day)	% TO SLUDGE	MASS TO SLUDGE (g/day)	MASS TO EFFLUENT (g/day)
Sodium	4020.00	76090.0	0 M[3]	0	0	90	68481.0	76090.0
Thallium	0.02	0.4	90 M[6]	0	0	90	0.4	0.1
Zinc	0.83	NC						
Lead	1.55	NC						
Phosphorus	169.00	3202.0	80 G	0	0	90	2881.8	640.4
Potassium	840.00	15890.0	0 G	0	0	90	14301	15890.0

NOTES:

[1]Calculated Contaminant Load (g/day) = [Calc. infl. conc. (mg/L)] [plant flow (L/day)] (1 g/10^3mg)
[2]Used data from 2,4-dichlorophenol based on similar physical and chemical properties.
[3]Used data from 101-500-parts per billion (ppb) concentration range.
[4]Used data from vinyl chloride based on similar physical and chemical properties.
[5]Used data from lindane and other pesticides based on similar physical and chemical properties.
[6]Used data from >5,000-ppb concentration range.
[7]Used data from 1,001-5,000-ppb concentration range.
[8]Used data from 501-1,000-ppb concentration range.
[9]Used data from aluminum based on similar physical and chemical properties.

G = Source: Treatability data from another activated sludge POTW (Grand Rapids, Michigan)
M = Source: "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA 1990).
NC = Mass balance not calculated. Influent concentration regulated by local limit.
ND = No Data

*Due to the use of several sources and conservative addumptions, % to air plus % to sludge may not equal % removal.

TABLE 11-5
CASE STUDY #1
TREATABILITY OF CERCLA WASTESTREAM AT POTW 4

POLLUTANT	SITE INFLUENT CONC (mg/L)	POTW INFLUENT CONC (mg/L)	CALCULATED INFLUENT CONC (mg/L)[1]	% REMOVAL	CALCULATED EFFLUENT CONC (mg/L)[2]	EFFLUENT LIMIT (mg/L)	POTW LOCAL LIMIT (mg/L)	PRETREAT OR DISCHARGE
Organics								
1,1,2,2-Tetrachloroethane	3.04	--	--	--	--		1.3	Pretreat
1,2-Dichloroethane	1.45	--	3.38×10^{-4}	60 M	1.35×10^{-4}	5×10^{-3} C	--	Discharge
2,4-Dichlorophenol	10.00	--	1.11×10^{-3}	96 M	4.44×10^{-5}	0.7 S	--	Discharge
2,6-Dichlorophenol	10.00	--	1.11×10^{-3}	96 M[3]	4.44×10^{-5}	0.7[3] S	--	Discharge
Acetone (2-Propanone)	68.58	--	7.62×10^{-3}	95 M[4]	3.81×10^{-4}	0.05 E	--	Discharge
Benzene	3.74	--	--	--	--	--	0.07	Pretreat
Benzoic Acid	4050.00	--	0.450	--	--	--	no limit P	Discharge
Benzyl Alcohol	10.00	--	1.11×10^{-3}	--	--	--	no limit P	Discharge
Chlorobenzene	3.10	--	--	--	--	--	1.4	Pretreat
Chloroform	12.60	--	--	--	--	--	0.07	Pretreat
Chloromethane	16.10	--	1.79×10^{-3}	82 M	3.22×10^{-4}	1.9×10^{-4} A	--	Pretreat
Ethylbenzene	2.69	--	2.99×10^{-4}	42 M	1.73×10^{-4}	0.68 R	--	Pretreat
Methylene Chloride	5.34	--	--	--	--	--	8.6	Pretreat
Phenol	2090.00	--	--	--	--	--	14.4	Pretreat
Tetrachloroethene	3.47	--	--	--	--	--	0.1	Pretreat
Toluene	14.20	--	--	--	--	--	14.4	Discharge

See notes, p. 11-14

TABLE 11-5
(continued)
CASE STUDY #1
TREATABILITY OF CERCLA WASTESTREAM AT POTW 4

POLLUTANT	SITE INFLUENT CONC (mg/L)	POTW INFLUENT CONC (mg/L)	CALCULATED INFLUENT CONC (mg/L)[1]	% REMOVAL	CALCULATED EFFLUENT CONC (mg/L)[2]	EFFLUENT LIMIT (mg/L)	POTW LOCAL LIMIT (mg/L)	PRETREAT OR DISCHARGE
Trans-1,2-dichloroethene	1.72	--	1.91×10^{-4}	42 M	1.11×10^{-4}	0.07 R	--	Pretreat
Trichloroethene	4.15	--	--	--	--	--	0.07	Pretreat
Herbicides/Pesticides								
Dieldrin	0.04	--	4.67×10^{-6}	31.91 M[6]	3.18×10^{-6}	7.1×10^{-8} A	--	Pretreat
Lindane	0.08	--	--	--	--	--	0.06	Pretreat
Metals/Elements								
Aluminum	5.53	--	6.14×10^{-4}	90 M[7]	6.14×10^{-5}	0.5 P	--	Discharge
Antimony	0.20	--	2.22×10^{-5}	17 M	1.84×10^{-5}	0.146 A	--	Discharge
Arsenic	0.04	--	--	--	--	--	1.0 P	Discharge
Cyanide	0.03	--	--	--	--	--	2.0 P	Discharge
Cadmium	2.82	0.002	--	--	--	--	3.0 P	Discharge
Calcium	1080.00	--	0.1200	4 M[7]	0.11	no limit P	--	Discharge
Copper	0.05	0.109	--	--	--	--	3.0 P	Discharge
Iron	1230.00	--	0.1367	81 M[8]	0.02	0.3 E	--	Discharge
Magnesium	306.00	--	0.034	0 M[7]	0.034	0.3 E	--	Discharge
Manganese	14.40	--	1.600×10^{-3}	38 M[9]	9.85×10^{-4}	0.3 E	--	Discharge

See notes, p. 11-14

TABLE 11-5

(continued)

CASE STUDY #1

TREATABILITY OF CERCLA WASTESTREAM AT POTW 4

POLLUTANT	SITE INFLUENT CONC (mg/L)	POTW INFLUENT CONC (mg/L)	CALCULATED INFLUENT CONC (mg/L)[1]	% REMOVAL	CALCULATED EFFLUENT CONC (mg/L)[2]	EFFLUENT LIMIT (mg/L)	POTW LOCAL LIMIT (mg/L)	PRETREAT OR DISCHARGE
Nickel	2.27	0.006	--	--	--	--	6.0 P	Discharge
Selenium	0.02	--	2.22×10^{-6}	0 M	2.22×10^{-6}	0.045 R	--	Discharge
Sodium	4020.00	--	0.4467	0 M[4]	0.4467	no limit P	--	Discharge
Thallium	0.02	--	2.222×10^{-6}	90 M[7,10]	2.22×10^{-7}	0.013 A	--	Discharge
Zinc	0.83	0.157	--	--	--	--	5.0 P	Discharge
Lead	1.55	0.010	--	--	--	--	3.0 P	Discharge
Phosphorus	169.00	--	0.0188	80 G	3.76×10^{-3}	1.0 P	--	Discharge
Potassium	840.00	--	0.0933	0 G	0.0933	no limit P	--	Discharge

See notes, p. 11-14

TABLE 11-5
(continued)
CASE STUDY #1
TREATABILITY OF CERCLA WASTESTREAM AT POTW 4

NOTES:

[1]Calculated Influent Conc. (mg/L) = [(site infl. conc. (mg/L)] [site infl. flow volume(L/day)] + [POTW conc. (mg/L)] [POTW flow volume (L/day)] / [Total flow (L/day)]

Site influent flow volume = 18,930 L/day
POTW flow volume = 170,330,000 L/day
Total flow (with site discharge) = 170,348,930 L/day
POTW influent concentration was assumed to be zero if no data was available.

[2]Calculated Effluent Conc. (mg/L) = [calc. infl. conc. (mg/L)] [1 - % Removal / 100]

[3]Used data from 2,4-dichlorophenol based on similar physical and chemical properties.
[4]Used data from 101-500 parts per billion (ppb) concentration range.
[5]Used data from vinyl chloride based on similar physical and chemical properties.
[6]Used data from lindane and other pesticides based on similar physical and chemical properties.
[7]Used data from >5,000-ppb concentration range.
[8]Used data from 1,001-5,000-ppb concentration range.
[9]Used data from 501-1,000-ppb concentration range.
[10]Used data from aluminum based on similar physical and chemical properties.

A = Source: Ambient Water Quality Criteria
C = Source: Maximum Contaminant Limit
E = Source: Decision by USEPA Regional Water Permits Section
G = Source: Treatability data from another activated sludge POTW (Grand Rapids, Michigan)
M = Source: "CERCLA Site Discharges to POTWs Treatability Manaual" (USEPA 1990)
P = Source: Decision by POTW Authority
R = Source: Recommended Maximum Contaminant Limit
S = Source: Drinking Water Suggested No Adverse Response Level, Chronic
-- = No Data

11.1.5. Identify and Screen Pretreatment Alternatives

11.1.5.1. Identify Pretreatment Technologies

FS writers used information from this document to identify and screen pretreatment technologies (Table 11-6).

11.1.5.2. Assemble Alternative Process Train Pretreatment

The FS team planned a pretreatment train for the CERCLA wastestream. The proposed pretreatment included oil and grease separation, followed by activated carbon adsorption. The scheme was designed to effectively pretreat the wastestream while minimizing the number of required processes.

11.1.6. Detailed Analysis of Discharge Alternative

The FS team's evaluation determined that the POTW discharge alternative is feasible for the CERCLA wastestream; the final analysis will be based primarily on the administrative and political feasibility of the POTW to accept hazardous waste by truck or dedicated pipe. Lagoon waste will be collected, pretreated in a two-step process, and transported to the POTW by either truck or dedicated pipe. POTW, state, and USEPA officials are confident that the wastestream will be effectively treated at the POTW, based on past experience and FS team calculations.

The POTW discharge alternative is expected to be effective in the short- and long-term, implementable, and cost-effective. It should reduce toxicity of contaminants, protect human health and the environment, and comply with

TABLE 11-6

CASE STUDY #1

PRETREATMENT OPTIONS FOR CERCLA WASTESTREAM

POLLUTANT	CLASS	APPLICABLE TECHNOLOGIES
1,1,2,2-Tetrachloroethane	V	Steam stripping, activated carbon
Benzene	V	Steam stripping, activated carbon
Chlorobenzene	V	Steam stripping, activated carbon
Chloroform	V	Steam stripping, activated carbon
Chloromethane	V	Steam stripping, activated carbon
Ethylbenzene	V	Steam stripping, activated carbon
Methylene Chloride	V	Steam stripping, activated carbon
Phenol	SV(A)	Steam stripping, activated carbon
Tetrachloroethene	V	Steam stripping, activated carbon
Trans-1,2-dichloroethene	V	Steam stripping, activated carbon
Trichloroethene	V	Steam stripping, activated carbon
Dieldrin	P(OH)	Activated carbon
Lindane	P(OH)	Activated carbon
Oil & Grease	---	Oil & Grease Separation

V = Volatile SV(A) = Semi-Volatile(Acid) P(OH) = Pesticide(Organohalides)

ARARs. Because POTW, state, and USEPA officials were involved in the planning of the alternative, the community and state are expected to accept the CERCLA wastestream discharge to POTW alternative.

11.2. CASE STUDY #2

In Case Study #2, a POTW was identified that already had local limits for several compounds detected in the CERCLA wastestream during the RI. The CERCLA site examined in Case Study #2 is a landfill that received municipal and industrial wastes. The wastestream of concern is the landfill leachate, which is contaminated by organics, metals, pesticides, and conventional and nonconventional pollutants.

To achieve remedial action objectives, treatment of leachate discharged at a maximum rate of 80,000 gpd for five years is required. POTW operators contacted during the screening process were generally receptive to accepting the CERCLA wastestream because of their experience with industrial discharges and knowledge of specific process capabilities. Regional USEPA and state regulatory personnel approved the discharge of pretreated CERCLA waste to a POTW. Based on treatability calculations generated during the screening of the POTW alternative, pretreatment would probably be required for several organics and metals detected in the leachate.

11.2.1. Identify and Characterize CERCLA Wastewater Discharge

The CERCLA wastestream is a leachate that drains into a collection system installed beneath the landfill. Samples collected during the RI identified leachate contaminant concentrations (Table 11-7). The leachate contains many compounds in excess of AWQC. The risk assessment undertaken during the RI indicated that leachate quality is a potential hazard to human health and the environment, and cannot be discharged without treatment.

Proposed remedial actions specify that leachate will be generated at a rate of 80,000 gpd over a five-year period. Wastestream quality is expected to improve with time; however, to be most protective of human health, the environment, and the treatment plant unit operations, the initial POTW discharge evaluation is based on the worst case (i.e., all compounds are present in the wastestream at the maximum concentration detected).

The CERCLA wastestream is classified under RCRA regulations as hazardous waste; the landfill contents, which include drums of spent solvents and chemical waste, are classified under RCRA as solid wastes because they have been discarded and abandoned (40 CFR §261.2). Spent solvents and chemical waste in the landfill are considered hazardous, and fall under F-, U-, and P-listed wastes (RCRA Subpart D). In addition, a mixture of solid waste and hazardous waste is defined as hazardous waste if it exhibits hazardous characteristics (40 CFR §261.3[a][2][iv]). Therefore, the leachate is defined as a hazardous waste, because it is a "solid waste generated from the ...disposal of a hazardous waste."

The leachate could be excluded as a hazardous waste if and when the DSE were applicable. According to the DSE, "any mixture of domestic sewage and other wastes that pass through a sewer system to a POTW for treatment" is excluded as a solid and, therefore, hazardous waste (40 CFR §261.4[a][1][ii]). For the DSE to apply, leachate would need to be discharged into a sewer on-site; trucking to an off-site manhole is unacceptable.

TABLE 11-7

CASE STUDY #2

CONCENTRATION OF POLLUTANTS DETECTED IN CERCLA WASTESTREAM

POLLUTANT	CONCENTRATION
Organics	
1,1,2,2-Tetrachloroethane	1,300 µg/L
1,2,4-Trichlorobenzene	4,660 µg/L
1,2-Dichlorobenzene	720 µg/L
1,4-Dichlorobenzene	960 µg/L
2,4-Dichlorophenol	830 µg/L
Acetone	500 µg/L
Benzene	1,740 µg/L
Benzoic Acid	96,300 µg/L
Benzyl Alcohol	710 µg/L
Carbon Tetrachloride	140 µg/L
Chlorobenzene	3,770 µg/L
Chloroform	520 µg/L
p-Cresol	160 µg/L
Pentachlorobenzene	550 µg/L
Phenol	200 µg/L
Tetrachloroethene	1,300 µg/L
Toluene	18,200 µg/L
Trans-1,2-dichloroethene	170 µg/L
Trichloroethene	600 µg/L
Herbicides/Pesticides	
Heptachlor	35 µg/L
Toxaphene	50 µg/L
Metals	
Calcium	225,000 µg/L
Cobalt	10 µg/L
Iron	6,700 µg/L
Magnesium	55,300 µg/L
Manganese	850 µg/L
Nickel	140 µg/L
Selenium	2 µg/L
Sodium	89,200 µg/L

TABLE 11-7

(continued)

CASE STUDY #2

POLLUTANT	CONCENTRATION
Metals (continued)	
Zinc	70 µg/L
Chromium	103,000 µg/L
Potassium	10,000 µg/L
Conventionals	
BOD	120 mg/L
O&G	20 mg/L
TSS	1,300 mg/L
Nonconventionals	
Ammonia, as N	1.6 mg/L
COD	260 mg/L
Fluoride	0.70 mg/L
Nitrogen, Total Kjeldahl	2.0 mg/L
Sulfide, Total Colorimetric	2.0 mg/L
TDS	7300 mg/L
TOC	90 mg/L

11.2.2. Identify Potential Local POTWs

Because the CERCLA site is located in an urban area with several large POTWs to handle city wastewater, the FS writers chose a 5-mile radius from the landfill within which to identify and characterize POTWs.

The USEPA Regional Water Management Division, Water Permits and Compliance Branch, was contacted to assist in locating individual POTWs and/or POTW authorities within a 5-mile radius of the site. Contact was made with representatives from three POTWs (i.e., POTWs 1, 2, and 3). Each POTW is administered by a separate authority.

