Appendix H. EPA Presumptive Remedy Guidance (provided on enclosed CD)

H1. Presumtive Remedy for CERCLA Municipal Landfill Sites (EPA, 1993a)

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

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Presumptive Remedy for CERCLA Municipal Landfill Sites

Office of Emergency and Remedial Response
Hazardous Site Control Division 5203G

Quick Reference Fact Sheet

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, the Superfund program is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these types of sites. The presumptive remedy approach is one tool of acceleration within the **Superfund Accelerated Cleanup Model (SACM).**

Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigation and speed up selection of cleanup actions. Over time presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances.

This directive establishes **containment** as the presumptive remedy for CERCLA municipal landfills. The framework for the presumptive remedy for these sites is presented in a streamlining manual entitled *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites,* February 1991 (OSWER Directive 9355. 3-11). This directive highlights and emphasizes the importance of certain streamlining principles related to the scoping (planning) stages of the remedial investigation/feasibility study (RI/FS) that were identified in the manual. The directive also provides clarification of and additional guidance in the following areas: (1) the level of detail appropriate for risk assessment of source areas at municipal landfills and (2) the characterization of hot spots.

BACKGROUND

Superfund has conducted pilot projects at four municipal landfill sites[1] on the National Priorities List (NPL) to evaluate the effectiveness of the manual *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (hereafter referred to as "the manual") as a streamlining tool and as the framework for the municipal landfill presumptive remedy. Consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (or NCP), EPA's expectation was that containment technologies generally would be appropriate for municipal landfill waste because the volume and heterogeneity of the waste generally make treatment impracticable. The results of the pilots support this expectation and demonstrate that the manual is an effective tool for streamlining the RI/FS process for municipal landfills.

Since the manual's development, the expectation to contain wastes at municipal landfills has evolved into a presumptive remedy for these sites.[2] Implementation of the streamlining principles outlined in the manual at the four pilot sites helped to highlight issues requiring further clarification, such as the degree to which risk assessments can be streamlined for source areas and the characterization and remediation of hot spots. The pilots also demonstrated the value of focusing streamlining efforts at the scoping stage, recognizing that the biggest savings in time and money can be realized if streamlining is incorporated at the beginning of the RI/FS process. Accordingly, this directive addresses those issues identified during the pilots and highlights streamlining opportunities to be considered during the scoping component of the RI/FS.

[1] Municipal landfill sites typically contain a combination of principally municipal and to a lesser extent hazardous wastes.

[2] See EPA Publication 9203.1-02I, SACM Bulletins, *Presumptive Remedies for Municipal Landfill Sites,* April 1992, Vol. 1, No. 1, and February 1993, Vol. 2, No. 1, and SACM Bulletin *Presumptive Remedies,* August 1992, Vol. 1, No. 3.

Finally, while the primary focus of the municipal landfill manual is on streamlining the RI/FS, Superfund's goal under SACM is to accelerate the entire clean-up process. Other guidance issued under the municipal landfill presumptive remedy initiative identifies design data that may be collected during the RI/FS to streamline the overall response process for these sites (see Publication No. 9355.3-18FS, *Presumptive Remedies:* CERCLA *Landfill Caps Data Collection Guide,* to be published in October 1993).

CONTAINMENT AS A PRESUMPTIVE REMEDY

Section 300.430(a)(iii)(B) of the NCP contains the expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat where treatment is impracticable. The preamble to the NCP identifies municipal landfills as a type of site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. Because treatment usually is impracticable, EPA generally considers containment to be the appropriate response action, or the "presumptive remedy," for the source areas of municipal landfill sites.

The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass and collection and/or treatment of landfill gas. In addition, measures to control landfill leachate, affected ground water at the perimeter of the landfill, and/or upgradient ground-water that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy.

The presumptive remedy does not address exposure pathways outside the source area (landfill), nor does it include the long-term ground-water response action. Additional RI/FS activities, including a risk assessment, will need to be performed, as appropriate, to address those exposure pathways outside the source area. It is expected that RI/FS activities addressing exposure pathways outside the source generally will reconducted concurrently with the streamlined RI/FS for the landfill source presumptive remedy. A response action for exposure pathways outside the source (if any) may be selected together with the presumptive remedy (thereby developing a comprehensive site response), or as an operable unit separate from the presumptive remedy.

Highlight 1 identifies the components of the presumptive remedy. Response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions.

Highlight 1: Components of the Presumptive Remedy: Source Containment

- Landfill cap;
- Source area ground-water control to contain plume;
- Leachate collection and treatment;
- Landfill gas collection and treatment; and/or
- Institutional controls to supplement engineering controls.

The EPA (or State) site manager will make the initial decision of whether a particular municipal landfill site is suitable for the presumptive remedy or whether a more comprehensive RI/FS is required. Generally, this determination will depend on whether the site is suitable for a streamlined risk evaluation, as described on page 4. The community, state, and potentially responsible parties (PRPs) should be notified that a presumptive remedy is being considered for the site before work on the RI/FS work plan is initiated. The notification may take the form of a fact sheet, a notoice in a local newspaper, and/or a public meeting.

Use of the presumptive remedy eliminates the need for the initial identification and screening of alternatives during the feasibility study (FS). Section 300.430(e)(1) of the NCP states that, "... the lead agency shall include art alternatives screening step, when needed, (emphasis added) to select a reasonable number of alternatives for detailed analysis."

EPA conducted an analysis of potentially available technologies for municipal landfills and found that certain technologies are routinely and appropriately screened out on the basis of effectiveness, feasibility, or cost (NCP Section 300.430(e)(7)). (See Appendix A to this directive and "Feasibility Study Analysis for CERCLA Municipal Landfills," September 1993 available at EPA Headquarters and Regional Offices.) Based on this analysis, the universe of alternatives that will be analyzed in detail may be limited to the components of the containment remedy identified in Highlight 1, unless site-specific conditions dictate otherwise or alternatives are considered that were not addressed in the FS analysis. The FS analysis document, together with this directive, must be included in the administrative record for each municipal landfill presumptive remedy site to support elimination of the initial identification and screening of site-specific alternatives. Further detailed and comprehensive supporting materials (e.g., FS reports included in analysis, technical reports) can be provided by Headquarters, as needed.

While the universe of alternatives to address the landfill source will be limited to those components identified in Highlight 1, potential alternatives that may exist for each component or combinations of components may be evaluated in the detailed analysis. For example, one component of the presumptive remedy is source area ground-water control. If appropriate, this component may be accomplished in a number of ways, including pump and treat, slurry walls, etc. These potential alternatives may then be combined with other components of the presumptive remedy to develop a range of containment alternatives suitable for site-specific conditions. Response alternatives must then be evaluated in detail against the nine criteria identified in Section 300.430(e)(g) of the NCP. The detailed analysis will identify site-specific ARARs and develop costs on the basis of the particular size and volume of the landfill.

EARLY ACTION AT MUNICIPAL LANDFILLS

EPA has identifies the presumptive remedy site categories as good candidates for early action under SACM. At municipal landfills, the upfront knowledge that the source area will be contained may facilitate such early actions as installation of a landfill cap or a ground-water containment system. Depending on the circumstances, early actions may be accomplished using either removal authority (e.g., non-time-critical removal actions) or remedial authority. In some cases, it may be appropriate for an Engineering Evaluation/Cost Analysis to replace part or all of the RI/FS if the source control component will be a non-time-critical removal action. Some factors may affect whether a specific response action would be better accomplished as a removal or remedial action including the size of the action, the associated state cost share, and/or the scope of O&M. A discussion of these factors is contained in *Early Action and Long-term Action Under SACM - Interim Guidance,* Publication No. 9203.1-05I, December 1992.

SCOPING A STREAMLINED RI/FS UNDER THE PRESUMPTIVE REMEDY FRAMEWORK

The goal of an RI/FS is to provide the information necessary to: (1) adequately characterize the site; (2) define site dynamics; (3) define risks; and (4) develop the response action. As discussed in the following sections, the process for achieving each of these goals can be streamlined for CERCLA municipal landfill sites because of the upfront presumption that landfill contents will be contained. The strategy for streamlining each of these areas should be developed early (i.e., during the scoping phase of the RI/FS).

1. Characterizing the Site

The use of existing data is especially important in conducting a streamlined RI/FS for municipal landfills. Characterization of a landfill's contents is not necessary or appropriate for selecting a response action for these sites except in limited cases; rather, existing data are used to determine whether the containment presumption is appropriate. Subsequent sampling efforts should focus on characterizing areas where contaminant migration is suspected, such as leachate discharge areas or areas where surface water runoff has caused erosion. It is important to note that the decision to characterize hot spots should also be based on existing information, such as reliable anecdotal information, documentation, and/or physical evidence (see page 6).

In those limited cases where no information is available for a site, it may not be advisable to initiate use of the presumptive remedy until some data are collected. For example, if there is extensive migration of contaminants from a site located in an area with several sources, it will be necessary to have some information about the landfill source in order to make an association between on-site and off-site contamination.

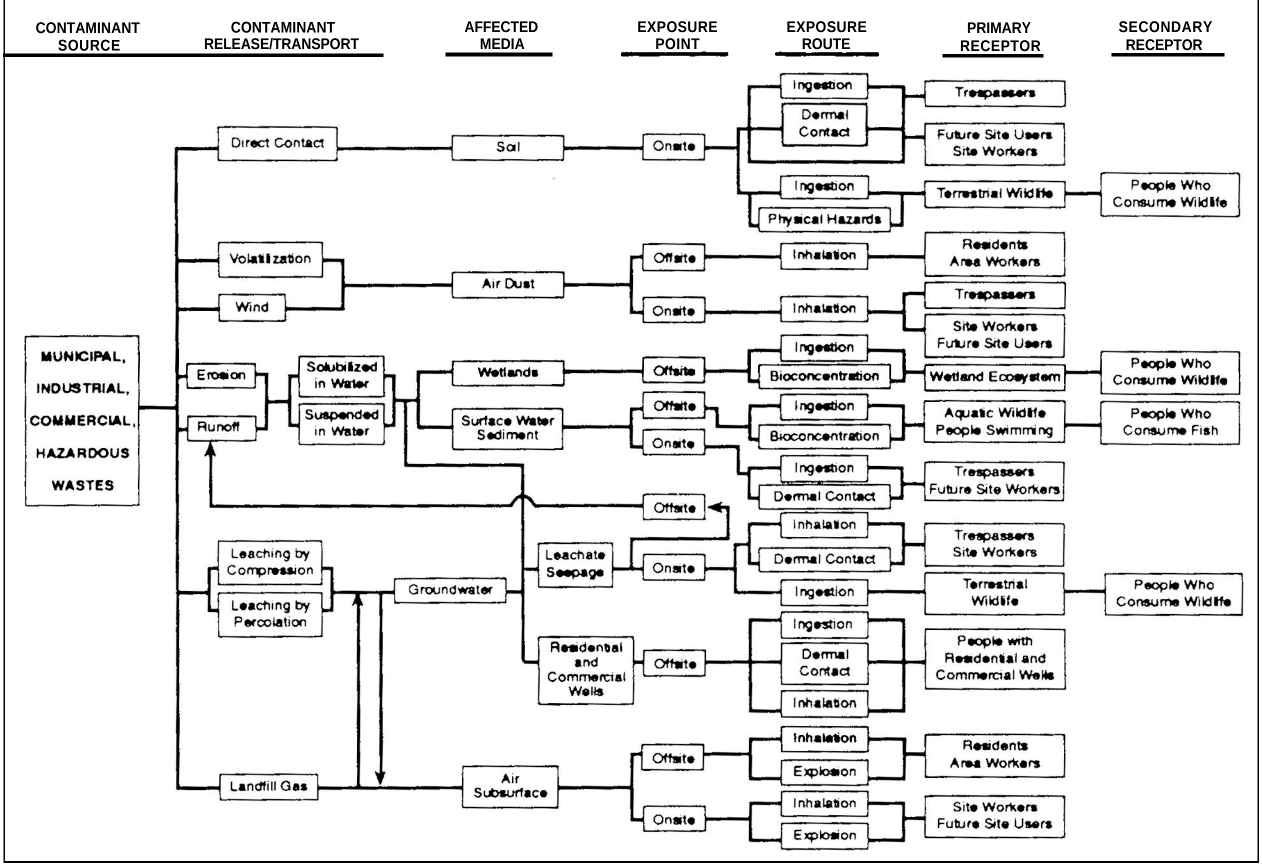
Sources of information of particular interest during scoping include records of previous ownership, state files, closure plans, etc., which may help to determine types and sources of hazardous materials present. In addition, a site visit is appropriate for several reasons, including the verification of existing data, the identification of existing site remediation systems, and to visually characterize wastes (e.g., leachate seeps). Specific information to be collected is provided in Sections 2.1 through 2.4 of the municipal landfill manual.

2. Defining Site Dynamics

The collected data are used to develop a conceptual site model, which is the key component of a streamlined RI/FS. The conceptual site model is an effective tool for defining the site dynamics, streamlining the risk evaluation, and developing the response action. Highlight 2 presents a generic conceptual site model for municipal landfill. The model is developed before any RI field activities are conducted, and its purpose is to aid in understanding and describing the site and to present hypotheses regarding:

- The suspected sources and types of contaminants present;
- Contaminant release and transport mechanisms;

Highlight 2: Generic Conceptual Site Model



- Rate of contaminant release and transport (where possible);
- Affected media;
- Known and potential routes of migration; and
- Known and potential human and environmental receptors.

After the data are evaluated and a site visit is completed, the contaminant release and transport mechanisms relevant to the site should be determined. The key element in developing the conceptual site model is to identify those aspects of the model that require more information to make a decision about response measures. Because containment of the landfill's contents is the presumed response action, the conceptual site model will be of most use in identifying areas beyond the landfill source itself that will require further study, thereby focusing site characterization away from the source area and on areas of potential contaminant migration (e.g., ground water or contaminated sediments).

3. Defining Risks

The municipal landfill manual states that a streamlined or limited baseline risk assessment will be sufficient to initiate response action on the most obvious problems at a municipal landfill (e.g., ground water, leachate, landfill contents, and landfill gas). One method for establishing risk using a streamlined approach is to compare contaminant concentration levels (if available) to standards that are potential chemical-specific applicable or relevant and appropriate requirements (ARARs) for the action. The manual states that where established standards for one or more contaminants in a given medium are clearly exceeded, remedial action generally is warranted.[3]

It is important to note, however, that based on site-specific conditions, an active response is not required if ground-water contaminant concentrations exceed chemical-specific standards but the site risk is within the Agency's acceptable risk range (10^{-4} to 10^{-6}). For example, if it is determined that the release of

[3]See also OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions,* April 22, 1991, which states that if MCLs or non-zero MCLGs are exceeded, [a response] action generally is warranted.

contaminants from a particular landfill is declining, and concentrations of one or more ground-water contaminants are at or barely exceed chemical-specific standards, the Agency may decide not to implement an active response. Such a decision might be based on the understanding that the landfill is no longer acting as a source of ground-water contamination, and that the landfill does not present an unacceptable risk from any other exposure pathway.

A site generally will not be eligible for a streamlined risk evaluation if ground-water contaminant concentrations do not clearly exceed chemical-specific standards or the Agency's accepted level of risk, or other conditions do not exist that provide a clear justification for action (e.g., direct contact with landfill contents resulting from unstable slopes). Under these circumstances, a quantitative risk assessment that addresses all exposure pathways will be necessary to determine whether action is needed.

Ultimately, it is necessary to demonstrate that the final remedy addresses all pathways and contaminants of concern, not just those that triggered the remedial action. As described in the following sections, the conceptual site model is an effective tool for identifying those pathways and illustrating that they have been addressed by the containment remedy.

Streamlined Risk Evaluation Of The Landfill Source

Experience from the presumptive remedy pilots supports the usefulness of a streamlined risk evaluation to initiate an early response action under certain circumstances. As a matter of policy, for the source area of municipal landfills, a quantitative risk assessment that considers all chemicals, their potential additive effects, etc., is not necessary to establish a basis for action if ground-water data are available to demonstrate that contaminants clearly exceed established standards or if other conditions exist that provide a clear justification for action.

A quantitative risk assessment also is not necessary to evaluate whether the containment remedy addresses all pathways and contaminants of concern associated with the source. Rather, all potential exposure pathways can be identified using the conceptual site model and compared to the pathways addressed by the containment presumptive remedy. Highlight 3 illustrates that the containment remedy addresses all exposure pathways associated with the source at municipal landfill sites.

Finally, a quantitative risk assessment is not required to determine clean-up levels because the type of cap will be determined by closure ARARs, and ground water that is extracted as a component of the presumptive remedy will be required to meet discharge limits, or other standards for its disposal. Calculation of clean-up levels for ground-water contamination that has migrated away from the source will not be accomplished under the presumptive remedy, since such contamination will require a conventional investigation and a risk assessment.

Highlight 3: Source Contaminant Exposure Pathways Addressed by Presumptive Remedy

1. Direct contact with soil and/or debris prevented by landfill cap;
2. Exposure to contaminated ground water within the landfill area prevented by ground-water control;
3. Exposure to contaminated leachate prevented by leachate collection and treatment; and
4. Exposure to landfill gas addressed by gas collection and treatment, as appropriate.

Streamlining the risk assessment of the source area eliminates the need for sampling and analysis to support the calculation of current or potential future risk associated with direct contact. It is important to note that because the continued effectiveness of the containment remedy depends on the integrity of the containment system, it is likely that institutional controls will be necessary to restrict future activities at a CERCLA municipal landfill after construction of the cap and associated systems. EPA has thus determined that it is not appropriate or necessary to estimate the risk associated with future residential use of the landfill source, as such use would be incompatible with the need to maintain the integrity of the containment system. (Long-term waste management areas, such as municipal landfills, may be appropriate, however, for recreational or other limited uses on a site-specific basis.) The availability and efficacy of institutional controls should be evaluated in the FS. Decision documents should include measures such as institutional controls to ensure the continued integrity of such containment systems whenever possible.

Areas of Contaminant Migration

Almost every municipal landfill site has some characteristic that may require additional study, such as leachate discharge to a wetland or significant surface water run-off caused by drainage problems. These migration pathways, as well as ground-water contamination that has migrated away from the source, generally will require characterization and a more comprehensive risk assessment to determine whether action is warranted beyond the source area and, if so, the type of action that is appropriate.

While future residential use of the landfill source area itself is not considered appropriate, the land adjacent to landfills is frequently used for residential purposes. Therefore, based on site-specific circumstances, it may be appropriate to consider future residential use for ground water and other exposure pathways when assessing risk from areas of **contaminant migration.**

4. Developing the Response Action

As a first step in developing containment alternatives, response action objectives should be developed on the basis of the pathways identified for action in the conceptual site model. Typically, the primary response action objectives for municipal landfill sites include:

<u>Presumptive Remedy</u>

- Preventing direct contact with landfill contents;
- Minimizing infiltration and resulting contaminant leaching to ground water;
- Controlling surface water runoff and erosion;
- Collecting and treating contaminated ground water and leachate to contain the contaminant plume and prevent further migration from source area; and
- Controlling and treating landfill gas.

<u>Non-Presumptive Remedy</u>

- Remediating ground water;
- Remediating contaminated surface water and sediments; and
- Remediating contaminated wetland areas.

As discussed in Section 3, "Defining Risks," the containment presumptive remedy accomplishes all but the last three of these objectives by addressing all pathways associated with the source. Therefore, the focus of the RI/FS can be shifted to characterizing the media addressed in the last three objectives (contaminated ground water, surface water and sediments, and wetland areas) and on collecting data to support design of the containment remedy.

Treatment of Hot Spots

The decision to characterize and/or treat hot spots is a site-specific judgement that should be based on the consideration of a standard set of factors. Highlight 4 lists questions that should be answered before making the decision to characterize and/or treat hot spots. The overriding question is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place. This question should be answered on the basis of what is <u>known</u> about a site (e.g., from operating records or other reliable information). An answer in the affirmative to all of the questions listed in Highlight 4 would indicate that it is likely that the integrity of the containment system would be threatened, or that excavation and treatment of hot spots would be practicable, and that a significant reduction in risk at the site would occur as a result of treating hot spots. EPA expects that few CERCLA municipal landfills will fall into this category; rather, based on the Agency's experience, the majority of sites are expected to be suitable for containment only, based on the heterogeneity of the waste, the lack of reliable information concerning disposal history, and the problems associated with excavating through refuse.

The volume of industrial and/or hazardous waste co-disposed with municipal waste at CERCLA municipal landfills varies from site to site, as does the amount of information available concerning disposal history. It is impossible to fully characterize, excavate, and/or treat the source area of municipal landfills, so uncertainty about the landfill contents is expected. Uncertainty by itself does not call into question the containment approach. However, containment remedies must be designed to take into account the possibility that hot spots are present in addition to those that have been identified and characterized. The presumptive remedy must be relied upon to contain landfill contents and prevent migration of comtaminants. This is accomplished by a combination of measures, such as a landfill cap combined with a leachate collection system. Monitoring will further ensure the continued effectiveness of the remedy.

The following examples illustrate site-specific decision making and show how these factors affect the decision whether to characterize and/or treat hot spots.

Examples of Site-Specific Decision Making Concerning Hot Spot Characterization/ Treatment

<u>Site A</u>

There is anecdotal information that approximately 200 drums of hazardous waste were disposed of at this 70-acre former municipal landfill, but their location and contents are unknown. The remedy includes a landfill cap and ground-water and landfill gas treatment.

A search for and characterization of hot spots is not supported at Site A based on the questions listed in

Highlight 4: Characterization of Hot Spots

If all of the following questions can be answered in the affirmative, it is likely that characterization and/or treatment of hot spots is warranted:

1. Does evidence exist to indicate the presence and approximate location of waste?
2. Is the hot spot known to be principal threat waste?*
3. Is the waste in a discrete, accessible part of the landfill?
4. Is the hot spot known to be large enough that its remediation will reduce the threat posed by the overall site but small enough that it is reasonable to consider removal (e.g., 100,000 cubic yards or less)?

*See *A Guide to Principal Threat and Low Level Threat Wastes,* November 1991, Superfund Publication No. 9380.3-06FS.

Highlight 4: (1) no reliable information exists to indicate the location of the waste; (2) the determination of whether the waste is principal threat waste cannot be made since the physical/chemical characteristics of the wastes are unknown; (3) since the location of the waste is unknown, the determination of whether the waste is in a discrete accessible location cannot be made; (4) in this ease, the presence of 200 drums in a 70-acre landfill is not considered to significantly affect the threat posed by the overall site. Rather, the containment system will include measures to ensure its continued effectiveness (e.g., monitoring and/or leachate collection) given the uncertainty associated with the landfill contents and suspected drums.

Site B

Approximately 35,000 drums, many containing hazardous wastes, were disposed of in two drum disposal units at this privately owned 80-acre inactive landfill, which was licensed to receive general refuse. The site is divided into two operable units. The remedy for Operable Unit 1 (OU 1) is incineration of drummed wastes in the two drum disposal units. The remedy for OU 2 consists of treatment of contaminated ground water and leachate and containment of treatment residuals (from OU 1) and remaining landfill contents, including passive gas collection and flaring.

Treatment of landfill contents is supported at Site B because all of the questions in Highlight 4 can be answered in the affirmative: (1) existing evidence from previous investigations and sampling conducted by the state (prior to the RI) indicated the presence and approximate location of wastes; (2) the wastes were considered principal threat wastes because they were liquids and (based on sampling) were believed to contain contaminants of concern; (3) the waste is located in discrete accessible parts of the landfill; and (4) the waste volume is large enough that its remediation will significantly reduce the threat posed by the overall site.

CLOSURE REQUIREMENTS

Subtitle D

In the absence of Federal Subtitle D closure regulations, State Subtitle D closure requirements generally have governed CERCLA response actions at municipal landfills as applicable or relevant and appropriate requirements (ARARs). New Federal Subtitle D closure and post-closure care regulations will be in effect on October 9, 1993 (56 FR 50978 and 40 CFR 258).[4] State closure requirements that are ARARs and that are more stringent than the Federal requirements must be attained or waived.

The new Federal regulations contain requirements related to construction and maintenance of the final cover, and leachate collection, ground-water monitoring, and gas monitoring systems. The final cover regulations will be applicable requirements for landfills that received household waste after October 9,1991. EPA expects that the final cover requirements will be applicable to few, if any, CERCLA municipal landfills, since the receipt of household wastes ceased at most CERCLA landfills before October 1991. Rather, the substantive requirements of the new Subtitle D regulations generally will be considered relevant and approptiate requirements for CERCLA response actions that occur after the effective date.

Subtitle C

RCRA Subtitle C closure requirements may be applicable or relevant and appropriate in certain circumstances. RCRA Subtitle C is applicable if the landfill received waste that is a listed or characteristic waste under RCRA, and:

1. The waste was disposed of after November 19,1980 (effective date of RCRA), or

[4]An extension of the effective date has been proposed but not finalized at this time.

2. The new response action constitutes disposal under RCRA (i.e., disposal back into the original landfill).[5]

The decision about whether a Subtitle C closure requirement is relevant and appropriate is based on a variety of factors, including the nature of the waste and its hazardous properties, the date on which it was disposed, and the nature of the requirement itself. For more information on RCRA Subtitle C closure requirements, see *RCRA ARARs:Focus on Closure Requirements,* Directive No. 9234.2-04FS, October 1989.

[5]Note that disposal of only small quantity hazardous waste and household hazardous waste does not make Subtitle C applicable.

Notice:

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APPENDIX A
TECHNICAL BASIS FOR PRESUMPTIVE REMEDIES

This Appendix summarizes the analysis that EPA conducted of feasibility study (FS) and Record of Decision (ROD) data from CERCLA municipal landfill sites which led to the establishment of containment as the presumptive remedy for these sites. The objective of the study was to identify those technologies that are consistently included in the remedies selected, those that are consistently screened out, and to identify the basis for their elimination. Results of this analysis support the decision to eliminate the initial technology identification and screening steps on a site-specific basis for this site type. The technical review found that certain technologies are appropriately screened out based on effectiveness, implementability, or excessive costs.

The methodology for this analysis entailed reviewing the technology identification and screening components of the remedy selection process for a representative sample of municipal landfill sites. The number of times each technology was either screened out or selected in each remedy was compiled. A detailed discussion of the methodology used is provided below.

METHODOLOGY

Identification of Sites for Feasibility Study Analysis

Of the 230 municipal landfill sites on the NPL, 149 sites have had a remedy selected for at least one operable unit. Of the 149 sites, 30 were selected for this study on a random basis, or slightly greater than 20 percent. The sites range in size from 8.5 acres to over 200 acres and are located primarily in Regions 1,2,3, and 5. This geographical distribution approximates the distribution of municipal landfills on the NPL.

Technology Secrrning and Remedial Alternative Analysis

The FS analysis involved a review of the technology identification and screening phase, including any pre-screening steps, followed by a review of the detailed analysis and comparative analysis phases. Information derived from each review was documented on site-specific data collection forms, which are available for evaluation as part of the Administrative Record for this presumptive remedy directive. The review focused on the landfill source contamination only; ground-water technologies and alternatives were not included in the analysis.

For the screening phase, the full range of technologies considered was listed on the data collection forms, along with the key reasons given for eliminating technologies from further consideration. These reasons were categorized according to the screening criteria: cost, effectiveness, or implementability. The frequency with which specific reasons were given for eliminating a technology from further consideration was then tallied and compiled into a screening phase summary table.

For the detailed analysis and comparative analysis, information on the relative performance of each technology/alternative with respect to the seven NCP criteria was documented on the site-specific data collection forms. The advantages and disadvantages associated with each clean-up option were highlighted. In some cases, a technology was combined with one or more technologies into one or more alternatives. The disadvantages of a technology/alternative were then compiled into a detailed analysis/comparative analysis summary table, under the assumption that these disadvantages contributed to non-selection. All summary tables are available for review as part of the Administrative Record.

RESULTS

The information from the technology screening and remedial alternative analyses is provided in Table 1. It demonstrates that containment (the presumptive remedy), was chosen as a component of the selected remedy at all thirty of the sites analyzed. No other technologies or treatments were consistently selected as a remedy or retained for consideration in a remedial alternative. However, at eight of the thirty sites, there were circumstances where technologies were included in the selected remedy to address a site-specific concern, such as principal threat wastes. These technologies are included in the column entitled "Tech. Not Primary Component of Alternative"[1] in Table 1 and include incineration at two sites, waste removal and off-site disposal at two sites, soil vapor extraction at two sites, and bioreclamation at one site.

Leachate collection and gas collection systems were also tracked as part of the detailed analysis and comparison of remedial alternatives. These types of systems generally were not considered as remediation technologies during the screening phases. At fifteen sites, leachate collection was selected as part of the overall containment remedy. At seventeen sites, gas collection systems were selected as part of the overall containment remedy.

This analysis supports the decision to eliminate the initial technology identification and screening step for municipal landfill sites. On a site-specific basis, consideration of remediation technologies may be retained as needed.

[1] This column title is used for record-keeping purposes only and is not meant to imply that these treatment technologies are not considered important components of the selected remedies.

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out[3]: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	#RODs Where Criterion Contributed to Non-selection: Protect	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Multi-layer Cap	28	25	3	0	2	2	0	18	7	1	0	0	1	3	5	3	---	---
Clay Cap	16	8	8	0	1	8	0	4	4	2	2	1	2	1	0	1	---	---
Asphalt Cap	17	0	17	0	2	14	5	0	0	0	0	0	0	0	0	0	---	---
Concrete Cap	17	0	17	0	3	14	5	0	0	0	0	0	0	0	0	0	---	---
Soil Cover	16	7	5	4	0	5	1	5	2	1	0	0	0	0	0	0	---	---
Synthetic Cap	13	3	10	0	0	10	1	2	1	1	1	1	1	1	1	1	---	---
Chemical Seal	5	0	5	0	0	4	0	0	0	0	0	0	0	0	0	0	---	---
Slurry Wall	22	5	14	3	2	8	6	2	3	3	2	2	1	2	0	2	---	---
Grout Curtain	18	0	18	0	3	15	9	0	0	0	0	0	0	0	0	0	---	---
Sheet Piling	17	1	16	0	0	13	5	0	1	0	0	0	0	0	0	0	---	---
Grout Injection	8	0	8	0	0	8	2	0	0	0	0	0	0	0	0	0	---	---
Block Displacement	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Bottom Sealing	5	0	5	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	#RODs Tech. Selected	#RODs Tech. Not Selected	#RODs Where Criterion Contributed to Non-selection: Protect	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns 4	Community Concerns 4
Vibrating Beam	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Liners	2	0	2	0	0	1	2	0	0	0	0	0	0	0	0	0	---	---
Offsite Nonhazardous Landfill	3	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	---	---
Offsite RCRA Landfill	17	0	13	4	8	3	12	0	0	0	0	0	0	0	0	0	---	---
Offsite Landfill (unspecified)	9	1	8	0	5	3	5	1	0	0	0	0	0	0	0	0	---	---
Onsite Nonhazardous Landfill	2	0	2	0	1	1	1	0	0	0	0	0	0	0	0	0	---	---
Onsite RCRA Landfill	14	1	11	2	3	2	10	0	1	0	0	0	0	0	0	1	---	---
Onsite Landfill (unspecified)	7	0	6	1	3	3	6	0	0	0	0	0	0	0	0	0	---	---
Bioremediation (unspecified)	13	0	13	0	0	13	1	0	0	0	0	0	0	0	0	0	---	---
Bioremediation Ex-situ	10	0	10	0	0	7	7	0	0	0	0	0	0	0	0	0	---	---
Bioremediation In-situ	15	1	14	0	1	13	7	1	0	0	0	0	0	0	0	0	---	---
Dechlorinization/ APEG	6	0	5	1	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Oxidation/ Reduction	12	0	12	0	1	8	5	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out[3]: Cost	# FSs Where Criterion Contributed To Screening Out[3]: Effectiveness	# FSs Where Criterion Contributed To Screening Out[3]: Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	#RODs Where Criterion Contributed to Non-selection: Protect	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Neutralization	4	0	3	1	0	2	1	0	0	0	0	0	0	0	0	0	---	---
Thermal Destruction (unspecified)	6	0	6	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---
Offsite Incineration (unspecified)	19	2	14	3	9	5	10	1	1	0	0	0	0	1	1	0	---	---
Onsite Incineration (unspecified)	12	0	8	3	5	5	6	0	1	0	0	0	0	1	1	1	---	---
Fluidized Bed	9	0	9	0	5	6	4	0	0	0	0	0	0	0	0	0	---	---
Infrared	8	0	7	1	6	3	3	0	0	0	0	0	0	0	0	0	---	---
Pyrolysis	5	2	3	1	2	2	1	0	1	0	1	0	0	1	1	1	---	---
Multiple Hearth	4	0	4	0	2	2	1	0	0	0	0	0	0	0	0	0	---	---
Rotary Kiln	10	0	9	1	6	5	4	0	0	0	0	0	0	0	0	0	---	---
Vitrification	21	0	21	0	8	15	11	0	0	0	0	0	0	0	0	0	---	---
Low Temperature Thermal Desorp/ Stripping	13	1	11	1	2	9	3	0	1	0	0	0	0	0	1	0	---	---
In-situ Steam Stripping	5	0	5	0	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Soil Flushing	16	2	14	0	2	9	10	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3			# RODs Tech. Selected	# RODs Tech. Not Selected	#RODs Where Criterion Contributed to Non-selection								
					Cost	Effectiveness	Implement			Protect	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Soil Washing	12	2	9	1	1	8	6	0	0	0	0	0	0	0	0	0	---	---
Soil Vapor Extraction (SVE)	14	1	11	2	2	9	5	1	0	0	0	0	0	0	0	0	---	---
Fixation	7	1	5	1	0	4	2	2	0	0	0	0	0	0	0	0	---	---
Stabilization/ Solidification	20	0	19	2	1	13	6	0	0	0	0	0	0	0	0	0	---	---
Aeration	7	0	7	0	0	5	3	0	0	0	0	0	0	0	0	0	---	---

[1] The study was conducted on 30 RODs and their corresponding FSs.