11.2.3. Involve POTW in Evaluation Process and Screen POTWs

USEPA personnel emphasized the importance of involving all concerned parties (i.e., state officials and POTW managers) early in the evaluation process to discuss the potential for discharging to a POTW, and to arrive at a suitable treatment scheme. The three POTW managers were contacted and asked to provide information about available capacity, treatment unit processes, treatment capabilities, and local ordinances regulating their operations (i.e., pretreatment program, sludge disposal practices, influent/effluent monitoring, air emissions, and local limits for industrial users). Information obtained from initial discussions with POTW managers was relayed to state officials to initiate an open communication path between all parties.

11.2.3.1. Determine Compliance Status

Because the state agency administered the NPDES program for the local POTWs, the state water permits division was asked to provide copies of the NPDES permit for each POTW under consideration, and the AWQC for POTW receiving waters. Air emissions permits were requested from the state air permits section. The Regional Off-site Coordinator was contacted to provide any applicable information. State regional offices were asked to provide summary data for each POTW influent, effluent, sludge, and air emissions monitoring programs, where applicable.

All POTW managers contacted indicated that their facilities have a good history of compliance with applicable regulations; there was no information indicating significant potential for groundwater contamination from impoundment of the CERCLA wastewater. Using the POTW compliance checklist (see Table 4-1), the facilities' individual permits (i.e., NPDES, sludge, and air) were examined. The regional USEPA Water Permits and Compliance Section was contacted to confirm that the POTWs were operating up to standards. Each POTW has an approved pretreatment program.

11.2.3.2. Consider Technical Feasibility

A screening table was prepared to evaluate technical feasibility of CERCLA wastestream discharge to the three plants (Table 11-8). Information from the POTWs indicated that all three use primary settling in combination with activated sludge treatment processes. In addition, POTW 3 uses a tertiary sand-filter system. POTWs 1 and 2 incinerate sludge and landfill the ash; POTW 3 composts and landspreads sludge.

Of the three, POTW 2 has the largest capacity (56.2 mgd), followed by POTW 1 (34 mgd) and POTW 3 (11.4 mgd). POTWs 2 and 3 are expected to have sufficient available capacity to handle discharge from the CERCLA site for the five-year duration; however, allowing for average loading increases from surrounding communities, POTW 1 is currently operating at capacity and is experiencing overloading problems during storms. Therefore, it would not be technically feasible to discharge to POTW 1. POTW 3 has available capacity to handle the CERCLA discharge. However, the operator was concerned about the effects of accepting the wastewater on his ability to continue to compost and landspread the sludge; therefore, the operator was hesitant to agree to accept the wastewater.

11.2.3.3. Consider Administrative Feasibility

The sewer system on-site is connected to POTW 2. Discharging to this sewer would be covered by the Domestic Sewage Exclusion (DSE). Treating the CERCLA wastestream at POTW 3 would require trucking or piping to the facility, and the facility would be required to obtain a RCRA permit-by-rule. Therefore, to discharge to POTW 3 would be more costly, and to obtain required permits would be more difficult than for POTW 2. In addition, public pressure to not accept the CERCLA wastestream (because of concerns about land application of the sludge) may rule out POTW 3. Due to administrative circumstances, discharge to POTW 2 is the preferable alternative. Once POTW 2 was identified as the most suitable alternative, discharge negotiations between the POTW authority, USEPA Remedial Project Manager (RPM), state authorities, and the FS team were initiated to discuss specific details of discharging CERCLA waste to the POTW. Table 11-9 shows the treatment process and methods employed at POTW 2.

TABLE 11-8

CASE STUDY #2

EVALUATION OF TECHNICAL FEASIBILITY OF CERCLA WASTESTREAM DISCHARGE TO IDENTIFIED POTWs

CRITERIA	POTWS		
	1	2	3
Does the POTW have hydraulic capacity to handle additional CERCLA wastestream flow?	No	Yes	Yes
Are unit operations suitable for treatment of contaminants in the CERCLA wastestream?	Yes	Yes	Yes
Is there a domestic sanitary sewer piping system running from the CERCLA site to the POTW?	No	Yes	No
Distance from CERCLA site to POTW? (miles)	5.2	1.6	3.5
POTW's sludge disposal process?	Incinerate/Landfill	Incinerate/Landfill	Compost/Landspread

The NPDES authority developed NPDES limits for all the CERCLA site contaminants not currently limited in the POTW's NPDES permit. Additionally, the POTW officially developed local limits for all compounds in the CERCLA waste before the CERCLA site discharge was implemented. In addition to creating limits, developing NPDES and local limits helped reduce the POTW's long-term liability.

11.2.4. Obtain/Estimate POTW Local Limits

11.2.4.1. Obtain Local Limits

The FS team requested a copy of POTW 2 local limits for industrial users and NPDES, air emissions, and sludge disposal permit limits. The operator indicated that local limits were contained in the municipality sewer use ordinance for metals and cyanide only. Because of the relatively small volume of the leachate (compared to the current

TABLE 11-9

CASE STUDY #2

POTW 2 UNIT OPERATIONS

UNIT OPERATIONS	TREATMENT METHOD
Screening	Bar Rack
Grit Removal	Grit Chamber
Primary Sedimentation	Settling Tank
Aeration	Activated Sludge
Final Sedimentation	Clarifier
Disinfection	Chlorine Gas
Sludge Thickening	Gravity Thickening

influent to the POTW), the operator indicated that influent limits would not initially be placed on conventional and nonconventional pollutants. Metals and cyanide local limits would be the same as for other discharges to the plant.

11.2.4.2. Estimate Local Limits

The FS writers evaluated the effect of CERCLA site discharge on the POTW, and estimated local limits that might be appropriate. The leachate contained concentrations of several compounds that created the potential for inhibition of activated sludge treatment processes at POTW 2. Among the compounds for which biological inhibition threshold concentrations are available (see Tables 10-1 and 10-2), only chlorobenzene and chromium were present in the leachate at possible inhibitory concentrations. However, when diluted by plant flow, concentrations will be well below inhibitory levels.

At the time of the evaluation, biological inhibition data were not available to the FS writers for the following compounds present in the leachate: 2-propanone, benzoic acid, benzyl alcohol, p-cresol, pentachlorobenzene, trans-1,2-dichloroethene (trans-1,2-DCE), heptachlor, toxaphene, cobalt, magnesium, selenium, sodium, and potassium. However, the FS writers inferred the behavior of the substances based on physical and chemical properties. Oxygenated species (e.g., 2-propanone, benzoic acid, benzyl alcohol, and p-cresol) at leachate concentrations are assumed sufficiently biodegradable to not impair the biological system. Chlorinated organics pentachlorobenzene and trans-1,2-DCE should behave similarly to compounds 1,2,4-trichlorobenzene and tetrachloroethene and, therefore, should not biologically inhibit at leachate concentrations. Highly soluble metals (i.e., magnesium, sodium, and potassium) are expected to behave similarly to calcium and, therefore, should not inhibit

TABLE 11-10
CASE STUDY #2
TREATABILITY OF CERCLA WASTESTREAM AT POTW 2

POLLUTANT	SITE EFFL. CONC. (mg/L)	POTW AVG. INFL. CONC. (mg/L)		CALC. INFLUENT[1] (mg/L)	PERCENT REMOVAL		CALC. EFFLUENT[2] (mg/L)	EFFLUENT LIMIT (mg/L)		DISCHARGE OR PRETREAT
Organics										
1,1,2,2-Tetrachloroethane	1.300	<0.005[3]	T	$4.35x10^{-3}$	85	M	$6.53x10^{-4}$	$1.7x10^{-4}$	S	*Pretreat
1,2,4-Trichlorobenzene	4.660	--	T	$6.63x10^{-3}$	83	M	$1.13x10^{-3}$	0.01	E	Discharge
1,2-Dichlorobenzene	0.719	0.003	T	$4.02x10^{-3}$	40	M	$2.41x10^{-3}$	0.62	D	Discharge
1,4-Dichlorobenzene	0.964	<0.011[3]	T	$6.86x10^{-3}$	86	M	$9.61x10^{-4}$	0.75	D	Discharge
2,4-Dichlorophenol	0.833	--	T	$1.18x10^{-3}$	95	M	$5.92x10^{-5}$	$3x10^{-4}$	E	Discharge
Acetone (2-Propanone)	0.500	--	T	$7.11x10^{-4}$	95	M[4]	$3.55x10^{-5}$	0.05	E	Discharge
Benzene	1.740	0.001	T	$3.47x10^{-3}$	74	M	$9.03x10^{-4}$	$6.6x10^{-4}$	S	*Pretreat
Benzoic Acid	96.300	--	T	$1.37x10^{-1}$	0		$1.37x10^{-1}$	No Limit	E	Discharge
Benzyl Alcohol	0.709	--	T	$1.01x10^{-3}$	0		$1.01x10^{-3}$	No Limit	E	Discharge
Carbon Tetrachloride (Tetrachloromethane)	0.141	--	T	$2.00x10^{-4}$	50	M	$1.00x10^{-4}$	$4x10^{-4}$	D	Discharge
Chlorobenzene	3.770	<0.005[3]	T	$7.86x10^{-3}$	62	M	$2.99x10^{-3}$	0.06	D	Discharge
Chloroform	0.518	0.005	T	$5.73x10^{-3}$	80	T	$1.15x10^{-3}$	$1.9x10^{-4}$	S	*Pretreat
p-Cresol	0.161	--	T	$2.29x10^{-4}$	95	M[4]	$1.14x10^{-5}$	0.05	E	Discharge
Pentachlorobenzene	0.548	--	T	$7.79x10^{-4}$	0	M	$7.79x10^{-4}$	$7.2x10^{-7}$	E	Pretreat
Phenol	0.199	0.055	T	$5.52x10^{-2}$	85	T	$8.28x10^{-3}$	$1x10^{-3}$	E	Pretreat
Tetrachloroethylene	1.300	0.015	T	$1.68x10^{-2}$	80	T	$3.36x10^{-3}$	$8x10^{-4}$	S	*Pretreat

See notes, p. 11-25

TABLE 11-10
(continued)
CASE STUDY #2
TREATABILITY OF CERCLA WASTESTREAM AT POTW 2

POLLUTANT	SITE EFFL. CONC. (mg/L)	POTW AVG. INFL. CONC. (mg/L)		CALC. INFLUENT[1] (mg/L)	PERCENT REMOVAL		CALC. EF-FLUENT[2] (mg/L)	EFFLUENT LIMIT (mg/L)		DIS-CHARGE OR PRETREAT
Toluene	18.200	0.015	T	4.08×10^{-2}	93	T	2.86×10^{-3}	2.0	D	Discharge
Trans-1,2-dichloroethylene	0.170	0.002	T	2.24×10^{-3}	49	M	1.14×10^{-3}	0.07	D	Discharge
Trichloroethylene	0.601	0.017	T	1.78×10^{-2}	76	T	4.28×10^{-3}	2.7×10^{-3}	S	*Pretreat
Herbicides/Pesticides										
Heptachlor	0.035	0.0004	T	4.49×10^{-4}	80	M	8.98×10^{-5}	2.8×10^{-7}	S	*Pretreat
Toxaphene	0.050	--	T	7.11×10^{-5}	94	M	4.26×10^{-6}	7.1×10^{-7}	S	*Pretreat
Metals/Elements										
Calcium	225	74	T	74.2	3	T	72.0	No Limit	E	Discharge
Cobalt	0.010	0.011	T	1.10×10^{-2}	9	T	1.00×10^{-2}	0.01	E	Discharge
Iron	6.70	1.32	A	1.33	26	A	0.984	No Limit	E	Discharge
Magnesium	55.30	20	T	20.1	5	T	19.1	No Limit	E	Discharge
Manganese	0.850	0.062	T	6.32×10^{-2}	3	T	6.13×10^{-2}	0.3	E	Discharge
Nickel	0.144	--		2.05×10^{-4}	35	M	1.33×10^{-4}	1.5	L	Discharge
Selenium	0.002	<0.003[3]	T	1.50×10^{-3}	0	M	1.50×10^{-3}	0.01	S	Discharge
Sodium	89.2	131	T	131	1	T	130	No Limit	E	Discharge
Zinc	0.070	--		9.95×10^{-5}	69	M	3.08×10^{-5}	2.6	L	Discharge

See notes, p. 11-25

TABLE 11-10
(continued)
CASE STUDY #2
TREATABILITY OF CERCLA WASTESTREAM AT POTW 2

POLLUTANT	SITE EFFL. CONC. (mg/L)	POTW AVG. INFL. CONC. (mg/L)		CALC. INFLUENT[1] (mg/L)	PERCENT REMOVAL		CALC. EFFLUENT[2] (mg/L)	EFFLUENT LIMIT (mg/L)		DISCHARGE OR PRETREAT
Chromium	103.0	--		1.46×10^{-1}	80	T	2.93×10^{-2}	2.0	L	Discharge
Potassium	10.0	--	T	1.149×10^{-2}	0		1.149×10^{-2}	No Limit	E	Discharge
Conventionals										
BOD	120	103	A	103	84.0	A	17	18	P[5]	Discharge
TSS	1,300	135	T	135	87	T	17.6	30	P	Discharge
Nonconventionals										
Ammonia, As N	1.6	11.3	A	11.3	0	T	11.3	13.5	P[5]	Discharge
COD	260	328	T	328	70	T	98.4	Monitor Only	P	Discharge
Fluoride	0.72	--	T	1.07×10^{-3}	0		1.07×10^{-3}	4.00	D	Discharge
Nitrogen, Total Kjeldahl	2.1	17.16	A	17.1	15	A	14.5	Monitor Only		Discharge
Sulfide, Total (Iodometric)	2.0	--	T	2.98×10^{-3}	0		2.98×10^{-3}	0.05	E	Discharge
TDS	7300	718	T	727	0	T	727	Monitor Only	P	Discharge
TOC	89	65	T	65.0	63	T	24.1	Monitor Only	P	Discharge
Total Phosphorus, As P	0.38	3.68	A	3.68	80	A	0.736	1.0	P	Discharge

TABLE 11-10
(continued)
CASE STUDY #2
TREATABILITY OF CERCLA WASTESTREAM AT POTW 2

-- = No Data Available
A = Source: POTW Annual Report
D = Source: Maximum Contaminant Limit or Recommended Maximum Contaminant Limit
E = Source: Decision by USEPA Regional Water Permits Section
M = Source: "CERCLA Site Discharges to POTWs Treatability Manual" (USEPA 1990)
P = SPDES Permit Limit
S = Ambient Water Quality Standard
T = POTW #2 Treatability Studies
L = Local Limit on Site Influent; Not an Effluent Limit
B = No Treatability Data Available - Assuming Zero % Removal

[1]Calculated Influent Conc. (mg/L) =

$$\frac{\text{(Site Effluent Conc.) (Avg. Daily Site Flow Volume) + (POTW Avg. Infl. Conc.) (Avg. Daily POTW Flow Volume)}}{\text{(Avg. Daily Site Flow Volume + Avg. Daily POTW Flow Volume)}}$$

CERCLA waste flow - 80,000 gpd
POTW #2 low seasonal average flow - 56.2 mgd
Combined influent - 56,280,000 gpd
POTW influent concentration was assumed to be zero if no data was available.

[2]Calculated Effluent Conc. (mg/L) = (Calculated Influent Conc.) $\left(1 - \frac{\text{\% Removal}}{100}\right)$

[3]Compound present at concentrations below the detection limit. Assumed concentration is half the reported detection limit.

[4]Data obtained from 101-500-ppb influent concentration range

[5]Low seasonal limit

* Pretreatment decisions based on Ambient Water Quality Standards. NPDES permit limits need to be developed for each original compound that exceeds standards. Based on NPDES limits, pretreatment may not be required for each compound.

biological systems at leachate concentrations. The pesticides heptachlor and toxaphene, as well as the metals cobalt and selenium, are a concern; however, leachate concentrations are low, and with dilution by other wastewaters at the treatment plant, inhibitory effect is expected to be insignificant.

Table 11-10 summarizes treatability of the CERCLA wastestream at POTW 2. No local limits were in place for organic pollutants; however, reasonable conservative effluent concentration limits were compiled from MCLs for drinking water and input from the regional USEPA Water Permits Section. Fortunately, POTW 2 compiled extensive treatability data through a USEPA grant; therefore, the fate of many CERCLA wastestream contaminants in POTW 2 processes was estimated. Treatability data also provided a comprehensive background study of pollutants regularly present in POTW 2 influent.