[2] This does not include the no-action or institutional control only alternatives. No RODs selected either of these as remedies.

[3] FSs and RODs may contain more than one criterion for screening or non-selection of technology. Also, some FSs did not fully explain the criteria for screening out a technology. Thus, the totals for screening and non-selection criteria are not equal to the number of FSs and RODs considered.

[4] Information on State and community concerns was not included in this analysis because FSs do not contain this information and RODs generally only reference supporting documentation (i.e., State concurrence letter and responsiveness summary).

H2. Presumtive Remedy: Policy and Procedures (EPA, 1993b)

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

Directive: 9355.0-47FS
EPA 540-F-93-047
PB 93-963345
September1993

EPA

Presumptive Remedies: Policy and Procedures

Office of Emergency and Remedial Response
Hazardous Site Control Division 5203G

Quick Reference Fact Sheet

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, Superfund is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these sites. The presumptive remedy approach is one tool of acceleration within the **Superfund Accelerated Cleanup Model (SACM).**

The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigations and speed up selection of cleanup actions. Overtime presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances. EPA plans to develop a series of directives on presumptive remedies for various types of sites.

This directive serves as an overall guide to the presumptive remedies initiative and its effect on site cleanup. Through a question and answer format, it explains, in general terms, ways in which presumptive remedies will streamline or change the remedial and removal processes from the conventional processes and how certain Superfund policies will be affected by the initiative. This directive also unites the series of directives, due to come out over the next year, on presumptive remedies for specific site types (e.g., Volatile Organic Compounds (VOCs), wood treaters, ground water). This general directive, together with the site type-specific directives, will provide readers with a comprehensive knowledge of the procedural as well as policy considerations of the presumptive remedies initiative. The directive is designed for use by staff involved in managing site cleanups (e.g., Remedial Project Managers (RPMs), On-Scene Coordinators (OSCs), Site Assessment Managers (SAMs)). Site managers in other programs, such as RCRA Corrective Action, the Underground Storage Tank program, State Project Managers, or private sector parties, may also use this directive, as appropriate.

Provided below are several common questions and answers regarding general issues associated with presumptive remedies.

Q1. What Are Presumptive Remedies and How Should They Be Used?

A. Presumptive Remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. EPA has evaluated technologies that have been consistently selected at past sites using the remedy selection criteria set out in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); reviewed currently available performance data on the application of these technologies; and has determined that a particular remedy, or set of remedies, is **presumptively** the most appropriate for addressing specific types of sites.

Presumptive remedies are expected to be used at all appropriate sites. The approaches described in each presumptive remedies directive are designed to accommodate a wide range of site-specific circumstances. In some cases, multiple technologies are included (e.g., VOCs); in others, various components of the presumptive remedy are optional, depending on site situation (e.g., municipal landfills). Further, these directives recognize that at some sites, there may be unusual circumstances (such as complex contaminant mixtures, soil conditions, or extraordinary State and community concerns) that may require the site manager to look beyond the presumptive remedies for additional (perhaps more innovative) technologies or remedial approaches.

These tools will help site managers to focus data collection efforts during site investigations (e.g., remedial investigations, removal site evaluation) and significantly reduce the technology evaluation phase (e.g., Engineering Evaluation/Cost Analysis (EE/CA) and/or Feasibility Studies (FS)) for certain categories of sites. The specific impacts on the various stages of the remedy selection process are highlighted in questions 7 and 8 of this guidance. It is advised that presumptive remedies be used with the assistance of the expert teams[1] for the various categories of sites.

Q2. Why Should Presumptive Remedies Be Used?

Presumptive remedies are expected to have several benefits. Limiting the number of technologies considered should promote focused data collection, resulting in streamlined site assessments and accelerated remedy selection decisions which achieve time and cost savings. Additional time savings could be realized during the remedial design since early knowledge of the remedy may allow technology-specific data to be collected upfront during the remedial investigation. Presumptive remedies will also produce the added benefit of promoting consistency in remedy selection, and improving the predictability of the remedy selection process for communities and potentially responsible parties (PRPs).

Presumptive remedies may be used as part of a wide variety of response actions. These actions include non-time-critical removal and early remedial actions, actions at sites with different leads (e.g., Fund-lead, State-lead, PRP-lead), actions addressing one or more contaminated media, actions with several operable unitss, and actions involving treatment trains.

Q3. Can Presumptive Remedies be Implemented Within the Existing NCP Process?

Yes. The presumptive remedy approach is consistent with all of the requirements of the NCP, and in particular the site management principle of streamlining (see section 300.430(a)(1)(ii)(C)). The presumptive remedy approach simply consolidates what have become the common, expected results of site-specific decision making at Superfund sites over the past decade. The various presumptive remedies directives and supporting documentation (e.g., "Feasibility Study Analysis for CERCLA Sites with Volatile Organic Compounds in Soils") provide the basis for an administrative record which justifies consideration of a very limited number of cleanup options. These materials summarize the findings of EPA's research and analysis, and the reasons that were found for generally considering certain technologies more or less appropriate.

The availability of presumptive remedies does not preclude a Region from expanding the FS (either on its own initiative or at the suggestion of outside parties) to consider other technologies under unusual site-specific circumstances. The site type directives will define the kind of circumstances (e.g., soil conditions, heterogeneous and complicated contamination mixtures, field tests demonstrating significant advantages of alternate or innovative technologies, etc.) that may make presumptive remedies less clearly suited for particular sites. Most of these directives also provide references to additional technologies if the presumptive remedies are found not to apply at a particular site.

Q4. How Did the Presumptive Remedies Initiative Evolve?

A. The general concept of presumptive remedies was first proposed in 1990 during the Superfund 90-Day Study and subsequently in 1991 during the 30-Day Study as a method of accelerating the remedial process. These management studies were efforts to generate options for accelerating the overall Superfund clean-up process. The presumptive remedies initiative is also consistent with, and supports, a larger program initiative known as the Superfund Accelerated Cleanup

[1] It is envisioned that for most categories of sites, teams of experts (technical, legal, policy, etc.) who have developed the presumptive remedies guidance and Regional site managers conducting field demonstrations, will be available to assist site managers in implementing presumptive remedies on a site-specific basis.

Table 1
Current Presumptive Remedies and Contacts

Site Type/Schedule	Presumptive Remedy(ies)	Anticipated Products	EPA Contact
General Policy and Procedures (9/93)	NA	*Presumptive Remedies: Policy and Procedures*	Shahid Mahmud Headquarters, HSCD (703) 603-8789
Volatile Organic Compounds (VOCs) in Soils (9/93)	Soil Vapor Extraction, Thermal Desorption, Incineration	*Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with VOCs in Soils*	Shahid Mahmud Headquarters, HSCD (703) 603-8789
Wood Treaters (6/94)	For Organics - Incineration, Bioremediation, Dechlorination For Inorganics - Immobilization	*Presumptive Remedy: Wood Treating Sites* *Technology Selection Guide for Wood Treater Sites (5/93)*	Lisa Boynton Headquarters, ERD (703) 603-9052 Harry Allen Emergency Response Division (908) 321-6747
Municipal Landfills (9/93)	Containment (could include capping, leachate collection and treatment, LF gas treatment, institutional controls, etc.)	*Presumptive Remedy for CERCLA Municipal Landfill Sites*	Andrea McLaughlin Headquarters, HSCD (703) 603-8793
Contaminated Ground Water (1/94)	Pump and Treat (Will specify preferred treatment technologies & describe overall approach)	*TBD*	Ken Lovelace Headquarters, HSCD (703) 603-8787
Region 7 Pilots - PCB Sites, Coal Gas Sites, Grain Storage Sites (6/94)	TBD	*TBD*	Diana Engeman Region 7 (913) 551-7746

KEY:
TBD - To Be Determined
NA - Not Applicable

Model (SACM). SACM incorporates theexperience gained from past Superfund actions into an integrated approach to site cleanup aimed at getting response action decisions made and implemented more quidkly. The presumptive remedies initiative is one mechanism for accomplishing the broad sreamlining goal set fort by SACM. The presemptive remedies initiative was also identifies as one of the Adminsitrative Improvements to Superfund in June of 1993.

Q5. What Other Presumptive Remedy Initiatives are Underway or Planned?

A. There are a variety of presumptive remedy activities currently planned or underway. Table 1 lists the site types with the anticipated schedule of associated presumptive remedy products that are currently underway along with the Headquarters and Regional contacts. There are four site types for which presumptive remedies are being developed in EPA Headquarters: VOCs, wood treaters, municipal landfills, and contaminated ground-water sites. Concurrently, Region 7 is preparing presumptive remedy guidances for PCB, coal gasification, and grain storage sites.

Q6. How Will Presumptive Remedies Affect the Remedy Secection Process?

A. Presumptive remedies are anticipated to affect se3veral phases of the ccurrent remedy selection process. A diagram depicting the generic impacts on the overall process is provded in Table 2.

Data collection during the initial site assessment(Preliminary Assessment/Site Inspection (PA/SI)

Table 2
Generic Effect of Presumptive Remedies

Stage	Phases of Cleanup Process	Effect on Cleanup Process
SITE ASSESSMENT	PA/SI or Removal Site Evaluation	X
SITE ASSESSMENT	Scoping • Collect and analyze existing data	○
SITE ASSESSMENT	• Identify initial project/OUs and remedial action objectives	■
SITE ASSESSMENT	• Identify range of likely alternatives	■
SITE ASSESSMENT	• Identify potential ARARs	○
SITE ASSESSMENT	• Identify initial DQOs	○
SITE ASSESSMENT	• Prepare project plans	■
SITE ASSESSMENT	Remedial Investigation • Conduct field investigation	X(1)
SITE ASSESSMENT	• Define nature and extent of contamination	○(1)
SITE ASSESSMENT	• Identify ARARs	○
SITE ASSESSMENT	• Conduct baseline risk assessment	○(1)
FEASIBILITY STUDY OR EE/CA	Remedy Selection • Identify potential treatment technologies and containment/disposal requirements	●
FEASIBILITY STUDY OR EE/CA	• Screen technologies	●
FEASIBILITY STUDY OR EE/CA	• Assemble technologies into alternatives	●
FEASIBILITY STUDY OR EE/CA	• Screen alternatives as necessary to reduce number subject to detailed analysis	●
FEASIBILITY STUDY OR EE/CA	• Further refine alternatives as necessary	■
FEASIBILITY STUDY OR EE/CA	• Analyze alternatives against the nine criteria and each other	■
	Proposed Plan	■
	Record of Decision	■
	Remedial Design	■

○ = not impacted ■ = Streamlined
X = Focused ● = Eliminated
(1) Streamlined for Municipal Landfills

or Removal Site Evaluation) can be used to help define the specific site typw and to determine whether presumptive remedies may be potentially applicable.

Assuming the site warrants further attention (i.e., it is listed on the National Priorities List (NPL) or determined by the Regional Decision Team (RDT) to be an NPL-caliber site or to merit a removal action), further confirmation of the site type should take place as either an RI/FS or EE/CA is scoped to determine whether the site is a potential candidate for presumptive remedies. For a detailed discussion of how to make this determination, refer to the appropriate site type-specific directive. If it is determined that a site falls into a certain category, the presumptive remedies associated with that site type should be included in the list of likely remedial alternatives (e.g., no action, presumptive remedies, etc.) For the site. Other aspects of scoping that may be affected by presumptive remedies are the designation of appropriate operable units (OUS) and identification of data needed to support the evaluation and selection of a presumptive remedy.

Presumptive remedies are expected to help focus data collection efforts. Specifically, initial data collection would focus on confirming the site type. If the site is of the typw for which presumptive remedies have been developed, the streamlined steps for site characterization outlined in the site type-specific directive for the particular site type should be followed. These steps outline data collection to determine the extent of contamination and to support selection of the presumptive remedy and Remedial Design (RD).

Presumptive remedies will streamline the FS and the alternatives analysis in the EE/CA more than any other phase of the remedy selection process. In most cases, after a site is confirmed as being a type for which presumptive remedies exist, a focused FS or EE/CA which eliminates the technology identification and screening step would be prepared. The study would limit its consideration to the no action alternative and the presumptive remedy technologies. This is possible because EPA has conducted an analysis of potentially available technologies for most of the presumptive remedies site categories and has determined that certain technologies are routinely and appropriately screened out either on the basis of effectiveness, implementability, or excessive cost (NCP Section 300.430 (e)(3) and (7)), or have not been selected under the nine criteria analysis identified in NCP Section 300.430 (e) (9). This detailed analysis will serve to substitute for the development and screening of alternatives phases of the FS (and will allow the remaining alternatives to be limited to variations of the presumptive remedy). The site-specific directive and supporting documentation (e.g., "Feasibility Study Analysis for CERCLA Municipal Landfill Sites") along with this directive then can be placed in the administrative record for the site to support the elimination of the screening step identified in section 300.430 (e) (1) of the NCP. Further supporting materials can be provided by Headquarters (e.g., FS reports included in the analysis, technical reports), as needed. The specific presumptive remedy directives address the process of eliminating the alternatives development and screening step of the RI/FS or EE/CA in further detail. The directives also provide generic discussion of a partial nine criteria analysis (excluding state ARARs and community and state acceptance) and may help streamline the detailed analysis of alternatives within the FS and EE/CA reports. However, the user is cautioned that the criteria are discussed on a general basis and the nine criteria analysis should be supplemented to reflect the site-specific conditions.

The Proposed Plan (PP) and subsequent ROD would be similarly streamlined by focusing only on the presumptive remedy(ies). The remedial design (RD) may be streamlined since some RD data will likely have been collected previously during the site assessment and RI.

Q?. How Will Presumptive Remedies Affect the Removal Process?

A. Non-time critical removal actions are anticipated to be used more often to accomplish early actions at Superfund sites under SACM. The presumptive remedies approach will focus the data collection during the removal site evaluation and reduce the number of technologies identified and analyzed in the EE/CA. Presumptive remedies are not expected to have an impact on emergency and time-critical actions under the removal program.

Q8. What are the Implications of Presumptive Remedies for Innovative Technologies?

The NCP in section 300.430 (a) (1) (iii) (E) states that "EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance and implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies." The use of the presumptive remedies may tend to reduce the frequency of the full evaluation of innovative technologies. However, as indicated previously, the presumptive remedies provide a tool for streamlining the remedy selection process. They do not preclude the consideration of innovative technologies should the technologies be demonstrated to be as effective or superior to the presumptive remedies. Innovative technologies may be evaluated and recommended in addition to the presumptive remedies where these criteria are met.

EPA encourages review of the latest Innovative Technologies Semi-Annual Reports or Engineering Bulletins for the up-to-date information on the potential effectiveness and applicability of various innovative technologies. Site managers are strongly encouraged to involve the site-type expert team (see Question 13) to determine whether unusual circumstances exist to consider a non-presumptive remedy based on site-specific conditions and/or community, state, and PRP concerns, or the availability of a potentially promising innovative technology.

Q9. How Will Presumptive Remedies Affect Risk Assessments?

A. Generally, the role of baseline risk assessments under the presumptive remedy approach would be unaffected with Municipal Landfill sites being a notable exception. It is anticipated that risk assessments would still be needed on a site-specific basis to assist site managers in determining the need for a response action. EPA managers have indicated the value of the risk assessment in communicating with states, PRPs, and local communities about the nature and extent of health and environmental threats. Therefore, it is recommended that the current risk assessment process be continued on an individual site basis except for Municipal Landfills. The site manager should refer to the EPA Directive entitled "Presumptive Remedy for CERCLA Municipal Landfill Sites," Directive No. 9355.0-49FS to identify streamlining opportunities at Municipal Landfill sites.

Guidance on developing risk-based preliminary remediation goals (PRGs) would be unaffected under this initiative. These goals are needed for individual sites especially in the absence of ARARs to assist in determining which remedial options will result in medium-specific chemical concentrations that are protective of human health. For example, there may be several candidate presumptive remedies identified in the site-type directives. But it is the extent and degree of contamination across a given site that will determine whether a technology, which is predicted to reduce a chemical's concentration to some specified level, will be adequate by itself to produce protective concentrations following remedial action. For some sites or site locations, because of the magnitude of contamination or co-occurrence of contaminants, it may be necessary to assemble several technologies into a treatment train to adequately reduce levels of all chemicals of concern in a medium to protective levels. In other cases, it may be necessary to evaluate the use of institutional and/or engineering controls on an area following remediation to ensure protection during subsequent land use. In other words, it is not reasonable to assume that because a specific technology resulted in "protection" at one site, it will result in protective levels at all sites. A determination that the selected remedy will result in protection of human health and the environment must be made for each site. Both ARARs and risk-based PRGs are important tools in this exercise.

Generally, presumptive remedy directives will specify those technologies that have been determined to achieve levels protective of human health and the environment under a variety of site conditions. However, because all sites differ to some extent, especially in their relation to surrounding communities and sensitive ecosystems, a determination must still be made on a site-specific basis as to how a given remedy design is expected to achieve "protectiveness" during remedy construction and following remedial action. Overall protection of human health and the environment is one of two threshold considerations (the other being compliance with ARARs) that must be met in order for an alternative to be eligible for selection as the remedy for a given site.

Q10. What if Outside Parties such as PRPs or the Community Want Other Alternatives Considered?

A. The identification of a presumptive remedy does not relieve EPA of the obligation to propose the remedy for public comment, or to respond to comments suggesting that other alternatives should have been considered. In some cases, the information in the site-type directive and supporting documentation may be sufficient to address such comments; in others, additional analysis may be required to assess the relative merits of an alternative technology proposed by a commenter.

To reduce the risk of delay due to the need to respond to such comments, it is generally desirable to publicize the planned use of presumptive remedies early on, and give States, communities, PRPs, and others an early opportunity to express any concerns they may have about focusing the FS or EE/CA in this way. The agency may then decide whether to include additional alternatives in the FS or EE/CA so that those concerns can be addressed before the remedy is proposed.

In general, it is expected that the directive and supporting documents will provide substantial justification for preferring the presumptive remedy over alternative technologies. Therefore, the submission of comments advocating other approaches does not necessarily require broadening of the FS or EE/CA, or conducting additional analysis after the plan has been proposed. Whether additional documentation is required will depend upon how substantial or persuasive the comments are (e.g., whether a comment identifies unusual site circumstances that seriously call into question the applicability of the presumptive remedy). The Region will have to assess this by evaluating each comment on its own merits.

It should be noted that even if the FS is broadened to consider alternatives other than the presumptive remedy, much of the benefit of the presumptive remedy approach can still be achieved. In such cases, it is not necessary to address the full array of possible technologies, rather only the presumptive remedy and the specific alternative(s) that genuinely warrant detailed study. Therefore, the FS can still be narrowed and data gathering can still be focused.

Q11. How do State ARARs Affect the Use of Presumptive Remedies?

A. Any remedy, including presumptive remedies, must be selected in accordance with Section 121(d)(2)(A)(ii) of the Comprehensive Environmental Response, Compensation and Liability Act

(CERCLA), which specifies that selected remedial actions comply with promulgated standards under Federal and more stringent State environmental laws (i.e., State ARARs). At this time it is difficult to predict situations where presumptive remedies will not comply with State ARARs, and such issues must necessarily be addressed on a site-specific basis. However, as the presumptive remedies have been widely selected, they are likely to be capable of meeting State ARARs.

Q12. What Are the Implications of Presumptive Remedies on Community, PRP, and State Relations?

A. It will generally be desirable to notify the community, State, and PRP(s) as early in the clean-up process as possible that presumptive remedies are being considered for the site. This notification can take the form of a fact sheet, a notice in the newspaper, and/or a public meeting in which the site manager (with assistance from the expert team, as desired) explains the rationale for taking such actions and distributes the appropriate directives of the site type in question. Additionally, the site manager should explain the potential benefits associated with the use of presumptive remedies such as time and cost savings, and consistency. Early discussions about the rationale for presumptive remedies should help instill confidence in both the technologies and remedy selection processes.

Q13. How Will EPA Communicate Progress on Current Presumptive Remedies, Newly Developed Presumptive Remedies, and Future Issues Related to Presumptive Remedies?

A. Information about presumptive remedies will be communicated in several ways. First, it is anticipated that an orientation will be provided to communicate the key elements of presumptive remedies to Regional site managers as appropriate. This may be followed by periodic meetings with expert teams, if necessary, to scope out the applications of presumptive remedies on a site-specific basis. The expert team may also be used to convey any new developments on technology or policies and procedures for general or specific applications. A quarterly conference call is also anticipated between site managers and the expert teams to allow for the exchange of ideas and to identify and resolve technical issues. Technology selection directives, SACM Bulletins, and Q&A directives will be published periodically to disseminate information on presumptive remedies and related issues as they arise. Finally, the presumptive remedies directives on the various site categories will be updated every several years to reflect new technology development and up-to-date performance data, as appropriate.

Notice:

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H3. Feasibility Study Analysis for CERCLA Municipal Landfill Sites (EPA, 1994)

PB95-963301
EPA540/R-94/081
9356.0-03

FEASIBILITY STUDY ANALYSIS FOR CERCLA MUNICIPAL LANDFILL SITES

August 1994

FEASIBILITY STUDY ANALYSIS FOR CERCLA MUNICIPAL LANDFILLS

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PREFACE

The *Feasibility Study Analysis For CERCLA Municipal Landfill Sites* is an evaluation of technologies considered in the feasibility studies (FSs) of 30 municipal landfill (MLF) sites. This evaluation involved analyzing technical literature and the results of the remedy selection process from the subject FSs and Records of Decisions (RODs) to formulate general conclusions about the appropriateness of applying the technologies at this site type. The evaluation concludes that certain technologies were routinely screened out based on effectiveness, implementability, or excessive costs, thereby providing a basis for limiting the universe of technologies and alternatives analyzed when applying the presumptive remedy for MLF sites. Because the presumptive remedy approach for MLF sites is outlined in guidance that is non-binding (i.e., Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-49FS entitled *Presumptive Remedy For CERCLA Municipal Landfill Sites*), and not a rule, the administrative record must contain information which provides the basis for limiting the analysis to only those technologies outlined in the OSWER directive. This document provides the necessary technical basis. The U.S. Environmental Protection Agency (EPA) intends for this document to replace the analysis of the other technologies that would normally be found in the alternative identification and screening steps of a feasibility study. As such, this document is a key element of the administrative record for any site where the presumptive remedy approach is used.

The presumptive remedy approach, however, does not entirely eliminate the analysis of technologies and alternatives for several reasons. First, the MLF presumptive remedy includes combinations of several technologies—capping, leachate collection and/or treatment, and gas collection and/or treatment—that may be recommended for consideration and, thus, analyzed. Second, even where only one technology is recommended, there are often various process options or applications of that technology that must be further evaluated. Third, before choosing the presumptive remedy approach, unusual site conditions might justify consideration of a non-presumptive remedy technology. In that case, the presumptive remedy approach could be used, except that the additional potentially suitable technology would be included. It would not be necessary to do a site-specific analysis of all other technologies. Finally, this document does not address innovative or developing technologies. The use of presumptive remedies does not preclude the consideration of such technologies.

This document contains information on non-presumptive remedy technologies, whereas the OSWER directive contains information on those that were selected as presumptive remedies. Part I of this document contains a general overview of the presumptive remedy process and supporting analysis. It includes a description of the:

- MLF sites, in general
- Remedy selection process

- Presumptive remedies for MLF sites
- Nature, results, and general conclusions of the analysis.

Part II reviews individual technologies. In each case, the discussion:

- Describes the technology's general strengths and weaknesses

- Identifies factors that may limit its usefulness for application at MLF sites

- Presents a statistical review of how often the technology was considered and how it fared in the screening and detailed analysis phases in past feasibility studies

- Draws conclusions regarding its general suitability for MLF sites in the context of the National Contingency Plan (NCP) criteria

- Identifies technical references for its findings.

Appendix A summarizes the findings as to the number of cases in which each technology was screened out in the 30 feasibility studies included in this analysis, and the criteria on which it was screened out (for seven of the nine NCP criteria). Appendix B describes in greater detail the reasons given in the FSs and RODs for screening out each technology. Appendix C presents a summary of the remedy selection process in the FS and ROD for each site that was analyzed.

Users of this document should familiarize themselves with all of its contents including its appendices. Much information relevant to justifying the exclusion of non-preferred technologies can be found in the appendices. However, for a complete, detailed discussion of a technology, the user must refer to the FS, ROD, or technical reference.

It is not anticipated that this document will fully address all the questions about the screening and elimination of particular technologies. At some sites, more sophisticated questions may be raised that may require a more detailed response than this document provides. In that case, a greater amount of site-specific analysis will be required. Nevertheless, it is expected that this document will provide an adequate basis for responding to general questions and comments on the presumptive remedy approach.

I. OVERVIEW OF ANALYSIS

A. INTRODUCTION

Presumptive remedies are preferred technologies for common categories of sites selected on the basis of historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigation and the selection of cleanup actions. Over time, presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances. Site-specific conditions (e.g., soil types, ground-water contamination) must be addressed, as they may make the presumptive remedy approach more or less appropriate at a given site.

Conditions at a site also may justify considering other technologies along with the presumptive remedy. These potential alternatives may then be combined with other components of the presumptive remedy to develop a range of alternatives suitable for site-specific conditions. At some sites, it will be determined that treatment of hot spots is appropriate. It is expected that the presumptive remedy of containment also will be implemented at these sites in conjunction with treatment of some portion of the waste. At sites such as these, a full-scale FS will be required to identify the most appropriate remedy. This report will not be used in lieu of the technology identification and screening steps at such sites, although it can be used for informational purposes. Other presumptive remedy documentation also will be appropriate for use, including OSWER Directive 9355.0-49FS, *Presumptive Remedy for CERCLA Municipal Landfill Sites, and Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, EPA/540/P-92-001.

It is important to note that this document does not address some innovative or developing technologies. As discussed in the directive entitled *Presumptive Remedies Policy and Procedures:* (OSWER Directive 9355.0-47FS), the use of presumptive remedies does not preclude the possibility of considering such technologies.

B. BACKGROUND

Since 1980, the Superfund program has found that certain categories of sites have similar characteristics such as, types of contaminants present, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, EPA has undertaken an initiative to develop "presumptive remedies" to accelerate future cleanups at these types of sites. Selecting presumptive remedies depends upon preferred technologies for common, categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation.

1. CERCLA MUNICIPAL LANDFILL SITES

Approximately 20 percent of the sites on the NPL are MLF sites which typically share similar characteristics. Waste in these landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. The volume of industrial/hazardous waste co-disposed with the municipal waste varies from site to site, as does what is known of the disposal history. (It is almost impossible to fully characterize, excavate, and/or treat the source area of these landfills, so uncertainty about the contents is expected.) Typically, MLF sites on the NPL can contain a variety of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs), as well as a host of inorganic compounds and metals. Because of the size and heterogeneity of the contents, the preamble to the NCP (found in the Code of Federal Regulations Title 40, Part 300) identifies MLF sites as a type of site where treatment of the waste may be impracticable.

2. PRESUMPTIVE REMEDY DESCRIPTION

The presumptive remedy for MLF sites is containment, which may include some or all of the following components as appropriate, based on site-specific conditions: landfill cap, collection and/or treatment of landfill gas, control of landfill leachate, affected ground water at the landfill perimeter, and/or upgradient ground water that is causing saturation of the landfill mass. The decision to select containment still allows the lead agency to consider a variety of options that fall within the scope of this technology (Table 1). For example, a variety of capping technologies and vertical/ horizontal barriers were identified in the FSs for MLF sites. The variety of caps available ranges from hardened layers (including asphalt and concrete caps) to protective layers (including clay or synthetic caps and soil covers). In some instances, this technology was used in conjunction with other remedial technologies. The value of capping technologies is that they minimize surface water infiltration and prevent exposure to the waste.

Table 1. CONTAINMENT TECHNOLOGY OPTIONS

Capping Techniques	Vertical/Horizontal Barriers
Multi-layer cap Asphalt cap Concrete cap Clay cap Soil cover Synthetic cap Chemical sealants	Slurry Wall Grout Curtain Sheet Piling Grout Injection Block Displacement Bottom Sealing Vibrating Beam Liners

3. REMEDY SELECTION PROCESS

The components of the remedy selection process pertinent to this analysis are the remedial investigation /feasibility study (RI/FS), proposed plan, and ROD. The RI, which is generally conducted concurrently with the FS, is designed to determine the nature and extent of contamination. The FS describes and analyzes the potential cleanup alternatives for a site and provides the basis for considering and eliminating technologies.

The FS consists of three major phases: identification and initial screening of technologies, development of alternatives, and detailed analysis of alternatives. During the initial screening, the full range of available technologies is evaluated based on cost, effectiveness, and implementability. Technologies passing this screening step are combined into remedial alternatives, taking into account the scope, characteristics, and complexity of the site problem(s) being addressed. This analysis document constitutes the technology identification and initial screening steps of the FS for MLF sites implementing the presumptive remedy.

Alternatives that represent viable approaches are assessed against each of the nine NCP evaluation criteria during the detailed analysis, which also compares the relative performance of each alternative. The nine NCP criteria are categorized as threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria are first used when evaluating a technology option. The technology must meet these criteria to be eligible for selection. The threshold criteria include:

- Overall protection of human health and the environment, and

- Compliance with applicable or relevant and appropriate requirements (ARARs).

During the next step, the major tradeoffs between alternative technologies are evaluated using the five primary balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

The initial screening draws preliminary conclusions as to the maximum extent to which permanent solutions and treatment can be practicably utilized in a cost-effective manner. In the detailed analysis, the alternative that is protective of human health and the environment, is ARAR-compliant, and affords the best combination of attributes is identified as the preferred alternative in the proposed plan.

After public review of the proposed plan, the two modifying criteria, State and community acceptance, are factored into a final determination of the remedy. The lead agency then selects the technology considered most effective, given the constraints of the site, and documents the decision in the ROD.

C. METHODOLOGY

The analysis entailed reviewing the technology identification and screening components of the remedy selection process for a representative sample of MLF sites. The number of times each technology was either screened out or selected in each remedy was compiled.

1. IDENTIFICATION OF MUNICIPAL LANDFILL SITES

Of the 230 MLF sites on the NPL, 149 have had a remedy selected for at least one operable unit. Of the 149 sites (see Appendix C, Table of Contents), 30 were selected for this study on a random basis, or slightly greater than 20 percent. The sites range in size from several acres to more than 200 acres and are located primarily in Regions 1, 2, 3, and 5. This geographical distribution approximates the distribution of MLF sites on the NPL.

2. TECHNOLOGY SCREENING AND REMEDIAL ALTERNATIVE ANALYSIS

The analysis involved a review of the technology identification and screening phase, including any pre-screening steps, followed by a review of the detailed analysis and comparative analysis phases. Information derived from each review was documented on site-specific data collection forms (Appendix C) The review focused on the landfill source contamination only; ground-water technologies and alternatives were not included.

For the screening phase, the full range of technologies considered, including different process options for a given technology, was listed on the data collection forms, along with the key reasons given for eliminating technologies from further consideration. These reasons were categorized according to the screening criteria: cost, effectiveness, or implementability. The frequency with which specific reasons were given for eliminating a technology from further consideration was then tallied and compiled into a technology-specific screening phase summary table (Appendix B). In cases where more than one process option was considered in the FS for a given technology, the technology was counted only once on the summary table in Appendix B.

For the detailed analysis and comparative analysis, information on the relative performance of each technology /alternative with respect to the NCP criteria was associated with each cleanup option were highlighted. In some cases, a technology was combined with one or more technologies into one or more alternatives. The disadvantages of a technology/alternative were then compiled into a technology-specific detailed analysis/comparative analysis summary table (Appendix B), under the assumption that these disadvantages contributed to non-selection.

D. RESULTS

The technology screening and remedial alternative analyses, summarized in Appendix A, demonstrate that containment (the presumptive remedy) was chosen as a component of the selected remedy at all 30 of the sites analyzed. No other technologies were consistently selected as a remedy or retained for consideration in a remedial alternative.

At eight of the 30 sites, conditions required non-containment technologies in the selected remedy to address a site-specific concern, such as principal threat wastes. These sites include:

Offsite Disposal

1) Rasmussen's Dump, MI—Installation of a cap and offsite disposal of drums unearthed during cap construction at a hazardous waste facility.

2) Old City of York, PA—Installation of soil cover and offsite disposal (unspecified) of vault sediment.

Incineration

3) G&H Landfill, MI—Construction of a landfill cover and a slurry wall around the perimeter of the landfill areas and oil seeps, excavation of PCB contaminated soil and sediment outside the slurry wall followed by either consolidation under the landfill cover or offsite incineration, depending on contaminant concentrations.

4) Fort Wayne Reduction, IN—Installation of a soil cover and excavation and offsite incineration of drums.

5) Wildcat Landfill, DE—Installation of a soil cover and, if necessary, excavation and offsite incineration of drums.

Soil Vapor Extraction (SVE)

6) Hassayampa Landfill, AZ—Installation of a cap and treatment of contamination in the vadose zone using soil vapor extraction at all locations where contamination exceeds clean-up levels.

7) Muskego Sanitary Landfill, WI—Installation of a cap and treatment of soil within the drum trench and north and south refuse areas using in-situ vapor extraction to remove VOCs.

Bioremediation

8) Onalaska Municipal Landfill, WI—Reconstruction of the landfill cover and in-situ bioremediation of onsite soil and, if feasible, a portion of the landfill debris.

Leachate collection and gas collection systems also were tracked as part of the detailed analysis and comparison of remedial alternatives. These types of systems, however, generally were not considered as remediation technologies during the initial screening phases. At 15 sites, leachate collection was selected as part of the overall containment remedy. At 17 sites, gas collection was selected as part of the overall containment remedy.

E. CONCLUSIONS

The results reported above support containment as the presumptive remedy for MLF sites and support the decision to eliminate the initial technology identification and screening step. Consideration of technologies other than the presumptive remedy, however, may be appropriate on a site-specific basis.

These results also are consistent with EPA expectations that containment technologies will generally be appropriate for waste that poses a relatively low long-term threat or where treatment is impracticable (55 Federal Register 8846). The Agency also expects treatment to be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site. Both factors make it possible to streamline the RI/FS for MLF sites with respect to site characterization, risk assessment, and development of remedial action alternatives.

II. SUMMARY ANALYSIS AND CONCLUSIONS FOR NON-PRESUMPTIVE REMEDY TECHNOLOGIES

This analysis examined the technical literature and technology screening and remedy selection process at 30 MLF sites on the NPL. As discussed in Part I, a containment remedy was chosen at all 30 sites investigated. Other ancillary technologies were selected to address site-specific concerns. This study supports the decision that the presumptive remedy—containment—is the technology "of choice" for this type of site. In addition, this study concludes that most other technologies (or classes of technologies) are consistently screened out due to the reasons presented below.

The following sections provide descriptions for each technology that is not a presumptive remedy for MLF sites. Each section is further divided into six parts:

- A general narrative describing the technology;

- Any limits to its applicability and effectiveness,

- The target contaminant groups for the technology. The target contaminants are those contaminants that a specific technology aims or targets to treat. The major contaminant groups used are:
  - (1) Halogenated volatiles (VOCs)
  - (2) Halogenated semivolatiles (VOCs)
  - (3) Non-halogenated volatiles (VOCs)
  - (4) Non halogenated semivolatiles (SVOCs)
  - (5) Fuel hydrocarbons
  - (6) Pesticides
  - (7) Inorganics.

  A list of examples of contaminants encountered at many sites can be found in Appendix B of the referenced document *Remediation Technologies Screening Matrix*, *Reference Guide, Version I*, U.S. EPA & U.S. Air Force, July 1993. (*Remediation Technologies Screening Matrix*, 1993, p. 139.)

- Discussion of results from the analysis of the 30 FSs studied. This section summarizes the specific reasons provided in the 30 FSs for screening a particular technology during the initial, screening.

- Discussion of results from the analysis of the 30 RODs studied. This section summarizes the specific reasons for screening a particular technology during the detailed analysis and comparison of alternatives.

- General conclusions why the technology may be eliminated from consideration at MLF sites.

Included with these summary results are codes, from 1 through 30, which identify the sites where the specific reasons were used for eliminating the technology from further consideration in the FS or ROD. Table 2 is an index of codes for the 30 MLF sites.

Table 2. INDEX OF SITE NAME CODES

Code	Site Name	Code	Site Name
1	Colesville Municipal Landfill, NY	16	LaGrande Sanitary Landfill, MN
2	Conklin Dumps, NY	17	Lemberger Landfill, WI
3	Coshocton City Landfill, OH	18	Mason County Landfill, MI
4	Dakhue Sanitary Landfill, MN	19	Michigan Disposal Service (Cork St. Landfill), MI
5	Dover Municipal Landfill, NH	20	Mid-State Disposal Landfill, WI
6	Fort Dix Landfill, NJ	21	Modern Sanitation Landfill, PA
7	Fort Wayne Reduction, IN	22	Mosley Road Sanitary Landfill, OK
8	G&H Landfill, MI	23	Muskego Sanitary Landfill, WI
9	Global Landfill, NJ	24	Old City of York Landfill, PA
10	Hassayampa Landfill, AZ	25	Onalaska Municipal Landfill, WI
11	Hertel Landfill, NY	26	Ramapo Landfill, NY
12	Islip Municipal Sanitary Landfill, NY	27	Rasmussen's Dump, MI
13	Juncos Landfill, PR	28	Stoughton City Landfill, WI
14	K&L Avenue Landfill, MI	29	Strasburg Landfill, PA
15	Kin-Buc Landfill, NJ	30	Wildcat Landfill, DE

A. LANDFILL DISPOSAL

Technology Description

Landfill disposal encompasses a set of process options for the removal of contaminated material to permitted onsite or offsite disposal facilities. Some pre-treatment of the contaminated media may be required to meet Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDRs). Landfill disposal reduces mobility of the contaminated media, however, by moving the media from the unsecured site to a disposal facility that will physically contain it. The process options discussed in this study are disposal in offsite hazardous, offsite nonhazardous, onsite hazardous, and onsite nonhazardous landfills.

Limitations

The following factors may limit the applicability and effectiveness of these process options:

- **!** Fugitive emissions may be generated during excavation and pose potential health and safety risks to site workers. Personal protective equipment at a level commensurate with the contaminants is normally required.

- Depth, composition, and volume of the media requiring excavation must be considered.

- RCRA hazardous wastes may require treatment to meet LDR treatment standards prior to land disposal.

For offsite facilities, the following factors apply:

- The distance from the MLF to the nearest disposal facility will affect cost and may affect community acceptability.

- Transportation to an offsite facility introduces a potential risk to the community via accidental releases.

- Offsite landfill disposal alleviates the contaminant problem at the site but transfers the risk offsite.

- The type of contaminant and its concentration level will impact landfill disposal requirements.

Overall costs associated with offsite landfill disposal are relatively high. Although the process is relatively simple, with proven procedures, it is a labor-intensive practice with little potential for further automation. (*Remediation Technologies Screening Matrix*, 1993, p. 71.).

Target Contaminant Groups

Landfill disposal is applicable to the complete range of contaminant groups with no particular target group. (*Remediation Technologies Screening Matrix*, 1993, p. 71.)

1. Offsite Disposal

OFFSITE HAZARDOUS LANDFILL

Initial Screening

Disposal in an offsite hazardous landfill was considered in 17 FSs. It was screened out 13 times (76 percent) and passed screening but was not considered as a primary component of a remedial alternative four times (24 percent).

The predominant factors for screening out offsite hazardous landfill were high costs (8 FSs: 3, 4, 5, 9, 10, 17, 18, 21) and difficulties in implementation, including difficulties in treating large volumes of waste and increased risk to the public and workers (12 FSs: 3, 4, 5, 8, 9, 10, 17, 18, 21, 26, 28, 30).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
17	0	4	13
Site Name Code:		14,19,20,25	3, 4, 5, 8, 9, 10, 17, 18, 21, 22, 26, 28, 30

Detailed Analysis

Offsite disposal at a hazardous waste landfill was not considered as a primary component of any remedial alternatives. (Note: At one site—Rasmussen's Dump, MI—offsite hazardous landfill was screened out as the overall remedy for the site even though offsite disposal was a part of the remedy for drums located onsite. See Appendix A, footnote 6, and Site-Specific Data Collection Forms in Appendix C for further clarification.)

Conclusion

The conclusion for offsite hazardous landfill has been combined with offsite landfill unspecified and offsite nonhazardous landfills.

OFFSITE LANDFILL (UNSPECIFIED)

Initial Screening

Disposal in an offsite landfill (unspecified) was considered in nine FSs. It was screened out eight times (89 percent), and one time (11 percent) it passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison).

The predominant factors for screening out offsite landfill (unspecified) were high cost, lack of effectiveness, and difficulties in implementation. High costs were most often noted (5 FSs: 2,11,13,16, 24). Also noted were the potential for adverse health effects during excavation (3 FSs: 13,16, 24) and the difficulties in implementation due to numerous site restrictions (e.g., storage, disposal) (3 FSs: 1,13, 27).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
9	1	0	8
Site Name Code:	15		1, 2, 7, 11, 13, 16, 24, 27

Detailed Analysis

The one time offsite landfill (unspecified) was retained for consideration in a remedial alternative, it was not selected as the final remedy., The reasons were high costs and no reduction of toxicity, mobility, or volume through treatment of site contaminants ROD: 15). (Note: At one site—Old City of York Landfill, PA—offsite landfill (unspecified) was screened out as the overall remedy for the site even though offsite disposal was a part of the remedy for sediments found in a leachate collection vault at the site. See Appendix A, footnote 7, and Site-Specific Data Collection Forms in Appendix C for further clarification.)

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
1	0	1
Site Name Code:		15

Conclusion

The conclusion for offsite landfill (unspecified) has been combined with offsite hazardous landfill and offsite nonhazardous landfill.

OFFSITE NONHAZARDOUS LANDFILL

Initial Screening

Disposal in an offsite nonhazardous landfill was considered in three FSs. Of those, it was screened out three times (100 percent).

The predominant factor cited in the FSs for screening out offsite nonhazardous landfill was difficulty in implementation due to compliance with LDRs (3 FSs: 1, 5, 30).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
3	0	0	3
Site Name Code:			1, 5, 30

Detailed Analysis

Offsite nonhazardous landfill disposal was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Offsite disposal, including offsite hazardous landfills. Offsite (unspecified) landfills, and offsite nonhazardous landfills is a generally ineffective alternative for MLF sites due to costs and implementability. LDRs and the large volume of waste to be addressed account for many of the difficulties in implementation. Other reasons for screening may include the increased potential for generation of fugitive emissions and associated potential health and safety risks.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• The technology poses risks to the community and workers from exposure during excavation and transportation.
Compliance with ARARs	• Transportation, storage, and disposal restrictions are all associated with this technology and must be considered. • An offsite hazardous landfill also must be in compliance with LDRs.
Reduction of Toxicity, Mobility, or Volume	• Offsite landfill disposal offers no treatment of the contaminated material.
Long-term Effectiveness and Permanence	• Landfill disposal alleviates the contaminant problem at the site but transfers the risk offsite without treating the contaminants
Short-term Effectiveness	• The technology poses risks to the community and workers from exposure during excavation and transportation.
Implementability	• Depth, volume, and composition of waste may affect implementation and transportation. • Other transportation issues, such as travel distances, also may affect implementation. • The technology is labor-intensive, with little potential for further automation.
Cost	• High costs are associated with this technology.

2. ONSITE DISPOSAL

This category should not be confused with the containment options discussed earlier. The processes included in "onsite disposal" entail excavating and redepositing the waste in newly constructed landfill units. The containment options keep the waste in place and use caps and barriers to manage the contaminants' migration.

ONSITE HAZARDOUS LANDFILL

Initial Screening

Onsite hazardous landfill was considered in 14 FSs. Of those, it was screened out 11 times (79 percent), passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison) two times (14 percent), and passed screening but was not considered as a primary component of a remedial alternative one time (7 percent).

The predominant factor for screening out onsite hazardous landfill was difficulty in implementation, especially due to adverse site conditions and large volumes of wastes (11 FSs: 1, 3, 4, 5, 10, 15, 17, 19, 25, 28, 30).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
14	2	1	11
Site Name Code:	8,18	14	1, 3, 4, 5, 10, 15, 17, 19, 25, 28, 30

Detailed Analysis

Of the two times onsite hazardous landfill was retained for consideration in a remedial alternative, it was not selected as the final remedy one time. The predominant reasons were high costs and difficult implementation due to waste handling and staging and landfill construction (1 FS: 18). It was selected for disposal of low level PCB-contaminated soils only at G&H Landfill, MI.

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
2	1	1
Site Name Code:	8	18

Conclusion

The conclusion for onsite hazardous landfill has been combined with onsite landfill (unspecified) and onsite nonhazardous landfill.

ONSITE LANDFILL (UNSPECIFIED)

Initial Screening

Onsite landfill (unspecified) was considered in seven FSs. Of those, it was screened out six times (86 percent). One time (14 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factors for screening out onsite landfill (unspecified) were high costs (3 FSs: 2, 3, 11) and difficulties in implementation due to site conditions, such as limited site area (3 FSs: 16, 19, 27).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
7	0	1	6
Site Name Code:		20	2, 3, 11, 16, 19, 27

Detailed Analysis

Onsite landfill (unspecified) disposal was not considered as a primary component of any remedial alternatives.

Conclusion

The conclusion for onsite landfill (unspecified) has been combined with onsite hazardous landfill and onsite nonhazardous landfill.

ONSITE NONHAZARDOUS LANDFILL

Initial Screening

Onsite nonhazardous, landfill was considered in two FSs. Of those, it was screened out two times (100 percent). The reasons provided were high costs, no reduction of leachate, and site conditions (wetlands) (2 FSs: 5, 30).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
2	0	0	2
Site Name Code:			5, 30

Detailed Analysis

Onsite nonhazardous landfill disposal was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Onsite disposal, including onsite hazardous landfills, onsite (unspecified) landfills, and onsite nonhazardous landfills, is a generally ineffective remedial alternative for addressing MLF sites. High costs and implementation difficulties are the two primary reasons noted in the screening of onsite disposal. Difficulties in implementation due to the waste characteristics and site conditions were predominantly noted. Other reasons for screening may include the increased potential for generation of fugitive emissions and associated potential health and safety risks.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• A potential risk of recontamination is associated with onsite landfilling. • Benefits of onsite landfill disposal may not outweigh the potential risks associated with the method.
Compliance with ARARs	• Applicable LDRs must be considered. • An onsite hazardous landfill must meet LDR requirements.
Reduction of Toxicity, Mobility, or Volume	• No reduction of toxicity, mobility, or volume through treatment.
Long-term Effectiveness and Permanence	• High maintenance is required to ensure effectiveness and reliability.
Short-term Effectiveness	• A potential risk for recontamination is associated with onsite landfilling. • Short-term effectiveness is compromised by the potential exposure to fugitive emissions during excavation.
Implementability	• Onsite disposal may be very difficult to implement due to the large volume of waste, and handling and construction staging requirements. • Site conditions also may affect implementation (i.e., limited area, wetlands).
Cost	• High costs are associated with this technology.

B. BIOREMEDIATION

1. IN-SITU BIOREMEDIATION

Technology Description

During in-situ bioremediation, the activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in-situ biological remediation of organic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials. Generally, the process includes above-ground treatment and conditioning of the infiltration water with nutrients and an oxygen (or other electron acceptor) source. In-situ bioremediation is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- Extensive treatability studies and site characterization may be necessary.
- The circulation of water-based solutions through the soil may increase contaminant mobility.
- The injection of microorganisms into the subsurface is not recommended. Naturally occurring organisms are generally adapted to the contaminants present.
- Preferential flow paths may severely decrease contact between injected fluids and contaminants throughout the contaminated zones.
- The system should be used only where ground water is near the surface and where the ground water underlying the contaminated soils is contaminated.
- The system should not be used for clay, highly layered, or heterogeneous subsurface environments due to oxygen (or other electron acceptor) transfer limitations.
- Bioremediation may not be applicable at sites with high concentrations of heavy metals, highly chlorinated organics, or inorganic salts.

Target Contaminant Groups

Target contaminants for in-situ bioremediation are non-halogenated VOCs and SVOCs, and fuel hydrocarbons. Halogenated VOCs and SVOCs and pesticides also can be treated, but the process may be less effective and may only be applicable to some compounds within these contaminant groups. (*Remediation Technologies Screening Matrix*, 1993, p. 21.)

Initial Screening

In-situ bioremediation was considered in 15 FSs. Of those, it was screened out 14 times (93 percent). One time (7 percent), it passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison)

The predominant factor for screening out in-situ bioremediation lack of effectiveness. Specifically, this technology is ineffective in treating heterogeneous municipal waste and compounds such as metals, chlorinated solvents and organics (13 FSs: 1, 5, 6, 10, 15, 16, 17, 19, 21, 22, 24, 27, 28). Difficulties in implementing the process also were noted (6 FSs: 6, 10, 21, 22, 26, 27), including general difficulties in controlling the process as well as the possible production of undesirable intermediates.

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
15	1	0	14
Site Name Code:	25		1, 5, 6, 10, 15, 16, 17, 19, 21, 22, 24, 26, 27, 28

Detailed Analysis

The one time in-situ bioremediation was retained for consideration as a remedial alternative, it was selected in the final remedy at Onalaska Municipal Landfill, WI.

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
1	1	0
Site Name Code:	25	

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. MLF sites characteristically contain different types of waste due to the nature of a landfill. Because MLF sites normally contain halogenated VOCs and SVOCs, bioremediation may be less effective and, therefore, screened. Also, MLF sites may contain chlorinated organics and pesticides which are not biodegradable, making bioremediation ineffective. Additional reasons for screening may include oxygen transfer limitations due to the heterogeneity of the waste and preferential flow paths which may severely decrease contact between injected fluids and contaminants throughout the contaminated zone.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• The degradation products may be more toxic than the contaminants, compromising overall protectiveness.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• The circulation of waste-based solutions through the waste may increase contaminant mobility. • The treatment may produce undesirable intermediates.
Long-term Effectiveness and Permanence	• The technology has unproven effectiveness in treating some contaminants (i.e., metals, chlorinated organics).
Short-term Effectiveness	• During treatment, it may be difficult to maintain proper distribution of reactants. • Nutrients injected into the ground during treatment may degrade ground water or surface water.
Implementability	• The technology is not readily applied to large hazardous waste areas. • Treatment may result in oxygenation of the landfill and aquifer, and process control is poor. • Other site conditions such as depth of fill and the presence of preferential flow paths may affect implementability. • The system should not be used for clay, highly layered, or heterogeneous subsurface environments due to oxygen's transfer limitations. • Treatability studies and site characterization may be necessary to determine feasibility.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

2. EX-SITU BIOREMEDIATION

Technology Description

Ex-situ bioremediation encompasses a set of process options in which the contaminated media are excavated or removed and treated using the biological processes of naturally occurring microorganisms. There are three general categories of ex-situ bioremediation in this analysis: slurry phase treatment, solid phase treatment, and landfarming. They are described below.

Slurry phase biological treatment involves the use of an aqueous slurry created by combining soil or sludge with water and other additives in a bioreactor. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Nutrients, oxygen, and pH in the bioreactor are controlled to enhance biodegradation. Upon completion of the process, the slurry is dewatered and the treated soil is disposed. (*Remediation Technologies Screening Matrix*, 1993, p. 37.)

Solid phase biological treatment mixes excavated soil with soil amendments and places them in above-ground enclosures that include leachate collection systems and some form of aeration. Controlled solid phase processes include prepared treatment beds, biotreatment cells, soil piles, and composting. Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation. (*Remediation Technolqgjes Screening Matrix*, 1993, p. 37.)

Landfarming applies the contaminated soils onto the soil surface and periodically turned over or tilled into the soil to aerate the waste. Although landfarming usually requires excavation of contaminated soils, surface-contaminated soils may sometimes be treated in place without excavation. Landfarming systems are increasingly incorporating liners and other methods to control leaching of contaminants. (*Remediation Technology Screening Matrix*, 1993, p. 41.)

Limitations

The following factors may limit the applicability and effectiveness of this process:

- ! Conditions advantageous for biological degradation of contaminants may be difficult to control, increasing the length of time to complete remediation.
- ! Reduction of contaminant concentrations may be caused more by volatilization during excavation than biodegradation.

- ! Extensive treatability testing, conducted to determine the biodegradability of contaminants and appropriate oxygenation and nutrient loading rates, may increase time and cost of implementation

- ! A large amount of space is required.

Target Contaminant Groups

Ex-situ bioremediation is primarily designed to treat non-halogenated VOCs and fuel hydrocarbons. Halogenated VOCs and SVOCs, non-halogenated SVOCs, and pesticides also can be treated, but the process may be less effective and may only be applicable to some compounds within these contaminant groups. Many chlorinated organics and pesticides are not very biodegradable, reducing this technology's applicability.

Initial Screening

Ex-situ bioremediation was considered in 10 FSs. Of those, it was screened out 10 times (100 percent). Ex-situ bioremediation was most often screened out because of its ineffectiveness in treating all the contaminants found in wastes characteristic of landfills (4 FSs: 10, 14, 17, 18).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
10	0	0	10
Site Name Code:			1, 10, 11, 14, 16, 17, 18, 22, 26, 27

Detailed Analysis

Ex-situ bioremediation was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Because MLF sites normally contain halogenated VOCs and SVOCs, ex-situ bioremediation may be less effective, and, therefore, screened. Also, MLF sites may contain chlorinated organics and pesticides which are not highly biodegradable which would make bioremediation ineffective. Additional reasons for screening may include difficulties in maintaining advantageous conditions for biological degradation and the necessity for excavation of the contaminated soils prior to treatment.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology poses potential risks to the community and workers from exposure during excavation.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• The process creates an additional waste stream that must be treated or incinerated. • Reduction of contaminant concentrations may be caused more by volatilization (during excavation) than biodegradation.
Long-term Effectiveness and Permanence	• This method is not effective due to the nature of landfill waste, as some contaminants may not be successfully remediated by the process.
Short-term Effectiveness	• The process creates an additional waste stream that must be treated or incinerated. • Certain site conditions as well as compaction of the waste, also may decrease effectiveness. • If treatment cells are not preserved as distinct zones, they cannot be removed or disposed, resulting in decreased effectiveness of the process. • This technology poses potential risks to the community and workers from exposure during excavation and treatment.
Implementability	• The process is extremely sensitive to temperature and other conditions, making it difficult to control and increasing the length of time to complete remediation. Site climates may require constant irrigation for effective landfarming. • Excavation of a large landfill is not practical as the bioremediation process requires a long implementation time. • Treatability testing should be conducted to determine the extent of biodegradation.
Cost*	

* Criterion did not contribute to eliminating the technology.

3. BIOREMEDIATION (UNSPECIFIED)

Technology Description

In 13 additional FSs, bioremediation also was considered as a remedial technology. However, these FSs did not specify ex-situ or in-situ bioremediation. Therefore, a separate bioremediation (unspecified) treatment category was established. See discussion of in-situ bioremediation and ex-situ bioremediation for more detailed information.

Limitations

This discussion does not apply to this category.

Target Contaminant Groups

This discussion does not apply to this category.

Initial Screening

Bioremediation (unspecified) was considered in 13 FSs. Of those, it was screened out 13 times (100 percent).

The predominant factor for screening out bioremediation (unspecified) was the ineffectiveness of this technology in treating all types of wastes found in MLF sites (13 FSs: 2, 4, 8, 11, 13, 14, 15, 18, 19, 20, 23, 24, 27). Difficulty in implementation was another factor noted also (3 FSs: 2, 20, 23), due to the high variability of municipal refuse and subsequent inefficient operations.

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
13	0	0	13
Site Name Code:			2, 4, 8, 11, 13, 14, 15, 18, 19, 20, 23, 24, 27

Detailed Analysis

Bioremediation (unspecified) was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. MLF sites characteristically contain different types of waste due to the nature of a landfill. Because MLF sites normally contain halogenated VOCs and SVOCs, bioremediation may be less effective and, therefore, screened. Also, MLF sites may contain chlorinated organics and pesticides which are not highly biodegradable, which would make bioremediation ineffective and provide reasons for screening. Other reasons applicable to both in-situ and ex-situ bioremediation of MLF sites also may be valid for screening bioremediation (unspecified). These reasons may include oxygen transfer limitations, preferential flow paths in the waste, difficulties in maintaining advantageous conditions for biodegradation, and the potential for exposure through excavation of waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• The technology poses potential risks to the community and workers from exposure during excavation.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• Treatment and the circulation of water-based solutions through the waste may increase contaminant mobility and potentially contaminate ground or surface water.
Long-term Effectiveness and Permanence	• The method is not effective due to the nature of municipal waste (i.e, sensitive to non-uniform waste streams, inappropriate for mixed refuse).
Short-term Effectiveness	• Conditions advantageous for biological degradation may be difficult to control, increasing the time to complete remediation. • Bioremediation may present a threat to ground water due to added nutrients during treatment.
Implementability	• This method is not feasible for typical contents of a municipal landfill, due to the physical characteristics of landfill waste. • Treatment poses a potential for contaminating surface or ground water. • The method is effective in shallow treatment only, requires a long retention time, and is not a proven technology.
Cost*	

*Criterion did not contribute to eliminating the technology.

C. CHEMICAL DESTRUCTION/DETOXIFICATION

1. OXIDATION/REDUCTION

Technology Description

Oxidation/reduction encompasses a set of process options in which hazardous contaminants are chemically converted to nonhazardous or less hazardous compounds that are more stable, less mobile, and/or inert. The oxidizing/reducing agents most commonly used for treatment of hazardous contaminants are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. A combination of these reagents, or combining them with ultraviolet (UV) oxidation, makes the process more effective. Oxidation /reduction is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

! Incomplete oxidation or formation of intermediate contaminants that are more toxic than the original contaminants may occur depending upon the contaminants and oxidizing agents used.

! The process is not cost-effective for highly contaminated materials due to the large amounts of oxidizing/reducing agents required.

! Oil and grease in the media can reduce efficiency of the process.

As an ex-situ remedy, the associated excavation oxidation/ reduction poses a potential health and safety risk to site workers through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, is normally required during excavation operations.

Target Contaminant Groups

The target contaminant group for oxidation/reduction is inorganics. The technology can be used but may be less effective against non-halogenated VOCs and SVOCs, fuel hydrocarbons, and pesticides. Oxidation/reduction is a well-established technology used for disinfecting drinking water and wastewater, and is a common treatment for cyanide wastes. Enhanced systems are now being used more frequently to treat hazardous wastes in soils. (*Remediation Technologies Screening Matrix*, 1993, pp. 53-54.)

Initial Screening

Oxidation/reduction was considered in 12 FSs. Of those, it was screened out 12 times (100 percent).

The predominant factors for screening out oxidation /reduction were lack of effectiveness and difficulties in implementation. The reason noted most often was ineffectiveness in treating all compounds present in MLF sites due to the heterogeneous nature of landfills (8 FSs: 5, 11, 14, 17, 18, 19, 20, 28). Another reason noted was difficulty in implementation, including such difficulties as achievement of good mixing (5 FSs: 6, 8, 22, 25, 28).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
12	0	0	12
Site Name Code:			5, 6, 8, 11, 14, 17, 18, 19, 20, 22, 25, 28

Detailed Analysis

Oxidation/reduction was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. MLF sites characteristically contain different types of waste due to the nature of a landfill, including solid and odd-sized wastes. Oxidation /reduction is not technically practical for destruction of all types of contaminants found in MLF sites. Additional reasons for screening may include the presence of unfavorable components, such as oils and grease, and also the variable contaminant concentrations present in municipal waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• As an ex-situ technology, the process poses a potential risk to the community and workers from emissions during excavation. • Treatment may result in the production of hazardous by-products or an increase in the solubility of some metals thereby limiting the protectiveness.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• Treatment may result in the production of hazardous by-products or an increase in the solubility of some metals.
Long-term Effectiveness and Permanence	• This technology is not feasible for landfill waste, as not all compounds can be treated.
Short-term Effectiveness	• Treatment may result in the production of hazardous by-products or an increase in the solubility of some metals. • As an ex-situ technology, the process poses a potential risk to the community and workers from emissions during excavation.
Implementability	• This technology is not possible due to the heterogeneous nature and physical characteristics of the landfill. • This technology is difficult to implement, and ex-situ treatment is not feasible due to an expected increased risk. • If waste pits are not preserved as distinct zones, they cannot be treated.
Cost	• Increased costs are associated with this technology. • Treatment may require a large amount of reagent and, therefore, not be cost-effective.

* Criterion did not contribute to eliminating the technology.

2. DEHALOGENATION

Technology Description

Dehalogenation encompasses a set of process options in which soil with halogenated contaminants is mixed in a reactor with chemical reagents and then heated. The resultant reaction removes and replaces the halogen molecules on the contaminants, thereby rendering them less or nonhazardous. There are two process options included in this study: base catalyzed decomposition (BCD) and glycolate dehalogenation.

BCD dehalogenation involves screening contaminated soil, followed by processing the soil with a crusher and pug mill, and mixing it with sodium bicarbonate. The mixture is heated at 630°F (333°C) in a rotary reactor to decompose and partially volatilize the contaminants. BCD dehalogenation is a full-scale technology; however, it has had very limited use.

Glycolate dehalogenation uses an alkaline polyethylene glycolate (APEG) reagent to dehalogenate halogenated aromatic compounds in a batch reactor. Potassium polyethylene glycolate (KPEG) is the most common APEG reagent. Contaminated soils and the reagent are mixed and heated in a treatment vessel. In the APEG process, the polyethylene glycol replaces halogen molecules and renders the compound nonhazardous. For example, the reaction between chlorinated organics and KPEG causes replacement of a chlorine molecule and results in a reduction in toxicity. Glycolate dehalogenation is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of BCD dehalogenation:

- If the influent matrix includes heavy metals and certain non-halogenated VOCs, they will not be destroyed by the process.
- High clay and moisture content will increase treatment costs.

As an ex-situ remedy, the excavation associated with dehalogenation (BCD) poses a potential health and safety risk to site workers, through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, is normally required during excavation operations. (*Remediation Technologies Screening Matrix*, 1993, p. 49.)

The following factors may limit the applicability and effectiveness of glycolate dehalogenation:

- The technology is generally not cost-effective for large waste volumes.

- Media water content above 20 percent requires excessive reagent volume.

- Concentrations of chlorinated organics greater than 5 percent require large volumes of reagent.

- The resultant soil has poor physical characteristics.

As an ex-situ remedy, the excavation associated with dehalogenation (BCD and APEG/KPEG) poses a potential health and safety risk to site workers through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, is normally required during excavation operations. (*Remediation Technologies Screening Matrix*, 1993, p.47.)

Target Contaminant Groups

The target contaminant groups for dehalogenation are halogenated SVOCs (including PCBs) and pesticides. The technology is not applicable to some contaminants within the halogenated VOCs groups. The dehalogenation process was developed as a clean, inexpensive way to remediate soil and sediments contaminated with chlorinated organic compounds, especially PCBs. The technology is amenable to small-scale applications.

Initial Screening

Dehalogenation was considered in six FSs. Of those, it was screened out five times (83 percent). One time (17 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factor for screening out dehalogenation was ineffectiveness. Specifically, the reason noted most often was limited applicability to a few contaminants which may not exist in large quantities onsite (4 FSs: 5,11,14,18).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
6	0	1	5
Site Name Code:		15	5, 11, 14, 18, 27

Detailed Analysis

Dehalogenation was not considered as a primary component any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Dehalogenation is applicable to very few contaminant types found in MLF sites, an example being chlorinated organics. This limited applicability and other reasons, including the large volumes of wastes and variable water content and contaminant concentrations, make dehalogenation ineffective.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• As an ex-situ remedy, the technology poses a potential risk to the community and workers from emissions during excavation.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• The resultant soil has poor physical characteristics.
Long-term Effectiveness and Permanence	• This technology is not effective for most of the contaminants present. • This technology is not applicable to treatment of waste materials.
Short-term Effectiveness	• As an ex-situ remedy, the process poses a potential risk to the community and workers from emissions during excavation.
Implementability	• The technology is difficult to implement, and testing is required to demonstrate process effectiveness. • Larger volumes of reagent are required for high water content media and chlorinated organics concentrations greater than 5%.
Cost	• Other options are more cost-effective, because of the high costs associated with this process and the handling of by-products.

* Criterion did not contribute to eliminating the technology.

3. NEUTRALIZATION

Technology Description

Neutralization is the process of decreasing the acidity or alkalinity by adding alkaline or acidic materials, respectively. One example of neutralization used as a remedial alternative is lime neutralization, in which acidic soil is neutralized by the addition of lime. (*Glossary of Environmental Terms and Acronym List*, EPA 19K-1002, December 1989, p. 12.)

Limitations

Neutralization is not considered an effective treatment for the wide variety of contaminants found in MLF sites.

Target Contaminant Groups

There are no particular target groups for this technology. In many cases, neutralization is used as part of a treatment train to prepare a medium for further treatment by bringing it to a more suitable pH.

Initial Screening

Neutralization was considered in four FSs. Of those, it was screened out three times (75 percent). One time (25 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The factors used for screening out neutralization were lack of effectiveness and difficulties in implementation. Specifically, neutralization was noted to be ineffective for treatment of the site chemicals (1 FS: 19) and not implementable due to site conditions (1 FS: 22). It also was noted that the technology was undergoing further research (1 FS: 15).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
4	0	1	3
Site Name Code:		20	15, 19, 22

Detailed Analysis

Neutralization was not considered as a primary component of any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Neutralization was screened from remedial alternatives primarily due to its ineffectiveness in the treatment of municipal waste. Other site-specific reasons, such as a neutral ground water pH of the region, also may be valid in screening neutralization.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness*	
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume*	
Long-term Effectiveness and Permanence	• Neutralization is undergoing further research. • The technology may not be applicable to MLF sites, as it is not effective for all chemicals present in the soil.
Short-term Effectiveness*	
Implementability	• Waste pits are not preserved as distinct zones, and cannot be treated. • This technology is not applicable if the pH is already neutral.
Cost*	

* Criterion did not contribute to eliminating the technology.