To determine treatability of the CERCLA wastestream at POTW 2, an influent concentration was calculated for each component (see Table 11-10). The calculated influent is the product of the daily CERCLA wastestream flow and concentration, and POTW average low seasonal flow and concentration, divided by the total flow. Effluent concentration for each contaminant was determined as the difference between influent concentration and total percentage removed. Principal removal mechanisms in a POTW are volatilization, biodegradation, and partitioning to the biomass. Removal percentages for various wastestream components were compiled from POTW 2 treatability studies, the POTW 2 annual report, and the treatability of compounds information presented in previous sections of this manual. Pretreatment was elected when wastestream contaminant concentration exceeded the local limit.

For compounds without specifically regulated discharge concentrations, the pretreat-or-discharge decision is made by calculating effects of the CERCLA discharge on the quality of POTW influent and effluent. Calculated POTW effluent is compared to existing NPDES permit limits, AWQC, and drinking water standards to decide whether particular compounds in the CERCLA wastestream will be effectively treated at the POTW or whether pretreatment will be required.

The treatability table, generated during the POTW alternate screening process, was examined by USEPA, state, and POTW officials. After negotiations, the groups tentatively agreed on the list of compounds requiring pretreatment (see Table 11-10).

11.2.5. Identify and Screen Pretreatment Alternatives

11.2.5.1. Identify Pretreatment Technologies

The FS writers identified and screened pretreatment technologies, and examined pretreatment options for compounds requiring concentration reduction before discharge to POTW 2. Table 11-11 lists compounds requiring pretreatment, their chemical classes, and the effective pretreatment techniques. Appropriate unit processes for the compounds requiring pretreatment are reduction/precipitation, steam-stripping, and activated carbon treatments.

11.2.5.2. Assemble Alternative Process Train Pretreatment

The FS team proposed a pretreatment train for the CERCLA wastestream, including reduction, precipitation, and activated carbon adsorption, to effectively pretreat the wastestream while minimizing the number of processes required.

Using the checklist in Subsection 6.2, FS writers determined that their pretreatment and discharge plan would meet ARARs. The treatability calculations and pretreatment plan were presented

TABLE 11-11

CASE STUDY #2

PRETREATMENT OPTIONS FOR CERCLA WASTESTREAM

POLLUTANT	CLASS	APPLICABLE PRETREATMENT TECHNOLOGIES
1,1,2,2-Tetrachloroethane	V	Steam-stripping, activated carbon
Benzene	V	Steam-stripping, activated carbon
Chloroform	V	Steam-stripping, activated carbon
Phenol	SV(A)	Steam-stripping, activated carbon
Tetrachloroethylene	V	Steam-stripping, activated carbon
Trichloroethylene	V	Steam-stripping, activated carbon
Heptachlor	P(OH)	Activated carbon
Toxaphene	P(OH)	Activated carbon
Chromium	M+E(C)	Reduction, precipitation

to POTW 2 for comment and approval and were accepted after verification through bench-tests.

11.2.6. Detailed Analysis of the POTW Discharge Alternative

The initial screening indicated that the POTW discharge alternative will be feasible for the CERCLA wastestream. Landfill leachate will be collected, pretreated on-site in a two-step process, and transported to the POTW through the on-site domestic sewer, thereby invoking the DSE and eliminating the need for RCRA permit-by-rule procedures and other hazardous waste transporting and recordkeeping requirements. POTW, state, and USEPA officials are confident that the wastestream will be effectively treated at the POTW, based on past experience and the FS team calculations.

The POTW discharge alternative is expected to be effective in the short- and long-term, implementable, and cost-effective. It should reduce the toxicity of contaminants, protect human health and the environment, and comply with ARARs. Because POTW, state, and USEPA officials were involved in the planning, the community and state are expected to accept the alternative.

11.3. CASE STUDY #3

Case Study #3 focuses on the feasibility of treating contaminated groundwater at a CERCLA site that resulted from improper disposal practices at several dye-manufacturing companies. Remedial action objectives established in the site FS dictate that groundwater remediation must achieve applicable drinking water standards and acceptable risk levels. Based on site conditions, groundwater extraction using a series of pumping wells appears technically feasible. The FS, therefore, evaluates both on- and off-site treatability alternatives for the extracted groundwater. Included in the list of remedial alternatives was the option to discharge contaminated groundwater to a POTW. Case Study #3 includes procedures, assumptions to evaluate discharging groundwater to a POTW, and conclusions of the evaluation. This case study emphasizes the need to examine administrative feasibility of using a POTW to treat

CERCLA wastes early in the POTW screening process.

A range of contaminants was detected in groundwater samples collected during the site RI. Metal concentrations ranged from 0.0012 mg/L (mercury) to 850 mg/L (sodium), and organic compound concentrations ranged from 125 mg/L (chlorodibromomethane) to 14,000 mg/L (nitrobenzene). Two groundwater pumping scenarios were developed in the FS. The first scenario assumed a pumping rate of 1 mgd to be implemented over a three-year period. The second assumed a pumping rate of 0.1 mgd, over a 10-year period. Both pumping schemes were considered during the evaluation process.

Three POTWs located near the site (i.e., POTWs 1, 2, and 3) were evaluated, based on compliance status of the POTW, hydraulic capacity, ability of the POTW to treat waste, options available to transport waste to the POTW, distance from the site, POTW limits, ability of the POTW to treat the wastestream for the required duration, and administrative feasibility.

It was concluded, based on administrative obstacles, that discharge of CERCLA site waste to the three POTWs was not a feasible alternative. POTW 1 was eliminated because its by-laws specifically prohibit discharge of treated or untreated groundwaters to the sewer system. Its by-laws also prohibit discharge of hazardous waste generated from treatment of hazardous or toxic waste. In addition, POTW 1 is currently operating over capacity and is not in compliance with its NPDES permit. POTWs 2 and 3 were eliminated for two reasons: (1) the CERCLA site was located outside the POTW districts, and the sewer commissioner indicated that discharge originating from outside the sewerage district is prohibited; and (2) the waste would need to be sent to these POTWs via truck or dedicated pipe; therefore, the DSE would not apply. Neither POTW was willing to obtain RCRA permit-by-rule status.

11.3.1. Identify CERCLA Wastewater Discharge

The CERCLA wastewater stream to be potentially discharged and treated by a POTW consists of contaminated groundwater. Several dye-manufacturing companies contributed to the contamination through improper disposal practices. Tables 11-12 and 11-13 list contaminants and the concentrations at which they were detected. Several metals and organic compounds were detected in a wide range of concentrations.

11.3.2. Characterize CERCLA Wastewater Discharge

MCLs, the maximum permissible level of a contaminant in water delivered to any user of a public water system, are not available for most compounds detected in the groundwater. However, chromium and lead levels exceed the MCL, and trichlorethylene concentrations exceed the MCL by a factor of almost 1,000. Concentrations of other organic constituents exceed 1 mg/L; COD of the water is 290 mg/L.

The need to pump and treat groundwater was established through the risk assessment process during the RI. Two groundwater pumping scenarios were developed in the FS. The first scenario, designed to rapidly remediate the aquifer, assumed a pumping rate of 1 mgd (i.e., approximately 700 gpm) to be implemented over a three-year period through a series of extraction wells. The second scenario assumed a pumping rate of 0.1 mgd (i.e., approximately 70 gpm) over a 10-year period. Flow rates represent average daily flows generated from aquifer pumping, and are estimated to 15 percent. Decision-makers must consider both pumping schemes before selecting an extraction system in the ROD; therefore, the FS must evaluate technical and institutional issues associated with both flow rates.

TABLE 11-12

CASE STUDY #3

METALS AND CONVENTIONAL POLLUTANT CONCENTRATIONS IN GROUNDWATER

POLLUTANT	ESTIMATED DISCHARGE CONCENTRATION (mg/L)	MAXIMUM COTAMINANT LEVEL (mg/L)
Metals		
Aluminum	24	--
Arsenic	0.02	0.05
Beryllium	0.18	--
Calcium	210	--
Chromium	0.06	0.05
Cobalt	0.18	--
Copper	0.3	1.3
Iron	89	--
Lead	0.08	0.05
Magnesium	48	--
Manganese	16	--
Mercury	0.001	0.002
Nickel	0.21	--
Potassium	26	--
Sodium	850	--
Zinc	0.78	--
Conventionals		
Ammonia	6.0	--
Organic Carbon	73	--
COD	290	--
Total Phosphorus	0.18	--
Suspended Solids	1610	--

NOTE:

mg/L = milligrams per liter

TABLE 11-13

CASE STUDY #3

ORGANIC CONCENTRATIONS IN GROUNDWATER

POLLUTANT	ESTIMATED DISCHARGE CONCENTRATION (mg/L)	MAXIMUM CONTAMINANT LEVEL (mg/L)
Chlorobenzene	3,400	--
Chlorodibromomethane	125	--
Chloroethane	250	--
Trichloroethylene	4,900	5
1,2-Dichlorobenzene	2,100	--
Nitrobenzene	14,000	--
Aniline	1,900	--

NOTE:

mg/L = milligrams per liter

Determine whether CERCLA Wastestream is a RCRA-listed Hazardous Waste. RCRA regulatory status of contaminated groundwater at the site was evaluated in conjunction with the lead agency. It was clearly established that discarded material from former dye-manufacturing operations was the source of contaminants in groundwater at the site. The FS team made a case-specific assessment to determine applicability of RCRA Subtitle C regulations.

The RI from the site indicated contaminants in groundwater leached from sludge disposed of on the property and from several soil areas where aqueous residues were dumped from barrels. According to interviews with former employees, discarded waste included distillation bottoms from aniline production, process residuals from aniline extraction, and combined wastewater streams generated from nitrobenzene/aniline production. These wastes are listed hazardous under 40 CFR §261.32 (i.e, K083, K103, and K104). Interviews also revealed that aniline residuals, listed a U102, and spent solvents (i.e., F001) were dumped on the property. Because the groundwater contained these wastes and their constituents, the groundwater must be managed as a hazardous waste until it no longer contains the waste, in accordance with the "contained-in" policy.

11.3.3. Identify Potential Local POTWs

The FS team contacted the Water Management Division, Municipal Facilities Branch, and Municipal Permits Section at USEPA regional offices to obtain locations, contact names, and telephone numbers for POTWs near the site. The state water pollution control agency was contacted to provide NPDES permits for POTWs near the site and state ambient water quality standards.

A major consideration for identifying POTWs that may accept the CERCLA discharge is determining whether the CERCLA waste would be regulated as a RCRA hazardous waste and, if so, whether the DSE applies to the discharge of the waste to the POTW.

Under 40 CFR §261.4, domestic sewage, and any mixture of domestic sewage and other wastes that flow through a sewer system to a POTW, is excluded as solid waste, and therefore would not be considered hazardous waste under RCRA Subtitle C. Even if domestic sewage mixes with a known RCRA hazardous waste and flows through a sewer system to a POTW, the mixture is excluded from RCRA control.

The DSE extends to most wastes that reach POTWs; however, it does not exempt waste received within POTW property boundaries by truck, rail, or dedicated pipeline. The DSE is only applicable to any solid wastes that mix with sanitary wastes in a sewer system leading to a POTW. USEPA ruled that waste falls within the DSE when it first enters a sewer system in which mixing with sanitary wastes will occur before receipt by a POTW (Federal Register, 1980).

In this instance, a sewer main passes along the road to the site; abandoned buildings on the site property were connected to the sewer line to discharge sanitary wastewater and some process wastewaters. The sewer line transports wastewater to a large metropolitan wastewater treatment facility (i.e., POTW 1) 20 miles east of the site. Discharge of the groundwater into this sewer would be covered by the DSE.

State officials identified two other POTWs within a 15-mile radius of the site (i.e., POTWs 2 and 3). Because no existing sewer line connects these plants to the site, pumped groundwater would need to be sent to these POTWs via truck or dedicated pipe. Therefore, DSE would not apply and the waste would have to be disposed of as a RCRA waste. These two POTWs are not currently RCRA Permit-by-Rule facilities. The following descriptions summarize POTWs 1, 2, and 3.

- POTW 1 is 20 miles east of the site; a domestic sanitary sewer line runs from the site to the treatment facility. Discharge of the groundwater into the sewer line would be covered by the DSE.

- POTW 2 is 15 miles from the site. No existing sewer line connects the site to the facility. If the groundwater is transported by truck, rail, or dedicated pipe, the POTW must become a RCRA permit-by-rule facility.

- POTW 3 is 15 miles from the site. No existing sewer line connects the site to the facility. If the groundwater is transported by truck, rail, or dedicated pipe, the POTW must become a RCRA permit-by-rule facility.

11.3.4. Involve POTW in the Evaluation Process and Screen POTWs

11.3.4.1. Determine Compliance Status

The first step in initially screening the three POTWs is to determine compliance status of each treatment plant. A compliance evaluation was done for each POTW by using the compliance checklist in Table 4-1, and consulting with an official from each POTW. Results of the evaluation indicated that POTW 1 exceeded its hydraulic capacity and periodically exceeds its NPDES permit limits for suspended solids, fecal coliform, and BOD. POTW 2 is currently in compliance with its NPDES permit, pretreatment program requirements, and all other applicable RCRA requirements or other laws. Although POTW 3 was generally in compliance, the facility is composting its sludge on-site and has received negative publicity due to significant odor

TABLE 11-14

CASE STUDY #3

SCREENING POTENTIAL POTWs

CERCLA WASTESTREAM DISCHARGE AND TREATMENT

EVALUATING TECHNICAL FEASIBILITY

CRITERIA	POTWS		
	1	2	3
Does the POTW have hydraulic capacity to handle additional CERCLA flow?	No	Yes	Yes
Are unit operations suitable for treatment of contaminants in the CERCLA wastestream?	Yes	Yes	Yes
Is there a domestic sanitary sewer piping system running from the site to the POTW and will the DSE apply?	Yes	No	No
Is the POTW a RCRA Permit-by-Rule facility?	No	No	No
Distance from the site to POTW? (miles)	20.0	15.0	15.0
POTW sludge disposal process?	Composting	Landfill	Composting
Could the POTW treat the CERCLA wastestream for the time duration required?	No	No	No

problems. There was no information at any of the candidate facilities indicating a significant potential for groundwater contamination from impoundment of the CERCLA wastewater.

11.3.4.2. Consider Technical Feasibility

The second step of the initial screening is determining whether each POTW can technically accept the waste. Table 11-14 summarizes technical information obtained from each POTW. Officials at the water resource authority for POTW 1 indicated that the treatment facility flow is over capacity and therefore could not accept the waste.

POTWs 2 and 3 serve the northern and southern portions (respectively) of a small city, and both receive domestic and industrial wastewater. No existing sewer line connects these plants to the site; the FS team considered installing a dedicated pipe from the site to the POTW sewer systems. Both POTWs are operating near capacity, but were not excluded as potential receivers of the waste.

The FS team determined it would not be feasible to truck or pipe wastewater to POTWs located outside the 15-mile radius of the site, based on the anticipated flow rates of wastewater from the site and the projected costs for trucking or building a dedicated pipe from the site to the sewer connection. Therefore, additional local POTWs were not contacted.

11.3.4.3. Consider Administrative Feasibility

The third step of the initial screening is to consider administrative feasibility of discharging the waste to the POTWs. When the sewer commission responsible for overseeing operations at POTWs 2 and 3 was contacted, the commissioner indicated that the two POTWs are not willing to comply with the additional requirements to become RCRA permit-by-rule facilities. In addition, both POTWs prohibit discharges originating from outside the sewerage district. Both plants currently operate close to capacity; therefore, the sewer commission would not consider exemptions to this by-law. Discharge to POTWs 2 and 3 was deemed administratively infeasible.

The FS team considered discharge to other POTWs beyond the initial 15-mile radius. On the basis of a preliminary screening, this option was considered significantly less cost-effective than on-site groundwater treatment by more conventional systems (e.g., air-stripping or granular activated carbon).