4. CHEMICAL DESTRUCTION/DETOXIFICATION (UNSPECIFIED)

Technology Description

In six additional FSs, chemical destruction/ detoxification also was considered as a remedial technology. However, these FSs did not specify the method of chemical destruction/detoxification. Therefore, a separate chemical destruction/ detoxification (unspecified) treatment category was established for data compilation purposes.

Limitations

This discussion does not apply to this category.

Target Contaminant Groups

This discussion does not apply to this category.

Initial Screening

Chemical destruction/ detoxification (unspecified) was considered in six FSs. Of those, it was screened out six times (100 percent).

The predominant factors for screening out chemical destruction/ detoxification (unspecified) were lack of effectiveness and difficulties in implementation. The reason provided most often was ineffectiveness due to the heterogeneous nature of waste (4 FSs: 4,13,14,16). Another reason provided was the impracticality of excavating the waste, most often due to the size of the landfill (3 FSs: 1, 13, 26).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
6	0	0	6
Site Name Code:			1, 4, 13, 14, 16, 26

Detailed Analysis

Chemical destruction/ detoxification (unspecified) was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Chemical destruction/ detoxification (unspecified) was screened from remedial alternatives primarily due to ineffectiveness and difficulties in implementation in the treatment of heterogeneous landfill waste. Additional reasons applicable to other chemical destruction/ detoxification technologies, such as oxidation/reduction, dehalogenation, and neutralization, may be valid in screening. These reasons may include variable contaminant concentrations, unfavorable components such as oils and greases, and large volumes of wastes.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• Chemicals added during treatment may threaten ground water quality.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• Side reactions during treatment may produce other hazardous substances.
Long-term Effectiveness and Permanence	• These technologies are not applicable to all types of contaminants found onsite.
Short-term Effectiveness	• During treatment, added chemicals may threaten ground water quality and side reactions may produce other hazardous substances. • Contaminants of concern concentrations may be too variable for effective treatment. • As ex-situ process, these technologies may allow potential for community or water exposure during excavation.
Implementability	• The technology may not be technically feasible due to the size of the landfill, or if excavation of the waste is not feasible.
Cost*	

* Criterion did not contribute to eliminating the technology.

D. THERMAL TREATMENT

1. INCINERATION

Technology Description

Incineration is an ex-situ engineered process that uses high temperatures 1,600°-2,200°F (871°-1,204°C) to volatilize and combust (in the presence of oxygen) organic constituents in hazardous wastes. Four common incinerator designs are rotary kiln, liquid injection, fluidized bed, and infrared incinerators. The destruction and removal efficiency (DRE) for properly operated incinerators often exceeds the 99.99 percent requirement for hazardous waste and can be operated to meet the 99.9999 percent requirements for PCBs and dioxins. Incinerators primarily reduce toxicity through destruction, however, the process also accomplishes volume reductions. Incineration is one of the most mature remediation technologies and has been used successfully at full scale.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- There are specific feed size and materials handling requirements that can impact applicability or cost at specific sites.
- The presence of volatile metals and salts may affect performance or incinerator life.
- Volatile metals, including lead and arsenic, leave the combustion unit with the flue gases or in bottom ash and may have to be removed prior to incineration.
- Metals can react with other elements in the feed stream, such as chlorine or sulfur, forming more volatile and toxic compounds than the original species.

As an ex-situ remedy, the excavation associated with incineration poses a potential health and safety risk to site workers through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, is normally required during excavation operations. If an offsite incinerator is used, the potential risk of transporting the hazardous waste through the community must be considered.

The capital expenditures associated with incinerators is relatively expensive. Materials handling control of bed temperatures and residence times, and system maintenance make the technology operation and maintenance (O&M) intensive as well. (*Remediation Technologies Screening Matrix*, 1993, p. 63.)

Target Contaminant Groups

The target contaminant groups for incineration are all halogenated and non-halogenated SVOCs and pesticides. The technology also may be used to treat halogenated and non-halogenated VOCs and fuels but may be less effective.

Initial Screening

A total of 26 FSs considered at least one type of incineration technology. Of those, all incineration types were screened out 19 times (73 percent). Five times (19 percent) incineration passed screening as a primary component of a remedial alternative, and two times (8 percent) it passed screening but was not considered as a primary component of a remedial alternative. The predominant factors for screening out incineration, including onsite and offsite unspecified incineration as well as specific types such as rotary kiln, fluidized bed, infrared, and multiple hearth, were high cost, lack of effectiveness, and difficulties in implementation. Specifically, the high capital and O&M cost associated with incineration was the reason provided most often (e.g., offsite incineration (unspecified) (9 FSs: 3, 4, 8, 10, 15, 17, 18, 19, 24), onsite incineration (unspecified) (5 FSs: 4, 9, 10, 13, 16), and rotary kiln (6 FSs: 5, 11, 13, 15, 17, 18). The threat of adverse health effects associated with potential air emissions produced during excavation, treatment (if onsite) and transportation (if offsite) also was frequently provided (e.g., offsite incineration (unspecified) (3 FSs: 4, 19, 24), and onsite incineration (unspecified) (2 FSs: 4,16). In addition, the difficulty in implementing this technology due to the size, shape, and contents (heterogeneous waste) of much of the waste material as well as difficulty in meeting the technical permit requirements were reasons provided for screening out incineration.

(Note: For this analysis, when a process option was not identified, the terms onsite or offsite incineration (unspecified) were used for data compilation purposes).

ONSITE INCINERATION (UNSPECIFIED)

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
12	3	1	8
Site Name Code:	7, 8, 19	20	4, 9, 10, 13, 16, 24, 27, 30

OFFSITE INCINERATION (UNSPECIFIED)

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
19	3	2	14
Site Name Code:	7, 25, 30	14, 20	1, 3, 4, 8, 10, 15, 17, 18, 19, 22, 24, 26, 27, 28

ROTARY KILN

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
10	0	1	9
Site Name Code:		14	1, 2, 5, 10, 11, 13, 15, 17, 18

FLUIDIZED BED

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
9	0	0	9
Site Name Code:			1, 2, 5, 11, 13, 14, 15, 17, 18

INFRARED

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
8	0	1	7
Site Name Code:		14	1, 5, 11, 13, 15, 17, 18

MULTIPLE HEARTH

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
4	0	0	4
Site Name Code:			5, 14, 17, 18

Detailed Analysis

The predominant factors for screening out both onsite and offsite incineration (unspecified) after a more detailed analysis include short-term effectiveness and cost Incineration requires many years to complete treatment and is very costly. The four times incineration passed initial screening and was retained for consideration as a remedial alternative, it was never selected as a final remedy for all the site wastes. However, at two sites, Fort Wayne Reduction, EST and Wildcat Landfill, DE, it was selected for treatment of drums excavated from portions of these sites.

Rotary kiln, fluidized bed, infrared, and multiple hearth were not considered in any remedial alternatives.

ONSITE INCINERATION (UNSPECIFIED)

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
3	0	3
Site Name Code:		7, 8, 19

OFFSITE INCINERATION (UNSPECIFIED)

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
2	2	1
Site Name Code:	7, 30	25

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. The high costs associated with incineration, as well as its effectiveness and implementability, were the primary reasons incineration was screened out. MLF sites characteristically contain many different types of waste due to the nature of a landfill. Incineration has not proven to be effective in treating all types of contaminants found in MLF sites. Also, a long time period is required to complete treatment by incineration, allowing potential increases in the short-term risks associated with excavation and air emissions. These reasons, therefore, are valid for screening incineration, including onsite and offsite unspecified incineration as well as specific types such as rotary kiln, fluidized bed, infrared, and multiple hearth, as a remedial alternative.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology provides only limited protection of public health and environment due to its ineffectiveness in treating non-organic waste present in MLF sites.
Compliance with ARARs	• Emission controls are required to ensure compliance with chemical-specific air emission standards.
Reduction of Toxicity, Mobility, or Volume	• Metals in the waste may react with other elements and form compounds that are more volatile and toxic than the original contaminants. • Residual contaminants may require further treatment or disposal.
Long-term Effectiveness and Permanence	• This technology is effective in treating organics but is not effective for treating other waste types present at MLF sites (i.e., inorganics and metals). • Residual risk remains after treatment.
Short-term Effectiveness	• This technology poses a threat of adverse health effects associated with potential air emissions produced during excavation, treatment (if onsite) and transportation (if offsite). • The time until remedial action objectives are achieved is long due to the large volume of waste.
Implementability	• This technology is difficult and impracticable to implement at MLF sites because of large waste volume, and specific feed size and material handling requirements.
Cost	• High costs are associated with this technology. It is not cost-effective in treating the large volume of waste present at MLF sites.

2. IN-SITU VITRIFICATION

Technology Description

In-situ vitrification is a relatively complex, high-energy technology, the operation of which requires a high degree of skill and training. In-situ vitrification uses electrodes for applying electricity or heat to melt contaminated soil and sludge, producing a glass and crystalline structure with very low leaching characteristics. It is predicted that the vitrified mass will resist leaching for geologic time periods. A vacuum hood placed over the treated area collects off-gases, which are treated before release. In-situ vitrification is currently in pilot-scale development. (*Remediation Technologies Screening Matrix*, 1993, p.33)

Limitations

The following factors may limit the applicability and effectiveness of this process:

- The process requires homogeneity of the contaminated media.
- In-situ vitrification is only effective to a maximum depth of approximately 30 feet (9 meters).
- In-situ vitrification is limited to operations in the vadose zone.
- Community acceptability of this technology is very low.

The high voltage used in the in-situ vitrification process, as well as control of the off-gases, present some health and safety risks. Recent operational problems involving a sudden gas release at a large-scale test posed technical concerns.

Target Contaminant Groups

While in-situ vitrification is used primarily to encapsulate non-volatile inorganic elements, temperatures of approximately 3,000EF (1,600EC) achieved in the process destroy organic contaminants by pyrolysis.

Initial Screening

In-situ vitrification was considered in 21 FSs. Of those, it was screened out 21 times (100 percent).

The predominant factors for screening out in-situ vitrification were high cost, lack of effectiveness, and difficulties in implementation. In particular, the heterogeneity of the landfill precluded the use of vitrification in the majority of FSs analyzed (14 FSs: 2, 5, 8, 10, 11, 13, 14, 17, 18, 19, 21, 23, 25, 28). In addition, the high capital and O&M costs (8 F5s: 5, 6, 10, 11, 13, 21, 22, 24) of vitrification and the lack of demonstrated effectiveness, mainly due to site-specific conditions (8 FSs: 1, 13, 14, 15, 19, 22, 26, 27), were primary reasons provided.

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
21	0	0	21
Site Name Code:			1, 2, 5, 6, 8, 10, 11, 13, 14, 15, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28

Detailed Analysis

In-situ vitrification was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. In-situ vitrification is a generally ineffective remedial technology due to the heterogeneity of MLF sites and other site-specific conditions, such as topography and depth of landfill. In addition, the high capital and O&M costs are primary reasons for the screening of in-situ vitrification.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• The limited effectiveness of this technology in treating site wastes reduces the overall protectiveness it provides
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume*	
Long-term Effectiveness and Permanence	• In-situ vitrification has not been routinely demonstrated on a remedial scale. • The technology is not applicable to heterogeneous landfill wastes.
Short-term Effectiveness	• High BTU and metal contents increase the potential risk for fire or short circuiting. • Depth and volume of landfill may affect the technology's effectiveness.
Implementability	• There is a limited availability of this technology. • Lack of space, shallow landfills, saturated soils and heterogeneous wastes all affect the implementability of this technology. • Increased risks, including short circuiting and fires due to metals contents, are associated with the technology, as is a general materials handling problem. • The process is limited to operations in the vadose zone and requires homogeneity of the media.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

3. PYROLYSIS

Technology Description

Pyrolysis is an ex-situ process that induces chemical decomposition by heat in the absence of oxygen. Organic materials are transformed into gaseous components and a solid residue (coke) containing fixed carbon and ash. Pyrolysis is currently pilot scale.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- ! Specific feed size and materials handling requirements may impact applicability or cost.
- ! The technology requires low-moisture soil.
- ! Highly abrasive feed may damage the processing unit.

As an ex-situ remedy, the excavation associated with pyrolysis poses a potential health and safety risk to site workers through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, normally would be required during excavation operations. The overall cost for pyrolysis is relatively high. (*Remediation Technology Screening Matrix*, 1993, p. 65.)

Target Contaminant Groups

The target contaminant groups for pyrolysis are all halogenated and non-halogenated SVOCs and pesticides. The technology also may be used to treat halogenated and nonhalogenated VOCs and fuels but may be less effective.

Initial Screening

Pyrolysis was considered in five FSs. It was screened out three times (60 percent), passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison) one time (20 percent), and passed screening but was not considered as a primary component of a remedial alternative one time (20 percent).

The predominant factors for screening out pyrolysis were high costs and ineffectiveness. The reasons provided included its high capital And O&M costs (2 FSs: 13, 18) and lack of demonstrated effectiveness compared to other thermal treatment processes (1 FS: 14).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
5	1	1	3
Site Name Code:	19	20	13, 14, 18

Detailed Analysis

The one time pyrolysis was retained for consideration in the detailed analysis, it was not selected as the remedial action. The reasons provided were extremely high capital and O&M costs, difficult implementation and compliance with LDR treatment standards because pyrolysis lacked demonstrated effectiveness against site contaminants, and risk of short-term exposure resulting from waste handling.

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
1	0	1
Site Name Code:		19

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. The high overall cost of pyrolysis was the primary reason for the screening out of pyrolysis as a remedial alternative, especially when compared with more effective thermal processes. Additional reasons for screening may include the variable size and shape of municipal waste components and the variable moisture content of the waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness *	
Compliance with ARARs	• Compliance with air emissions standards and RCRA LDR treatment standards may limit use of the technology.
Reduction of Toxicity, Mobility, or Volume	• Additional waste products may be generated during treatment.
Long-term Effectiveness and Permanence	• Prolysis lacks demonstrated effectiveness.
Short-term Effectiveness	• The technology poses potential risks from exposure to fugitive emissions during excavation and treatment. • Waste products may be generated during treatment. • Large volumes or low contaminants of concern concentrations may inhibit effectiveness.
Implementability	• This technology is technically very difficult to implement. • Site conditions such as landfill size may affect implementability.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

E. CHEMICAL/PHYICAL EXTRACTION

1. IN-SITU SOIL VAPOR EXTRACTION (SVE)

Technology Description

In-situ soil vapor extraction (SVE) involves applying a vacuum through extraction wells to create a pressure gradient that induces volatiles to diffuse through the soil to extraction wells. The process includes a system for handling off-gases. This process also is known as in-situ soil venting, in-situ volatilization, enhanced volatilization, or soil vacuum extraction. Since SVE is an in-situ remedy and all contaminants are under vacuum until treatment, the possibility of release is greatly reduced. (*Remediation Technologies Screening Matrix*, 1993, p. 25.) In-situ SVE is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- High humic content of soil inhibits contaminant volatilization.
- Heterogeneous soil conditions may result in inconsistent removal rates.
- Low soil permeability limits subsurface air flow rates and reduces process efficiency.

In-situ SVE generally applies only to the vadose zone. Treatment of the saturated zone is only possible by artificially lowering the water table.

Target Contaminant Groups

The target contaminant groups for in-situ SVE are halogenated and non-halogenated VOCs, and some fuel hydrocarbons. The technology is applicable only to volatile compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 units.

Initial Screening

SVE was considered in 14 FSs. It was screened out 11 times (79 percent), two times (14 percent) passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison), and one time (7 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factor for screening out SVE was ineffectiveness. The reason provided most often was ineffectiveness due to the heterogeneity of landfill waste (11 FSs: 1, 5, 8, 14, 15, 18, 19, 24, 25, 27, 28).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
14	2	1	11
Site Name Code:	10,23	20	1, 5, 8, 14, 15, 18, 19, 24, 25, 27, 28

Detailed Analysis

The two times SVE was retained for consideration in a remedial alternative, Hassayampa Landfill, AZ and Muskego Sanitary Landfill, WI, it was selected in the final remedy.

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
2	2	0
Site Name Code:	10, 23	

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. SVE is a generally ineffective treatment method due to the heterogeneity of municipal landfill wastes. SVE is applicable only to VOCs, and therefore, semi-VOCs and inorganic contamination would remain after treatment. Additional reasons for screening may include the high humic content of municipal waste and the variable vapor pressures of the compounds in the waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness *	
Compliance with ARARs	
Reduction of Toxicity, Mobility, or Volume*	
Long-term Effectiveness and Permanence	• The technology is not effective on municipal landfill waste, where there and is a wide variety of contaminants in a compacted volume of waste.
Short-term Effectiveness*	
Implementability	• Depth of landfill may affect implementation, as in-situ SVE generally applies only to the vadose zone. • High humic contents of soil inhibit contaminant volatilization. • Heterogeneous soil conditions and low soil permeability reduce process efficiency
Cost	• High costs are associated with implementing this technology at MLF sites.

*Criterion did not contribute to eliminating the technology.

2. IN-SITU SOIL FLUSHING

Technology Description

During in-situ soil flushing, water or water containing an additive to enhance contaminant solubility is applied to the soil or injected into the ground water to raise the water table into the contaminated soil zone. Contaminants are leached into the ground water. The process includes extraction of the ground water and capture/treatment/removal of the leached contaminants before the ground water is recirculated. Soil flushing is a pilot-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- The technology is applicable only to sites with favorable hydrology, where flushed contaminants and soil flushing fluid can be contained and recaptured.

- Low-permeability soil is difficult to treat.

- Surfactants can adhere to soil and reduce soil porosity.

- Solvent reactions with soil can reduce contaminant mobility.

Soil flushing introduces potential toxins (e.g., the flushing solution) into the soil, which also may alter the physical/chemical properties of the soil system. (*Remediation Technologies Screening Matrix*, 1993, p. 27.)

Target Contaminant Groups

The target contaminant, groups for soil flushing are halogenated and non-halogenated VOCs, and inorganics. The technology can be used to treat halogenated and non-halogenated SVOCs, fuels, and pesticides. Compatible surfactants may be added to increase the solubility of some compounds. The technology offers the potential for recovery of metals and can clean a wide range of organic and inorganic contaminants from coarse-grained soils.

Initial Screening

Soil flushing was considered in 16 FSs. Of those, it was screened out 16 times (100 percent).

The predominant factor for screening out soil flushing was ineffectiveness. The reason provided most often was ineffectiveness due to the heterogeneous nature of landfill waste (11 FSs: 8, 10, 11, 13, 17, 19, 23, 24, 25, 27, 28). High costs also were noted (2 FSs: 5, 6).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
16	0	0	16
Site Name Code:			1, 5, 6, 8, 10, 11, 13, 17, 19 22, 23, 24, 25, 26, 27, 28

Detailed Analysis

Soil flushing was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Ineffectiveness was the reason most often noted for the screening out of soil flushing as a remedial alternative. Soil flushing is not an appropriate treatment for heterogeneous landfill waste. Other site-specific conditions, such as the hydrology of the landfill region and soil permeability, also may be valid in the screening of soil flushing.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness*	
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• The addition of water during treatment may result in an increased volume and mobility of waste. • The technology introduces potential toxins into the soil, which may alter the physical and/or chemical properties of the soil.
Long-term Effectiveness and Permanence	• This technology is not effective due to the heterogeneity of waste.
Short-term Effectiveness*	• Technology may adversely affect ground water quality in the short-term. • Site conditions such as geology of the area may impede effectiveness of the treatment technology.
Implementability	• Volume of waste and other site conditions (i.e., large area, depth) may affect implementability. • The technology is generally very difficult to implement. The technology is only applicable to sites with favorable hydrology, where flushed contaminants and soil flushing fluid can be contained and recaptured.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

3. EX-SITU SOIL WASHING

Technology Description

Soil washing is an ex-situ process in which contaminants sorbed onto soil particles are separated from soil in an aqueous-based system. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics or heavy metals. Soil washing is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- Fine soil particles (i.e., silts, clays) are difficult to remove from the washing fluid.
- Complex waste mixtures (e.g., metals with organics) make it difficult to formulate wash water.
- High humic content in soil inhibits desorption.
- Presence of additives in washed soil and waste water treatment sludge can make disposal difficult.

As an ex-situ remedy, the excavation associated with soil washing poses a potential health and safety risk to site workers through skin contact and air emissions. Personal protective equipment, at a level commensurate with the contaminants involved, is normally required during excavation operations. (*Remediation Technologies Screening Matrix*, 1993, p. 43.)

Target Contaminant Groups

The target contaminant groups for soil washing are halogenated and non-halogenated SVOCs, fuel hydrocarbons, and inorganics. The technology can be used but may be less effective against halogenated and non-halogenated Vocs and pesticides. The technology offers the potential for recovery of metals and can clean a wide range of organic and inorganic contaminants from coarse-grained soil.

Initial Screening

Soil washing was considered in 12 FSs. Of those, it was screened out 11 times (92 percent). One time (8 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factors for screening out soil washing were effectiveness and implementability. Specifically, one main reason noted was ineffectiveness of treatment due to the heterogeneous characteristics of municipal landfill waste (7 FSs: 11, 13, 14, 17, 18, 24, 27). Difficulties in implementation also were noted (6 FSs: 1, 5, 6, 13, 15, 27) due to large volumes of waste to treat, the technical infeasibility of excavation, and other site-specific conditions.

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
12	0	1	11
Site Name Code:		10	1, 5, 6, 11, 13, 14, 15, 17, 18, 24, 27

Detailed Analysis

Soil washing was not considered as a primary component of any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. The ineffectiveness of soil washing in treatment of MLF wastes, as well as difficulties in the implementation of this technology, are the most often noted reasons for the screening of soil washing as a remedial alternative. Additional reasons for screening may include the high humic content in landfill soil, the complex waste mixtures found in municipal waste, and the presence of additives in municipal waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology provides only limited protection of public health and environment due to its ineffectiveness in treating heterogeneous landfill waste.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• The washwater may increase volume and mobility of waste. • Residual additives may be present in washed soil and wastewater.
Long-term Effectiveness and Permanence	• This technology is effective in treating SVOCs and inorganics; but less effective in treating other waste types present at MLF sites (i.e., VOCs and pesticides). • Presence of residual additives in washed soil and wastewater may require further treatment and disposal.
Short-term Effectiveness	• This technology allows for potential risk to community and workers during excavation.
Implementability	• The complex waste mixtures present at MLF sites makes formulating washing fluid difficult. • Large waste volumes, as well as certain soil types (i.e., high humic content) inhibit implementation.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

F. THERMAL DESORPTION

1. LOW TEMPERATURE THERMAL DESORPTION/STRIPPING

Technology Description

Low temperature thermal desorption is an ex-situ process that uses direct or indirect heat exchange to volatilize water and stripping organic contaminants from soil, sediment, sludge, or other solid and semi-solid matrices. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. Low temperature thermal desorption systems are physical separation processes and are not designed to destroy organics. The bed temperatures and residence times designed into these systems will volatilize selected contaminants, but typically not oxidize them. By volatilizing contaminants and concentrating them, thermal desorption reduces the volume of contamination, but the concentrated waste stream still requires treatment. Low temperature thermal desorption is a full-scale technology.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- There are specific feed size and materials handling requirements that can impact applicability or cost at specific sites.
- Dewatering may be necessary to achieve acceptable soil moisture content levels.

Soils that are tightly aggregated or largely clay, or soils that consist of non-homogeneous matrices that contain rock fragments or particles greater than 1 to 1.5 inches can result in poor processing performance due to caking. Low temperature thermal desorption has relatively high capital and O&M costs. (*Remediation Technologies Screening Matrix*, 1993, p. 57.)

Target Contaminant Groups

The target contaminant groups for low temperature thermal desorption systems are halogenated and non-halogenated VOCs and fuels. The technology can be used to treat halogenated and non-halogenated SVOCs and pesticides but may be less effective. The technology is not appropriate for inorganic contaminants, although some metals (i.e., mercury, arsenic) may volatilize during treatment.

Initial Screening

Low temperature thermal desorption/stripping was considered in 13 FSs. Of those, it was screened out 10 times (77 percent). One time (8 percent), it passed the screening and was considered as a primary component of a remedial alternative (detailed analysis and comparison). Two times (15 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factor for screening out low temperature thermal desorption/stripping was ineffectiveness. The reason provided most often was the heterogeneity of the landfill waste which would result in poor processing performance (7 FSs: 5, 10, 14, 17, 18, 19, 24).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
13	1	2	10
Site Name Code:	15	8, 25	1, 5, 6, 10, 14, 15, 17, 18, 19, 24, 28

Detailed Analysis

The one time low temperature thermal desorption/stripping was retained for consideration in a remedial alternative, it was not selected as the final remedy predominantly because of the high cost.

No. FSs Technology Passed Screening	No. RODs Technology Selected	No. RODs Technology Not Selected
1	0	1
Site Name Code:		15

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and arie SVOCs, pesticides, metals, and other inorganics. Thermal desorption generally can be screened from appropriate remedial alternatives, primarily due to its ineffectiveness in treatment of characteristically heterogeneous landfill wastes. Additional reasons for screening may include the variable sizes and shapes of municipal waste, the variable water content of the waste, and high costs.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology provides only limited protection of public health and environment due to its ineffectiveness in treating heterogeneous waste present in MLF sites.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• This technology volatilizes and concentrates contaminants, thereby reducing the volume of contamination but the concentrated waste stream requires further treatment. • This technology is not expected to effectively reduce the toxicity, mobility, or volume of non-volatile contaminants.
Long-term Effectiveness and Permanence	• This technology is effective in treating VOCs but is less effective or is not appropriate for treating other waste types present at sites (i.e., SVOCS, pesticides, and inorganics). • Residual risk remains after treatment.
Short-term Effectiveness	• This technology allows for potential risk to community and workers during excavation.
Implementability	• The large volume of waste at MLF sites as well as specific feed size and material requirements make implementation difficult and impracticable. • MLF sites may contain soils that are tightly aggregated or largely clay or non-homogeneous which can result in poor processing.
Cost	• High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

2. IN-SITU STEAM STRIPPING

Technology Description

In the in-situ steam stripping technology, steam is injected through a piping system and heats the ground, increasing the vapor pressure of volatile contaminants and allowing them to be stripped. Air and steam then carry the contaminants to the surface where they are collected and sent to a process train. There, volatile contaminants and water vapor are removed from the off-gas steam by condensation.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- Generation of fugitive air emissions may be a problem during operation.
- The process is not sufficiently applicable to the treatment of inorganics, heavy metals, and mixed wastes.

Target Contaminant Groups

This technology is applicable to the treatment of volatile organics, such as hydrocarbons and solvents, with sufficient vapor pressure in the soil. The process is generally not limited by the soil particle size, initial porosity, chemical concentration, or viscosity. (*The Superfund Innovative Technology Evaluation Program: Technology Profiles*,EPA/540/S-89/013, November 1989, pp. 79-80.)

Initial Screening

In-situ steam stripping was considered in five FSs. Of those, it was screened out five times (100 percent).

The predominant factors for screening out in-situ steam stripping were lack of effectiveness and difficulties in implementation. Specifically, the heterogeneous nature of landfill waste and the characteristics of the landfill site resulted in the screening of in-situ steam stripping (4 FSs: 1, 10, 15, 19).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
5	0	0	5
Site Name Code:			1, 10, 15, 17, 19

Detailed Analysis

In-situ steam stripping was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. The heterogeneity of municipal waste and landfill site characteristics make this technology difficult to implement, control, and monitor, and therefore, less efficient than other treatment methods. The presence of inorganics, heavy metals, and mixed wastes in MLF sites is the principal reason in-situ steam stripping can be screened and not considered

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology provides only limited protection of public health and environment due to its ineffectiveness in treating heterogeneous waste present in MLF sites.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• This technology volatilizes and concentrates contaminants, thereby reducing the volume of contamination but the concentrated waste stream requires further treatment. • This technology is not expected to effectively reduce the toxicity, mobility, or volume of non-volatile contaminants found at MLF sites.
Long-term Effectiveness and Permanence	• This technology is effective in treating VOCs but is not effective in treating other waste types found at MLF sites (i.e, inorganics, metals, mixed waste). • Residual risk remains after treatment.
Short-term Effectiveness	• This technology allows for potential threats to community and workers during treatment. • The potential for ground water contamination may increase due to migration of the condensed stream.
Implementability	• This technology is difficult and impracticable to implement at MLF sites because of the large volume and the compacted nature and depth of the waste.
Cost	High costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

G. IMMOBILIZATION

1. STABILIZATION/SOLIDIFICATION

Technology Description

Stabilization/solidification process involves physically binding or enclosing contaminants within a stabilized mass (solidification), or inducing chemical reactions between the stabilizing agent and contaminants to reduce their mobility (stabilization). Ex-situ stabilization/solidification is relatively simple, uses readily available equipment, and has high throughput rates compared to other technologies.

The following factors may limit the applicability and effectiveness of this process:

- Some processes significantly increase the volume (up to double the original volume).
- Certain wastes are incompatible with different processes. Treatability studies may be required.
- Depending on the original contaminants and the chemical reactions that take place in the stabilization /solidification process, the resultant stabilized mass may still have to be treated as a hazardous waste.
- Environmental conditions may affect the long-term immobilization of contaminants.

As an ex-situ remedy, the excavation associated with stabilization /solidification poses a potential health and safety risk to site workers through skin contact and air emissions. (*Remediation Technologies Screening Matrix*, 1993, p. 45.)

Target Contaminant Groups

The target contaminant group for ex-situ stabilization/solidification is inorganics. The technology has limited effectiveness on halogenated and non-halogenated SVOCs and pesticides. However, systems designed to be more effective against organic contaminants are being developed and tested.

Initial Screening

Stabilization/solidification was considered in 20 FSs. Of those, it was screened out 17 times (85 percent). Three times (15 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factors for screening out stabilization / solidification were effectiveness and implementability. The reasons provided most often were the fact that it was an unproven technology for municipal wastes (10 FSs: 1, 2, 4, 10, 11, 16, 17, 18, 23, 24) and was not implementable on a site-wide basis due to size, volume and depth of waste (4 FSs: 10, 14, 26, 27).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
20	0	3	17
Site Name Code:		8, 19, 20	1, 2, 4, 6, 10, 11, 14, 15, 16, 17, 18, 22, 23, 24, 26, 27, 28

Detailed Analysis

Stabilization/solidification was not considered as a primary component of any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Stabilization/solidification was screened from potential remedial alternatives due to effectiveness and implementability. The heterogeneity of municipal wastes combined with the limited applicability of the stabilization /solidification treatment provide sufficient rationale in this screening. Additional reasons for screening may include the potential for a significant increase in volume and also the potential that the treated mass may still have to be treated as a hazardous waste.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• This technology provides only limited protection of public health and environment due to its ineffectiveness in treating heterogeneous waste present in MLF sites.
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• This technology reduces the mobility of inorganic contaminants only. • This technology is not expected to reduce the toxicity, mobility or volume of organic contaminants present at MLF sites. • Some processes may result in a significant increase in volume. • Environmental conditions may affect the long-term immobilization of the contaminants.
Long-term Effectiveness and Permanence	• This technology is effective in treating inorganics but is not effective in treating other waste types present in MLF sites (i.e., organics, pesticides). • The resultant stabilized mass may still be susceptible to leaching and require disposal as a hazardous waste.
Short-term Effectiveness	• As an ex-situ technology, solidification/stabilization allows for potential risks to community and workers during excavation.
Implementability	• The large volume of waste at MLF sites as well as the depth and size of waste materials and the incompatibility of certain wastes with different processes makes implementation difficult and impracticable.
Cost	• Increased costs are associated with this technology.

* Criterion did not contribute to eliminating the technology.

2. FIXATION

Technology Description

Fixation, or in-situ stabilization/solidification, uses reagents to immobilize organic and inorganic compounds to produce a cement-like mass.

Limitations

The following factors may limit the applicability and effectiveness of this process:

- ! Some processes result in a significant increase in volume (up to a 10 percent increase).
- ! Performance of the process with regard to PCBs, metals, and other organic compounds is still uncertain. Treatability studies are recommended.

Target Contaminant Groups

The fixation technology can be applied to organic compounds and metals in wet or dry soils. However, immobilization of PCBs, VOCs and SVOCs has not been fully determine. (*The Superfund Innovative Technology Evaluation Program: Technology Profiles, Fourth Edition*, E'PA/540/S-91/008, November 1991, pp. 98-99.)

Initial Screening

Fixation was considered in seven FSs. Of those, it was screened out four times (57 percent). Three times (43 percent), it passed screening but was not considered as a primary component of a remedial alternative.