11.3.5. Conclusion

Because administrative obstacles were encountered at each POTW, use of a POTW to treat the contaminated groundwater at the site is not a viable alternative; further discussions with local POTWs were discontinued. POTW 1 was eliminated because it had difficulties meeting compliance standards and is currently operating over capacity. POTWs 2 and 3 were eliminated because neither POTW was willing to become a RCRA permit-by-rule facility and each prohibits discharges originating from outside the sewer district. In addition, POTWs 2 and 3 are operating near capacity; therefore, the sewer commission would not consider exemption to this by-law.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BOD	biological oxygen demand
BPJ	Best Professional Judgment
BPT	Best Practicable Control Technology Currently Available
CAS	Chemical Abstract System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COD	chemical oxygen demand
CWA	Clean Water Act
DCE	dichloroethene
DSE	Domestic Sewage Exclusion
DSS	Domestic Sewage Study
ELGs	effluent limits guidelines
EP	Extraction Procedure (toxicity)
FS	Feasibility Study
FWPCA	Federal Water Pollution Control Act
GC	gas chromatography
gpd	gallons per day
gpm	gallons per minute
ITD	Industrial Technology Division
kg/day	kilogram per day
K_{ow}	Octanol/water partition coefficient
MCL	Maximum Contaminant Level
mgd	million gallons per day

mg/L	milligrams per liter
MLVSS	mixed liquor volatile suspended solids
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PCB	polychlorinated biphenyl
PHE	Public Health Evaluation
POTW	Publicly Owned Treatment Works
ppb	parts per billion
PRP	potentially responsible party
RAR	relevant and appropriate requirement
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act
SVOC	semivolatile organic compound
TCL	Target Compound List
TCLP	Toxic Characteristic Leaching Procedure
TIE	toxicity identification evaluation
TRE	toxicity reduction evaluation
TSD	treatment, storage, and disposal
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

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APPENDIX A

USEPA OFF-SITE POLICY

United States
Environmental Protection
Agency

Office of
Solid Waste and
Emergency Response

EPA

DIRECTIVE NUMBER: 9834.11

TITLE: Revised Procedures for Implementing Off-Site Response Actions

APPROVAL DATE: November 13, 1987

EFFECTIVE DATE: November 13, 1987

ORIGINATING OFFICE: Office of Waste Programs Enforcement

☒ **FINAL** (Interim)

☐ **DRAFT**

LEVEL OF DRAFT

- ☒ A — Signed by AA or DAA
- ☐ B — Signed by Office Director
- ☐ C — Review & Comment

REFERENCE (other documents):

SWER OSWER OSWER
DIRECTIVE DIRECTIVE DI

EPA

United States Environmental Protection Agency
Washington, DC 20460

OSWER Directive Initiation Request

1. Directive Number
9834.11

2. Originator Information

Name of Contact Person	Mail Code	Office	Telephone Code
NANCY BROWNE	WH-527	RM 2830	475-9326

3. Title

Revised Procedures for Implementing Off-Site Response Actions

4. Summary of Directive (include brief statement of purpose)

This Directive describes procedures that should be observed when a response action under CERCLA or Section 7003 of RCRA involves the off-site treatment, storage or disposal of CERCLA waste.

5. Keywords

Off-Site Policy, Off-Site Waste, CERCLA Waste, Off-Site Management of Waste

6a. Does This Directive Supersede Previous Directive(s)? ☐ No ☒ Yes (xx)

What directive (number, title)

1) Procedures for Planning & Impl. off-site Response Actions.
2) Providing Notice to Facilities (9330.2-5)
3) Eligibility of Facilities in Assessment Monitoring (9330.2-6)

b. Does It Supplement Previous Directive(s)? ☐ No ☐ Yes

7. Draft Level

☐ A – Signed by AA/DAA ☐ B – Signed by Office Director ☐ C – For Review & Comment ☐ D – In Development

8. Document to be distributed to States by Headquarters? ☐ Yes ☒ No

This Request Meets OSWER Directives System Format Standards.

9. Signature of Lead Office Directives Coordinator	Date
[signature]	11/13/87
10. Name and Title of Approving Official	**Date**
[signature] Acting	11/13/87

EPA Form 1315-17 (Rev. 5-87) Previous editions are obsolete.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

November 13, 1987

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Revised Procedures for Planning and Implementing Off-site Response Actions

FROM: J. Winston Porter
Assistant Administrator

TO: Regional Administrators
Regions I-X

With this memo I am transmitting the revised procedures for planning and implementing off-site response actions (the "off-site policy"). These procedures should be observed when a response action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Section 7003 of the Resource Conservation and Recovery Act (RCRA) involves off-site treatment, storage or disposal of CERCLA waste.

This policy incorporates all of the mandates of CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) and expands several of the more stringent requirements when applying them to wastes resulting from CERCLA decision documents signed, and RCRA section 7003 actions initiated, after the enactment of SARA. This revised policy also reinterprets the original off-site policy, issued in May 1985, as it applies to CERCLA wastes resulting from decision documents signed, and RCRA section 7003 actions initiated, before the enactment of SARA.

This revised policy is effective immediately upon issuance. It is considered to be an interim final policy as key elements of the policy will be incorporated in a proposed rule to be published in the Federal Register. As part of that rulemaking, the policy will be subject to public comment. Comments received during that period may cause additional revisions to the policy.

If you have comments regarding this revised policy, please contact Gene Lucero, Director, Office of Waste Programs Enforcement.

cc: Waste Management Division Directors
Regions I-X

REVISED PROCEDURES FOR IMPLEMENTING OFF-SITE RESPONSE ACTIONS

I. INTRODUCTION

The off-site policy describes procedures that should be observed when a response action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Section 7003 of RCRA involves off-site storage, treatment or disposal of CERCLA waste. The procedures also apply to actions taken jointly under CERCLA and another statute.

The purpose of the off-site policy is to avoid having CERCLA wastes contribute to present or future environmental problems by directing these wastes to facilities determined to be environmentally sound. It is EPA's responsibility to ensure that the criteria for governing off-site transfer of CERCLA waste result in decisions that are environmentally sensible and that reflect sound public policy. Therefore, in developing acceptability criteria, the Agency has applied environmental standards and other sound management practices to ensure that CERCLA waste will be appropriately managed.

EPA issued the original off-site policy in May 1985. See "Procedures for Planning and Implementing Off-Site Response Actions", memorandum from Jack W. McGraw to the Regional Administrators. That policy was published in the Federal Register on November 5, 1985. The 1986 amendments to CERCLA, the Superfund Amendments and Reauthorization Act (SARA), adopted EPA's policy for off-site transfer of CERCLA wastes, with some modifications. CERCLA §121(d)(3) requires that hazardous substances, pollutants or contaminants transferred off-site for treatment, storage or disposal during a CERCLA response action be transferred to a facility operating in compliance with §§3004 and 3005 of RCRA and other applicable laws or regulations. The statute also requires that receiving units at land disposal facilities have no releases of hazardous wastes or hazardous constituents. Any releases from other units at a land disposal facility must also be controlled by a RCRA or equivalent corrective action program. While the original policy required compliance with RCRA and other applicable laws, SARA goes beyond the original policy, primarily by prohibiting disposal at units at a land disposal facility with releases, rather than allowing the Agency to judge whether the releases constituted environmental conditions that affected the satisfactory operation of a facility.

The off-site policy has been revised in light of the mandates of SARA. This revised policy also extends the SARA concepts to certain situations not specifically covered by the statute. These requirements apply to CERCLA decision documents signed, and RCRA §7003 actions taken, after enactment of SARA. Specifically, this policy covers:

- Extending SARA's "no release" requirement to all RCRA units receiving CERCLA waste, not just units at RCRA land disposal facilities;

- Expanding SARA's release prohibition to include releases of CERCLA hazardous substances, in addition to releases of RCRA hazardous waste and hazardous constituents;

- Addressing releases from other units at RCRA treatment and storage facilities; and

- Addressing off-site transfer to non-RCRA facilities.

The revised policy also reinterprets the May 1985 policy as it now applies to CERCLA decision documents signed, and RCRA §7003 actions taken, prior to the enactment of SARA.

The revised off-site policy is effective immediately upon issuance. It is considered to be an interim policy as key elements of the policy will be incorporated in a proposed rule to be published in the Federal Register. As part of that rulemaking, the policy will be subject to public comment. Comments received during that period may cause additional revisions to the policy. The final rule will reflect the final policy under CERCLA §121(d)(3) and EPA will issue a revised implementation policy memorandum if necessary.

II. APPLICABILITY

There are a number of variables which will determine whether and how the off-site policy applies: waste type, authority, funding source, and whether the decision document or order supporting the clean-up was signed before or after the enactment of SARA (i.e., before or after October 17, 1986). In order to determine which elements of the policy apply to a specific CERCLA cleanup each factor must be considered.

The first factor to consider is the type of waste to be transferred. The revised policy applies to the off-site treatment, storage or disposal of all CERCLA waste. CERCLA wastes include RCRA hazardous wastes and other CERCLA hazardous substances, pollutants and contaminants. RCRA hazardous wastes are either listed or defined by characteristic in 40 CFR Part 261. CERCLA hazardous substances are defined in 40 CFR 300.6.

Because RCRA permits and interim status apply to specific wastes and specific storage, treatment or disposal processes, the Remedial Project Manager (RPM) or On-Scene Coordinator (OSC) must determine that the facility's permit or interim status authorizes receipt of the wastes that would be transported to the facility and the type of process contemplated for the wastes. Therefore, it is important that facility selection be coordinated with RCRA personnel.

A CERCLA hazardous substance that is not a RCRA hazardous waste or hazardous constituent (i.e., non-RCRA waste) may be taken to a RCRA facility if it is not otherwise incompatible with the RCRA waste, even though receipt of that waste is not expressly authorized under interim status or in the permit. Non-RCRA wastes can also be managed at non-RCRA facilities. Criteria applicable to CERCLA wastes that can be disposed of at non-Subtitle C facilities are discussed later in this revised policy.

The second factor to consider in determining whether this revised policy applies is the statutory authority for the action. This revised off-site policy applies to any remedial or removal action involving the off-site transfer of any hazardous substance, pollutant, or contaminant under any CERCLA authority or under RCRA §7003. This policy also applies to response actions taken under §311 of the Clean Water Act, except for cleanups of petroleum products. The policy also covers cleanups at Federal facilities under §120 of SARA.

The third factor to assess is the source of funding. The revised policy applies to all Fund-financed response actions, whether EPA or the State is the lead agency. The policy does not apply to State-lead enforcement actions (even at NPL sites) if no CERCLA funds are involved. It does apply to State-lead enforcement actions where EPA provides any site-specific funding through a Cooperative Agreement or Multi-Site Cooperative Agreement, even though the State may be using its own enforcement authorities to compel the cleanup. Similarly, non-NPL sites are covered by this policy only where there is an expenditure of Fund money or where the cleanup is undertaken under CERCLA authority.

The final factor that affects how this revised policy applies is the date of the decision document. As noted earlier, there are two classes of actions subject to slightly different procedures governing off-site transfer: first, those actions resulting from pre-SARA decision documents or RCRA §7003 orders issued prior to October 17, 1986, are subject to the May 1985 policy as updated by this revised policy; and second, those actions resulting from post-SARA decision documents or RCRA §7003 orders issued after October 17, 1986, are subject to the requirements of SARA as interpreted and expanded by this revised policy. Although the procedures in this policy are similar for these two classes of actions, there are important differences (e.g., the requirements pertaining to releases from other units at a facility) that will be highlighted throughout this document.

Compliance with the revised procedures is mandatory for removal and remedial actions. However, there is an emergency exemption for removals if the OSC determines that the exigencies of the situation require off-site treatment, storage or disposal without following the requirements. This exception may be used when the OSC believes that the threat posed by the substances makes it imperative to remove the substances immediately and there is insufficient time to observe these procedures without endangering public health, welfare or the environment. In such cases, the OSC should consider temporary solutions (e.g., interim storage) to allow time to locate an acceptable facility. The OSC must provide a written explanation of his or her decision to use this emergency exemption to the Regional Administrator within 60 days of taking the action. In Regions in which authority to make removal decisions has not been fully delegated by the Regional Administrator to the OSC, the decisions discussed above must be made by the Regional official to whom removal authority has been delegated. This emergency exemption is also available to OSC's taking response actions under §311 of the Clean Water Act.

III. DEFINITIONS

A. Release

For the purposes of this policy, the term "release" is defined here as it is defined by §101(22) of CERCLA, which is repeated in 40 CFR 300.6 of the NCP, and the RCRA §3008(h) guidance ("Interpretation of Section 3008(h) of the Solid Waste Disposal Act", memorandum from J. Winston Porter and Courtney M. Price to the Regional Administrators, et al, December 16, 1985). To summarize, a release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injection, escaping, leaching, dumping or disposing to the environment. This includes releases to surface water, ground water, land surface, soil and air.

A release also includes a substantial threat of a release. In determining whether a substantial threat of release exists, both the imminence of the threat and the potential magnitude of the release should be considered. Examples of situations where a substantial threat of a release may exist include a weakened or inadequately engineered dike wall at a surface impoundment, or a severely rusted treatment or storage tank.

De minimis releases from receiving units are exempt; that is, they are not considered to be releases under the off-site policy. De minimis releases are those that do not adversely affect public health or the environment, such as releases to the air from temporary opening and closing of bungs, releases between landfill liners of 1 gallon/acre/day or less, or stack emissions from incinerators not otherwise subject to Clean Air Act permits. Releases that need to be addressed by implementing a contingency plan would not normally be considered de minimis releases.

Federally-permitted releases, as defined by CERCLA §101(10) and 40 CFR 300.6, are also exempt. These include discharges or releases in compliance with applicable permits under RCRA, the Clean Water Act, Clean Air Act, Safe Drinking Water Act, Marine Protection, Research and Sanctuaries Act, and Atomic Energy Act or analogous State authorities.

For purposes of this policy, an interim status unit in RCRA ground-water assessment monitoring (under 40 CFR 265.93) or a permitted unit in compliance monitoring (under 40 CFR 264.99) is not presumed to have a release. EPA will evaluate available information, including the data which led to a determination of the need for assessment or compliance monitoring, data gathered during assessment monitoring, and any other relevant data, including that gathered from applicable compliance inspections. A determination of unacceptability should be made when information will support the conclusion that there is a probable release to ground water from the receiving unit. Finding a release can happen at any time before, during or after an assessment or compliance monitoring program.

On the other hand, it is not necessary to have actual sampling data to determine that there is a release. An inspector may find other evidence that a release has occurred, such as a broken dike or feed line at a surface impoundment. Less obvious indications of a release might also be adequate to make the determination. For example, EPA could have sufficient information on the contents of a land disposal unit, the design and operating characteristics of the unit, or the hydrogeology of the area in which the unit is located to conclude that there is or has been a release to the environment.

B. Receiving Unit

The receiving unit is any unit that receives off-site CERCLA waste:

(1) for treatment using BDAT, including any pre-treatment or storage units used prior to treatment;

(2) for treatment to substantially reduce its mobility,

toxicity or persistence in the absence of a defined BDAT or

(3) for storage or ultimate disposal of waste not treated to the previous criteria.

Note that the acceptability criteria may vary from unit to unit, and that the receiving unit may vary from transfer to transfer.

C. Other Units

Other units are all other regulated units and solid waste management units (SWMU's) at a facility that are not receiving units.

D. Controlled Release

In order to be considered a controlled release, the release must be addressed by a RCRA corrective action program (incorporated in a permit or order) or a corrective action program approved and enforceable under another applicable Federal or delegated State authority.

E. Relevant Violations

Relevant violations include Class I violations as defined by the RCRA Enforcement Response Policy (December 21, 1984, and subsequent revisions) at or affecting a receiving unit. A Class I violation is a significant deviation from regulations, compliance order provisions or permit conditions designed to:

- Ensure that hazardous waste is destined for and delivered to authorized facilities;
- Prevent releases of hazardous waste or constituents to the environment;
- Ensure early detection of such releases; or
- Compel corrective action for releases.

Recordkeeping and reporting requirements (such as failure to submit the biennial report or failure to maintain a copy of the closure plan at the facility) are generally not considered to be Class I violations.

Violations affecting a receiving unit include all ground-water monitoring violations unless the receiving unit is outside the waste management area which the ground-water monitoring system was designed to monitor. Facility-wide Class I violations (such as failure to comply with financial responsibility requirements, inadequate closure plan, inadequate waste analysis plan, inadequate inspection plan, etc.) that affect the receiving unit are also relevant violations.

Violations of State or other Federal laws should also be examined for relevance, considering the significance of the requirement that is being violated; the extent of deviation from the requirement; and the potential or actual threat to human health or the environment.

F. Relevant Release

A relevant release under this revised policy includes:

- Any release or significant threat of release of a hazardous substance (defined in 40 CFR 300.6) not previously excluded (i.e., de minimis releases or permitted releases) at all units of a RCRA Subtitle C land disposal facility and at receiving units of a RCRA Subtitle C treatment or storage facility; and

- Environmentally significant releases of any hazardous substance not previously excluded at non-receiving units at RCRA Subtitle C treatment and storage facilities and at all units at other facilities.