The predominant factor for screening out fixation was in effectiveness. Specifically, fixation was most often noted to be inapplicable to site contaminants due to the heterogeneity of waste (3 FSs: 5, 10, 14). Fixation also was noted to be not implementable due to site conditions (1 FS: 19).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
7	0	3	4
Site Name Code:		8, 18, 20	5, 10, 14, 19

Detailed Analysis

Fixation was not considered as a primary component of any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCs and SVOCs, pesticides, metals, and other inorganics. Effectiveness and implementability were primary reasons for the screening out of fixation as a potential remedial alternative. The heterogeneous characteristics of municipal waste provides the main rationale behind these reasons. Other reasons for screening may include the presence of metals, PCBs, and other organic compounds, as well as the potential for an increase in soil volume after treatment.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness*	
Compliance with ARARs*	
Reduction of Toxicity, Mobility, or Volume	• Fixation does not reduce toxicity. • The process may result in a significant increase in volume.
Long-term Effectiveness and Permanence	• The technology is not applicable to all site contaminants (i.e., VOCs, PCBs, metals).
Short-term Effectiveness*	
Implementability	• The technology may not be implementable due to site conditions. • Treatability studies are recommended to determine feasibility.
Cost*	

* Criterion did not contribute to eliminating the technology.

H. OTHER

1. SOIL AERATION

Technology Description

Enclosed mechanical soil aeration, both ex-situ and in-situ, uses air stripping to detoxify soil contaminated with VOCs. Aerated (in-situ) or excavated (ex-situ) soil is mixed, increasing air/soil contact, which allows for the release of VOCs from the soil. VOC emissions are captured as air is forced through the system and carried to an air pollution control device (e.g., scrubber, vapor phase carbon adsorption) for treatment.

Limitations

The following factors may limit the applicability and effectiveness of this process:

! Soil aeration is applicable only to volatile and semi-volatile organics, not to PCBs or dioxins.

! Further pilot testing will be required to determine the effectiveness of this method.

! Excavation of soil may result in increased air emissions and the potential for associated health risks.

Target Contaminant Groups

Target contaminants for soil aeration are VOCs and SVOCs. The process is significantly less effective for PCBs and dioxins. (*Feasibility Study: Cork Street Land-fill Superfund Site*, April 1991.)

Initial Screening

Soil aeration was considered in seven FSs. Of those, it was screened out seven times (100 percent).

The predominant factors for screening out soil aeration were effectiveness and implementability. Specifically, soil aeration was most often noted as not applicable for treatment of all landfill waste materials (5 FSs: 11, 14, 18, 19, 27). Difficulty in implementation due to site-specific conditions also was noted (2 FSs: 19, 22).

No. FSs Where Technology Considered	No. FSs Technology Passed Screening	No. FSs Technology Not Primary Component of Alternative	No. FSs Technology Screened Out
7	0	0	7
Site Name Code:			5, 11, 14, 18, 19, 22, 27

Detailed Analysis

Soil aeration was not considered in any remedial alternatives.

Conclusion

MLF sites are a heterogeneous mixture of municipal, industrial, and household hazardous wastes. They are generally large in size, ranging from several acres to more than 200 acres containing large volumes of waste. Typically, MLF sites can contain a variety of contaminant groups, including halogenated and non-halogenated VOCS and SVOCs, pesticides, metals, and other inorganics. Soil aeration was determined to be an inapplicable remediation technology due to ineffectiveness and difficulty in implementation. Generally, the heterogeneous characteristics of municipal waste and the presence of non-volatiles influenced the screening of soil aeration. Other reasons, including the increased potential for fugitive air emissions, also may be valid in screening soil aeration as a remedial alternative.

The following table provides a breakdown by NCP criteria of the factors contributing to the elimination of this technology.

NCP Criteria	Key Factors
Overall Protectiveness	• Excavation of soil may result in increased air emissions and the potential for associated health risks.
Compliance with ARARs	• Soil aeration would not comply with established treatment standards for total halogenated organic compounds.
Reduction of Toxicity, Mobility, or Volume*	
Long-term Effectiveness and Permanence	• The technology is not suitable for the treatment of heterogeneous waste materials (i.e., PCBs, dioxins, metals).
Short-term Effectiveness	• Pilot testing is recommended to determine effectiveness. • Excavation of soil may result in increased air emissions and the potential for associated health risks.
Implementability	• Site restrictions such as size may affect implementability. • If waste pits are not preserved as distinct zones, they cannot be treated
Cost*	

* Criterion did not contribute to eliminating the technology.

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APPENDIX A

Summary of Screening and Detailed Analysis

SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR MUNICIPAL LANDFILLS ①

Remedial Technology Or Treatment ②	#FSs Where Technology Considered	#FSs Tech. Passed Screening	#FSs Tech Not Primary Component of Alternative	#FSs Technology Screened OUt	#FSs Where Criterion Contributed To Screening Out ③			#RODs Tech. Selected ④	# RODs Tech Not Selected	# RODs Where Criterion Contributed to Non-Selection ③,⑤						
					Cost	Effectiveness	Implement			Overall Protectiveness	ARARs	Reduction of TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implement.
Capping																
Multi-layer Cap	28	25	–	3	2	2	–	19	6	1	–	1	1	3	5	4
Asphalt Cap	17	–	–	17	2	14	5	–	–	–	–	–	–	–	–	–
Concrete Cap	17	–	–	17	3	14	5	–	–	–	–	–	–	–	–	–
Clay Cap	16	7	1	8	2	8	2	3	4	2	2	1	2	2	1	1
Soil Cover	16	18	3	5	–	5	1	6	2	2	–	1	1	–	–	–
Synthetic Cap	13	3	–	10	–	10	1	2	1	1	1	1	1	1	–	1
Chemical Sealants	5	–	–	5	–	4	–	–	–	–	–	–	–	–	–	–
Vertical/Horizontal Barriers																
Slurry Wall	21	5	2	14	2	8	6	2	3	3	2	2	1	2	1	2
Grout Curtain	17	–	–	17	2	15	8	–	–	–	–	–	–	–	–	–
Sheet Piling	17	–	1	16	–	13	5	–	–	–	–	–	–	–	–	–
Grout Injection	9	–	–	9	–	7	4	–	–	–	–	–	–	–	–	–
Block Displacement	6	–	–	6	–	3	4	–	–	–	–	–	–	–	–	–
Bottom Sealing	5	–	–	5	1	3	4	–	–	–	–	–	–	–	–	–
Vibrating Beam	5	–	–	5	3	3	–	–	–	–	–	–	–	–	–	–
Liners	3	–	–	3	1	3	–	–	–	–	–	–	–	–	–	–
Landfill Disposal																
Offsite Hazardous Landfill	17	0	4	13	8	3	12	–⑥	–	–	–	–	–	–	–	–
Onsite Hazardous Landfill	14	2	0	11	3	2	10	1	1	–	–	–	–	–	1	1

SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR MUNICIPAL LANDFILLS ①

Remedial Technology Or Treatment ②	#FSs Where Technology Considered	#FSs Tech. Passed Screening	#FSs Tech Not Primary Component of Alternative	#FSs Technology Screened OUt	#FSs Where Criterion Contributed To Screening Out ③			#RODs Tech. Selected ④	# RODs Tech Not Selected	# RODs Where Criterion Contributed to Non-Selection ③,⑤						
					Cost	Effectiveness	Implement			Overall Protectiveness	ARARs	Reduction of TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implement.
Offsite Landfill (unspecified)	9	1	–	8	5	4	5	–⑦	1	–	–	1	–	–	1	–
Onsite Landfill (unspecified)	7	–	1	6	3	2	6	–	–	–	–	–	–	–	–	–
Offsite Non-hazardous Landfill	3	–	–	3	–	–	3	–	–	–	–	–	–	–	–	–
Onsite Non-hazardous Landfill	2	–	–	2	1	1	1	–	–	–	–	–	–	–	–	–
Bioremediation																
In-situ Bioremediation	15	1	–	14	1	13	6	1	–	–	–	–	–	–	–	–
Ex-situ Bioremediation	10	–	–	10	–	8	5	–	–	–	–	–	–	–	–	–
Bioremediation (unspecified)	13	–	–	13	–	12	3	–	–	–	–	–	–	–	–	–
Chemical Destruction/Detoxification																
Oxidation/ Reduction	12	–	–	12	1	8	5	–	–	–	–	–	–	–	–	–
Dehalogenation	6	–	1	5	1	4	2	–	–	–	–	–	–	–	–	–
Neutralization	4	–	1	3	–	2	1	–	–	–	–	–	–	–	–	–
Chemical Destruc/ Detoxification (unspecified)	6	–	–	6	–	4	3	–	–	–	–	–	–	–	–	–

SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR MUNICIPAL LANDFILLS ①

Remedial Technology Or Treatment ②	#FSs Where Technology Considered	#FSs Tech. Passed Screening	#FSs Tech Not Primary Component of Alternative	#FSs Technology Screened OUt	#FSs Where Criterion Contributed To Screening Out ③			④ #RODs Tech. Selected	# RODs Tech Not Selected	# RODs Where Criterion Contributed to Non-Selection ③,⑤						
					Cost	Effectiveness	Implement			Overall Protectiveness	ARARs	Reduction of TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implement.
Thermal Treatment																
Onsite Incineration (unspecified)	12	3	1	8	5	4	6	–	3	–	1	–	–	3	3	3
Offsite Incineration (unspecified)	19	3	2	14	9	5	10	2	1	–	–	–	–	1	1	–
Rotary Kiln	10	–	1	9	6	6	5	–	–	–	–	–	–	–	–	–
Fluidized Bed	9	–	–	9	5	5	5	–	–	–	–	–	–	–	–	–
Infrared	8	–	1	7	6	4	3	–	–	–	–	–	–	–	–	–
Multiple Hearth	4	–	–	4	2	3	2	–	–	–	–	–	–	–	–	–
In-situ Vitrification	21	–	–	21	8	15	11	–	–	–	–	–	–	–	–	–
Pyrolysis	5	1	1	3	2	2	1	–	1	–	1	–	–	1	1	1
Chemical/Physical Extraction																
In-situ Soil Vapor Extraction (SVE)	14	2	1	11	2	11	3	2	–	–	–	–	–	–	–	–
In-situ Soil Flushing	16	–	–	16	2	11	8	–	–	–	–	–	–	–	–	–
Ex-situ Soil Washing	12	–	1	11	1	8	6	–	–	–	–	–	–	–	–	–
Thermal Desorption																
Low Temp. Thermal Desorp/ Stripping	13	1	2	10	2	8	3	–	1	–	–	–	–	–	1	–
In-situ Steam Stripping	5	–	–	5	1	4	2	–	–	–	–	–	–	–	–	–

SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR MUNICIPAL LANDFILLS ①																
Remedial Technology Or Treatment ②	#FSs Where Technology Considered	#FSs Tech. Passed Screening	#FSs Tech Not Primary Component of Alternative	#FSs Technology Screened OUt	#FSs Where Criterion Contributed To Screening Out ③			④ #RODs Tech. Selected	# RODs Tech Not Selected	# RODs Where Criterion Contributed to Non-Selection ③,⑤						
					Cost	Effectiveness	Implement			Overall Protectiveness	ARARs	Reduction of TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implement.
Immobilization																
Stabilization/ Solidification	20	–	3	17	1	12	5	–	–	–	–	–	–	–	–	–
Fixation	7	–	3	4	–	3	1	–	–	–	–	–	–	–	–	–
Other																
(In-situ or Ex-situ) Soil Aeration	7	–	–	7	–	5	3	–	–	–	–	–	–	–	–	–

Î This study was conducted on 30 municipal landfill sites

Ï This category does not include the no-action or institutional control only alternatives. No RODs selected either of these as remedies.

Ð Fss and RODs may contain more than one criterion for screening or non-selection of a technology. Also, some Fss did not fully explain the criteria for screening out a technology. Thus, the totals for screening and non-selection criteria are not equal to the number of Fss and RODs considered.

Ñ This column includes ROSs in which more than one technology may have been selected in the final remedy. Thus, the total for this column is greater than the number of sites analyzed.

Ò Information on State and community concerns was not included in this analysis because Fss do not contain this information and RODs generally only reference supporting documentation (i.e., State concurrence letter and responsiveness summary).

Ó This remedy was selected for disposal of drums found at the site. As an overall remedy for all site wastes, it was screened out.

Ô This remedy was selected for disposal of sediments found at the site. As an overall remedy for all site wastes, it was screened out.

APPENDIX B

Technology-Specific Summary Tables

Table of Contents

I. SCREENING PHASE · MUNICIPAL LANDFILLS

TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
CAPPING										
Multi-layer Cap	28	25	–	3	High cost	2	Minimal reduction of infiltration Affected by site conditions	1 1		
Asphalt Cap	17	–	–	17	High maintenance cost	2	Subject to cracking Not reliable in long term	11 2	Future land use restrictions Site conditions (slopes) Special equipment required Poor aesthetics	1 3 1 1
Concrete	17	–	–	17	High O&M cost	3	Subject to cracking Subject to root penetration Subject to weathering	11 1 2	Future restrictions on land use Site conditions (slope) Special handling Poor aesthetics	1 3 1 1
Clay Cap	16	7	1	8	High maintenance cost High cost	1 1	Susceptible to cracking Susceptible to root penetration No protective layer Questionable due to reliability	4 2 2 1	Clay not available locally Clay cap already present/ needs repair Permitting required	1 1 1
Soil Cover	16	8	3	5			Does not meet requirements Not as effective as other alternatives Not effective due to site conditions (marsh)	1 5 1	Site conditions (slope)	1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Synthetic Cap	13	3	–	10			Likely to degrade	1	Special installation required	1
							Reliability/integrity a problem	5		
							Settling	3		
							Surface water ponding	1		
							Does not meet requirements	1		
							Not effective alone	3		
Chemical Sealants	5	–	–	5			No long-term integrity	2		
							Waste is too heterogeneous	1		
							Not as effective as other options	1		
VERTICAL/HORIZONTAL BARRIERS										
Slurry Wall	21	5	2	14	High cost	2	Ineffective due to site conditions (discontinuous clay layer, depth to appropriate soil layer too much, site topography)	8	Site conditions (bedrock too deep, too compressible)	6
									Driving piles in waste not feasible	1
							Ground water does not flow laterally	1	Waste materials are not appropriate to contain slurry	1
									Disposal of excavated material difficult	1

(Continued)

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Grout Curtain	17	–	–	17	High cost	3	Site conditions (underlying rock formations, high water table) Not established for site Difficult to determine integrity	11 1 5	Site conditions Not implementable in waste Toxic grouting materials may be released	5 2 1
Sheet Piling	17	–	1	16	High cost	1	Questionable reliability Not chemically resistant Site conditions (discontinuous clay layer, ground water) Does not prevent downward mobility May introduce contaminants	3 2 10 2 1	Site conditions (depth too great) Driving piles in waste not feasible Quality control difficult	3 1 1
Grout Injection	9	–	–	9			Not proven (integrity) Site conditions (discontinuous clay layer)	3 5	Site conditions (topography, depth, waste matrix) Not proven	4 1
Block Displacement	6	–	–	6			Site conditions (discontinuous layers, waste matrix) Effectiveness not demonstrated	2 1	Highly difficult to determine integrity Site conditions	3 2
Bottom Sealing	5	–	–	5	High cost	1	May puncture drums in place Difficult to establish integrity	1 2	Site conditions (depth) Need storage for waste Difficult to implement	2 1 1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT										
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Vibrating Beam	5	–	–	5			Questionable technology Site conditions (discontinuous layers) Does not prevent downward migration	1 1 1	Site conditions (depth too great) Not implementable in waste matrix	3 1
Liners	3	–	–	3			Difficult to establish integrity	1	Requires excavation of entire landfill (storage space)	2
LANDFILL DISPOSAL										
Offsite Hazardous Landfill	17	–	4	13	High capital High cost	1 8	Waste pits are not preserved as distinct zones and cannot be removed or disposed Would not eliminate ground water degradation Waste contamination	1 2 2	Quantity too large (to transport volume) Remediation will not be completed before land ban goes into effect Risk to public workers Difficult to implement Must pass TCLP requirements Regulatory agencies may not approve transportation Leachate	8 1 3 3 1 1 1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)												
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT											
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Onsite Hazardous Landfill	14	1	2	11	High capital cost High costs	1 1	Not classified as RCRA hazardous waste Maintenance required for reliability Potential risk (recontamination)	1 1 1	Site topography (conditions) Large volume , small waste Need imported materials Not determined if RCRA waste Site not likely to be approved Difficult to implement Air emissions	6 3 1 1 1 1 1
Offsite Landfill (unspecified)	9	1	–	8	High cost	5	Adverse health effects Not as effective as alternatives	3 1	Many restrictions (storage, disposal) Volume too great	3 1
Onsite Landfill (unspecified)	7	–	1	6	High cost	3	Requires high maintenance to ensure effectiveness Long-term benefits do not outweigh low potential risks	1 1	Difficult if waste hazardous, large volume Site conditions (limited area)	3 3
Offsite Nonhazardous Landfill	3	–	–	3					Disposal restrictions Difficult material handling problems	3 1
Onsite Nonhazardous Landfill	2	–	–	2	High cost	1	Does not reduce leachate	1	Site conditions (wetlands)	1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)											
TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT										
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
BIOREMEDIATION										
In-situ Bioremediation	15	1	–	14	High costs	1	Not effective due to nature of waste	6	Not readily applied to hazardous waste area	1
							Difficult to maintain proper distribution of reactants	1	Oxygenation of landfill and aquifer	1
							Technically not feasible due to site conditions	1	Depth of fill required	1
									Process control is poor	2
							Large mass of waste, small mass of VOCs	1	May produce undesirable intermediates	2
							Unproven effectiveness for the treatment for site chemicals (not all compounds can be treated, chlorinated solvents and metals)	7	Only laboratory proven	1
							Waste pits are not preserved as distinct zones and cannot be removed or disposed	1		
Bioremediation (unspecified)	13	–	–	13			Not effective due to nature of waste (sensitivity to non-uniform waste streams, inappropriate for mixed refuse)	8	Potential for contaminating surface or ground water	1
									Not feasible for typical contents of sanitary landfill	2
							COC contamination too low to be useful	1		
							Long retention time	1		
							Shallow treatment only	2		
							Added nutrients may present threat to ground water	1		
							Not a proven technology	1		

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
Ex-situ Bioremediation	10	–	–	10			Waste pits are not preserved as distinct zones and cannot be removed or disposed	2	Shaft breakage and failure have been chronic problems	1
							Not effective due to nature of landfill waste	3	Extremely sensitive to temperature and difficult to control	1
							Compaction of the waste	1	Excavation of large landfill not practical	2
							Creates an additional waste stream that must be treated or incinerated	1	Site climate may require constant irrigation for effective landfarming	1
							Some contaminants may not be successfully remediated by this process	4	Long implementation time	1
							Large mass of waste, small mass of VOCs	1		
							Site conditions	1		
CHEMICAL DESTRUCTION/DETOXIFICATION										
Oxidation/ Reduction	12	–	–	12	Increased costs	1	Not effective for solids or solid waste	1	Ex-situ treatment not feasible due to expected increased risk	1
							Not all compounds can be treated	5	Waste pits are not preserved as distinct zones and cannot be treated	1
							Not feasible for landfill waste	6	Not possible due to heterogeneous nature of landfill	1
							Could increase solubility of some metals	1	Difficult to implement	2
							Hazardous by-products could be produced	4		
							May require too much reagent	1		

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Dehalogenation	6	–	–	5	High costs associated with process and handling of by-products Other options more cost effective	1 1	Not effective for most of the contaminants present Not applicable to treatment of waste materials	3 1	Difficult to implement Testing is required to demonstrate process	1 1
Chemical Destruction/ Detoxification (unspecified)	6	–	–	6			Not applicable to all types of contaminants found onsite Added chemicals may threaten ground water Side reactions may produce other hazardous substance Not effective due to heterogeneous nature of waste COC concentrations are too low for effective use	1 1 1 3 1	Not technically feasible due to size of landfill Excavation of waste is not feasible	1 2
Neutralization	4	–	1	3			Undergoing further research Not necessary for the site Not effective for all chemicals present in soil	1 1 1	Waste pits are not preserved as distinct zones and cannot be treated pH is probably neutral already	1 1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
THERMAL TREATMENT										
In-situ Vitrification	21	–	–	21	High costs	8	Not routinely demonstrated on remedial scale	7	Limited availability	2
							Not applicable to landfill (heterogeneous) wastes	8	Lack of space requires pilot demonstration	2
							Not effective in treating chemicals onsite	6	Materials handling problem	1
							High Btu and metal proportions suggest possible fire/short circuit	2	Metal object short circuit the process/fire	2
							Not demonstrated at depth present at site	1	Increased risks	2
							May generate waste products	2	Heterogeneous nature of landfill	1
							Large volume	1	Areas too shallow (depth)	2
							No control of emissions	2	Saturated soils	1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Offsite Incineration (unspecified)	19	3	2	14	High cost Not cost effective for large quantity High O&M	8 1 1	Potential adverse impact to human health and environment Effective for organic chemicals Volume too high Emissions may occur Effectiveness not demonstrated at full scale	2 1 1 2 1	High difficulty Large volume Material handling requires size reduction and control Mechanically complex Long time to implement Waste pits are not preserved as distinct zones and cannot be removed or disposed Significant administrative action Limited vendor accepting dioxins	4 2 1 1 2 1 1 2
Onsite Incineration (unspecified)	12	3	1	8	High cost	5	Waste type not compatible Air emissions Potential adverse health impacts	2 2 2	Offsite incinerator nearby Too small volume of waste Site conditions (space) Administrative requirements Residuals handling a problem Long time	1 1 1 1 1 1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Rotary Kiln	10	–	1	9	High cost	6	Limited short-term effectiveness	3	Not feasible due to type of waste	2
							Not effective on waste type (inorganics, metals)	3	Permits required	3
Fluidized Bed	9	–	–	9	High capital	1	Technically not feasible due to restrictions	1	Limited number of suppliers	1
					High cost	4	Rotary Kiln better option	2	Not feasible due to heterogeneity of wastes	1
							Not effective due to excavation	1	Air permit problems	2
							Not effective due to heterogeneous nature of waste	2	Site conditions (site size)	1
							Does not address inorganics	2		
							May generate waste product	1		
							Volume of waste is too great	1		
							COC concentration is too low	1		
Infrared	8	–	1	7	High capital	1	Technically not feasible due to restrictions	1	Site conditions (not enough space)	1
					High cost	5	Rotary Kiln better option	2	Offgas control (air permits needed)	2
							Not effective due to excavation	1		
							Not effective due to heterogeneous nature of waste	2		
							Does not address inorganics	1		
							May generate waste product	1		
							Volume of waste is too great	1		
							COC concentration is too low	1		

I. SCREENING PHASE • MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT										
	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Where Tech. Not Primary Component of Alternative	#FSs Technology Screened Out	Cost	#FSs	Effectiveness	#FSs	Implementability	#FSs
Pyrolysis	5	1	1	3	High cost	2	May generate waste product Volume of waste too great COC concentration too low Not as effective as other thermal treatments	1 1 1 1	Site conditions (site size)	1
Multiple Hearth	4	–	–	4	High costs	2	Not as effective as Rotary Kiln Not effective due to excavation Screening due to heterogeneous waste Does not address inorganics More effective on sludges	1 1 1 1 1	Air permit problems Shredding would be required	1 1
CHEMICAL/PHYSICAL EXTRACTION										
In-situ Soil Flushing	16	–	–	16	High cost	2	Not effective due to heterogeneity of waste Adding water may increase volume and mobility of waste Increased risk Site conditions (geology)	11 2 1 1	Too much waste Site conditions (too large of area, too deep) Very difficult	3 2 1
In-situ Soil Vapor Extraction (SVE)	14	2	1	11	High cost	2	Not effective on this type of waste (small volume of VOCs, waste compacted)	11	Too deep to be implemented Permitting requirements	2 1

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
TECHNOLOGY	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
Ex-situ Soil Washing	12	–	1	11	High cost	1	Not effective due to heterogeneity of waste Residuals pose health problem Not fully demonstrated	7 1 2	Large waste volume No vendors for regeneration of filters Site conditions (too small)	3 1 1
THERMAL DESORPTION										
Low Temperature Thermal Desorption/ Stripping	13	1	2	10	High cost Not cost effective	1 1	Not effective due to heterogeneity of waste Not effective due to compaction of waste	7 1	Risk of explosion Too much to excavate Not feasible due to increased risk	1 1 1
In-situ Steam Stripping	5	–	–	5	Higher cost than soil vapor extraction	1	Compaction of waste Large mass of waste, small mass of VOCs Not effective in treating chemicals at site Not applicable to site in general Potential for increased ground water contamination due to migration of condensed steam	1 1 2 1 1	Not applicable due to site conditions (depth)	2

I. SCREENING PHASE · MUNICIPAL LANDFILLS (Continued)										
	SCREENING CRITERIA AND REASONS FOR SCREENING OUT									
TECHNOLOGY	# FSs Where Technology Considered	# FSs Tech. Passed	# FSs Where Tech. not Primary Component Alternative	#FSs Technology Screened Out	Cost	#FS	Effectiveness	#FS	Implementability	#FS
IMMOBILIZATION										
Stabilization/ Solidification	20	–	3	17	Increased cost	1	Unproven for municipal waste (not feasible for heterogeneous waste; not suitable for treatment of waste materials)	10	Size of waste materials	1
							May be susceptible to leaching	1	Increased risk	1
							Large volume	1	Not implementable on a site-wide basis (size, volume)	3
							Depth of landfill	1	Depth of fill	1
							Not able to obtain acceptable remediation goals	1		
							Waste pits cannot be treated/cannot be moved	1		
							Site conditions	4		
Fixation	7	–	3	4			Not applicable to all contaminants onsite	2	Not applicable due to site conditions	1
							Not feasible VOCs	2		
							Doe not chemically immobilize contaminants	1		
OTHER										
Soil Aeration	7	–	–	7			Not suitable for treatment of waste materials	4	Site restrictions (size)	1
							Ineffective in treating metals	1	Waste pits are not preserved as distinct zones and cannot be treated	1
							Would not comply (with established treatment standards for THOCs)	1	Not effective due to heterogeneous nature of waste	1
							Pilot testing to determine effectiveness	1		

II. DETAILED ANALYSIS PHASE • MUNICIPAL LANDFILLS

TECHNOLOGY	# FSs Where Made b D.A.	# RODs Where Selected	# RODs Where Not Selected	NCP CRITERIA AND REASONS FOR NOT SELECTING Overall Protectiveness	# FSs	Compliance with ARARs	# FSs	Reduction of Toxicity, Mobility, or Volume	# FSs	Long-term Effectiveness and Permanence	# FSs	Short-term Effectiveness	# FSs	Implementability	# FSs	Cost	# FSs
CAPPING																	
Multi-layer Cap	25	19	6	Fill is not clean fill	1			No reduction	2	Not as effective as other alternatives Fill subject to cracking	1 1	Risks during installation	3	State may not allow size of Type III fill (permitting) More difficult than other alternatives	2 2	High cost	6
Asphalt Cap	–	–	–														
Concrete	–	–	–														
Clay Cap	7	3	4	Cap integrity not guaranteed Ground water contamination is possible	2 1	Does not meet State requirements Does not comply	1 1	No reduction	1	No frost protective layer Less effective alternative	1 1	Potential risk to workers and community during repair	1	Considerable handling involved	1		
Soil Cover	8	6	2	Does not address whole site No ground water protection	1 1			No reduction	1	Less effective than other alternatives	1						
Synthetic Cap	3	2	1	Ecological damage	1	Mitigation to meet ARARs required	1	No treatment	1	Contaminants remain	1	Remedy is invasive with many impacts	1	Long-term O&M	1		
Chemical Sealants	–	–	–														
VERTICAL/HORIZONTAL BARRIERS																	
Slurry Wall	5	2	3	Not as protective as other Only partial ground water protection	2 1	Does not comply	2	Does not limit all contamination Does not treat	1 2	Contaminants will remain	1	May cause wetland or adverse health impacts	2	Depth very great Long-term maintenance	1 2	High cost	1
Grout Curtain	–	–	–														
Sheet Piling	–	–	–														
Grout Injection	–	–	–														
Block Displacement	–	–	–														
Bottom Sealing	–	–	–														
Vibrating Beam	–	–	–														
Liners	–	–	–														

II. DETAILED ANALYSIS PHASE • MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	# FSs Where Made b D.A.	# RODs Where Selected	# RODs Where Not Selected	NCP CRITERIA AND REASONS FOR NOT SELECTING: Overall Protectiveness	# FSs	Compliance with ARARs	# FSs	Reduction of Toxicity, Mobility, or Volume	# FSs	Long-term Effectiveness and Permanence	# FSs	Short-term Effectiveness	# FSs	Implementability	# FSs	Cost	# FSs
LANDFILL DISPOSAL																	
Offsite Hazardous Landfill	–	–	–														
Onsite Hazardous Landfill	2	1	1											Very difficult to implement due to handling and construction staging requirements	1	Most expensive	1
Offsite Landfill (unspecified)	1	–	1					No treatment	1							High cost	1
Onsite Landfill (unspecified)	–	–	–														
Offsite Nonhazardous Landfill	–	–	–														
Onsite Nonhazardous Landfill	–	–	–														
BIOREMEDIATION																	
In-situ Bioremediation	1	1	–														
Bioremediation (unspecified)	–	–	–														
Ex-situ Bioremediation	–	–	–														
CHEMICAL DESTRUCTION/DETOXIFICATION																	
Oxidation/ Reduction	–	–	–														
Dehalogenation	–	–	–														
Chemical Destruction/ Detoxification (unspecified)	–	–	–														
Neutralization	–	–	–														
THERMAL TREATMENT																	
In-situ Vitrification	–	–	–														

II. DETAILED ANALYSIS PHASE • MUNICIPAL LANDFILLS (Continued)

TECHNOLOGY	# FSs Where Made to D.A.	# RODs Where Selected	# RODs Where Not Selected	NCP CRITERIA AND REASONS FOR NOT SELECTING: Overall Protectiveness	# FSs	Compliance with ARARs	# FSs	Reduction of Toxicity, Mobility, or Volume	# FSs	Long-term Effectiveness and Permanence	# FSs	Short-term Effectiveness	# FSs	Implementability	# FSs	Cost	# FSs
Offsite Incineration (unspecified)	1	–	1									High adverse impacts for comparable treatment	1			High costs	1
Onsite Incineration (unspecified)	3	–	3			Air emissions	1					Air emissions increase risk None, due to long time to implement	1 1	Difficult Permitting required High administrative requirements	1 1 1	High costs	3
Rotary Kiln	–	–	–														
Fluidized Bed	–	–	–														
Infrared	–	–	–														
Pyrolysis	1	–	1			Potential emissions and imposing RCRA LDRs if hazardous	1					Greatest potential for short-term contamination exposure due to increased handling	1	Most difficult technical implementation	1	Extremely high cost	1
Multiple Hearth	–	–	–														
CHEMICAL/PHYSICAL EXTRACTION																	
In-situ Soil Flushing	–	–	–														
In-situ Soil Vapor Extraction (SVE)	2	2	–														
Ex-situ Soil Washing	–	–	–														
THERMAL DESORPTION																	
Low Temperature Thermal Desorption/ Stripping	1	–	1													High costs	1
In-situ Steam Stripping	–	–	–														
IMMOBILIZATION																	
Stabilization/ Solidification	–	–	–														
Fixation	–	–	–														
OTHER																	
Soil Aeration	–	–	–														

II. DETAILED ANALYSIS PHASE • MUNICIPAL LANDFILLS (Continued)																		
TECHNOLOGY	NCP CRITERIA AND REASONS FOR NOT SELECTING																	
	# FSs Where Made to DA.	# RODs Where Selected	# RODs Where Not Selected	Overall Protectiveness	# FSs	Compliance with ARARs	# FSs	Reduction of Toxicity, Mobility, or Volume	# FSs	Long-term Effectiveness and Permanence	# FSs	Short-term Effectiveness	# FSs	Implementability	# FSs	Cost	# FSs

APPENDIX C

Site-Specific Data Collection Forms

TABLE OF CONTENTS

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Colesville Municipal Landfill, NY
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: Pg.4 ROD.)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Phase II evaluates alternatives not technologies. NIA (Not In Analysis) Technologies were considered in Phase I but were not mentioned in Phase II or anywhere else after.

Capping alone would cut off infiltration but not affect base flow.

Ancillary Processes include regrading, backfilling, dikes, berms, channels, ditches, and trenches.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	Multi-media Cap	Y	Y				A cap complying with NY state Part 360 Solid Waste Regulations.
Soil Cover	Single Layer	N			Does not meet requirements. Not as effective as other options.		
Synthetic	Synthetic Membrane / Soil	N			Does not meet requirements or have proper stability.		
Vertical/Horizontal Barriers							
Slurry Wall	Slurry Walls	Y	NIA				
Vitrification	Vitrified Wall Barrier	N			Requires pilot testing.		
Sheet Piling	Sheet Piles	N			Not chemically resistant. Not completely impermeable.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Grout Curtain	Grout Curtains	N			Not applicable due to underlying rock formation.		
Bottom Sealing	Bottom Sealing	N			Potential for puncturing intact drums in landfill.		
Landfill Disposal							
Offsite Nonhazardous landfill		Y	N			Disposal restrictions. Difficulties due to materials handling problems.	
Onsite Hazardous Landfill		N			Not classified as RCRA hazardous waste.		
Offsite Landfill (unspecified)		N				Not feasible to stage large amount of waste while waiting for proper disposal.	
	Excavation	Y	N			Difficult due to materials handling.	
Bioremediation							
In-situ Bioremediation		N			Technically not feasible due to site conditions. Large mass of waste and small mass of VOCs.		