G. Relevant Conditions

Relevant conditions include any environmental conditions (besides a relevant violation) at a facility that pose a significant threat to public health, welfare or the environment or that otherwise affect the satisfactory operation of the facility.

H. Responsible Agency

Determinations of acceptability to receive an off-site transfer of CERCLA waste will be made by EPA or by States authorized for corrective action under §3004(u) of RCRA. References in this document to the "responsible Agency" refer only to EPA Regions or to States with this authority.

I. Responsible Government Official

The responsible government official is that person authorized in the responsible Agency to make acceptability determinations under this revised policy.

IV. ACCEPTABILITY CRITERIA

A. Acceptability Criteria for Wastes Generated Under Pre-SARA Decision Documents

CERCLA wastes from actions resulting from pre-SARA decision documents and pre-SARA RCRA §7003 orders may go to a facility meeting the following criteria:

- o There are no relevant violations at or affecting the receiving unit; and
- o There are no relevant conditions at the facility (i.e., other environmental conditions that pose a significant threat to public health, welfare or the environment or otherwise affect the satisfactory operation of the facility).

In order to determine if there is a relevant violation, an appropriate compliance inspection must be conducted no more than six months before the expected date of receipt of CERCLA waste. This inspection, at a minimum, must address all regulated units. This inspection may be conducted by EPA, a State or an authorized representative. When a State conducts the inspection, it should determine the facility's compliance status. Where a violation or potential violation comes to EPA's attention (e.g., through a citizen complaint or a facility visit by permit staff), the Region or State is expected to investigate whether a violation occurred as soon as is reasonably possible.

The May 1985 policy does not refer specifically to releases. Rather, a corrective action plan is required for relevant conditions. Therefore, in some cases, a facility receiving CERCLA wastes from an action subject to a pre-SARA decision document may not need to institute a program to control releases. Releases will be evaluated by the responsible Agency to determine whether such releases constitute relevant conditions under this policy.

The activities related to determining acceptability, providing notice to facilities, regaining acceptability and implementation procedures are discussed in the "Implementation" section of this document, and apply to off-site transfers of waste generated under pre-SARA and post-SARA decision documents.

B. Acceptability Criteria for Wastes Generated Under Post-SARA Decision Documents

Under this revised policy, there are three basic criteria that are used to determine the acceptability of a facility to receive off-site transfers of CERCLA waste generated under a post-SARA decision document or post-SARA RCRA §7003 cleanup. The criteria are:

- There must be no relevant violations at or affecting the receiving unit;
- There must be no releases from receiving units and contamination from prior releases at receiving units must be addressed as appropriate; and
- Releases at other units must be addressed as appropriate.

The last two criteria are applied somewhat differently, depending on the type of facility. These differences are described below.

1. Criteria Applicable to All RCRA Subtitle C Treatment, Storage and Disposal Facilities. The first criterion that applies to all Subtitle C facilities is that there can be no relevant violations at or affecting the receiving unit. As discussed earlier, this determination must be based on an inspection conducted no more than six months prior to receipt of CERCLA waste.

A second element that applies to all Subtitle C facilities is that there must be no releases at receiving units. Releases from receiving units, except for *de minimis* releases and State- and Federally-permitted releases, must be eliminated and any prior contamination from the release must be controlled by a corrective action permit or order under Subtitle C, as described in the next section.

The final criterion that applies to all Subtitle C facilities, is that the facility must have undergone a RCRA Facility Assessment (RFA) or equivalent facility-wide investigation. This investigation addresses EPA's affirmative duty under CERCLA §121(d)(3) to determine that there are no releases at the facility.

Releases of RCRA hazardous waste or hazardous constituents and CERCLA hazardous substances are all included under the policy. While the RFA need not focus on identifying releases of hazardous substances that are not RCRA hazardous wastes or hazardous constituents, to the extent such releases are discovered in an RFA or through other means, they will be considered the same as a release of hazardous waste or hazardous constituents.

o <u>Additional Criteria Applicable to RCRA Subtitle C Land Disposal Facilities</u>. Land disposal facilities must meet additional requirements imposed by SARA and this policy. The term "land disposal facility" means any RCRA facility at which a land disposal unit is located, regardless of whether the land disposal unit is the receiving unit. Land disposal units include surface impoundments, landfills, land treatment units and waste piles.

As stated earlier, there must be no releases at or from receiving units. In addition, releases from other units at a land disposal facility must be controlled under a corrective action program. The RFA will help determine whether there is a release. In addition, land disposal facilities must have received a comprehensive ground-water monitoring evaluation (CME) or an operation and maintenance (O&M) inspection within the last year.

Units at RCRA Subtitle C land disposal facilities receiving CERCLA waste that is also RCRA hazardous waste must meet the RCRA minimum technology requirements of RCRA §3004(o). Only where a facility has been granted a waiver can a land disposal unit not meeting the minimum technology requirements be considered acceptable for off-site disposal of CERCLA waste that is RCRA hazardous waste.

o <u>Criteria Applicable to Subtitle C Treatment and Storage Facilities</u>. The criterion for controlling releases from other units does not apply to all releases at treatment and storage facilities, as it does at land disposal facilities. Releases from other units at treatment and storage facilities must be evaluated for environmental significance and their effect on the satisfactory operation of the facility. If determined by the responsible Agency to be environmentally significant, releases must be controlled by a corrective action program under an applicable authority. Releases from other units at treatment and storage facilities determined not to be environmentally significant do not affect the acceptability of the facility for receipt of CERCLA waste.

2. <u>Criteria Applicable to RCRA Permit-by-Rule Facilities</u>. This revised policy is also applicable to facilities subject to the RCRA permit-by-rule provisions in 40 CFR 270.60. These include ocean disposal barges or vessels, injection wells and publicly owned treatment works (POTWs). Permit-by-rule facilities receiving RCRA hazardous waste must have a RCRA permit or RCRA interim status. RCRA permit-by-rule facilities must also receive an inspection for compliance with applicable RCRA permit or interim status requirements. In addition, these

facilities (and other non-RCRA facilities) should be inspected by the appropriate inspectors for other applicable laws.

In general, except for POTWs (discussed below), these facilities will be subject to the same requirements as RCRA treatment and storage facilities. That is, there can be no releases of hazardous waste, hazardous constituents or hazardous substances from receiving units. There also can be no relevant violations at or affecting the receiving unit, as confirmed by an inspection conducted no more than six months prior to the receipt of CERCLA waste. Releases from other units determined by the responsible Agency to be environmentally significant must be controlled by an enforceable agreement under the applicable authority.

Criteria for discharge of wastewater from CERCLA sites to POTWs can be found in a memorandum titled, "Discharge of Wastewater from CERCLA Sites into POTWs," dated April 15, 1986. That memorandum requires an evaluation during the RI/FS process for the CERCLA site to consider such points as:

- the quantity and quality of the CERCLA wastewater and its compatibility with the POTW;
- the ability of the POTW to ensure compliance with applicable pretreatment standards;
- the POTWs record of compliance with its NPDES permit; and
- the potential for ground-water contamination from transport to or impoundment of CERCLA wastewater at the POTW.

Based on a consideration of these and other points listed in the memorandum, the POTW may be deemed appropriate or inappropriate for receipt of CERCLA waste.

3. Criteria Applicable to Non-Subtitle C Facilities. In some instances, it may be appropriate to use a non-Subtitle C facility for off-site transfer: for example, PCB disposal is regulated under the Toxic Substances Control Act (TSCA); nonhazardous waste disposal is regulated under Subtitle D of RCRA and applicable State laws; and disposal of radionuclides is regulated under the Atomic Energy Act. At such facilities, all releases are treated in the same manner as releases from other units at Subtitle C treatment and storage facilities. That is, the responsible Agency should make a determination as to whether the release is environmentally significant and, if so, the release should be controlled by a corrective action program under the applicable Federal or State authority.

Requirements for the disposal of PCBs are established in 40 CFR 761.60. Generally, these regulations require that whenever disposal of PCBs is undertaken, they must be incinerated, unless the concentrations are less than 50 ppm. If the concentrations are between 50 and 500 ppm, the rule provides for certain exceptions that provide alternatives to the incineration requirements. The principal alternative is disposal in a TSCA-permitted landfill for PCBs. If a TSCA landfill is the receiving unit for PCBs, then that facility is subject to the same criteria applicable if a RCRA land disposal unit is the receiving unit; i.e., no relevant violations, no releases at the receiving unit and controlled releases at other units. PCBs at levels less than 50 ppm may be transported to acceptable Subtitle D facilities as discussed previously.

V. IMPLEMENTATION

A. Determining Acceptability

Acceptability determinations under the off-site policy will be made by EPA or by States authorized for corrective action under §3004(u) of RCRA. Where States have such authority, the State may make acceptability determinations for facilities in the State in consultation with EPA. Regardless of a State's authorization status, the Region and States should establish, in the Superfund Memorandum of Agreement, mechanisms to ensure timely exchange of information, notification of facilities and coordination of activities related to the acceptability of facilities and potential selection of facilities for off-site transfer. The Regions and States also need to establish or enhance coordination mechanisms with their respective RCRA program staffs in order to ensure timely receipt of information on inspections, violations and releases. These agreements can be embodied in State authorization Memoranda of Agreement, State grant agreements, or State-EPA enforcement agreements.

The responsible government official in the Region or State in which a hazardous waste facility is located will determine whether the facility has relevant violations or releases which may preclude its use for off-site transfer of CERCLA wastes. Each Region and State should have a designated off-site coordinator responsible for ensuring effective communication between CERCLA response program staff and RCRA enforcement staff within the Regional Offices, with States, and with other Regions and States.

The off-site coordinator should maintain a file of all information on the compliance and release status of each commercial facility in the Region or State. This information should be updated based on the results of State- or

EPA-conducted compliance inspections or other information on these facilities.

CERCLA response program staff should identify potential off-site facilities early in the removal action or the remedial design process and check with the appropriate Regional and/or State off-site coordinator(s) regarding the acceptability status of the facilities. If one or more facilities is identified that has not received an inspection within the last six months, the Regional off-site coordinator(s) should arrange to have such inspection(s) conducted within a timeframe dictated by the project schedule. The CERCLA REM/FIT contractor may conduct the inspection under the direction of the Deputy Project Officer. If contractor personnel are used, the Region should ensure that such personnel are adequately trained to conduct the inspections.

Responsible Agencies should base their acceptability determinations on an evaluation of a facility's compliance status and, as appropriate, whether the facility has releases or other environmental conditions that affect the satisfactory operation of the facility. States not authorized for HSWA corrective action may assist EPA in making the acceptability determination by determining a facility's compliance status (based on a State inspection) and providing this information to EPA. Regions and States should use the following types of information to make acceptability determinations:

- <u>State- or EPA-conducted inspections</u>. EPA will continue to assign high priority to conducting inspections at commercial land disposal, treatment and storage facilities. Facilities designated to receive CERCLA waste must be inspected within six months of the planned receipt of the waste. In addition, land disposal facilities must have received a comprehensive ground-water monitoring inspection (CME) or an operation and maintenance (O&M) inspection within the last year, in accordance with the timeframes specified in the RCRA Implementation Plan (RIP).

- <u>RCRA Facility Assessments (RFAs)</u>. To be eligible under this policy, a RCRA Subtitle C facility must have had an RFA or equivalent facility-wide investigation. The RFA or its equivalent must be designed to identify existing and potential releases of hazardous waste and hazardous constituents from solid waste management units at the facility.

- <u>Other data sources</u>. Other documents such as the facility's permit application, permit, Ground Water Task Force report, ground-water monitoring data or ground-water assessment report can contain information on violations, releases or other conditions. Relevant information from these documents should also be used to determine a facility's acceptability to receive waste under the off-site policy.

B. Notice Procedures

EPA expects that Regions and States will take timely and appropriate enforcement action on determining that a violation has occurred. Where a responsible Agency performs an inspection that identifies a relevant violation at a commercial facility likely to accept CERCLA wastes, within five working days of the violation determination, the responsible Agency must provide written notice to the facility of the violation and the effects of applying this policy. States not authorized for HSWA corrective action should inform EPA of the violation so that EPA can notify the facility of the effect of the violation under this policy. (See RCRA Enforcement Response Policy for a discussion of appropriate enforcement responses and timeframes for Class I violations.)

When the responsible Agency determines that a relevant release has occurred, or that relevant conditions exist, the responsible Agency must notify the facility in writing within five working days of that determination. The notice must also state the effect of the determination under this policy. A copy of any notice must also be provided to the non-issuing Region or State in which the facility is located. States not authorized for HSWA corrective action should provide EPA with information on releases so that EPA can determine whether a relevant release has occurred.

Private parties conducting a response action subject to this policy will need to obtain information on the acceptability of commercial facilities. The responsible Agency must respond with respect to both pre-SARA and post-SARA wastes. In addition, the responsible Agency should indicate whether the facility is currently undergoing a review of acceptability and the date the review is expected to be completed. No enforcement sensitive or predecisional information should be released.

A facility may submit a bid for receipt of CERCLA waste during a period of unacceptability. However, a facility must be acceptable in order to be awarded a contract for receipt of CERCLA waste.

Scope and Contents of the Notice. The responsible Agency must send the notice to the facility owner/operator by certified and first-class mail, return receipt requested. The certified notice, if not acknowledged by the receipt return card, will be considered to have been received by the addressee if properly sent by first-class mail to the last address known to the responsible Agency. The notice should contain the following:

- o A finding that the facility may have conditions that render it unacceptable for receipt of off-site waste, based upon available information from an RFA, an inspection, or other data sources;

- o A description of the specific acts, omissions or conditions that form the basis of the findings;

- o Notice that the facility owner/operator has the opportunity to request an informal conference with the responsible government official to discuss the basis for the facility's unacceptability determination under this revised policy, provided that such a request is made within 10 calendar days from the date of the notice. The owner/operator may submit written comments within 30 calendar days from the date of the notice in lieu of holding the conference.

- o Notice that failure to request an informal meeting or submit written comments will result in no further consideration of the determination by the responsible Agency during the 60 calendar days after issuance of the notice. The responsible Agency will cease any transport of CERCLA waste to the facility on the 60th calendar day after issuance of the notice.

- o Notice that the owner/operator may request, within 10 calendar days of hearing from the responsible government official after the informal conference or the submittal of written comments, a reconsideration of the determination by the Regional Administrator or appropriate State official. The Regional Administrator or State official may agree to review the determination at his or her discretion; and

- o Notice that such a review by the Regional Administrator or appropriate State official, if agreed to, will be conducted within 60 calendar days of the initial notice, if possible, but that the review will not stay the determination.

The facility may continue to receive CERCLA waste for 60 calendar days after issuance of the initial notice. As indicated above, facility owners or operators may request an informal conference with the responsible government official within 10 calendar days from the date of issuance of the notice, to discuss the basis for a violation or release determination and its relevance to the facility's acceptability to receive CERCLA wastes. Any such meeting should take place within 30 calendar days of the date the initial notice is issued. If unacceptability is based on a State inspection or enforcement action, a representative of the State should attend the meeting. If the State does not attend, EPA will notify the State of the outcome of the meeting. The owner/opeator may submit written comments within 30 calendar days from the date of the notice in lieu of holding the conference. If the responsible Agency does not find that the information submitted at the informal conference or in comments is sufficient to support a finding of acceptability to receive CERCLA wastes, it should so inform the facility orally or in writing.

Within 10 calendar days of hearing from the responsible government official after the informal conference or the submittal of written comments, the facility owner or operator may request a reconsideration of the determination by the Regional Administrator or appropriate State official. The Regional Administrator or appropriate State official may use his or her discretion in deciding whether to conduct a review of the determination. Such a review, if granted, should be conducted within the 60 day period (originating with the notice) to the extent possible. The review will not stay the determination.

The RPM, OSC or equivalent site manager must stop transfer of waste to a facility on the 60th calendar day after issuance of a notice. The facility then remains unacceptable until such time as the responsible Agency notifies the owner or operator otherwise. The off-site coordinator and the OSC/RPM should maintain close coordination throughout the 60-day period.

In limited cases, the responsible Agency may use its discretion to extend the 60 day period if it requires more time to review a submission. The facility should be notified of any extension, and it remains acceptable during any extension.

The responsible Agency may also use its discretion to determine that a facility's unacceptability is immediately effective upon receipt of a notice to that effect. This may occur in situations such as, but not limited to, emergencies (e.g., fire or explosion) or egregious violations (e.g., criminal violations or chronic recalcitrance) or other situations that render the facility incapable of safely handling CERCLA waste.

Implementation of this notice provision does not relieve the Regions or States from taking appropriate enforcement action under RCRA or CERCLA.

C. Procedures for Facilities with Outstanding Unacceptability Determinations

Under the original May 1985 off-site policy, facilities determined to be unacceptable to receive CERCLA wastes were provided with written notice and were generally afforded informal opportunities to comment on the determination (the latter step was not required by the policy). Although the Agency believes that these steps represented adequate procedural safeguards for facilities seeking to receive CERCLA wastes, EPA has decided to provide an additional opportunity for review, in light of this revised policy, for facilities with unacceptability determinations already in place on the effective date of the revised policy.

Any such facility that wishes to meet with the responsible Agency to discuss the basis for a violation or release determination and its relevance to the facility's ability to receive CERCLA wastes, may request an informal conference with or submit written comments to the responsible Agency at any point up to the 60th day after the publication of the proposed rule on the off-site policy in the Federal Register. Such a meeting should take place within 30 calendar days of the request. If the responsible government Agency does not find the information presented to be sufficient to support a finding of acceptability to receive CERCLA wastes, then it should inform the facility orally or in writing that the unacceptability determination will continue to be in force. The facility may, within 10 calendar days of hearing from the responsible government official after the informal conference or submittal of written comments, petition the EPA Regional Administrator or appropriate State official for reconsideration. The Regional Administrator or State official may use his or her discretion in deciding whether to grant reconsideration.

These procedures for review of unacceptability determinations that were already in place on the effective date of this revised policy will not act to stay the effect of the underlying unacceptability determinations during the period of review.

D. Re-evaluating Unacceptability

An unacceptable facility can be reconsidered for management of CERCLA wastes whenever the responsible Agency finds that the facility meets the criteria described in the "Acceptability Criteria" section of this policy.

For the purposes of this policy, releases will be considered controlled upon issuance of an order or permit that initiates and requires completion of one or more of the following: a facility-wide RCRA Facility Investigation (RFI); a Corrective Measures Study (CMS); or Corrective Measures Implementation (CMI). The facility must comply with the permit or order to remain acceptable to receive CERCLA waste. At the completion of any such phase of the corrective action process, the responsible Agency should again review the facility for acceptability under the off-site policy using the criteria listed in this document, and as necessary and appropriate, make new acceptability determinations, and issue additional orders or modify permit conditions to control identified releases. Releases that require a determination of environmental significance will be considered controlled upon issuance of an order or permit to conduct an RFI, CMS or CMI, or upon completion of an RFI which concludes that the release is not environmentally significant. Again, the facility must comply with the permit or order to remain acceptable to receive CERCLA waste.

If the facility is determined to be unacceptable as a result of relevant violations at or affecting the receiving unit, the State (if it made the initial determination) or EPA must determine that the receiving unit is in full physical compliance with all applicable requirements. Where a State not authorized for HSWA corrective action makes this determination, it should notify EPA immediately of the facility's return to compliance, so that the Agency can expeditiously inform the facility that it is once again acceptable to receive CERCLA wastes.

The responsible Agency will notify the facility of its return to acceptability by certified and first-class mail, return receipt requested.

E. Implementation Procedures

All remedial decision documents must discuss compliance with this policy for alternatives involving off-site management of CERCLA wastes. Decision documents for removal actions also should include such a discussion.

Provisions requiring compliance with this policy should be included in all contracts for response action, Cooperative Agreements with States undertaking Superfund response actions, and enforcement agreements. For ongoing projects, these provisions will be implemented as follows, taking into consideration the differences in applicable requirements for pre- and post-SARA decision documents:

- RI/FS: The Regions shall immediately notify Agency contractors and States that alternatives for off-site management of wastes must be evaluated against the provisions of this policy.

- Remedial Design: The Regions shall immediately notify Agency contractors, the States, and the U.S. Army Corps of Engineers that all remedies that include off-site disposal of CERCLA waste must comply with the provisions of this policy.

- Remedial Action: The Regions shall immediately assess the status of compliance, releases and other environmental conditions at facilities receiving CERCLA waste from ongoing projects. If a facility is found not to be acceptable, the responsible Agency should notify the facility of its unacceptability.

- Enforcement: Cleanups by responsible parties under enforcement actions currently under negotiation and all future actions must comply with this policy. Existing agreements need not be amended. However, EPA reserves the right to apply these procedures to existing agreements, to the extent it is consistent with the release and reopener clauses in the settlement agreement.

If the response action is proceeding under a Federal lead, the Regions should work with the Corps of Engineers or EPA Contracts Officer to negotiate a contracts modification to an existing contract, if necessary. If the response action is proceeding under a State lead, the Regions should amend the Cooperative Agreement.

APPENDIX B

USEPA POLICY MEMORANDUM - DISCHARGES FROM CERCLA SITES TO POTWs

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 15 1986

MEMORANDUM

SUBJECT: Discharge of Wastewater from CERCLA Sites into POTWS

FROM: Henry L. Longest II, Director
Office of Emergency and Remedial Response

Rebecca Hanmer, Director
Office of Water Enforcement and Permits

Gene A. Lucero, Director
Office of Waste Programs Enforcement

TO: Waste Management Division Directors
Regions I - X

Water Management Division Directors
Regions I - X

A number of emergency removals and remedial cleanup actions under CERCLA will involve consideration of publicly owned treatment works (POTWs) for discharge of wastewater. The current off-site policy (issued on May 6, 1985) does not address the set of concerns and issues unique to POTWs that must be evaluated during the Remedial Investigation and Feasibility Study (RI/FS) for discharge of CERCLA wastewater to POTWs.

Recently, we have had meetings with representatives of the Association of Metropolitan Sewerage Authorities (AMSA) to discuss technical and policy concerns related to the POTW/CERCLA issue. This memorandum is to highlight some of the major points under consideration which were shared with AMSA at their recent Winter Technical Conference. The Agency intends to develop policy on the use and selection of POTWs for CERCLA wastewater. Your comments are sought on the proposed criteria set forth herein. These criteria may be useful in evaluation of POTWs for response actions (fund financed or responsible party financed) to be taken in the interim.

Our position is that no CERCLA discharges to a POTW should occur unless handled in a manner demonstrated to be protective of human health and the environment. Full compliance with all applicable requirements of the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and any other relevant or appropriate environmental statutes will be necessary.

The national pretreatment program, under the Clean Water Act, requires an analysis to determine whether the discharge of an industrial user of a POTW may pass through the POTW to cause receiving water quality problems or may interfere with POTW operations (including sludge disposal). If the analysis suggests that limits on the industrial user's discharge are needed to prevent pass through or interference, local limits or other safeguards, as necessary, must be established by the POTW and/or the NPDES permitting authority. The national pretreatment program requirements apply to the introduction of all non-domestic wastewater into any POTW, and include, among other things, the following elements:

- o Prohibited discharge standards - prohibit the introduction of pollutants to the POTW which are ignitable, corrosive, excessively high in temperature, or which may cause interference or pass through at the POTW.
- o Categorical discharge standards - include specific pretreatment standards which are established by EPA for the purpose of regulating industrial discharges in specific industrial categories.
- o Local limits - where no categorical standards have been promulgated or where more stringent controls are necessary.

POTWs under consideration as potential receptors of CERCLA wastewaters may include those POTWs either with or without an approved pretreatment program. POTWs <u>with</u> an approved pretreatment program are required to have the mechanisms necessary to ensure compliance by industrial users with applicable pretreatment standards and requirements.* POTWs <u>without</u> an approved pretreatment program must be evaluated to determine whether sufficient mechanisms exist to allow the POTW to meet the requirements of the national pretreatment program in accepting CERCLA wastewaters. As noted above, pass through and interference are always prohibited, regardless of whether a POTW has an approved pretreatment program. POTWs without an approved pretreatment program must therefore have mechanisms which are adequate to apply the requirements of the national pretreatment program to specific situations.

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*POTWs with approved pretreatment programs must, among other things, establish procedures to notify industrial users (IUs) of applicable pretreatment standards and requirements, receive and analyze self-monitoring reports from IUs, sample and analyze industrial effluents, investigate noncompliance, and comply with public participation requirements.

Determination of a POTW's ability to accept CERCLA wastewater as an alternative to on-site treatment and direct discharge to receiving waters must be made during the Remedial Investigation/ Feasibility Study (RI/FS) process. During the remedial alternatives analysis, the appropriateness of using a POTW must be carefully evaluated. Water Division officials and their state counterparts should participate in the evaluation of any remedial alternatives recommending the use of a POTW, and should concur on the selection of the POTW.

If an alternative considers the discharge of wastewater from a CERCLA site into a POTW, the following points should be evaluated in the RI/FS prior to the selection of the remedy for the site:

- o The quantity and quality of the CERCLA wastewater and its compatibility with the POTW (The constituents in the CERCLA wastewater must not cause pass through or interference, including unacceptable sludge contamination or a hazard to employees at the POTW; in some cases, control equipment at the CERCLA site may be appropriate in order to pretreat the CERCLA discharge prior to introduction to the POTW).

- o The ability (i.e., legal authority, enforceable mechanisms, etc.) of the POTW to ensure compliance with applicable pretreatment standards and requirements, including monitoring and reporting requirements.

- o The POTW's record of compliance with its NPDES permit and pretreatment program requirements to determine if the POTW is a suitable disposal site for the CERCLA wastewater.

- o The potential for volatilization of the wastewater at the CERCLA site and POTW and its impact upon air quality.

- o The potential for groundwater contamination from transport of CERCLA wastewater or impoundment at the POTW, and the need for groundwater monitoring.

- o The potential effect of the CERCLA wastewaters upon the POTW's discharge as evaluated by maintenance of water quality standards in the POTW's receiving waters, including the narrative standard of "no toxics in toxic amounts".

- The POTW's knowledge of and compliance with any applicable RCRA requirements or requirements of other environmental statutes (RCRA permit-by-rule requirements may be triggered if the POTW receives CERCLA wastewaters that are classified as "hazardous wastes" without prior mixing with domestic sewage, i.e., direct delivery to the POTW by truck, rail, or dedicated pipe; CERCLA wastewaters are not all necessarily considered hazardous wastes; case by case determinations have to be made).

- The various costs of managing CERCLA wastewater, including all risks, liabilities, permit fees, etc. (It may be appropriate to reflect these costs in the POTW's connection fees and user charge system).

Based upon consideration of the above elements, the discharge of CERCLA wastewater to a POTW should be deemed inappropriate if the evaluation indicates that:

- The constituents in the CERCLA discharge are not compatible with the POTW and will cause pass through, interference, toxic pollutants in toxic amounts in the POTW's receiving waters, unacceptable sludge contamination, or a hazard to employees of the POTW.

- The impact of the transport mechanism and/or discharging of CERCLA wastewater into a POTW would result in unacceptable impacts upon any environmental media.

- The POTW is determined to be an unacceptable receptor of CERCLA wastewaters based upon a review of the POTW's compliance history.

- The use of the POTW is not cost-effective.

If consideration of the various elements indicates that the discharge of CERCLA wastewater to a POTW is deemed appropriate:

- There should be early public involvement, including contact with POTW officials and users, in accordance with the CERCLA community relations plan and public participation requirements.

- The NPDES permit and fact sheet may need to be modified to reflect the conditions of acceptance of CERCLA wastewaters; permit modification may be necessitated by the need to incorporate specific pretreatment requirements, local limits, monitoring requirements and/or limitations on additional pollutants of concern in the POTW's discharge or other factors.

Policy to be developed in the future will apply to all removal, remedial, and enforcement actions taken pursuant to CERCLA and Section 7003 of RCRA. We would appreciate your feedback on this memorandum and any experience in the use of POTWs for CERCLA removal or remedial actions that you have to offer.

If you have any comments or questions on this issue, please submit written comments to the workgroup co-chairs: Shirley Ross (FTS-382-5755) from the Office of Emergency and Remedial Response, or Victoria Price (FTS-382-5681) from the Office of Water.

cc: Ed Johnson
Russ Wyer
Tim Fields
Steve Lingle

APPENDIX C

PERCENT REMOVAL OF COMPOUNDS IN POTWs

APPENDIX C - PERCENT REMOVAL OF COMPOUNDS IN POTWS. To evaluate the feasibility of discharging wastes from CERCLA sites to POTWs, the user of the guidance manual may need to estimate the treatability of compounds in the CERCLA waste and their potential to impact removal processes in the treatment system. The removal mechanisms in a POTW include air stripping, partitioning (sorption) to the solids and biomass, and biodegradation. Appendix C presents summary tables of published treatability data for individual compounds that can be used to estimate a mass balance for each compound detected in a CERCLA wastestream if site specific treatability data is unavailable.

The data presented in Appendix C was generated from a number of different published studies on the total percent removal of specific pollutants in biological treatment systems. Biological treatment systems presented in the tables include aerated lagoon (AL), activated sludge (AS), and trickling filter (TF). The data was separated into six concentration ranges, and distinguished between effluent samples that were chlorinated and those that were not. The number of observations (OBSV) is the number of publications from which data was taken and averaged to obtain a mean percent removal. The minimum and maximum percent removal, standard error (SE), and 90% confidence interval are also presented.

The following key is to be used with Appendix C:

AL	- Aerated Lagoon	MEAN	- Mean Percent Removal
AS	- Activated Sludge	MIN	- Minimum Percent Removal
TF	- Trickling Filter	MAX	- Maximum Percent Removal
N	- Number of Data Points	SE	- Standard Error
OBSV	- Number of Publications Used	90% CI	- 90% Confidence Interval

PARAMETER: 1,1,1-TRICHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	1	90.91	90.91	90.91	0.00	(0,0)
51-100	6	1	88.76	88.76	88.76	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	140	16	50.51	0.00	95.35	10.45	(32,69)	103	18	69.67	0.00	100.00	7.06	(57,82)
51-100	29	4	83.47	58.94	98.65	8.68	(63,99)	6	2	77.64	69.57	85.71	8.07	(19,100)
101-500	24	4	87.82	68.66	99.56	6.76	(72,99)	24	4	95.33	90.40	99.77	1.93	(91,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	0	1	98.28	98.28	98.28	0.00	(0,0)	7	2	98.93	97.98	99.88	0.95	(93,100)
> 5000	6	1	87.04	87.04	87.04	0.00	(0,0)	6	2	99.25	98.64	99.24	0.60	(95,100)

TREATMENT: TF

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	30	5	55.08	0.00	98.00	22.57	(7,100)	6	1	41.18	41.18	41.18	0.00	(0,0)
51-100	12	1	97.00	97.00	97.00	0.00	(0,0)	-	-	-	-	-	-	-
101-500	6	1	92.94	92.94	92.94	0.00	(0,0)	6	1	98.40	98.40	98.40	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,1,2,2-TETRACHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	53	4	22.22	0.00	88.89	22.22	(0,75)	7	2	85.29	70.59	100.00	14.71	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	2	95.31	94.53	96.15	0.81	(90,100)

TREATMENT: TF

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,1,2-TRICHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	81	5	47.67	0.00	95.65	19.83	(5,90)	5	3	52.78	0.00	100.00	29.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	20	2	79.47	78.95	80.00	0.53	(76,83)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,1-DICHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	62.96	62.96	62.96	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	68.75	68.75	68.75	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	12	3	45.83	0.00	87.50	25.35	(0,100)	47	11	49.97	0.00	100.00	9.59	(33,55)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	2	92.22	90.00	94.44	2.22	(78,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	6	1	75.00	75.00	75.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	34.72	34.72	34.72	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,1-DICHLOROETHENE

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	60.85	60.85	60.85	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	100	8	50.92	0.00	98.61	15.43	(22,80)	12	4	53.47	0.00	97.22	20.33	(6,100)
51-100	-	-	-	-	-	-	-	20	1	99.74	99.74	99.74	0.00	(0,0)
101-500	-	-	-	-	-	-	-	14	2	94.20	93.40	95.00	0.80	(89,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	75.00	75.00	75.00	0.00	(0,0)	6	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	59.91	59.91	59.91	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,2,4-TRICHLOROBENZENE