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I	TECH RETAIN Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Ex-situ Bioremediation	Onsite Composting	N			Technically not feasible due to compaction of waste. Large mass of waste and small mass of VOCs.		
Ex-situ Bioremediation	Onsite Slurry Bioreactor	N			Technically not feasible due to site conditions. Large mass of waste and small mass of VOCs.		
Ex-situ Bioremediation	Onsite Leach Bed	N			Technically not feasible due to site conditions. Large mass of waste and small mass of VOCs.		
Chemical Destruction/Detoxification							
Chemical Destruction (unspecified)	In-situ Chemical Treatment	N				Not technically feasible due to size of landfill.	
Thermal Treatment							
In-situ Vitrification	Onsite Vitrification	Y	N			Materials handling problem.	
Offsite Incineration (unspecified)	Off-Site Commercial Incineration	Y	NIA				**Not provided.**
Fluidized Bed	Onsite Fluidized Bed	N			Technically not feasible due to restrictions. Rotary kiln better option.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Colesville Municipal Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Infrared	Onsite Infrared	N			Technically not feasible due to restrictions. Rotary kiln better option.		
Rotary Kiln	Onsite Rotary Kiln	Y	NIA				**Not provided.**
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Onsite Low Temperature Thermal Stripping	N			Technically not feasible due to compaction of waste. Large mass of waste and small mass of VOCs.		
In-situ Steam Stripping	In-situ Steam Extraction	N			Technically not feasible due to compaction of waste. Large mass of waste and small mass of VOCs.		
Low Temperature Thermal Desorption/ Stripping	Onsite High Thermal Stripping	N			Technically not feasible due to compaction of waste. Large mass of waste and small mass of VOCs.		
Chemical/Physical Extraction							
In-situ Soil Flushing		N				Technically not feasible due to large mass of waste and small mass of VOCs.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Colesville Municipal Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Ex-situ Soil Washing		N				Technically not feasible due to large mass of waste and small mass of VOCs.	
In-situ Vacuum Extraction (SVE)		N			Technically not feasible due to compaction of waste. Large mass of waste and small mass of VOCs.		
Immobilization							
Stabilization/ Solidification	In-situ Stabilization/ Solidification	N			Technically not feasible due to heterogeneity of waste.		
Stabilization/ Solidification	Onsite Stabilization/ Solidification	Y	NIA				
Stabilization/ Solidification	Offsite Stabilization/ Solidification	Y	NIA				
Other							
	Ancillary Processes	Y	NIA				

NIA - Not in Analysis

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Colesville Municipal Landfill, NY
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__ D__ None F/G TBD__ (Page or Section References: Pg. 12 ROD. See comments.)

Comments: Landfill soils contain RCRA listed hazardous waste, regulations specified in 40 CRF Part 264 Subpart F and G would be considered, however, NYCRR Part 360 final cover will meet or exceed the performance requirements of P264 Subparts F and G at this Site.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer Cap; P&T: Down Gradient; Existing Water Supply; LC; GC	N		Compliance takes longer than other alternatives.		Long-term maintenance and monitoring. Not as effective as other alternatives.			
Multi-layer Cap; P&T: Down Gradient; New Water Supply; LC; GC	N		Compliance takes longer than other alternatives.					
Multi-layer Cap; P&T: Down Gradient and Landfill; Existing Water Supply; LC; GC	N				Long-term maintenance and monitoring. Not as effective as other alternatives.			
Multi-layer Cap; P&T: Down Gradient and Landfill; New Water Supply; LC; GC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Colesville Municipal Landfill, NY
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer Cap; Slurry Wall; P&T: Down Gradient; New Water Supply; LC; GC	N				Long-term maintenance and monitoring. Not as effective as other alternatives.	Takes longer for aquifer clean up. Additional worker protection measures required.	More difficult construction due to site conditions.	More expen-sive
Multi-layer Cap; Slurry Wall; P&T: Down Gradient; Existing Water Supply; LC; GC	N					Relatively greater potential environmental impact, involving greater litigation measures.	More difficult construction due to site conditions.	More expen-sive

P&T – alternative includes a pump and treat component for ground water in the remedy
GC – alternative includes gas collection as a component in the remedy
LC – alternative includes leachate collection component in the remedy

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Conklin Dumps, NY
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments:

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		Y	N		Susceptible to cracking.		
Clay Cap	Clay/Soil Cap	Y	N		Susceptible to cracking.	Clay not readily available locally.	
Concrete		Y	N	High O&M.	Susceptible to cracking.		
Multi-layer Cap		Y	Y				Consistent with 6 NYCRR Part 360 (FML).
Landfill Disposal							
Offsite Landfill (unspecified)	Offsite Commercial Landfill	Y	N	High Capital.			Type of landfill required dependent on analysis of landfill material.
Onsite Landfill (unspecified)		Y	N	Extremely high cost if material found to be hazardous.		Not implementable if material found to be hazardous.	Onsite landfill includes combining two areas through excavation and capping.
Bioremediation							
Bioremediation (unspecified)	Aerobic	N				Not feasible for typical contents of sanitary landfill.	
Bioremediation (unspecified)	Anaerobic	N				Not feasible for typical contents of sanitary landfill.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Conklin Dumps, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Treatment							
Fluidized Bed		N				Not feasible due to size, shape, and contents of much of the waste materials.	
Rotary Kiln		N				Not feasible due to size, shape, and contents of much of the waste materials.	
In-situ Vitrification		N				Not feasible due to the presence of metal objects in waste which would short circuit the process.	
Immobilization							
Stabilization/ Solidification	Stabilization	N				Not feasible due to size of much of the waste materials.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Conklin Dumps, NY
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X_ D___ None___ TBD___

(Page or Section References: Multi-layer cap under 40 CFR RCRA Part 264.310/ RCRA Part 360 pg.15 ROD.)

Comments: If necessary, a gas collection and treatment plan will be provided. The selected remedy includes offsite discharge or onsite treatment.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer Cap Both Landfill Areas; LC; P&T	Y							
Multi-layer Cap Both Landfill Areas; LC; P&T	N					Active system of ground water extraction would interfere with natural degradation process and therefore take longer in attaining Class GA ground water standards.		
Multi-layer Cap Both Landfill Areas; LC; P&T	N					Same as above.		
Multi-layer Cap Both Landfill Areas; LC; P&T (Offsite)	N					Same as above.		Highest cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Coshocton City Landfill, OH
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ___________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: FS not available at time of review. Was not possible to determine Phase I screening details.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap			N	High Maintenance.	High maintenance required because of: - Poor weathering, - Brittleness with age - Photodegradation - Settlement.		
Clay Cap			N		Maintenance required to: - Repair erosion damage - Maintain moisture content to prevent failure caused by cracking.		
Concrete			N	High maintenance.	Very susceptible to settlement cracking.		
Multi-layer Cap	Gravel-Clay		N		Gravel yields: - Lower vegetative cover - Lower evapo-transportation		
Multi-layer Cap	Soil-Clay		Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Multi-layer Cap	Synthetic Membrane-Soil		N		Useful life undefined. Membrane puncture possible in refuse fill.	More difficult to implement.	
Soil Cap			Y				
Multi-layer Cap	Soil-Synthetic Membrane-Clay		Y				
Landfill Disposal							
Offsite Hazardous Landfill			N	High capital costs.		Requires large volume of waste material to be transported long distances.	
Onsite Hazardous Landfill	RCRA Type Landfill		N	Very high capital costs.	Maintenance required for reliability.	Implementation difficult because of: - Limited site area - Need for imported materials.	
Onsite Landfill (unspecified)	Vault		N	Very high capital costs.	Maintenance required for reliability.	Implementation difficult because of large volume of landfill contents.	

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Treatment							
Offsite Incineration (unspecified)	Incineration: RCRA Incineration		N	Very high capital costs. High O&M.	Effectiveness not demonstrated at full scale.	Implementation very difficult. Materials handling requires size reduction and control. Process is mechanically complex and requires numerous operators for refuse fill.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Coshocton City Landfill, OH
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X_ None___ TBD___

(Page or Section References: Page 10 ROD.)

Comments: The RCRA regulations which govern Hazardous Waste Treatment, Storage and Disposal facilities did not become effective until November 19, 1980. The Coshocton Landfill ceased accepting wastes prior to that date. Though RCRA regulations are not jurisdictionally applicable to the remediation of the site, they are certainly "relevant" to the actions occurring thereon. Though both subtitle C and D of RCRA are relevant to the remedy for the Coshocton Landfill, the Subtitle D provisions relating to capping / covering the landfill are deemed more appropriate (pg. 10 ROD).

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Soil Filling and Grading	N		Does not meet State solid waste landfill closure regulations.					
Soil Cap; GC; LC; P&T	Y							
Multi-layer (Clay/ Soil/ Sand) Cap; GC; LC; P&T (Disposal)	N							High cost.
Multi-layer (Soil/ Synthetic Membrane/ Clay) Cap; GC; LC; :P&T	N							High cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dakhue Sanitary Landfill, MN
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ___________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Screening analysis eliminated all but "cover" alternatives incorporating elements of clay, membrane and soil cover components. While multi-layer capping was not specifically referenced, combined analysis and decision for further evaluation of linked capping components infers screening for multi-layer alternatives.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap	Asphalt/Soil Cap	Y	N		Subject to cracking and differential settlement.		
Clay Cap		Y	Y				
Concrete	Cement/Soil Admixture	Y	N		Subject to cracking.		
Multi-layer Cap		Y	Y				
Soil Cover		Y	Y				
Synthetic	Synthetic Membrane	Y	N		Long-term effectiveness decreases — uncertain life-expectancy.		
Concrete	Bentonite Membrane	Y	N		Subject to cracking and differential settlement.		
	Lime Sludge Admixture Cover	Y	N			Limited contractors available. High waste content may make construction difficult.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dakhue Sanitary Landfill, MN
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	TECH. RETAIN Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Landfill Disposal							
Offsite Hazardous Landfill	Offsite Disposal	N		Excessive fees for hazardous waste disposal ($300 M).		Potential for spills, human exposure, and air emissions.	Likely that commercial operators would require disposal as hazardous waste.
Onsite Hazardous Landfill	Onsite Reburial in RCRA-Compliant Landfill	N				Potential air emissions during excavation. Available land is insufficient.	
Bioremediation							
Bioremediation (unspecified)	Biological Treatment	N			Inappropriate for mixed refuse.		
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	Chemical Treatment	N			Inappropriate for mixed refuse.		
Thermal Treatment							
Offsite Incineration (unspecified)	Incineration	N		Excessive costs above onsite incineration.	Short-term risk from excavation and air emissions.	Many years to complete treatment.	
Onsite Incineration (unspecified)	Incineration	N		Excessive costs ($330 M).	Short-term risk from excavation and air emissions.	Many years to complete treatment.	
Immobilization							
Stabilization/ Solidification	Solidification	N			Inappropriate for mixed refuse.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dakhue Sanitary Landfill, MN
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None__X__ TBD___

(Page or Section References: ROD Pages 14, last paragraph - no documentation to support RCRA wastes disposed at Dakhue.)

Comments: All alternatives meet protection, ARARs, short-term effectiveness and implementability criteria, however selected alternative presents the most cost effective remedy with least chance of damage and long-term O&M costs. Treatment options for air emissions from gas vents will be considered after constructions of final remedy .

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
MN Mixed Waste Cover System - Soil Cover with Clay Barrier	N				Alternative is most likely to fail due to thickness of cover and frost damage due to barrier layer above frost-line.			
MN Mixed Waste Cover System - Soil Cover with Clay Barrier with Frost Protection	Y							
Multi-layer (RCRA Subtitle C) Cover	N					Longest time requirement for construction results in highest exposure potential.	Most difficult to construct due to Flexible Membrane Layer design.	Capital costs are higher than other com-pliant alterna-tives.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dover Municipal Landfill, NH
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No X TBD ___ (Page or Section References: Pg.5, ROD.)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Chemical wastes were disposed of in drums in the landfill; however, the location or amount is unknown. Because characterization studies have not revealed amount or location, hot spots are not a consideration at the landfill, despite the presence of drum chemical waste.
The FS has an unusual Phase II approach. Technology options retained from Phase I were evaluated according to effectiveness, implementability, cost, and only certain technology options were retained. There is an intermediate phase where technology options are then placed into media-specific alternatives and evaluated according to effectiveness, implementability, cost (not the nine criteria). Those that are retained then formed into Alternatives that are given a nine-criteria Phase III analysis.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Chemical Sealants	Surface Macroencap-sulation	N			Waste is too heterogeneous.		
Multi-layer Cap	Clay and Soil	Y	N	High cost.	Susceptible to cracking. Difficult slope stability problems.		
Multi-Layer Cap	Clay/FML Cap	Y	Y				
Multi-layer Cap	Geocomposite/ FML Cap	Y	Y				
Synthetic	Single-Layer Synthetic	Y	N		Susceptible to tears from differential settling of waste.		
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Sheet Pile		Y	N		Effectiveness depends on absence of obstacles in waste and the ability to make interlockings work well.		
Grout Curtain		Y	N	High.	Not effective because it is difficult to ensure overlap.		
Bottom Sealing	Bottom Seal Grouting	Y	N	High.	Very limited effectiveness due to the uncertainties of covering the entire bottom layer.	Very difficult to implement.	
	Interceptor/ Diversion Trench (with Potential Inclusion of Extraction Wells)	N/A	Y				This technology is not presented until the end of Phase II analysis.
Landfill Disposal							
Offsite Hazardous Landfill		Y	N	Very high costs.		Low implementability. Solid waste must pass TCLP requirements for offsite RCRA disposal.	
Offsite Nonhazardous Landfill		N				Nonhazardous facility cannot accept any hazardous waste.	

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Onsite Hazardous Landfill		Y	N	Very high costs.		High-water table may pose problems.	
Onsite Nonhazardous Landfill	Subtitle D Solid Waste Facility	Y	N	Very high costs associated with the necessary disposal of hazardous solid waste at an alternate facility.	Low effectiveness in reducing leachate contamination.		
Bioremediation							
In-situ Bioremediation		Y	N		Not effective for chlorinated solvents and metals.		
Chemical Destruction/Detoxification							
Dehalogenation	Dechlorination	Y	N		Not effective for most of the contaminants present.	Difficult to implement.	
Oxidation/ Reduction	Wet Air Oxidation	N			Not effective for solids or solid waste.		
Thermal Treatment							
Fluidized Bed		Y	N	High costs due to fuel.	Not effective because it requires: S Excavation S Screening due to heterogeneous nature of waste. Does not address inorganics.	Air permit problems.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dover Municipal Landfill, NH
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Infrared		Y	N	High costs due to fuel.	Not effective because it requires: S Excavation S Screening due to heterogeneous nature of waste. Does not address inorganics.	Air permit problems.	
Multiple Hearth		Y	N	High costs due to fuel.	Not effective because it requires: S Excavation S Screening due to heterogeneous nature of waste. Does not address inorganics.	Air permit problems.	
Rotary Kiln		Y	N	High costs due to fuel.	Does not address inorganics.	Air permit problems. Not implementable because it requires excavation, and screening due to heterogeneous nature of waste.	
In-situ Vitrification		Y	N	High electricity costs.	Not yet tested on a full scale.	Not implementable due to heterogeneous nature of landfill.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dover Municipal Landfill, NH
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Other Thermal Treatment	Thermoplastics	N			Not effective. VOCs may cause further leaching problem.		
Other Thermal Treatment	Thermosets	N			Not effective. VOCs may cause further leaching problem.		
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping		Y	N		Limited effectiveness due to the nature of the COCs.	Risk of explosion.	
Chemical/Physical Extraction							
In-situ Soil Flushing		Y	N	High cost.		Difficult to implement. Not implementable due to heterogeneous nature of waste. Only for soils.	
Ex-situ Soil Washing	Solvent Extraction	Y	N		Residual solvents pose a problem.	Difficult to implement. Limited success on a large scale.	
In-situ Vacuum Extraction (SVE)		Y	N		Effective on VOCs, in vadose zone only.	Only applicable at limited depths.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dover Municipal Landfill, NH
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Immobilization							
Fixation	Chemical and Silicate Fixatives	N			Not feasible for soils with VOC contamination.		
Other							
Aeration		N				Not effective due to heterogeneous nature of waste.	
	Dewatering of Waste Below Ground Water	Y	Y				

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Dover Municipal Landfill, NH
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C X D___ None___ TBD___ (Page or Section References: Pg. 67, ROD, 3rd Paragraph.)

Comments: Much of the Phase III analysis was discussed in the secondary part of the Phase II analysis. There are two groups of alternatives to be analyzed in Phase III - On-site, or source control (which includes contaminated ground water under the landfill), and secondly, contaminated ground water that has migrated from the landfill base. This Phase III analysis is only concerned with source control alternatives.

Additionally, alternatives presented here have an undecided source control (SC) ground water treatment design, as presented in the ROD. Alternatives SC-5 and SC-7 have full on-site ground water treatment and subsequent discharge into a nearby river. Alternatives SC-5A and SC-7A have partial on-site treatment and subsequent discharge to a POTW. Even so, SC and SCA alternatives are analyzed in Phase III as if they were the same alternative, noting that the ground water treatment decision will be made in the design phase.

Furthermore, it is important to note that although joint alternatives SC-5/SC-5A and SC-7/SC-7A both have multi-layer caps, the caps are significantly of different composition, even though they have the same low permeability standard. Alternative SC-5/SC-5A has a clay/FML cap while alternative SC-7/SC-7A has a less bulky geocomposite/FML cap, which is ultimately less costly to use. Also, alternative SC-5/SC-5A has a slurry wall, which is more expensive than the interceptor/diversion trench used in alternatives SC-7/SC-7A.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
SC-5/SC-5A Clay/FML Cap; Slurry Wall	N				Clay FML multi-layer cap may suffer desiccation and slope instability.		SC-5A involves construction of a 2.5-mile sewer line to POTW. Clay/FML cap requires much more fill to be transported than the geocomposite/FML cap. (This means a higher cost.)	50% higher than SC-7/7A. Slurry wall is more costly.
SC-7/SC-7A Geocomposite/ FML Cap	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Dix Landfill, NJ
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: __________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: No hot spots are known to exist, but it is possible that the landfill may contain wastes in containers that could rupture at any time in the future, releasing additional contaminants (page 3, FS). Waste prior to 1980 are unknown. Wastes after 1980 included waste paints and thinners, pesticides and empty containers, and combined wastes.

THE FS FOR THIS SITE WAS COMPLETED BEFOR SARA, 1987, WHICH SET UP THE PHASED APPROACH FOR THIS SITE. As a result, the phased approach was not used for this site and the following distinction must be noted:

Excavation for treatment and/or disposal was considered unfeasible for this site, primarily because of excessive costs and increased risks associated with a large scale operations, especially with the possibility of uncovering buried munitions at the site. Some in-situ treatment is examined in what could be considered a Phase I analysis.

Source control alternatives (with the exclusion of vertical barriers and some in-situ treatment) were not analyzed at all. This is because a predetermined source control technology, a multi-layer cap or cover system, was selected because it was “required by both NJDEP sanitary landfill closure regulations and RCRA disposal regulations,” as stated in the FS (page 3-9). This source control alternative is first presented in the alternative analysis (what could be considered a Phase III analysis) and is a part of each of the alternatives (excluding no action) in “Phase III”.

The nine criteria of Phase III are not used here. First, technology options were initially screened, but not according to any specific criteria. Then alternatives were developed and “initially screened” (in what might be considered a Phase II analysis) according to technical feasibility, environmental impacts, and public health concerns. Finally, alternatives were screened (in what could be considered a Phase III analysis) according to feasibility, cost, and public health and environmental protection criteria.

Only partial capping is to be used at this site. Only a more recently filled 50 out of a total of 120 acres are to be capped. The only reasons for this, as presented in the FS (pages 3-10, 3-17/18), are that computer modeling indicated no significant benefit, and several significant disadvantages such as increased risk due to buried munitions, high cost, and preservation of the tree cover on part of the landfill is highly desirable. It is also expected that any contaminated leachate that originated from the older portion of the landfill would have already naturally flushed through the ground water system.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Dix Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	Multi-layer Cover System	Y	Y				
Vertical/Horizontal Barriers							
Slurry Wall	Upgradient	N		High cost.	Not effective due to site topography.		
Slurry Wall	Circumferen-tial	N		High cost.	Not effective due to site topography.		
Slurry Wall	Downgradient	Y	N	High costs.	May not be effective due to site topography. There may be a constructability problem associated with dewatering. Long-term effectiveness has not been proven.	Disposal of excavated material may be a problem.	Most feasible slurry wall despite its disadvantages. Ground water wells/ interceptors seen as better alternative.
Sheet Pile		Y	N		Not effective due to ground water configuration. Structure easily damaged.		
Grout curtain		Y	N		Not effective - incapable of forming a reliable barrier.	Toxic grouting materials may present a release problem.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Dix Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation							
In-situ Bioremediation		N			Not effective due to heterogeneous nature of waste. Difficult to maintain proper distribution of reactants.	Only laboratory proven.	
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	Chelation	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Oxidation/ Reduction		N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Thermal Treatment							
Vitrification		N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Thermal Desorption							
Low Temperature Thermal Desorption	Heating	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Dix Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing	Precipitation	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Ex-situ Soil Washing	Hydrolysis	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Other	Activated Carbon	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Other	Ion Exchange	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Other	Freezing	N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	
Immobilization							
Stabilization/ Solidification		N		Increased cost.		Ex-situ treatment not feasible due to expected increased risk.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Dix Landfill, NJ
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C X D___ None___ TBD___

(Page or Section References: Pg. 2-37 of the ROD, p. 1-61 of the FS (RCRA part 264 is Subtitle C).)

Comments: The FS for this site was completed in 1987 before the NCP and the nine criteria for the phased analysis approach were used. As a result, the alternatives were not evaluated according to the nine criteria in the FS; however, because the ROD was completed in 1991, the alternatives were evaluated according to a nine criteria Phase 3 approach. Furthermore, only one source control was carried over into the final analysis of the alternatives, this being use of a multi-layer cap.

The selected alternative was a part of all of the other alternatives (excluding No Action) so cost was a major factor.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Multi-layer Cap with monitoring	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Wayne Reduction, IN
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes __X__ No___ TBD ___ (Page or Section References: __ROD.)
If yes, where are they located? In landfill__X_ Periphery______
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes __X__ No ___ TBD __

Comments: FS not available at time of review. Phase I screening cannot be determined without the FS.

The general response actions: removal, disposal, and treatment were addressed as “not applicable for technology screening.” It cannot be determined specifically why these were screened. The general response actions were not counted in the summary tables.

Drum excavation on Western Portion of the site may be considered a Hot Spot.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap			Y				
Soil Cover			Y				
Clay Cap	Single layer		N	Low to high maintenance cost.	Impermeable layer susceptible to cracking due to environmental conditions and settlement.		
Multi-layer Cap	Multi-layer Cap with Membrane		N	Moderate to high: - Capital cost - Maintenance cost.		Requires most time to implement.	
Vertical/Horizontal Barriers							
Slurry Wall			Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Wayne Reduction, IN
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Treatment							
Onsite Incineration (unspecified)	Drum Excavation Area (Hot Spot)		Y				
Offsite Incineration (unspecified)	Drum Excavation Area (Hot Spot)		Y				
Landfill Disposal							
Offsite Landfill (unspecified)	Disposal		N			Not applicable for technology screening.	See comments.
Other							
	Removal		N			Not applicable for technology screening.	See comments.
	Treatment		N			Not applicable for technology screening.	See comments.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Wayne Reduction, IN
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X_ None___ TBD___

(Page or Section References: Soil cover complaint with Indiana Subtitle D solid waste landfill closure requirements.)

Comments: Access restrictions, soil cover and ground water program are the major components of all the alternatives for solid waste landfill closure (pg.18 ROD).

Hot Spot identified in the ROD was the Western Portion of the landfill, drum excavation area.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Soil Cover Cap; Slurry Wall; P&T	N					Does not minimize the major sources contributing to the major threat.	Difficult to predict long-term performance of slurry wall/trench technology.	
Soil Cover Cap; Slurry Wall; P&T (with Barriers)	N					Does not minimize the major sources contributing to the major threat	Same as above.	
Soil Cover Cap; Slurry Wall; P&T; Soil Excavation for Drum Removal and Offsite Incineration	Y						Same as above.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Fort Wayne Reduction, IN
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH FEDERAL ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer (Soil-Clay Cover) Cap; Slurry Wall; P&T; Soil Excavation for Drum Removal; Onsite Incineration.	N					Long time before program is implemented.	Permitting/approval/ deed restrictions required for incineration. Incineration includes all around high risk. Incineration includes high administrative implementability. Same as above.	Most ex-pensive.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: G & H Landfill, MI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No___ TBD ___ (Page or Section References: Pg.5-6, Pg.3-5, Fig.3-2, Pgs.D-17, D-23.)

If yes, where are they located? In landfill__X_ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD _X_

-

Comments: Phase II discussion pgs. 4-4 to 4-11 and Appendix B and D. Hot Spots: Soils and sediments with high concentrations may be treated (Phase II Analysis: Appendix D). They are located in Phase I Area of landfill. However, treatment of hot spots was not in selected remedy.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap	Asphaltic Concrete	N			Not likely to provide long-term integrity.		
Asphalt Cap	Sprayed Asphalt	N			Not likely to provide long-term integrity.		
Soil Cover	Single-layer Clay Cap	Y	Y				Meets Subtitle D closure regulations.
Concrete		N			Settlement likely to cause cracks.		
Multi-layer Cap	Soil/Clay Cap	Y	Y				Meets Subtitle C closure regulations.
Multi-layer Cap	Clay-Geomembrane	Y	Y				Meets Subtitle C closure regulations.
Synthetic	Synthetic Membranes	Y	N		Unknown reliability.		
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				Ground water pumping required.
Sheet Pile	Vertical Barrier	Y	Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: G & H Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Grout Curtain		Y	N	Relatively high.	Questionable.		
Bottom Sealing	Horizontal (unspecified)	N			Difficult to establish integrity.	Need storage for 3.2 million cubic yds.	
	Permeability Reduction Agents	N			Difficult to establish integrity.	Questionable.	
Vibrating Beam		Y	N		Questionable.		
Landfill Disposal							
Offsite Hazardous Landfill		N				Quantity too large to transport.	
Onsite Hazardous Landfill		Y	Y				
Bioremediation							
Bioremediation (unspecified)		N			Not applicable to heterogeneous wastes.		
Chemical Destruction/Detoxification							
Oxidation/ Reduction	Oxidation	N				Difficult to implement.	
Oxidation/ Reduction	Reduction	N				Difficult to implement.	
Thermal Treatment							
Offsite Incineration (unspecified)		Y	N	Not cost-effective for large quantities.			Pg. D-23, FS.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: G & H Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Onsite Incineration (unspecified)		Y	Y				Pg. D-23, FS.
In-situ Vitrification	Vitrification	N			Not applicable to landfill wastes.		
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low Temperature Volatilization	Y	Y				
Chemical/Physical Extraction							
In-situ Soil Flushing		N			Not applicable to heterogeneous wastes.		
In-situ Vacuum Extractions (SVE)		N			Not applicable to heterogeneous wastes.		
Immobilization							
Fixation	Sorption	Y	Y				Combined in Phase II as one technology with Pozzolanic Agents.
Stabilization/ Solidification	Pozzolanic Agents	Y	Y				Combined in Phase II as one technology, with Sorption.
Encapsulation		N			Not applicable for waste present.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: G & H Landfill, MI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C_X_ D___ None___ TBD___ (Page or Section References: Pg. 36.)

Comments: ARAR comparative analysis (pgs. 35-36 of ROD) lists RCRA Subtitle C as ARAR. Selected remedy includes excavation of PCB-contaminated soils with disposal to an onsite landfill or disposal to an offsite hazardous landfill. Personal communication with Region 5 on July 27, 1994, indicated that offsite treatment has not and will likely not occur. In such a circumstance, however, the RPM would decide on appropriate offsite treatment technology.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Soil-Clay Cover Only (GC, LC&T)	N	Ground water contaminants will migrate.	Ground water will continue to exceed MCLs.	No reduction of toxicity, mobility, or volume.				Moderate
Soil-Clay Cover/ Vertical Barrier (GC, LC&T)	N	Ground water contaminants could continue to migrate.	Ground water will continue to exceed MCLs.	No reduction of toxicity, mobility, or volume		Some VOC emissions. Increased risk of vehicular accidents.	May create ground water mounding.	Moderate
Soil-Clay Cover/ Vertical Barrier/ Hot Spot Excavation and Onsite Disposal (GC, LC&T, P&T)	Y							
Soil-Clay Cover/ Vertical Barrier/ Hot Spot Excavation and Incineration (GC, LC&T, P&T)	N					Some VOC emissions from excavation and treatment. Increased accident risk. 20 yr. time frame.	Air emission permit required. Difficult to meet siting requirements for onsite landfill.	Very high

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Global Landfill, NJ
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No___ TBD ___ (Page or Section References: Pg.1-6, FS.)

If yes, where are they located? In landfill____ Periphery_X_

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes _X_ No __ TBD ___

Comments: There are no hot spots within the landfill, but surface water leachate seeps and ponds are present at the periphery of the landfill. A slope stability problem has added to leachate release at the landfill, and design of a stabilization berm, along with leachate collection, should mitigate this problem. A leachate collection pond and a leachate collection well were installed at the landfill, but they are not currently in operation.

There is a Hot Spot consisting of 63 drums in the periphery of the landfill. Many of these drums contained hazardous waste and were discovered and removed from the site under special action. The special action is not address in this report.

The stabilization berm will not be analyzed here because its primary function is not source control but prevention of slope instability.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	NJDEP Solid Waste Cap	Y	Y				
Multi-layer Cap	NJDEP Hazardous Waste Cap	Y	Y				
Multi-layer Cap	EPA RCRA Cap	Y	Y				
Multi-layer Cap	Bentonite Clay Cap	Y	Y				
Multi-layer Cap	Modified Hazardous Waste Cap	Y	Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Global Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Synthetic Membrane Only	Flexible Membrane Caps	N			Not effective due to anticipated slope movement and settlement, especially on sideslopes. To be used only as part of a composite cap.		
Landfill Disposal							
Offsite Hazardous Landfill		N		High cost		Not implementable due to volume of waste.	
Thermal Treatment							
Onsite Incineration (unspecified)		N		High cost	Not effective due to incompatibility of treatment with volume and types of waste.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Global Landfill, NJ
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D____ None____ TBD____

(Page or Section References: Pg. 21 of ROD states that RCRA C requirements and NJ Hazardous Waste Closure Regulations are relevant and appropriate.)

Comments: RCRA Subtitle C regulations are met for the selected remedy. A NJ closure requirement ARAR is waived due to technical impracticability. Groundwater is addressed under a separate ROD.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Multi-layer Cap (NJDEP Solid Waste Cap—clay only; no synthetic membrane); GC; LC	N	Slightly less reduction of surface infiltration than other alternatives. Less control of gas migration due to lack of synthetic membrane. Slightly greater impact on wetlands due to weight of material.		No treatment,	Slightly less reduction of surface infiltration than other alternatives.			Lowest cost.
Alternative 3 Multi-layer (NJDEP Hazardous Waste); GC; LC	N	Slightly greater impact on wetlands due to weight of material.		No treatment.			More difficult to implement due to heavier weight and slope instability.	Highest cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Global Landfill, NJ
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4 Multi-layer (RCRA) Cap; GC; LC	N	Slightly greater impact on wetlands due to weight of material.		No treatment.			More difficult to implement due to heavier weight and slope instability.	High cost.
Alternative 5 Multi-layer (Bentonite Clay) Cap (clay only; no synthetic membrane); GC; LC	N	Less control of gas migration due to lack of synthetic membrane.	Waiver of state closure requirements needed.	No treatment.				Medium cost.
Alternative 6 Multi-layer (Modified NJDEP Hazardous Waste) Cap; GC; LC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes __X__ No ___ TBD ___ (Page or Section References: __Pg.1, Section A of the ROD.)

If yes, where are they located? In landfill__X__ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes __X__No ___ TBD

Comments: The hot spot area of the site consists of a 10 acre area (out of a total 47 acre area landfill) where significant amounts of solid and liquid wastes were dumped in an unlined area. The ROD considers only this 10 acre area as "the site" as well as any areas where site-related contaminants (contaminants related to hazardous waste disposal) have been located.

The feasibility study does discuss another significant area within the 10 acre area known as "Pit 1," which has the most significant VOC and SVOC contamination. Wastes in this Pit are subject to separate / different treatment because they are the most hazardous and because they are liquid, unlike most of the other waste. Pit 1 is also a discrete yet small enough area to make removal and offsite treatment feasible. Removal and offsite treatment are seen as options for wastes other than Pit 1.

Upon closure of the site, the hazardous waste area was capped with a soil cover to mitigate potential off-site migration.