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	2	57.35	50.00	64.71	7.35	(11,100)	0	1	83.33	83.33	83.33	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	16	4	89.51	83.33	100.00	3.75	(81,98)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,2-DICHLOROBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	76	11	53.22	0.00	95.65	12.27	(31,75)	36	8	39.96	0.00	100.00	14.72	(12,68)
51-100	6	1	98.00	98.00	98.00	0.00	(0,0)	-	-	-	-	-	-	-
101-500	6	1	94.29	94.29	94.29	0.00	(0,0)	5	3	91.79	90.00	93.82	1.11	(89,95)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	2	99.72	99.50	99.94	0.22	(98,100)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	12	2	25.00	0.00	50.00	25.00	(0,100)	6	1	28.57	28.57	28.57	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,2-DICHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	70.59	70.59	70.59	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	4	21.72	0.00	86.91	21.72	(0,73)	4	4	60.30	0.00	90.00	20.71	(12,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	2	87.81	85.62	90.00	2.19	(74,100)
501-1000	-	-	-	-	-	-	-	5	1	98.28	98.28	98.28	0.00	(0,0)
1001-5000	6	1	99.75	99.75	99.75	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	6	2	60.94	32.85	89.03	28.09	(0,100)	6	2	98.41	98.25	98.57	0.16	(97,99)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	50.00	50.00	50.00	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	39.22	39.22	39.22	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,2-DICHLOROPROPANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	8	2	75.00	50.00	100.00	25.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	6	1	99.54	99.54	99.54	0.00	(0,0)	25	3	94.33	90.00	98.06	2.35	(88,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	2	99.33	99.01	99.65	0.32	(97,100)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	33.33	33.33	33.33	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,3-DICHLOROBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	2	45.70	33.33	58.07	12.37	(0,100)	0	1	87.10	87.10	87.10	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	6	3	99.80	99.48	99.99	0.16	(99,100)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 1,4-DICHLOROBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	11	2	83.33	67.67	100.00	16.67	(0,100)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	83.33	83.33	83.33	0.00	(0,0)	36	5	86.52	70.59	100.00	5.02	(76,97)
51-100	-	-	-	-	-	-	-	11	1	94.62	94.62	94.62	0.00	(0,0)
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	11	1	37.63	37.63	37.63	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 2,4-DICHLOROPHENOL

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	32.02	32.02	32.02	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	50.00	50.00	50.00	0.00	(0,0)	2	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	16	3	95.88	93.08	99.54	1.92	(90,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	2	86.19	77.18	95.20	9.01	(29,100)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	12.28	12.28	12.28	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 2,4-DIMETHYLPHENOL

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	0.00	0.00	0.00	0.00	(0,0)	3	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	8	1	99.06	99.06	99.06	0.00	(0,0)
101-500	-	-	-	-	-	-	-	5	2	96.57	95.00	98.15	1.57	(87,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 2,4-DINITROPHENOL

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	5	1	91.23	91.23	91.23	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	1	99.31	99.31	99.31	0.00	(0,0)

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 2-CHLORONAPHTHALENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: 2-CHLOROPHENOL

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	0.00	0.00	0.00	0.00	(0,0)	2	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	5	1	33.96	33.96	33.96	0.00	(0,0)
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ACENAPHTHENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	1	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	2	89.18	88.89	89.47	0.29	(87,91)	18	3	99.00	96.99	100.00	1.01	(96,100)
51-100	-	-	-	-	-	-	-	5	1	94.05	94.05	94.05	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ACENAPHTHYLENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	0.00	0.00	0.00	0.00	(0,0)	0	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	5	1	92.31	92.31	92.31	0.00	(0,0)
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ANTHRACENE

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	116	14	8.10	0.00	80.00	6.02	(0,19)	62	11	17.95	0.00	100.00	12.04	(0,49)
51-100	6	1	78.85	78.85	78.85	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	42	6	6.76	0.00	40.54	6.76	(0,20)	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ANTIMONY

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	3	41.23	0.00	73.68	21.72	(0,100)	0	2	17.11	0.00	34.21	17.11	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	0.00	0.00	0.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ARSENIC

INFL CONC.	CHLORINATED TREATMENT: AL							NON-CHLORINATED TREATMENT: AL						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

INFL CONC.	CHLORINATED TREATMENT: AS							NON-CHLORINATED TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	149	19	39.40	0.00	90.63	7.53	(26,53)	45	3	33.85	18.93	63.33	14.74	(0,77)
51-100	0	1	50.00	50.00	50.00	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	50.00	50.00	50.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

INFL CONC.	CHLORINATED TREATMENT: TF							NON-CHLORINATED TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	25.00	25.00	25.00	0.00	(0,0)	6	1	10.00	10.00	10.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: BARIUM

INFL CONC.	CHLORINATED TREATMENT: AL							NON-CHLORINATED TREATMENT: AL						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	56.60	56.60	56.60	0.00	(0,0)
101-500	6	1	75.90	75.90	75.90	0.00	(0,0)	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

INFL CONC.	CHLORINATED TREATMENT: AS							NON-CHLORINATED TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	72.09	72.09	72.09	0.00	(0,0)	-	-	-	-	-	-	-
51-100	37	5	70.43	64.15	75.64	2.24	(66,75)	12	2	75.82	72.62	79.01	3.20	(56,96)
101-500	170	18	72.75	43.72	99.17	3.79	(66,79)	52	10	76.14	62.31	94.21	4.04	(69,84)
501-1000	4	1	65.68	65.68	65.68	0.00	(0,0)	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

INFL CONC.	CHLORINATED TREATMENT: TF							NON-CHLORINATED TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	18	3	58.56	38.89	87.37	14.72	(16,100)	-	-	-	-	-	-	-
101-500	30	4	50.21	21.28	70.23	11.91	(22,78)	12	2	55.65	53.55	57.75	2.10	(42,69)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: BENZENE

CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	6	1	98.91	98.91	98.91	0.00	(0,0)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	124	13	53.68	0.00	85.71	9.02	(38,70)
51-100	-	-	-	-	-	-	-
101-500	18	3	96.72	91.09	99.55	2.81	(89,100)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	30	4	56.74	0.00	96.97	21.26	(7,100)
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

NON-CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	2	2	100.00	100.00	100.00	0.00	(100,100)
51-100	0	1	100.00	100.00	100.00	0.00	(0,0)
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	56	12	74.04	48.53	98.25	5.58	(64,84)
51-100	20	1	99.73	99.73	99.73	0.00	(0,0)
101-500	13	4	98.41	95.00	99.83	1.14	(96,100)
501-1000	5	1	98.97	98.97	98.97	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-
> 5000	15	3	99.95	99.87	100.00	0.04	(99,100)

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	91.67	91.67	91.67	0.00	(0,0)
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

PARAMETER: BIS(2-CHLOROETHOXY) METHANE

CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	66.67	66.67	66.67	0.00	(0,0)
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

NON-CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	0	1	66.67	66.67	66.67	0.00	(0,0)
51-100	-	-	-	-	-	-	-
101-500	0	1	10.00	10.00	10.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

PARAMETER: BIS(2-CHLOROETHYL) ETHER

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	28.67	28.67	28.67	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	0	1	0.00	0.00	0.00	0.00	(0,0)	0	3	66.67	0.00	100.00	33.33	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	2	84.51	79.02	90.00	5.49	(50,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	7.69	7.69	7.69	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: BIS(2-ETHYLHEXYL) PHTHALATE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	5	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	6	1	23.47	23.47	23.47	0.00	(0,0)
101-500	6	1	40.65	40.65	40.65	0.00	(0,0)	11	1	79.76	79.76	79.76	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	157	17	39.80	0.00	87.50	7.91	(26,54)	41	10	43.93	0.00	78.00	9.40	(27,61)
51-100	36	6	61.57	0.00	89.54	14.37	(33,91)	26	4	48.41	10.11	78.14	16.56	(9,87)
101-500	18	4	76.24	55.63	98.76	9.93	(53,100)	61	6	82.25	58.53	100.00	6.19	(70,95)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	36	5	32.94	14.29	64.52	8.50	(15,51)	12	3	65.66	33.33	100.00	19.27	(10,100)
51-100	6	2	6.06	0.00	12.12	6.06	(0,44)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	76.79	76.79	76.79	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: BROMODICHLOROMETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	18	4	30.83	0.00	50.00	10.83	(5,56)	5	2	87.50	75.00	100.00	12.50	(9,100)
51-100	-	-	-	-	-	-	-	20	1	99.78	99.78	99.78	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: BUTYL BENZYL PHTHALATE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	6	2	96.43	92.86	100.00	3.57	(74,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	146	20	24.60	0.00	92.00	7.16	(12,37)	74	15	47.90	0.00	100.00	10.72	(29,67)
51-100	6	1	96.67	96.67	96.67	0.00	(0,0)	5	1	93.02	93.02	93.02	0.00	(0,0)
101-500	6	2	99.56	99.43	99.68	0.13	(99,100)	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	48	7	32.06	0.00	97.30	15.76	(1,63)	12	2	31.25	0.00	62.50	31.25	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CADMIUM

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	1	44.00	44.00	44.00	0.00	(0,0)
51-100	6	1	0.00	0.00	0.00	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	265	35	39.47	0.00	99.47	6.24	(29,50)	119	15	30.60	0.00	97.06	9.47	(14,47)
51-100	12	2	43.14	0.00	86.28	43.14	(0,100)	6	1	97.02	97.02	97.02	0.00	(0,0)
101-500	6	1	91.38	91.38	91.38	0.00	(0,0)	0	1	27.00	27.00	27.00	0.00	(0,0)
501-1000	6	1	90.06	90.06	90.06	0.00	(0,0)	-	-	-	-	-	-	-
1001-5000	6	1	93.96	93.96	93.96	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	48	7	6.35	0.00	33.33	4.76	(0,16)	20	2	14.00	0.00	28.00	14.00	(0,100)
51-100	-	-	-	-	-	-	-	6	1	76.12	76.12	76.12	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CHLOROBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	100.00	100.00	100.00	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	41	2	40.00	0.00	80.00	40.00	(0,100)	17	3	62.22	20.00	100.00	23.20	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	6	2	99.32	98.91	99.72	0.40	(97,100)	20	4	97.10	90.00	99.89	2.37	(92,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	2	37.50	0.00	75.00	37.50	(0,100)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CHLOROETHANE

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	5	1	58.33	58.33	58.33	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CHLOROFORM

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	60.74	60.74	60.74	0.00	(0,0)
501-1000	6	1	97.79	97.79	97.79	0.00	(0,0)	3	1	100.00	100.00	100.00	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	152	23	40.27	0.00	96.49	6.78	(29,52)	166	28	59.22	0.00	100.00	5.56	(50,69)
51-100	41	2	60.44	52.06	68.83	8.39	(7,100)	-	-	-	-	-	-	-
101-500	6	1	50.00	50.00	50.00	0.00	(0,0)	39	4	92.58	86.67	97.37	2.55	(87,99)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	0	1	99.25	99.25	99.25	0.00	(0,0)

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	42	6	37.64	0.00	87.50	15.59	(6,69)	12	3	87.83	77.78	100.00	6.50	(69,100)
51-100	6	1	85.92	85.92	85.92	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	24.44	24.44	24.44	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CHLOROMETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	58.33	58.33	58.33	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	0	1	100.00	100.00	10.00	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	47	2	0.00	0.00	0.00	0.00	(0,0)	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	18	3	81.65	67.29	97.98	8.92	(56,100)	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	60.32	60.32	60.32	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CHROMIUM

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	48.78	48.78	48.78	0.00	(0,0)
101-500	-	-	-	-	-	-	-	14	1	70.59	70.59	70.59	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	6	1	89.78	89.78	89.78	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	58	8	45.67	0.00	83.72	13.66	(20,72)	12	2	85.39	73.33	97.44	12.05	(9,100)
51-100	53	9	68.55	18.99	94.55	7.61	(54,83)	18	4	78.29	68.75	94.55	5.79	(65,92)
101-500	160	19	75.05	21.43	93.44	4.20	(68,82)	50	10	81.29	70.00	89.49	1.90	(78,85)
501-1000	6	1	93.36	93.36	93.36	0.00	(0,0)	45	1	46.03	46.03	46.03	0.00	(0,0)
1001-5000	18	3	94.24	89.73	97.46	2.32	(87,100)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	36	5	36.41	0.00	58.33	10.12	(15,58)	6	1	67.39	67.39	67.39	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	12	2	46.49	22.59	70.40	23.90	(0,100)	20	2	54.20	51.58	56.18	2.62	(38,71)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: COPPER

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	20.97	20.97	20.97	0.00	(0,0)
101-500	6	1	96.38	96.38	96.38	0.00	(0,0)	14	1	74.20	74.20	74.20	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	39	7	63.77	0.00	90.00	11.82	(41,87)	6	2	45.24	0.00	90.48	45.24	(0,100)
51-100	89	10	80.18	41.27	99.00	6.26	(69,92)	12	3	79.93	56.10	99.00	12.61	(43,100)
101-500	137	18	81.85	50.00	95.51	2.95	(77,87)	62	10	80.07	0.00	96.97	9.18	(63,97)
501-1000	18	3	91.47	89.91	93.82	1.20	(88,95)	45	1	80.00	80.00	80.00	0.00	(0,0)
1001-5000	6	1	92.43	92.43	92.43	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	-	-	-	-	-	-	-
51-100	12	2	53.89	49.15	58.62	4.73	(24,84)	-	-	-	-	-	-	-
101-500	24	4	58.41	38.18	74.79	9.56	(36,81)	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: CYANIDE

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	6	1	7.35	7.35	7.35	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	6	1	89.78	89.78	89.78	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	50	6	55.68	0.00	85.71	11.87	(32,80)	12	4	47.57	0.00	75.00	17.45	(7,89)
51-100	83	8	18.99	0.00	67.07	9.65	(1,37)	-	-	-	-	-	-	-
101-500	42	8	59.78	28.76	91.87	7.99	(45,75)	30	7	58.29	33.14	90.00	7.97	(43,74)
501-1000	12	2	69.04	57.91	80.17	11.13	(0,100)	6	1	65.41	65.41	65.41	0.00	(0,0)
1001-5000	18	3	86.72	71.13	97.58	7.99	(63,100)	18	3	85.49	79.92	89.49	2.87	(77,94)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	6	1	36.15	36.15	36.15	0.00	(0,0)	-	-	-	-	-	-	-
101-500	36	5	39.29	0.00	73.14	16.19	(5,74)	12	2	42.16	26.64	57.68	15.52	(0,100)
501-1000	6	1	56.80	56.80	56.80	0.00	(0,0)	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: DI-N-OCTYL PHTHALATE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	0.00	0.00	0.00	0.00	(0,0)	13	2	82.56	82.14	82.98	0.42	(80,85)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: DIBROMOCHLOROMETANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	5	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	20	1	87.93	87.93	87.93	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: DIETHYL PHTHALATE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	2	50.00	0.00	100.00	50.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	187	23	54.03	0.00	100.00	8.05	(40,68)	85	14	28.68	0.00	100.00	11.57	(8,49)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	5	2	91.64	90.00	93.28	1.64	(81,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	30	4	33.75	0.00	60.00	13.44	(2,65)	12	2	30.77	0.00	61.54	30.77	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: ETHYLBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	61.54	61.54	61.54	0.00	(0,0)	9	2	91.67	83.33	100.00	8.33	(39,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	75.68	75.68	75.68	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	199	24	41.53	0.00	97.73	8.98	(26,57)	95	17	62.10	0.00	99.22	9.57	(45,79)
51-100	-	-	-	-	-	-	-	26	3	96.66	90.72	99.76	2.97	(88,100)
101-500	12	3	98.73	97.45	98.73	0.64	(97,100)	19	4	96.91	94.60	99.80	1.26	(94,100)
501-1000	-	-	-	-	-	-	-	24	1	100.00	100.00	100.00	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	0	1	99.95	99.95	99.95	0.00	(0,0)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	48	7	33.03	0.00	90.00	13.06	(8,58)	12	6	25.00	0.00	50.00	25.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	14	1	72.07	72.07	72.07	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: FLUORANTHENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	65.39	65.39	65.39	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	2	41.67	0.00	83.33	41.67	(0,100)	13	4	85.46	64.71	100.00	7.73	(67,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	95.19	95.19	95.19	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	52.89	52.89	52.89	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: FLUORENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	1	0.00	0.00	0.00	0.00	(0,0)	10	3	97.42	94.12	100.00	1.74	(92,100)
51-100	-	-	-	-	-	-	-	5	1	91.07	91.07	91.07	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: HEPTACHLOR

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	3	1	66.67	66.67	66.67	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	11	2	79.71	6.67	92.74	13.04	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	3	1	53.85	53.85	53.85	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