The phased approach is not outlined clearly in this FS. Technology options are presented initially and are evaluated, at various lengths, according to "technical feasibility" and " public health and environmental screening." This is clearly a Phase I approach, even though some technologies are eliminated outright without discussion and some technologies are eliminated after discussion. Effectiveness, Implementability, and Cost criteria - which are Phase II analysis criteria - are not applied until the technologies have been put together in eight separate site-wide alternatives. These alternatives are then generally evaluated according to Phase II criteria, and half are eliminated. The other half are then subjected to detailed analysis, or a Phase III approach. What is significant about this is that technologies are never really individually analyzed according to e, i, c criteria, so that the Phase II analysis of specific technologies is not clearly evident, and thus may not be satisfactorily represented in the table.

See FS pgs. 77-79 and Table 2.15, and Table 3.9 for QA.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	RCRA cover	N		Not as cost effective as the soil cap, which exceeds Arizona landfill requirements.			RCRA is not applicable to the site because it was closed before November, 1980; however, a RCRA cap is evaluated in comparison to the soil cap for this site.
Soil Cover		Y	Y				There may be a problem with VOCs from soil gas contaminating the ground water of this cap is used without any treatment.
Landfill Disposal							
Offsite Hazardous Landfill		N		High cost.	Incineration required for the most hazardous wastes. RCRA disposal prohibited due to high halogenated VOC concentration.	Transportation of waste creates potential problems. Approved space may not be available.	
Onsite Hazardous Landfill		N				The amount of contaminated soils to be disposed of is too small for on-site RCRA disposal to be feasible.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation							
Ex-situ Bioremediation	Liquid-Solids Treatment with Landfarming	N			Creates an additional waste stream that must be treated or incinerated. Some contaminants may not be successfully remediated by this process.	Site climate may require constant irrigation for effective landfarming.	
In-situ Bioremediation		N			In-situ bioremediation creates a leachate problem.	Not readily applied to the hazardous waste area.	
Thermal Treatment							
Off-site Incineration (unspecified)		N		High cost.			
On-site Incineration (See Circulating Bed and Rotary Kiln)		Y	N	High cost.		More difficult to implement than other alternatives.	Not chosen in Phase II because soil washing of Pit 1 wastes was seen as a more easily implementable and less costly technology.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Onsite Incineration (unspecified)	Circulating Bed Combuster (Onsite)	Y	N		Effective only for liquid waste from Pit 1. Not feasible for soils that need to be removed. (also no volume reduction for soils). Clean backfill may be required sue to any volume reduction. Volume reduction may increase the concentration of metals that remain after incineration.	Permitting concerns may be a problem.	Not chosen in Phase II because soil washing of Pit 1 wastes was seem as a more easily implementable and less costly technology.
Rotary Kiln	(Onsite)	Y	N		Effective only for liquid waste from Pit 1. Not feasible for soils that need to be removed. (also no volume reduction for soils). Clean backfill may be required due to any volume reduction. Volume reduction may increase the concentration of metals that remain after incineration.	Permitting concerns may be a problem.	Not chosen in Phase II because soil washing of Pit 1 wastes was seem as a more easily implementable and less costly technology.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
In-situ Vitrification		N		Very high cost. Not very cost-effective compared to other forms of thermal treatment	Vitrification is more effective and suitable for inorganiocs and metals, which are not the primary contaminants of concern at this site..		May require a complex vapor collection system.
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping		N		Less cost-effective than other treatment technologies.	Would require additional treatment of collected organics (most likely through incineration) and possible solidification of metals. Volume of waste from Pit 1 are relatively small for effective use of this treatment. This technology is still in the developmental stage.		This option applies only to treatment of waste from Pit 1.
In-situ Steam Stripping	Stem Injection/ Sparging	N		Higher cost than soil vapor extraction.	Potential for increased ground water contamination due to migration of condensed steam.	Site characteristics (e.g., depth of landfill) make this technology difficult to implement, control and monitor.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical / Physical Extraction							
In-situ Soil Flushing	(same as in-situ soil washing)	N			Adding water would create great potential for ground water contamination.		
Ex-situ Soil Washing	Ex-situ	Y	Y				
In-situ Vacuum Extraction (SVE)		Y	Y				
Immobilization							
Fixation	Ex-situ	Y	N		Effective only for excavated soils from Pit 1, specifically to be used after off-site incineration as a away of containing metals in the incineration waste. Not effective for contaminated soils that have VOC, SVOC contamination because they can migrate through a fixed matrix.		

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Stabilization/ Solidification	Ex-situ	Y	N		Effective only for excavated soils from Pit 1, specifically to be used after off-site incineration waste. Not effective for contaminated soils that have VOC, SVOC contamination because they can migrate through a fixed matrix.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hassayampa Landfill, AZ
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D____ None _X__ TBD____

(Page or Section References:)

Comments: Capping is included in all of the Alternatives (excluding no action) Only one kind of cap was chosen in the Phase I/Phase II analysis (soil cover). A RCRA cap was not incorporated into the alternatives because the landfill was closed before RCRA became applicable. Ground water treatment and monitoring and deed and access restrictions are also part of each alternative.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Cap (P&T)	N	Less protective than alternatives 3 and 4.	More time to achieve ground water cleanup standards due to lack of soil treatment.	No source control treatment.	No soil treatment to prevent potential ground water contamination			
Alternative 3 Cap, Soil Vapor Extraction/ Treatment (P&T)	Y							
Alternative 4 Cap, Soil Vapor Extraction/ Treatment, Excavation/Ex-situ Soil Washing (P&T)	N					Increased potential for short-term risk due to excavation.		Highest cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hertel Landfill, NY
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No ___ TBD __X__ (Page or Section References: __Declaration of ROD.)

If yes, where are they located? In landfill______ Periphery___X___

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD __X__

Comments: Additional soil sampling along the western portion of the disposal area to determine the need to extend the cap or to consolidate these soils under the caps.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		Y	N		Susceptible to cracking and weathering.		
Clay Cap		Y	N		Susceptible to cracking.		
Concrete		Y	N		Susceptible to weathering.		
Multi-layer Cap		Y	Y				
Synthetic		Y	N		Susceptible to surface water ponding.		
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				
Landfill Disposal							
Offsite Landfill (unspecified)		Y	N	Extremely high cost.	Not as effective as other options.	Low feasibility.	
Onsite Landfill (unspecified)		Y	N	Very high capital.		Difficult to implement.	
Bioremediation							
Bioremediation (Ex-situ)	Landfarming	N			Not applicable to treatment of waste materials		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation (unspecified)	Biodegradation	N			Not applicable to treatment of waste materials.		
Chemical Destruction/Detoxification							
Oxidation/ Reduction		N			Not applicable to treatment of waste materials.		
Dehalogenation	Dechlorination	N			Not applicable to treatment of waste materials.		
Thermal Treatment							
Fluidized Bed	Fluidized Bed Incineration	Y	N	High capital.		Limited number of suppliers.	
Infrared	Infrared Incineration	Y	N	High capital.			
	Radio Frequency Heating	N			Not applicable to treatment of waste materials.		
In-situ Vitrification	Vitrification	Y	N	High costs.	Not previously been proven.	Limited availability.	Potential for underground fire.
Rotary Kiln		Y	N	High costs.	Not as effective as other options. Limited short-term effectiveness.		
Extraction							
In-situ Soil Flushing		N			Not applicable to treatment of waste materials.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hertel Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Ex-situ Soil Washing		N			Not applicable to treatment of waste materials.		
Immobilization							
Solidification/ Stabilization	Cement Based	N			Not suitable for treatment of waste materials.		
	Pozzolanic	N			Not suitable for treatment of waste materials.		
Other							
Aeration	Mechanical/ Thermal Aeration	N			Not suitable for treatment of waste materials.		
	Various offsite treatment	Y	N	High costs.	Not as effective as other options.	Requires offsite transportation.	Depends on treatment; (Incineration chosen for evaluation).
	Soil Venting	N			Not applicable to treatment of waste materials.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Hertel Landfill, NY
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None_X__ TBD___

(Page or Section References: Capping in accordance with 6 NYCRB Part 360 closure requirements for New York waste landfills. Declaration of ROD. No RCRA wastes pg.8 ROD.)

Comments: The innovative treatment may not be as effective as other P&T, although would meet ARARs. Capping with standard ground water pump and treatment is the contingency Alternative.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer Cap	N	Not as protective as other alternatives.	Will not comply with ARARs for a significant amount of time.	Does not limit all con-tamination.	Does not provide the same degree of protection as other alternatives.			
Multi-layer Cap; Slurry Wall	N	Not as protective as other alternatives.	Will not comply with ARARs for a significant amount of time.	Does not limit all con-tamination.				
Multi-layer Cap; P&T	N					Greater risks to onsite workers because of installation.	Higher administration needs and implementability.	Higher costs.
Multi-layer Cap; P&T (Innovative Treatment)	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Islip Municipal Sanitary Landfill, NY
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References: __________)

If yes, where are they located? In landfill _X_ Periphery____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No _X_ TBD___

Comments: Hot spot consists of 60-70 drums of dry cleaning waste on an unlined area located beneath an intermediate cap/liner system and covered with 150 ft. of waste. Two interim measures have been taken: a gas collection system, and an interim landfill cap (begun in July 1992).Based on EPA guidance, neither source treatment nor source removal were seen to be technically feasible. Only capping was examined for source control, and the same cap was applied in all alternatives in the Phase III analysis.

An experimental capping option has been predetermined for the site. The proposed cap is a synthetic membrane and the use of Rolite-treated incinerator ash as past of the gas-venting layer, constructed in accordance with the CO and 6NYCRR Part 360. According to the FS, no other capping options are used in the Phase III because the proposed cap was determined to be “more suitable” for the site.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		Y	N			Special equipment required.	
Chemical Sealants	Additive-Derived	Y	N		Not as effective as other options.		
Multi-layer Cap	Clay and Soil	Y	N	High capital costs.	Susceptible to cracking.	Presents restrictions on future and land use.	
Concrete		Y	N			Special handling and applications required.	
Multi-layer Cap	RCRA Cap	Y	N		No gas venting. Cracks possible due to tears and clay shrinkage.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Islip Municipal Sanitary Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Multi-layer Cap	Modified 6NYCRR Part 360 (using the experimental Rolite layer)	Y	Y				
Multi-layer Cap	Standard 6NYCRR part 360	Y	N		May be susceptible to tearing. Effective, but it has been decided that a modified version using an experimental "Rolite" gas-venting layer is to be used.	Landfill surface needs to be properly prepared so that no tears occur in the membrane. Experiment of Rolite treated ash is needed.	
Vertical/Horizontal Barriers							
Slurry Wall		N			Physical constraints and construction difficulties.		
Sheet Pile		N			Physical constraints and construction difficulties.		
Grout Curtain		N			Physical constraints and construction difficulties.		
Slurry Wall	Diaphragm Wall, trench filled with reinforced concrete panels	N				Wall would be 800 ft. deep.	
Block Displacement.		N				Not implementable due to physical constraints.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Islip Municipal Sanitary Landfill, NY
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D___ None___ TBD___

(Page or Section References: Pg. 30 of the ROD. According to the ROD, the selected remedy satisfies action specific ARARs regarding federal hazardous waste management requirements for capping, on-site containment, and general closure standards.)

Comments: The selected source control remedy, which is the only source control alternative presented in the Phase III analysis, was designed in compliance with Part 360 of the Title of the New York Code of Rules and Regulations (6 NYCRR Part 360), Solid Waste Management Facilities. See pg. 13 of the ROD for description of the design and discussion of agencies involved on the experiment.

Two interim measures have been taken: a gas collection system, and an interim landfill cap.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer cap (Synthetic Membrane Using the Experimental Rolite Gas-Venting Layer); P&T	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Juncos Landfill, PR
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes __ No _X_ TBD ___ (Page or Section References: _Pg. 3, FS; pg.17 FS._)
If yes, where are they located? In landfill____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: It is likely that mercury from thermometers was dumped at the site, but there is no specific hot spot area. According to pg. 2, second paragraph, in the ROD, locations and concentrations of mercury were not identified. Two Operable Units exist for this site. This ROD covers OU I, which is concerned with source control measures.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Clay Cap	Single Layer Cap	Y	Y				
Multi-layer Cap	RCRA C Cap	Y	Y				
Soil Cover	Soil Cap	Y	Y				
Synthetic	Single Layer, Synthetic Geomembrane Cap	Y	Y				
Vegetative Cover		N			Not effective alone.		
Landfill Disposal							
Offsite Landfill (unspecified)	Excavation and Offsite Disposal	N		Too costly.	Health risks to neighbors and workers.	Volume of waste is too great.	
Bioremediation							
Bioremediation (unspecified)		N			Not effective due to heterogeneous waste. COC concentration levels are too low to be useful.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	In-situ Chemical Treatment	N			COC concentrations are too low for effective use. Not effective due to heterogeneous nature of waste.	Excavation of waste is not feasible.	
Thermal Treatment							
Onsite Incineration (unspecified)	(general incineration)	N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	
Fluidized Bed		N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	
Infrared		N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Juncos Landfill, PR
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Pyrolysis	Pyrolite Incineration	N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	
Rotary Kiln		N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	
In-situ Vitrification	Vitrification	N		Cost is prohibitively high.	May generate waste products. Volume of waste is too great. COC concentration is too low.	Lack of space for incineration and proximity to residential area make onsite incineration highly unlikely.	
Chemical/Physical Extraction							
In-situ Soil Flushing		N			COC concentrations are too low for effective use. Not effective due to heterogeneous nature of waste.	Excavation of waste is not feasible.	

TECHNOLOGY	FS NAME	TECH RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Ex-situ Soil Washing		N			COC concentrations are too low for effective use. Not effective due to heterogeneous nature of waste.	Excavation of waste is not feasible.	
Other	Chemical Extraction (unspecified)	N			Not effective due to heterogeneous nature of waste. COC concentrations are too low for effective use.	Excavation of waste is not feasible.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Juncos Landfill, PR
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X__ None____ TBD___

(Page or Section References: Pg. 21 ROD - ARAR Section., pg. 26 ROD, ARAR Section. Chosen remedy also complies with Rule I-805c Closure and Post Closure of the Puerto Rico Hazardous and Non-Hazardous Solid Waste Regulations.)

Comments: Hazardous waste disposal at this site cannot be proven, therefore RCRA C Closure standards are not applicable. Single-Barrier cap, the chosen alternative, exceeds RCRA Subtitle D requirements, and meets some relevant and appropriate RCRA Subtitle C requirements.
For Alternative IV, both a clay and a synthetic single-layer membrane were carried through in the Phase III analysis as Alternative IV, and a synthetic (30 mil FML) layer was chosen.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative III Multi-layer RCRA C cap	N					Longer construction time may increase short-term risk due to exposure, but not really a serious concern.	More difficult to construct than single-layer and soil caps. Also requires regrading.	Highest cost.
Alternative IV Single Layer Cap (Clay or Synthetic Geomembrane)	Y (Synthetic Geomem-brane)							
Alternative V Soil Cap	N	Less ground water protection.						

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: K & L Avenue Landfill, MI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: Pg. 5 ROD.)

If yes, where are they located? In landfill_____ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Pg. 7 ROD comments on FS and screening out of alternatives. The FS was not available. Certain remedial alternatives were eliminated from further consideration due to the technical and administrative infeasibility of implementing the alternative, and/or due to the grossly excessive cost compared to the overall effectiveness. (ROD pg. 7).

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap			N			Relief of landfill would prevent application on steep slopes.	
Clay Cap			N		Susceptible to frost and root penetration.		
Concrete			N			Relief of landfill would prevent application on steep slopes.	
Multi-layer Cap	Soil-Clay Cap		Y				
Multi-layer Cap	Soil-Synthetic Membrane Cap		Y				
Multi-layer Cap	RCRA "Model" Cap		Y				
Vertical/ Horizontal Barriers							
Slurry Wall	Soil-Bentonite Slurry Wall					Depth of wall would be too great.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: K & L Avenue Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Slurry Wall	Cement-Bentonite Slurry Wall		N			Depth of wall would be too great.	
Sheet Piles			N			Depth of wall would be too great.	
Vibrating Beam Wall			N			Depth of landfill is too great.	
Block Displacement			N			Depth of landfill is too great.	
Grout Injection			N			Depth of would be too great.	
Landfill Disposal							
Offsite Hazardous Landfill			Y				
Onsite Hazardous Landfill			Y				
Bioremediation							
Bioremediation (unspecified)	Bio-degradation		N		Shallow treatment only. Not treatment of inorganics. Not a proven technology.		
Bioremediation (ex-situ)	Composting		N		Not effective on all types of contaminants.	Requires excavation of landfill contents. Intensive operation.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: K & L Avenue Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	Chemical Reactions		N		Not applicable to all types of contaminants found onsite. Added chemicals may threaten ground water. Side reactions may produce other hazardous substances.		
Oxidation/ Reduction	Reduction		N		Not applicable to all contaminants found onsite.		
Dehalogenation	Dechlorination Process		N		Applicable only to chlorinated organics contamination.		
Oxidation/ Reduction	Wet air Oxidation		N		Not technically practical on large scale for destruction of types of contaminants found onsite.		
Oxidation/ Reduction	Oxidation		N		Side reactions may produce other hazardous substances. Not suited for treatment of solids or odd sizes of materials.		
Thermal Treatment							
Offsite Incineration (unspecified)	RCRA Incineration		Y				

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Fluidized Bed			N		Not as effective as rotary kiln.		
Infrared			Y				
Multiple Hearth			N		Not as effective as rotary kiln.		
Pyrolysis			N		Not as effective as other types of thermal treatment.		
Rotary Kiln			Y				
	Molten Salt		N		Not as effective as rotary kiln.		
	HTFW Reactor		N		Not demonstrated.		
In-situ Vitrification	Vitrification		N		Not applicable to landfill contents. Not demonstrated at depths present at site.		
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Thermal Volatilization		N		Not applicable to all types of contaminants found onsite.		
Chemical/Physical Extraction							
SVE	Vapor Extraction		N		Not applicable to all types of contaminants found onsite.		
Ex-situ Soil Washing			N		Not technically practicable for removal of organics found in site soil or landfill contents.		

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
	Solvent Extraction		N		Control of migrating solvents not assured. Solvent may contaminate ground water. Not applicable to all contaminants found onsite.		
	Photolysis		N		Shallow penetration depth. Not applicable to all contaminants found onsite. Large volume makes impracticable.		
Immobilization							
Stabilization/ Solidification	Injection Grouting		N		Limited effectiveness due to depth of landfill.		
Fixation			N		Not applicable to all contaminants found onsite.		
Fixation	Sorbent Fixation		N		Not applicable to all contaminants found onsite. Does not chemically immobilize contaminants.		
Other							
Aeration	Soil Aeration		N		Not applicable to all contaminants found onsite.		

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
	Retrievable Sorbents		N		Not applicable to all types of contaminants found onsite. Not suited for treatment of solids or odd sizes of materials.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: K & L Avenue Landfill, MI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: **C** X **D**___ **None**____ **TBD**___ (Page or Section References: Pg. 13/Pg. 29 ROD.)

Comments: The alternatives were broken down into two sections, ground water and landfill. Only the landfill alternatives are below. The selected Alternative Multi-layer Cap (RCRA type) does not comply with Michigan Act 64, but does achieve similar or greater performance.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Containment Multi-layer (Clay Cap, Michigan Act 64); P&T; GC	N	Less protective than other capping alternatives		Less long-term effectiveness than other capping alternatives		Allows more infiltration, therefore less mobility reduction than other capping alternatives.		
Containment Multi-layer Cap (RCRA type); P&T; GC	Y							
Containment Multi-layer (Clay Capping with Synthetic Liner) Cap; P&T; GC	N				More short-term effects due to materials for construction.		Slightly more difficult to install.	Higher cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Kin-Buc Landfill, NJ
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References:_________________)

If yes, where are they located? In landfill_____ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: This a review of the Kin-Buc Landfill Operable Unit 2, which was intended to address the contaminated sediments found in the Edmonds Creek marsh area. (pg. 4 ROD) Operable Unit 1 consisted of: 1) a slurry wall around the site, 2) RCRA capping over areas: Kin-Buc II, low-lying area between Kin-Buc I and Edison Landfill area, and Pool C area, 3) maintenance of Kin-Buc I landfill cap, 4) leachate collection, 5) treatment of leachate and ground water, and 6) ground water monitoring (ROD pg. 2). The FS report OU2 Study area consists of Edmonds Creek/Marsh Area, Mound B, and the Low lying Area. The Edmund Creek/Marsh Area consists of Edmunds Creek, the pool C connecting channel, and approx. 50 acres of wetlands. (pg. ES-1 FS) Technology screening Phase I found in Section 2, Phase II in Section 3, Phase III in Section 4.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	Composite Cap (Soil & Membrane)	N			Not effective due to site conditions (Marsh Area).		
Soil Cover	Single Layer Soil Cover	N			Not effective due to site conditions (Marsh Area).		
Synthetic	Single Layer Synthetic Membrane Cap	Y	Y				
	Sediment Accumulation	N			Cannot ensure effectiveness.		
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Landfill Disposal							
Onsite Hazardous Landfill	Onsite RCRA Vault	N				Not determined if waste characterized as RCRA Hazardous Waste.	Removal must be co-ordinated with OU1 remediation schedule.
Offsite Landfill (Unspecified)	Offsite Landfill Disposal	Y					
Bioremediation							
In-situ Bioremediation		N			Method not effective on present compounds at landfill.		
Bioremediation (unspecified)	Onsite Bioremediation	N			Method not effective on present compounds at landfill.		
Chemical Destruction/Detoxification							
Dehalogenation	Onsite APEG	Y					
Dehalogenation	Onsite APEG	N			Used on oils not sediments.		
Neutralization	Quicklime	N			Undergoing further research.		
Thermal Treatment							
Offsite Incineration (unspecified)	(Commercial)	N		High cost.			

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Kin-Buc Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Fluidized Bed	Onsite Fluidized Bed	N		Onsite incineration is generally not applied to sites with less than 8-10,000 cubic yards of contaminated solids.		Off gas control would be a major operating factor compared to other alternatives.	
Infrared	Onsite Infrared Incineration	N		Onsite incineration is generally not applied to sites with less than 8-10,000 cubic yards of contaminated solids.		Off gas control would be a major operating factor compared to other alternatives.	
Rotary Kiln	Onsite Rotary Kiln	N		Same as above.			
Vitrification	In-situ Vitrification	N			Site conditions (water) would limit effectiveness.		
Vitrification	Onsite Vitrification	N			Offsite gas emissions. Technology has not been demonstrated.		
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Onsite Low Temperature Thermal Desorption	Y	Y				

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
In-situ Steam Stripping	In-situ Steam Extraction	N			Technology for VOCs not PCBs.		
Chemical/Physical Extraction							
Ex-situ Soil Washing	Onsite Detergent Extraction	N			Has not been fully demonstrated.		
Soil Washing	In-Situ Sediment Washing/ Chemical Extraction	N				Site conditions too small an area to control extensive surface water control required to perform the treatment.	
In-situ Vacuum Extaction (SVE)		N			Applicable for VOCs not PCBs.		
Other	CF Extraction System/Onsite Solvent Extraction	Y					
Other	LEEP Onsite Solvent Extraction						
Other	Onsite Solvent Extraction	Y					
Immobilization							
Stabilization/ Solidification	In-situ Stabilization Solid	N			Due to site conditions, highly organic nature of sediments.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Kin-Buc Landfill, NJ
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Stabilization/ Solidification	Onsite Stabilization/ Solidification	N			Due to site conditions, highly organic nature of sediments.		
Stabilization/ Solidification	Offsite Stabilization/ Solidification	N			Due to site conditions, highly organic nature of sediments.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Kin-Buc Landfill, NJ
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None _X_ TBD___ (Page or Section References:_ Pg. 26 ROD. _)

Comments: Sediments must be tested to be characterized before any disposal. With remedy chosen, NO RCRA land disposal restriction are applicable because consolidation within the same area of containment does not constitute placement. (pg. 26 ROD).

Leachate collection, ground water treatment was addressed in previous operable unit.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Sediment Removal; Consolidation in Onsite Containment	Y							
Sediment Removal; Offsite Disposal	N			Does not involve treatment of the principal threats.				High cost due to land disposal in commercial chemical waste facility.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Sediment Removal; Onsite Treatment	N							Most ex-pensive because of high unit cost associ-ated with onsite treat-ment of sedi-ments. (pg. 23 ROD).
Sediment Capping; Stream Relocation	N	Permanent ecological damage.	Involves greater displacement and has permanent ecological damage, a greater degree of mitigation/ restoration will be required to satisfy state and federal ARARs.	Does not involve treatment of principal threats.	Greater loss of wetlands. Least effective Alternative because of technical difficulty of construction and maintaining containment. Also, contaminants will remain in the wetlands.	More short term impacts due to lengthier implementation times and more complex and invasive nature of remedy. (pg. 21 ROD).	Requires long-term maintenance and operation of the containment systems.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Kin-Buc Landfill, NJ
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Sediment Containment in Vicinity of Pool C by (Synthetic) Capping and Slurry Wall; Remaining Sediment Consolidation; Limited Stream Relocation	N	Permanent ecological damage.	Involves greater displacement and has permanent ecological damage, a greater degree of mitigation/ restoration will be required to satisfy state and federal ARARs. (pg. 20 ROD).	Does not involve treatment of the principal threats.	Greater loss of wetlands. Least effective Alternative because of technical difficulty of construction and maintaining containment. Also, contaminants will remain in the wetlands.	More short term impacts due to lengthier implementation times and more complex and invasive nature of remedy. (pg. 21 ROD).	Requires long-term maintenance and operation of the containment systems.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: La Grande Sanitary Landfill, MN
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ________________)

If yes, where are they located? In landfill_____ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Currently, there is not actual threat to human health and the environment from the landfill. The purpose of the remedial action is to prevent any potential contamination that may result from the landfill in the future. No known hazardous materials were dumped at the site, and no hot spots exist in the landfill. The only areas of additional concern for this site are a stability problem in the western portion of the landfill and a cover erosion problem in the northwest corner of the landfill.

In general, ex-situ treatment of any kind was not retained as an option. This is primarily because removal/excavation of the entire landfill would be necessary, but would not feasible due to high volume and potential health and safety impacts.

Phase I and II are not given clearly separate analysis. Evaluation criteria of effectiveness, implementability and cost are presented before any technology options are discussed. Almost all technologies were eliminated, but some technologies were discussed in somewhat greater depth and are therefore considered to have been analyzed in Phase II.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Clay Cap	Landfill Slope Stabilization	Y	Y				
	Capping (unspecified)	Y	N	Moderate cost; much higher than maintaining the existing cover.	Does not provide significant additional environmental and public health protection compared to the existing cover.		
Landfill Disposal							
Offsite Landfill (unspecified)		Y	N	Very high cost	Potential for increased human exposure.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: La Grande Sanitary Landfill, MN
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Onsite Landfill (unspecified)		Y	N		Long-term benefits do not outweigh the current low risk potential.	Adjacent land for simultaneous excavation and landfill construction may be unavailable.	
Bioremediation							
Ex-situ Bioremediation		N			Hazardous waste is not in a discrete location, and therefore cannot be removed and treated.		
In-situ Bioremediation		N			Not effective due to the heterogeneous nature of the waste.		
Thermal Treatment							
Onsite Incineration (unspecified)	In-situ	Y	N	Very high cost.	Not effective due to high potential for negative air impacts.		
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	In-situ	N			Not effective due to heterogeneous nature of the waste.		
Immobilization							
Stabilization/ Solidification	Solidification (In-situ)	N			Not effective due to heterogeneous nature of the waste.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: La Grande Sanitary Landfill, MN
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None _X_ TBD___

(Page or Section References: See Federal and State ARARs compliance section in ROD, page 19. Only state regulations are of greatest concern. There is no mention of RCRA Subtitle D, but the clay/soil cover on the landfill may apply to RCRA Subtitle D.)

Comments: Phase III Analysis is not truly applicable to this study because no technologies were carried over from the Phase II analysis. As a result, the only action provided in this table is slope stabilization (which is directly related to capping) even though it is not a "technology." Upon closure, the cap was covered with about two feet of clay and about four inches of topsoil.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 3 Long-term Monitoring of Ground Water and Gas, Gas Vent, and Slope Stabilization of the Existing Clay Cover	Y			No treatment; however, future mobility of contaminants will be minimized by preventing leaching of contaminants into the environment.		Some mitigation measures are required to minimize impact of dust emissions and drainage during construction.		Highest cost, but still cost-effective

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: This is one of two RODs for this site. It covers ground water contamination at LL and LTR and source control at LL. The second ROD covers source control at LTR, which contains hot spots that need further characterization.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N			Subject to cracking.	Poor aesthetic quality.	
Chemical Sealants	Chemicals Sealants/ Stabilizers	N			Easily disturbed.		
Multi-layer Cap	Clay and Solid Waste Cap	Y	Y				
Multi-layer Cap		Y	Y				
Concrete		N			Subject to cracking.	Poor aesthetic quality.	
Soil Cover		Y	N		Does not prevent further contamination of ground water.		
Synthetic	Soil and Synthetic Membrane	N			No long term reliability. Subject to cracking.		
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Sheet Pile		N			Difficulty in sealing interlocks. Dosen't prevent downward migration.		
Grout Curtain		Y	N		Dosen't prevent downward migration.	Would require additional site investigation. Quality control more difficult than with a slurry wall.	
Grout Curtain	Rock Grouting	N			Unnecessary due to bedrock geology.		
Vibrating Beam	Vibrating Beam Grout Curtain	N			Dosen't prevent downward migration.	Difficult to implement and maintain structural integrity.	
Landfill Disposal							
Offsite Hazardous Landfill		Y	N	High cost.		Regulatory agencies may not approve out-of state transportation.	
Onsite Hazardous Landfill		Y	N		Potential exists for recontamination.	Very difficult to implement	
Bioremediation							
Ex-situ Bioremediation	Composting	N			Technology not proven effective.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	TECH. RETAIN Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Ex-situ Bioremediation	Landfarming	N			Not applicable to municipal waste, only to solid waste and waste water.		
Bioremediation In-situ	Aerobic Respiration	N			Not feasible for landfill waste (e.g., metals need special treatment and can impede bioremediation).		
Chemical Destruction/Detoxification							
Reduction/ Oxidation	In-situ Hydrogen Reduction/ Oxidation	N			Not feasible for landfill waste. Could increase solubility of some metals.		
Thermal Treatment							
Offsite Incineration (unspecified)		Y	N	Greater than onsite incineration.		Scheduling and transport difficult due to volume. Ash may require RCRA disposal.	
Circulating Bed		Y	N	Higher cost than others.	Disturbing the landfill may cause unnecessary risk to workers. RCRA disposal may be needed.		Rejected in favor of Rotary Kiln.
Fluidized Bed		N			Not applicable due to bulk wastes and high heavy metal content.		
Infrared		Y	N	Higher cost than others.	Rejected in favor of Rotary Kiln.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Multiple Hearth		N			More effective on sludges.	Shredding would be required.	
Plasma Arc		N			Only applicable to liquid organic wastes.		
Rotary Kiln		Y	N	Higher cost than others.	Could create worker risk.	May require RCRA disposal.	Eliminated prior to consideration in ROD.
In-situ Vitrification		N			Not applicable due to drums and large debris present in landfill.		
Other	Molten Alkali Salts	Y	N	High.	Technology not currently available.	Disturbing the landfill may cause unnecessary risk to workers. RCRA disposal may be needed.	
Other	High Temperature Wall Reactor	N				More energy intensive than other thermal processes.	
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low-Temperature Thermal Separation	N			Not effective on municipal waste.		
In-situ Steam Stripping	In-situ Vapor Extraction	N				Not applicable; unsaturated zone is needed beneath site.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing	In-situ Soil-Flushing	N				Not feasible for landfill waste. Only for soils.	
Ex-situ Soil Washing		N				Not feasible for landfill waste. Only for soils.	
Supercritical Fluid Extraction	Solvent Extraction.	N			Not effective for municipal wastes. Only for soils.		
Immobilization							
Stabilization/ Solidification	Stabilization (In-situ and Ex-situ)	N			Not effective on municipal waste of variable composition.		
Other							
Recycling	Processed for Reusable Products	N			No reusable products of worth.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Lemberger Landfill, WI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X__ None____ TBD__(Page or Section References:__ROD pg. 34: Solid Waste Cap.)

Comments: Ground water P&T alternatives were considered separately. P&T was selected in the chosen remedy. Gas collection (GC) system will be installed, if needed.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 3 Multi-layer (Clay and Solid Waste) Cap	N			No reduction in toxicity, mobility or volume.	Long-term risk due to lack of material treatment.	Noise, dust, and labor risks.		
Alternative 4 Multi-Layer Cap	N			No reduction in toxicity, mobility or volume.	Long-term risk due to lack of material treatment.	Noise, dust, and labor risks.	May require a more complex design due to ground water treatment.	
Alternative 5 Multi-layer (Clay and Solid Waste) Cap; Slurry Wall	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: FS not available at time of review. Phase II screening of technologies not identified. Although the subject of hot spots was discussed in the ROD, no hot spots were identified.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N				Site conditions, relief of landfill prevents application to steep slopes without extensive regrading.	
Clay Cap		N			This option addressed by regrading and revegetation.	Site already has clay cap.	
Concrete		N				Site conditions, relief of landfill would prevent installation of slab to steep slopes.	
Multi-layer Cap	Soil-Clay	Y	Y				
Multi-layer Cap	Soil-Synthetic Membrane	Y	N	High cost.			
Multi-layer Cap	Soil-Synthetic Membrane-Clay	Y	N	High cost.	Excessive protection not as effective as soil/clay cap.		Contamination does not warrant extra protection.