POTW - Percent Removal

PARAMETER: IRON

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	6	1	25.98	25.98	25.98	0.00	(0,0)
> 5000	6	1	85.46	85.46	85.46	0.00	(0,0)	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	6	1	81.18	81.18	81.18	0.00	(0,0)	-	-	-	-	-	-	-
1001-5000	120	15	80.66	42.58	98.00	3.37	(75,87)	111	12	85.41	67.00	96.65	3.27	(80,91)
> 5000	85	9	88.41	66.78	99.20	4.11	(81,96)	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	24	3	74.52	55.23	90.71	10.36	(44,100)	-	-	-	-	-	-	-
1001-5000	18	3	32.65	3.74	69.97	19.58	(0,90)	12	6	72.30	68.87	75.72	3.42	(65,79)
> 5000	6	1	50.61	50.61	50.61	0.00	(0,0)	-	-	-	-	-	-	-

PARAMETER: ISOPHORONE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	11	1	23.60	23.60	23.60	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	2	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	11	1	97.75	97.75	97.75	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	5	1	100.00	100.00	100.00	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	11	1	19.10	19.10	19.10	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: LEAD

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	0.00	0.00	0.00	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	6	1	7.83	7.83	7.83	0.00	(0,0)	14	1	57.58	57.58	57.58	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	148	15	45.95	0.00	97.96	10.88	(27,65)	18	0	0.00	0.00	0.00	0.00	(0,0)
51-100	56	9	77.21	1.96	98.68	10.59	(58,97)	24	5	48.17	9.09	86.46	13.20	(20,76)
101-500	65	12	73.91	51.22	98.18	4.86	(65,83)	38	7	56.59	25.20	83.09	8.56	(40,73)
501-1000	6	1	79.93	79.93	79.93	0.00	(0,0)	45	1	87.50	87.50	87.50	0.00	(0,0)
1001-5000	6	1	97.22	97.22	97.22	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	42	6	9.03	0.00	54.17	9.03	(0,27)	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	6	1	45.06	45.06	45.06	0.00	(0,0)
101-500	6	1	19.62	19.62	19.62	0.00	(0,0)	14	1	47.88	47.88	47.88	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: LINDANE

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	3	1	43.59	43.59	43.59	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	0	2	37.50	0.00	75.00	37.50	(0,100)	11	2	31.91	20.51	43.30	11.39	(0,100)
51-100	-	-	-	-	-	-	-	0	1	7.58	7.58	7.58	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	3	1	12.82	12.82	12.82	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: MANGANESE

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: AS							TREATMENT: AS						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	21	3	33.33	0.00	50.00	16.67	(0,82)	-	-	-	-	-	-	-
51-100	7	1	33.33	33.33	33.33	0.00	(0,0)	-	-	-	-	-	-	-
101-500	91	9	32.69	11.77	86.67	7.96	(18,47)	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	45	1	38.46	38.46	38.46	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TREATMENT: TF							TREATMENT: TF						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: MERCURY

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	66.67	66.67	66.67	0.00	(0,0)	6	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	205	27	42.06	0.00	93.75	7.08	(30,54)	111	16	53.18	0.00	100.00	10.17	(35,71)
51-100	6	1	40.01	40.01	40.01	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	12	2	60.71	50.00	71.43	10.71	(90,100)
51-100	48	7	42.82	0.00	75.00	12.15	(19,66)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: METHYLENE CHLORIDE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	81.62	81.62	81.62	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	6	1	96.15	96.15	96.15	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	3	1	100.00	100.00	100.00	0.00	(0,0)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	116	16	29.71	0.00	60.00	5.78	(20,40)	75	14	37.11	0.00	93.29	8.50	(22,52)
51-100	47	3	40.98	27.69	60.67	10.05	(12,70)	18	3	61.43	34.41	77.33	13.58	(22,100)
101-500	6	2	27.31	0.00	54.61	27.31	(0,100)	45	7	79.91	0.00	100.00	13.93	(53,100)
501-1000	12	3	36.33	0.00	78.21	22.75	(0,100)	0	1	71.87	71.87	71.87	0.00	(0,0)
1001-5000	24	3	66.66	3.04	99.19	31.82	(0,100)	-	-	-	-	-	-	-
> 5000	6	1	11.36	11.36	11.36	0.00	(0,0)	6	2	99.81	99.72	99.91	0.10	(99,100)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	30	4	74.65	66.67	83.33	3.69	(66,83)	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	12	2	76.31	75.95	76.67	0.36	(74,79)	6	1	66.04	66.04	66.04	0.00	(0,0)
101-500	6	1	54.84	54.84	54.84	0.00	(0,0)	6	1	89.33	89.33	89.33	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: NAPHTHALENE

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	8	2	50.00	0.00	100.00	50.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	66.67	66.67	66.67	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	157	17	41.12	0.00	96.33	10.33	(23,59)	80	13	31.94	0.00	100.00	11.88	(11,53)
51-100	12	2	89.79	85.46	94.12	4.33	(62,100)	8	1	99.09	99.09	99.09	0.00	(0,0)
101-500	6	1	94.65	94.65	94.65	0.00	(0,0)	11	2	95.65	95.00	96.30	0.65	(92,100)
501-1000	-	-	-	-	-	-	-	5	1	99.25	99.25	99.25	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	0	1	97.83	97.83	97.83	0.00	(0,0)
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	18	3	16.67	0.00	50.00	16.67	(0,65)	6	1	96.30	96.30	96.30	0.00	(0,0)
51-100	6	1	60.00	60.00	60.00	0.00	(0,0)	0	1	100.00	100.00	100.00	0.00	(0,0)
101-500	-	-	-	-	-	-	-	11	1	31.48	31.48	31.48	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: NICKEL

TREATMENT: AL

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	6	1	13.64	13.64	13.64	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	6	1	75.69	75.69	75.69	0.00	(0,0)	14	1	35.46	35.46	35.46	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	104	16	39.86	0.00	94.44	8.49	(25,55)	30	5	8.33	0.00	41.67	8.33	(0,26)
51-100	99	7	22.45	0.00	56.99	8.24	(6,38)	18	3	39.37	16.67	66.67	14.62	(0,82)
101-500	80	13	50.26	15.00	99.71	7.92	(36,64)	77	7	35.19	5.80	60.00	6.64	(22,48)
501-1000	6	3	44.87	0.00	76.56	23.06	(0,100)	0	2	27.34	0.00	54.69	27.34	(0,100)
1001-5000	6	1	81.22	81.22	81.22	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	Non-Chlorinated N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	24	4	15.92	0.00	56.00	13.48	(0,48)	-	-	-	-	-	-	-
51-100	18	2	54.43	23.44	85.42	30.99	(0,100)	6	1	35.48	35.48	35.48	0.00	(0,0)
101-500	6	1	4.27	4.27	4.27	0.00	(0,0)	20	2	32.84	30.50	35.19	2.34	(18,48)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: NITROBENZENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	0.00	0.00	0.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	2	93.89	90.00	97.79	3.90	(69,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	5	1	96.97	96.97	96.97	0.00	(0,0)
> 5000	-	-	-	-	-	-	-	6	2	65.83	33.87	97.80	31.97	(0,100)

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: PCB-1254

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	8	1	91.34	91.34	91.34	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	92.00	92.00	92.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: PENTACHLOROPHENOL

TREATMENT: AL

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	104	9	38.52	0.00	86.67	10.04	(20,57)	6	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	11	1	32.14	32.14	32.14	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	36	5	30.87	0.00	68.89	13.50	(2,60)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	11	1	2.38	2.38	2.38	0.00	(0,0)
101-500	-	-	-	-	-	-	-	6	1	35.86	35.86	35.86	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: PHENANTHRENE

TREATMENT: AL

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	11	1	57.90	57.90	57.90	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	40	4	35.16	0.00	90.63	21.93	(0.87)	8	2	93.95	90.63	97.28	93.95	(73,100)
51-100	6	1	78.85	78.85	78.85	0.00	(0,0)	11	1	95.79	95.79	95.79	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	0	1	98.24	98.24	98.24	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	Chlorinated N	Chlorinated OBSV	Chlorinated MEAN	Chlorinated MIN	Chlorinated MAX	Chlorinated SE	Chlorinated 90% C.I.	Non-Chlorinated N	Non-Chlorinated OBSV	Non-Chlorinated MEAN	Non-Chlorinated MIN	Non-Chlorinated MAX	Non-Chlorinated SE	Non-Chlorinated 90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	11	1	46.32	46.32	46.32	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER: PHENOL

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	9	2	75.00	50.00	100.00	25.00	(0,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	33.33	33.33	33.33	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	TREATMENT: AS							TREATMENT: AS						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	116	14	31.28	0.00	94.44	11.67	(11,52)	54	9	19.07	0.00	80.00	10.11	(0,37)
51-100	18	3	54.82	11.11	95.71	24.46	(0,100)	-	-	-	-	-	-	-
101-500	53	4	93.12	80.10	99.59	4.48	(83,100)	61	7	94.14	80.77	100.00	2.69	(89,99)
501-1000	12	2	99.57	99.25	99.89	0.32	(98,100)	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	6	1	99.99	99.99	99.99	0.00	(0,0)

	TREATMENT: TF							TREATMENT: TF						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	96.08	96.08	96.08	0.00	(0,0)	6	2	90.00	80.00	100.00	10.00	(37,100)
51-100	-	-	-	-	-	-	-	6	1	98.18	98.18	98.18	0.00	(0,0)
101-500	-	-	-	-	-	-	-	11	2	74.60	49.21	100.00	25.40	(0,100)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

POTW - Percent Removal

PARAMETER:PYRENE

	CHLORINATED							NON-CHLORINATED						
	TREATMENT: AL							TREATMENT: AL						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	65.39	65.39	65.39	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	TREATMENT: AS							TREATMENT: AS						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	18	3	86.04	64.71	100.00	10.84	(54,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	95.19	95.19	95.19	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	TREATMENT: TF							TREATMENT: TF						
INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	11	1	53.85	53.85	53.85	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:SILVER

TREATMENT: AL

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	35	4	72.38	26.04	94.22	15.72	(35,100)	45	4	58.80	26.04	94.22	16.15	(21,97)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:TETRACHLOROETHENE

TREATMENT: AL

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	1	6	80.00	80.00	80.00	0.00	(0,0)	6	2	95.65	91.30	100.00	4.53	(68,100)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	95	17	47.11	0.00	100.00	9.07	(31,63)	120	21	62.69	0.00	100.00	7.02	(51,75)
51-100	9	6	78.63	32.69	97.53	9.93	(59,99)	-	-	-	-	-	-	-
101-500	18	3	74.02	65.20	79.49	4.46	(61,87)	47	4	93.50	90.00	96.68	1.37	(90,97)
501-1000	0	1	99.21	99.21	99.21	0.00	(0,0)	6	2	98.24	97.42	99.05	0.82	(93,100)
1001-5000	6	1	84.63	84.63	84.63	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED							NON-CHLORINATED						
	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	30	4	48.50	0.00	81.82	17.29	(8,89)	12	2	90.00	86.67	93.33	3.33	(69,100)
51-100	12	2	90.59	87.27	93.90	3.32	(70,100)	-	-	-	-	-	-	-
101-500	6	1	97.80	97.80	97.80	0.00	(0,0)	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:TETRACHLOROMETHANE

CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	12	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-
101-500	6	1	87.79	87.79	87.79	0.00	(0,0)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

NON-CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	14	1	78.26	78.26	78.26	0.00	(0,0)
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	0	1	0.00	0.00	0.00	0.00	(0,0)
51-100	26	3	93.61	81.16	100.00	6.23	(75,100)
101-500	2	2	95.00	90.00	100.00	5.00	(63,100)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	0	1	99.90	99.90	99.90	0.00	(0,0)

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

PARAMETER:TOLUENE

CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	6	1	97.23	97.23	97.23	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	124	17	53.74	0.00	97.73	9.51	(37,70)
51-100	12	2	98.24	97.86	98.63	0.39	(96,100)
101-500	57	6	78.88	0.00	99.11	15.87	(47,100)
501-1000	12	2	96.16	92.84	99.48	3.32	(75,100)
1001-5000	6	1	99.81	99.81	99.81	0.00	(0,0)
> 5000	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	42	6	61.90	0.00	96.00	14.50	(33,91)
51-100	-	-	-	-	-	-	-
101-500	6	1	97.29	97.29	97.29	0.00	(0,0)
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

NON-CHLORINATED

TREATMENT: AL

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	88.89	88.89	88.89	(0,0)	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	112	19	85.21	0.00	100.00	5.65	(75,95)
51-100	19	4	98.01	96.67	99.00	0.49	(97,99)
101-500	58	6	98.85	95.00	100.00	0.78	(97,100)
501-1000	6	1	95.39	95.39	95.39	0.00	(0,0)
1001-5000	5	1	99.84	99.84	99.84	0.00	(0,0)
> 5000	0	1	99.94	99.94	99.94	0.00	(0,0)

TREATMENT: TF

INFL CONC.	N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-

PARAMETER:TRANS-1,2-DICHLOROETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	6	1	87.50	87.50	87.50	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	146	20	42.09	0.00	100.00	8.88	(27,57)	59	11	49.22	0.00	93.75	12.45	(27,72)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	90.00	90.00	90.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	48	7	47.07	0.00	97.67	17.99	(12,82)	6	1	50.00	50.00	50.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:TRIBROMOMETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	14	1	83.33	83.33	83.33	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	14	1	67.78	67.78	67.78	0.00	(0,0)
101-500	-	-	-	-	-	-	-	0	1	65.00	65.00	65.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	0	1	100.00	100.00	100.00	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	14	1	54.44	54.44	54.44	0.00	(0,0)
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:TRICHLOROETHENE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	75.00	75.00	75.00	0.00	(0,0)	6	1	97.30	97.30	97.30	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	157	17	48.24	0.00	97.73	10.22	(30,66)	106	18	53.77	0.00	100.00	8.26	(39,68)
51-100	36	5	78.46	51.72	98.21	7.87	(62,95)	6	1	97.65	97.65	97.65	0.00	(0,0)
101-500	12	2	89.71	86.86	92.56	2.85	(72,100)	26	3	97.74	95.00	99.61	1.40	(94,100)
501-1000	6	1	86.80	86.80	86.80	0.00	(0,0)	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	24	3	94.19	88.84	98.04	2.85	(86,100)	6	2	91.67	83.33	100.00	8.33	(39,100)
51-100	18	3	94.19	88.84	98.04	2.85	(86,100)	6	1	88.24	88.24	88.24	0.00	(0,0)
101-500	6	1	99.19	99.19	99.19	0.00	(0,0)	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:TRICHLOROFLUOROMETHANE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	41	2	48.65	0.00	97.30	48.65	(0,100)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-							
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	5	1	100.00	100.00	100.00	0.00	(0,0)
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	6	1	0.00	0.00	0.00	0.00	(0,0)	0	1	100.00	100.00	100.00	0.00	(0,0)
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:VINYL CHLORIDE

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	41	2	0.00	0.00	0.00	0.00	(0,0)	5	1	100.00	100.00	100.00	0.00	(0,0)
51-100	6	1	71.43	71.43	71.43	0.00	(0,0)	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	0	1	95.00	95.00	95.00	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	6	1	94.05	94.05	94.05	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	6	1	92.93	92.93	92.93	0.00	(0,0)	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PARAMETER:ZINC

TREATMENT: AL

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	-	-	-	-	-	-	-	6	1	51.10	51.10	51.10	0.00	(0,0)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	6	1	89.98	89.98	89.98	0.00	(0,0)	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TREATMENT: AS

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	7	1	97.50	97.50	97.50	0.00	(0,0)	-	-	-	-	-	-	-
51-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101-500	183	21	68.59	29.73	68.59	3.41	(63,74)	48	9	79.90	60.00	90.27	3.42	(74,86)
501-1000	24	3	82.13	74.15	88.74	4.27	(70,95)	18	3	77.24	82.55	80.45	1.63	(72,82)
1001-5000	69	13	83.32	49.05	99.25	4.66	(75,92)	45	3	74.10	62.90	90.63	8.26	(51,99)
> 5000	12	2	71.27	63.64	78.90	7.63	(23,100)	-	-	-	-	-	-	-

TREATMENT: TF

INFL CONC.	CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.	NON-CHLORINATED N	OBSV	MEAN	MIN	MAX	SE	90% C.I.
0-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-100	6	1	17.20	17.20	17.20	0.00	(0,0)	-	-	-	-	-	-	-
101-500	42	6	47.20	30.77	75.17	6.27	(34,60)	12	2	69.25	65.49	73.01	3.76	(46,93)
501-1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001-5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX D

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