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Soil Cover		Y	N		Not effective.		
Vertical/Horizontal Barriers							
Slurry Wall	Soil Bentonite Slurry Wall	N			Site conditions, discontinuous confining layers to key into and strong vertical gradients, make a hanging wall ineffective.		
Sheet Pile		N			Site conditions, discontinuous confining layers to key into and strong vertical gradients, make a hanging wall ineffective.		
Grout Curtain		N			Site conditions, discontinuous confining layers to key into and strong vertical gradients, make a hanging wall ineffective.		
Vibrating Beam Wall		N			Site conditions, discontinuous confining layers to key into and strong vertical gradients, make a hanging wall ineffective.		
Block Displacement		N			Not effective because site conditions, the absence of continuous stratigraphic units beneath landfill.	Difficult to determine integrity of barrier.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Grout Injection		N			Difficult to determine integrity of barrier. Site conditions, not effective because of the absence of continuous stratigraphic units beneath landfill.		
Landfill Disposal							
Offsite Hazardous Landfill		Y	N	High cost.		Risk to public.	
Onsite Hazardous Landfill	Onsite RCRA Type	Y	Y				
Bioremediation							
Bioremediation (unspecified)	Biodegradation	N			Shallow treatment only. Added nutrients may present threat to ground water quality.		
Bioremediation (ex-situ)	Bioharvesting	N			Not applicable to all types of contaminants on site, especially VOCs that will not accumulate.		
Bioremediation (ex-situ)	Composting	Y	N		Not effective in the degradation of volatile organics. Does not degrade heavy metals.	Long time for implementation.	
Bioremediation (ex-situ)	Licensed Land Farm	N			Not applicable to wide variety of contaminants.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Dehalogenation	Dechlorination Process	N			Applicability limited to few contaminant types that may not exist in large quantity on site.		
	Chemical Reactions	N			Not applicable to all types of contaminants found on site. Added chemicals may pose a threat to ground water. Side reactions may produce other hazardous substances.		
Oxidation/ Reduction	Reduction	N			Applicability limited to few contaminant types that may not exist in large quantity on site.		
Oxidation/ Reduction	Wet Air Oxidation	N			Not technically practical on large scale for destruction of contaminant types found on site.		
Oxidation/ Reduction	Oxidation	N			Side reactions may produce other hazardous substances. Not suited for treatment of solids or odd sizes of materials.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Treatment							
Offsite Incineration (unspecified)	RCRA Incineration	Y	N	High cost.		Long time to implement.	
Fluidized Bed		Y	N	High cost.			
Infrared	Infrared Volatilization	Y	N	High cost.			
	Liquid Injection	N			Not appropriate, appropriate only for liquids and vapor wastes with low ash content.		
Multiple Hearth		Y	N	High cost.			
Pyrolysis		Y	N	High cost.			
Rotary Kiln		Y	N	High cost.			
	HTWF Reactor	N			Requires very large electric load.		
	Molten Salt	N			Not appropriate, appropriate only for highly toxic inorganic or halogenated waste.		
In-situ Vitrification	Vitrification	N			Not applicable to the landfill contents because of their heterogeneous nature. High BTU and metal proportion of landfill contents suggests possibility for fire a short circuiting, respectively.		

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Thermal Volatilization	N			Applicability limited to few contaminant types that may not exist in large quantity on site.		
Chemical/Physical Extraction							
Ex-situ Soil Washing		N			Not technically practical for removal of organics found in site soil landfill contents. Not suited for treatment of odd sizes of materials.		
In-situ Vacuum Extraction (SVE)	Vapor Extraction	N			Not applicable to all types of contaminants on site or drummed waste, if present.		
	Retrievable Sorbents	N			Not applicable to all types of contaminants on site. Not suited for treatment of solids or odd sizes of materials.		
	Solvent Extraction	N			Control of mitigating solvents not assured. Solvent may become a ground water contaminant. Not applicable to all types of contaminants on site.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Immobilization							
Fixation	Sorbent Fixation	N			Not applicable to all types of contaminants on site. Does not chemically immobilize contaminants.		
Stabilization/ Solidification	Injection Grouting	N			Not applicable to: - Large volume , and - Variety of landfill contents.		
Fixation		Y	Y				
Other							
	Mechanical Excavation	Y	Y				
Aeration	Soil Aeration	N			Not applicable to all types of contaminants on site or drummed waste, if present.		
	Photolysis	N			Shallow penetration depth. Not applicable to all types of contaminants on site .		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mason County Landfill, MI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D____ None___ (Page or Section References: RCRA C compliant cap pg.30 ROD.)

Comments: The selected remedy is an operable unit that will address the landfill contents portion of the site by properly capping the landfill. The operable unit that will directly address the ground water contamination and other offsite contamination, or potential contamination, shall be addressed after more investigation is done (pg.1 ROD Declaration).

In 1983, a clay cap was completed and drainage improvements were made (pg. 2 ROD). Also two surface aerators were installed in a pond and 15 gas vents were placed on top of the landfill.

Phase II analysis were discussed in the ROD beginning on page 16.

The selected alternative will be designed to meet all applicable, or relevant and appropriate requirements of Federal and more stringent State environmental laws (pg. 31 ROD).

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Containment (Surface Controls)	N		Would not meet ARARs.					
Containment Multi-layer (Soil-Clay) Cap	Y							
Removal, Treatment, and Disposal	N						Very difficult to implement because of the various waste types that require handling and construction staging requirements.	Most ex-pensive.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Michigan Disposal Service (Cork St. Landfill), MI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References: _Pg. 4 of the Proposed Plan._)

If yes, where are they located? In landfill_____ Periphery__X__

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes _X_ No ___ TBD ___

Comments: This ROD covers the third operable unit for this site. The first ROD was for a leachate system in the southeast corner of the site that diverted leachate to a sewer system from a creek/river. The second ROD concerns the design of a security fence for the site, now in the design phase. This ROD is intended to include an expanded leachate collection system to control the "hot spots" - other leachate seeps - in the western and northeastern borders of the property.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		Y	N	High cost.	Susceptible to weathering and cracking.	Imposes restrictions on future land use.	
Clay Cap		Y	Y				
Concrete		Y	N	High maintenance costs.	Susceptible to weathering and cracking.	Imposes restrictions on future land use.	
Multi-layer Cap	Multimedia Type III Solid Waste/Clay Cap	Y	Y				
Multi-layer Cap	Multimedia Type II Solid Waste/Clay Cap	Y	Y				
Synthetic	Synthetic Membrane	Y	N		Effective when combined with other capping materials.	Special tools and skilled personnel required.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Michigan Disposal Service (Cork St. Landfill), MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Vertical/Horizontal Barriers							
Slurry Wall		Y	N		Ineffective due to discontinuous clay layer.		
Sheet Pile		Y	N		Ineffective due to discontinuous clay layer.		
Grout Curtain		N			Ineffective due to discontinuous clay layer.		
Liners		N				Not applicable due to site topography.	
Grout Injection		N				Not applicable due to site topography.	
Landfill Disposal							
Offsite Hazardous Landfill		Y	Y				
Onsite Hazardous Landfill		Y	N			Not applicable due to: - Site topography - Large volumes of waste.	
Onsite Unspecified Landfill	Piles and Vaults	Y	N			Not applicable due to limited area at the site.	
	Backfill of treated waste.	Y	Y				

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation							
Bioremediation (unspecified)	Nutrient Enhancement and Composting	N			Only effective for organics, metals may impede process.		
In-situ Bioremediation	Enhanced Aerobic Biodegradation	N			Only effective for organics, metals may impede process.		
Chemical Destruction/Detoxification							
Oxidation/ Reduction		N			Undesirable oxidized compounds may form. Landfill contents not homogeneous.		
Neutralization	Lime	N			Not necessary for this site.		
Neutralization		N			Not effective for all chemicals present in soil.		
Thermal Treatment							
Offsite Incineration (unspecified)		Y	N		Effective on organic chemicals only. Emissions may occur.	Discouraged under SARA.	
Onsite Incineration (unspecified)		Y	Y	Very high cost.			
Pyrolysis		Y	Y				

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Michigan Disposal Service (Cork St. Landfill), MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
	In-situ Radio Frequency Volatilization	Y	N	Very high cost.	Untested effectiveness for full scale operation. Additional treatment of waste required.	Field pilot study required.	
In-situ Vitrification		N			Not effective in treating chemicals at site. Not applicable to site in general.		
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low-Temperature Thermal Aeration	N			Not effective in removing PCBs detected in site leachate.		
In-situ Steam Stripping	In-situ Steam Flushing	N			Not effective in treating chemicals at site. Not applicable to site in general.		
Low Temperature Thermal Desorption/ Stripping	In-situ Thermal Stripping	N			Not effective in treating chemicals at site. Not applicable to site in general.		
Chemical/Physical Extraction							
In-situ Soil Flushing	In-situ Soil Flushing	Y	N		May increase volume of waste. Surfactants inhibit recovery of waste stream. Not effective due to heterogeneous nature of landfill waste.		

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	TECH. RETAIN Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
In-situ Vacuum Extraction (SVE)	In-situ Vacuum Extraction/Soil Aeration	Y	N	High cost.	Not effective on PCBs. Effective on organics only. Not effective due to heterogeneous nature of landfill waste.		
	Liquefied Gas Solvent Extraction	N			Untested technology.		
	In-situ Solvent Extraction	N			Not effective in treating chemicals at site. Not applicable to site in general.		
	Freeze Crystallization	N			Not effective for all chemicals present in soil.		
In-situ Soil Flushing	Water/ Solvent Leaching	N			Untested technology. Ineffective for metals.		
Immobilization							
Fixation	Chemical Fixation	N				Not applicable to site conditions.	
Stabilization/ Solidification		Y	Y				
	In-situ Polymerization.	N			Not practical for site. Not effective in treating all site chemicals.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Michigan Disposal Service (Cork St. Landfill), MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Other							
Aeration	Ambient Temperature Aeration	N			Ineffective in treating metals.	Small onsite area precludes effective treatment of large volumes.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Michigan Disposal Service (Cork St. Landfill), MI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D___ None___ TBD___

(Page or Section References: ROD, Page 46, Federal ARARs, RCRA Subtitle C LDRs are applicable if ground water treatment requires a pretreatment step and any of the waste products of that process are RCRA hazardous waste.)

Comments: Ground water P&T alternatives were considered separately from source alternatives. P&T was selected in conjunction with the source control remedy noted below.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 3 Clay Cap	Y							
Alternative 4 Multi-layer (Multimedia Type III Solid Waste) Cap	N	Type III fill may increase risk because it is not entirely clean fill.		No reduction of toxicity, mobility or volume because no treatment takes place.	Type III fill may settle and cause cap to crack.		Site-specific State order to stop dumping may cause implementation due to Type III fill.	
Alternative 5 High Temperature Thermal Treatment Immobilization of Landfill Residuals and Associated Soils	N		Potential emissions and imposing of RCRA LDRs if hazardous.			Greatest potential for short-term contamination exposure due to increased handling.	Most difficult technical implementation.	Ex-tremely high cost
Alternative 7 Multi-layer (Multimedia Type II Solid waste) Cap	N	Type II fill may increase risk because it is not entirely clean fill.		No reduction of toxicity, mobility or volume because no treatment takes place.	Type II fill may settle and cause cap to crack.		Site-specific State order to stop dumping may cause implementation due to Type II fill.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: None identified in ROD.)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: FS not available at the time. Technologies that passed initial screening were made in Phase I. Without the FS it cannot be determined why they were not used in Phase III Alternatives.

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N			Susceptible to cracking.		
Concrete		N			Susceptible to cracking.		
Multi-layer Cap		Y	Y				
Multi-layer Cap	Soil and Clay Cover	Y	Y				
Clay Cap	Repair Existing Cap	Y	Y				
Vertical/Horizontal Barriers							
Slurry Wall		N				Unknown depth to aquilude makes installation difficult.	
Sheet Pile		N			Interlocks difficult to seal. Leakage may occur.	Difficult to install bedrock.	
Grout Curtain		N			Difficult to control and determine integrity.	Difficult to install in bedrock.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Block Displacement		N			Difficult to control through landfill Difficult to control and determine integrity.	Still experimental.	
Grout Injection					Difficult to control through landfill Difficult to control and determine integrity.	Still experimental.	
Landfill Disposal							
Offsite Hazardous Landfill		Y					
Onsite Landfill (unspecified)		Y					
Bioremediation							
Bioremediation (unspecified)	Aerobic	N			Some contaminants (metal) may not be easily biodegradable.		
Bioremediation (unspecified)	Anaerobic	N			Some contaminants (metal) may not be easily biodegradable.		
Bioremediation (unspecified)	Land Treatment	N				Potential for contaminating ground surface of ground water.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Oxidation/ Reduction	Reduction	N			Waste not homogeneous. Hazardous by-products may be produced. May require too much reagent.		
Oxidation/ Reduction	Oxidation	N			Waste not homogeneous. Hazardous by-products may be produced. May require too much reagent.		
Neutralization	pH Adjustment	Y					
Thermal Treatment							
Offsite Incineration (unspecified)	RCRA Incinerator	Y	Y				
Onsite Incineration (unspecified)		Y					
Pyrolysis		Y					
Chemical/Physical Extraction							
Other	Gravity Thickening	N				Waste in sludge is too thick.	
In-situ Vacuum Extraction (SVE)		Y					
B.E.S.T. Process		Y					

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Immobilization							
Fixation	Sorption	Y					
Stabilization/ Solidification	Pozzolanic Agent	Y					
Stabilization/ Solidification	Encapsulation	N				Volatile organics present may vaporize during process.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D__X__ None___ TBD___ (Page or Section References: Page. 29 ROD.)

Comments: A 1979 agreement to properly abandon the site included a leachate collection system, covering of the disposal areas, and removal of the pond leachate. (There were no technologies that were screen out due to community/State acceptance criteria.) Sludge solidification is a contingency component of the alternative.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Repair Cap; Alternative Water Supply; GC; and LC.	N		Does not comply to ARARs.					
Repair Cap; Ground Water Remediation; P&T, GC; and LC.	N		Does not comply to ARARs.		Requires maintenance of treatment system.		Operation of treatment system requires regular attention for a long time.	
Repair Cap; Sludge Solidification; P&T, GC;, and LC.	N		Does not comply to ARARs.			Potential risk to community and workers during implementation.	Difficult to solidify lagoon because of considerable materials handling.	
Multi-layer (Soil/Clay) Cap; Sludge Solidification; Alternative Water Supply; GC; and LC.	Y							
Multi-layer (Soil/Clay) Cap; Sludge Solidification; P&T, GC; and LC	N					Potential risk to community and workers.	More difficult to construct. Operational requirements.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mid-State Disposal Landfill, WI
DETAILED PHASE ANALYSIS

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer Cap; Sludge Solidification; P&T, GC; and LC	N					Potential risk to community and workers.	Most difficult alternative to construct (liner). Operational requirements.	Most ex-pensive.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Modern Sanitation Landfill, PA
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No ___ TBD _X_ (Page or Section References:________________________)
If yes, where are they located? In landfill______ Periphery______
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No _X_ TBD___

Comments: Site fencing and Township Ordinances (institutional controls) were considered as minimal/no action remedies. May not be possible to identify hot spots (pg. 2-25).

TECHNOLOGY	FS NAME	TECH RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Synthetic	Low Permeability Cap		Y				Combined synthetic membrane on plateau areas and clay over rest, pg. 2-22.
Vertical/Horizontal Barriers							
Slurry Wall			N	High.		Compressive strength of bedrock is too great for remedy to be feasible.	21.500 ft. long/100 ft. deep to low-perm rock, pg. 2-22. Eliminated because technology is not feasible in this setting, pg. 2-56.
Grout Curtain			N	Grouting is more expensive than existing ground water extraction system.	Wastes remain onsite. Existing ground water extraction system more effective in preventing offsite migration—does not remove leachate constituents and may actually introduce contaminants.	Construction would be an immense task because perimeter is large and bedrock is deep.	Minimum permeability 10^{-5} cm/sec. Testing of grout materials would be required to evaluate effect of waste on grout material. Grouts are typically not intended for permanent control, pg. 2-23. Eliminated as technology because is less effective than ground water and feasibility is uncertain due to toxicity interaction concerns, pg. 2-56.

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Landfill Disposal							
Offsite Hazardous Landfill	Total Removal (excavation of entire 66-acre landfill).		N	Removal, transportation, and disposal of 8,000,000 cu/yds of waste material costs more than $1.5 billion	Would not eliminate existing ground water degradation.	Removal, transportation, and disposal of large amount of waste material is impractical. Potential risks to workers and public through exhumation and transportation. Disruption of removal and remedial actions would be required.	Estimate 8,000,000 cu/yds of disposal material—4M each of waste and cover. Eliminated because management of large volumes of material is impractical, does not address existing ground water contamination and high costs, pg. 2-57.
Offsite Hazardous Landfill	Partial Excavation		N	Costs associated with use of large volume of landfill space for disposal.	Would not eliminate existing ground water degradation.	Quantity and location of material for removal cannot be ascertained with certainty. Likely that leachate constituent waste sources covered by large amounts of overlying wastes. May not be possible to identify hot spots.	Removal of “hot spots” pg. 2-25. Similar reasons as Total Excavations with added complexity based on focus on high contaminant areas, pg. 2-58.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation							
In-situ Bioremediation	In-situ Biological Treatment		N	High.	Unproven effectiveness for this treatment for site chemicals.	Oxygenation of landfill would provide heat potentially oxidizing refuse material. Oxygenation of the aquifer would require shutting down the extraction system.	Technology generally limited to aquifers with high permeability. Aquifer under landfill is low permeable $<10^{-5}$ cm/sec, pg. 2-28A and B. Eliminated because of technical implementation difficulties and that technology has not been shown to be effective on the combination of chemicals present at site, pg. 2-59.
Thermal Treatment							
In-situ Vitrification			N	Very high.	Not proven for low silicate soils. Site test required to determine technical feasibility. Typically applied to only high-hazard wastes.		After treatment, evaluation of ground water to determine need for continued remediation.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Modern Sanitation Landfill, PA
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D____ None___ TBD__X__ (Page or Section References: Pgs.3-122/38.)

Comments: All alternatives meet threshold criteria, however, offer increasingly more protectiveness by further reducing precipitation infiltration and maximizing ground water containment. Selected alternative offers greatest assurance of capturing degraded ground water at only $153,500 more.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
No Further Action P&T, GC (Partial Cap and Continued Operation of Existing Ground Water and Vapor Extraction Systems)	N	Complies with goals, however, it is possible that leachate is escaping at northwest end of ground water extraction system.	Complies, however, if ground water is bypassing extraction system, requirements may be exceeded on and off the property.				N / A - all phases have been implemented except additional monitoring wells.	
Complete Low Permeability Capping and Addition of New Extraction Well P&T, GC	N		Complies, however, if ground water may continue to bypass extraction system, requirements may be exceeded on and off the property.					TC = $36.5M.

SITE NAME: Modern Sanitation Landfill, PA
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Complete Low Permeability Capping and Expansion of Extraction Well System P&T, GC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mosley Road Sanitary Landfill, OK
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes __ No _X_ TBD ___ (Page or Section References: _ROD, pg.23._)

If yes, where are they located? In landfill_____ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes __ No __ TBD __

Comments: 1.7 million gallons of liquid industrial waste were disposed of on top of the landfill, creating three "waste pits." Following this, an additional 80 ft, of municipal waste was disposed of on top of the waste pits before the landfill was closed. A clay cap was placed over the landfill upon closure, but it is presently in a state of disrepair. The need for remediation of these waste pits is what placed the site on the NPL; however, according to the ROD, characterization has shown that the waste pits no longer exist (most likely they have leached through or throughout the landfill) and they are no longer considered to be "hot spots."

This feasibility study, in general, was already assumed a presumptive remedy in the Phase I/Phase II Analysis. Any kind of ex-situ treatment - chemical, physical, thermal, etc. - has been eliminated in the Phase I analysis without any real analysis because excavation and removal of wastes were considered to be unfeasible. Similarly, in-situ treatment of any kind has also been eliminated because the waste areas to be remediated were not distinct zones. As a result, only two capping options - a clay cap and a composite cap - were considered for source control (along with a slurry wall). Furthermore, only one capping option - a clay cap - and a slurry wall are presented in the Proposed Plan/Phase III analysis (see pg. 5-3 for the final comparative analysis of the two capping options). The clay cap option is broken down into three "sub-options" that include cap repair with additional clay over the waste pit areas, and cap repair with additional clay over the entire landfill. These three "sub-options" of the same technology are presented as three separate capping alternatives in the ROD.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N			Susceptible to cracking.		
Clay Cap	Cap repair	Y	Y				
Concrete		N			Susceptible to cracking.		
Multi-layer Cap	Clay and Synthetic Membrane Composite Cap	Y	N	Higher cost than clay alone without added benefit.	Synthetic Layer only minimally reduces the amount of infiltration through cover.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mosley Road Sanitary Landfill, OK
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				
Sheet Pile	Sheet Pile Liners	N			Subject to corrosion. Difficult to maintain a good seal.		
Grout Curtain		N			Not effective in unconsolidated alluvium or highly penetrated bedrock.		
Landfill Disposal							
Offsite Hazardous Landfill		N			Waste pits are not preserved as distinct zones and cannot be removed or disposed of.		
Bioremediation							
Bioremediation (ex-situ)	Above-Grade Bioremediation	N			Waste pits are not preserved as distinct zones and cannot be removed or disposed of. Presence of metals may impede process.		
Bioremediation (ex-situ)	Landfarming	N			Waste pits are not preserved as distinct zones and cannot be removed or disposed of. Presence of metals may impede process.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mosley Road Sanitary Landfill, OK
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
In-situ Bioremediation		N			Waste pits are not preserved as distinct zones and cannot be removed or disposed of. Presence of metals may impede process.	Process is difficult to control. May produce undesirable intermediates.	
Chemical Destruction/Detoxification							
Neutralization	(Ex-situ, In-situ)	N				Waste pits are not preserved as distinct zones and cannot be treated. pH is probably neutral already.	
Oxidation/ Reduction	In-situ	N				Waste pits are not preserved as distinct zones and cannot be treated.	
Thermal Treatment							
Offsite Incineration (unspecified)	Incineration	N				Waste pits are not preserved as distinct zones and cannot be removed or disposed of.	
In-situ Vitrification		N		High costs.		Waste pits are not preserved as distinct zones and cannot be treated. Explosive hazard due to methane presence.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mosley Road Sanitary Landfill, OK
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing	Ex-situ, In-situ Water/Solvent Leaching	N				Waste pits are not preserved as distinct zones and cannot be treated.	
Immobilization							
Stabilization/ Solidification	Stabilization/ Immobilization	N				Waste pits are not preserved as distinct zones and cannot be treated.	
Stabilization/ Solidification	Solidification	N				Waste pits are not preserved as distinct zones and cannot be treated.	
Other							
Aeration	Ex-situ, In-situ	N				Waste pits are not preserved as distinct zones and cannot be treated.	
	Solids Processing	N			Waste pits are not preserved as distinct zones and cannot be treated. Not effective due to heterogeneous nature of wastes.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Mosley Road Sanitary Landfill, OK
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X__ None___ TBD___

(Page or Section References: ROD, pg.37. There is no discussions of RCRA classification, but it assumed the selected remedy will satisfy the solid waste disposal requirements of RCRA Subtitle D. The remedy also meets the Oklahoma Solid Waste Management Act and the Oklahoma Controlled Industrial Waste Disposal Act.)

Comments: Three capping alternatives of the same technology (clay cap) were analyzed separately from ground water alternatives in the Phase III analysis. The slurry wall was the only other source control technology that was looked at in the Phase III analysis, and was examined as part of the ground water alternatives. It is presented here in the Phase III analysis, along with reasons for why it was not chosen as part of the selected ground water remedy.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Capping Alternative I Clay Cap Repair.	Y							
Capping Alternative II Clay Cap Repair., with 2 ft. of clay over Waste Pit areas.	N	Additional clay is unnecessary because waste pits don't exist anymore.		No treatment.				Cost almost the same as selected remedy.
Capping Alternative III Clay Cap Repair., with 2 ft. of clay over the entire landfill.	N	Additional clay does not significantly increase protection.		No treatment.				Cost almost double selected remedy.

SITE NAME: Mosley Road Sanitary Landfill, OK
PHASE III ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Slurry Wall	N	Does not greatly enhance overall protection.				May have negative short-term impacts on wetlands due to draining.	Construction at great depth is likely to be difficult.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Muskego Sanitary Landfill, WI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References: _Pg.18 ROD, pgs.4-2, 3-3 FS.)_

If yes, where are they located? In landfill_____ Periphery__X___

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes _X_ No __ TBD __

Comments: Pg. 4-4 FS Source areas of concern: 1) Old Fill Area 2) Southeast Fill Area 3) Non-Contiguous Fill Areas (pg.4-5 FS).

There was no Phase I screening if technologies. Technologies were immediately screened on cost/effectiveness/implementability. The Old Fill Area was closed and covered in 1977. In 1980 and 1982, reparative fills No. 1 and No. 2 (respectively) were added to the Old Fill Area to improve surface grade and reduce infiltration (pg. 2-1 FS).
The Southeast Fill Area was closed, covered with clay and topsoil, and vegetated in 1980 (pg. 2-2 FS).

The hot spot is the Drum Trench in the Non-Contiguous Fill Areas 4.2 acres in size. The Drum Trench was removed in 1990. The excavation has been backfilled with clean, low permeability sand material and covered with four feet of compacted material (sand and clay (pg.2-2 FS).

There is no definite evidence that materials subsequently listed as Hazardous Waste under State or Federal Regulations disposed at this site (pg. 2-2 FS).

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Soil Cover	Cover Upgrade		Y				
Asphalt Cap			N		Potential for cracking.		
Concrete			N		Potential for cracking.		
Clay Cap			N		Clay alone is not considered suitable. Some protective layer would be required.		
Multi-layer Cap	Soil - Clay		Y				Would be effective and satisfy NR 504 requirements.

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Muskego Sanitary Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Multi-layer Cap	Gravel - Clay Cap		N		Gravel over clay would only be used in some specialized application, where drainage or a trafficable surface was needed.		
Multi-layer Cap	Soil - Synthetic Membrane		N		Most areas already have clay of suitably low permeability.		
Multi-layer Cap	Soil - Synthetic Membrane - Clay		N		Not applicable.		An NR 660 cap is not relevant to the site.
Vertical/Horizontal Barriers							
Slurry Wall			N			Not feasible due to loss of slurry in waste materials. Driving piles in waste is not feasible.	
Sheet Pile			N			Not feasible due to loss of slurry in waste materials. Driving piles in waste is not feasible.	
Grout Curtain			N			Not feasible due to loss of slurry in waste materials. Driving piles in waste is not feasible.	

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Vibrating Beam			N			Not feasible due to loss of slurry in waste materials. Driving piles in waste is not feasible.	
Block Displacement			N		Ability to obtain a competent barrier suitable for containing leachate has not been demonstrated.		
Grout Injection	Injection Grouting		N		Ability to obtain a competent barrier suitable for containing leachate has not been demonstrated.		
Bioremediation							
Bioremediation (unspecified)	Bioenhance-ment		N		Obtaining acceptable remediation goals unlikely.	High variability of municipal refuse makes efficient operation difficult.	
Thermal Treatment							
In-situ Vitrification	Vitrification		N		High variability of municipal refuse makes: - Efficient operation difficult - Obtaining acceptable remediation goals unlikely.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Muskego Sanitary Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing			N		High variability of municipal refuse makes: - Efficient operation difficult - Obtaining acceptable remediation goals unlikely.		
In-situ Vacuum Extraction (SVE)	Vapor Extraction		Y				
Immobilization							
Stabilization/ Solidification	Solidification		N		High variability of municipal refuse makes: - Efficient operation difficult - Obtaining acceptable remediation goals unlikely.		
Other							
	Aboveground Treatment		N			Aboveground treatment methods are not appropriate for large quantities of municipal refuse.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Muskego Sanitary Landfill, WI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None__X__ TBD___ (Page or Section References: __Pg. 4-6 FS ; pg. 27 ROD.)

Comments: To accelerate the remediation of the sources of contamination, EPA organized the work into two operable units: 1. Interim Action Source Control Operable Unit and 2. Ground Water Operable Unit (pg. 6 ROD). This ROD deals with the first operable unit.

The selected remedy was a modified Alternative with the addition of a ground water monitoring program. The selected Alternative consists of all the components of the other Alternative with the addition of capping in the Non-Contiguous Zone and In-situ vacuum extraction of the Non-Contiguous Zone (pg. 24 ROD).

In general, issues in the comments were directed toward the inclusion of ground water monitoring for the final remedy, and a delay in capping the Southeast Fill Area (pg. 31 ROD).

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Capping-Soil Cover in Accordance with NR 50 WAC in Some Areas; GC; LC	N	Does not directly address contamination in Non-Contiguous Area.		Does not reduce the mobility and volume of VOCs at the Non-Contiguous Area.	Less long-term effectiveness than the other alternatives because of the Non-Contiguous Area.			
Capping- Multi-Layer; In-situ Vapor Extraction Treatment of Portions of Non-Contiguous Area LC; GC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Old City of York Landfill, PA
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References: ________________.)
If yes, where are they located? In landfill______ Periphery___X___
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes __X__ No ___ TBD ___

Comments: Hot spot identified as vault sediment from a failed leachate collection system. The sediment is to be removed for offsite disposal. Please note that offsite disposal was eliminated as an option for the whole site.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N			Subject to cracking and root penetration.		
Concrete		N			Subject to cracking and root penetration.		
Multi-layer Cap		Y	Y				
Soil Cover		Y	Y				
Synthetic		N			UV light degradation Invasion of burrowing animals; Uneven setting.		
Vertical/ Horizontal Barriers							
Slurry Wall		N				Technically unfeasible due to site conditions.	
Sheet Piles		N				Technically unfeasible due to site conditions.	
Grout Curtains		N				Technically unfeasible due to site conditions.	

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bottom Sealing		N				Technically unfeasible due to site conditions.	
Landfill Disposal							
Offsite Disposal (unspecified)		Y	N	Very high capital.	Potential adverse impact to human health and environment.		
Offsite Disposal (Hot Spot)		Y	Y				
Bioremediation							
In-situ Bioremediation	Bioremediation	N			Not applicable due to heterogeneity of refuse.		
Bioremediation (unspecified)	Onsite Biodegradation	N			Not applicable due to heterogeneity of refuse		
Thermal Treatment							
Offsite Incineration (unspecified)		Y	N	High costs.	Potential adverse impact to human health and environment.	High difficulty.	Low benefit.
Onsite Incineration (unspecified)		Y	N			Nearby incinerator makes not applicable.	Mobile unit on-site.
In-situ Vitrification	Vitrification Thermal	Y	N	Very high capital.	Not routinely demonstrated on remedial scale.	Limited availability; requires pilot demonstration.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Old City of York Landfill, PA
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low Temperature Thermal Stripping	N			Not applicable due to heterogeneity of refuse.		
Chemical/Physical Extraction							
In-situ Soil Flushing		N			Not feasible due to heterogeneity of refuse.		
Ex-situ Soil Washing	Contaminant Extraction	N			Not feasible due to heterogeneity of refuse.		
In-situ Vacuum Extraction (SVE)		Y	N		Unproven for refuse material.		
Immobilization							
Stabilization/ Solidification		Y	N		Unproven for municipal waste. May be susceptible to leaching.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Old City of York Landfill, PA
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None____ TBD_X_ (Page or Section References: Pg. 36)

Comments: An additional alternative was added in the ROD (Alternative 7), pg. 24 ROD.

The selected alternative was a combination of two alternatives (#3 and #7). The selected alternative consisted of 1) restoration of soil cover in Area #3; 2) diversion swale; 3) revegetation of soil cover; 4) P&T Area # 1 and #3; 5) GC #3 and 6) vault sediment removal (ROD). The selected alternative was not formally compared on the nine criteria against the other alternatives.

The accumulated sediment from the concrete collection vaults shall be tested (TCLP) and disposed of at an approved facility, pg. 36 ROD. The vault is a failed leachate collection system. It is not labeled as a hot spot but is addressed in every alternative.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Treatment Refuse Area #3; Vault Sediment Removal; P&T	N			Does not reduce toxicity, mobility, or volume as much as other alternatives.	Does not address ground water contamination completely Not as effective as other alternatives.	Risks to workers who might come in contact with contaminated ground water during maintenance.		
Alternative 3 Treatment Refuse Area #3; Restore Soil Cover; Vault Sediment Removal; P&T, GC	Y combina-tion of Alt . 3 and Alt. 7							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Old City of York Landfill, PA
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4 Multi-layer Cap over Area #1; Vault Sediment Removal with Offsite Disposal; P&T, GC	N			Does not reduce toxicity, mobility, or volume as much as other alternatives.	Does not address ground water contamination completely. Not as effective as other alternatives.	Risks to workers who might come in contact with contaminated ground water during maintenance. Risks to workers and community due to installation of cap.		
Alternative 5 Partial Multi-layer Cap over Area #3; Vault Sediment Removal; GC	N	Does not address contaminated ground water. No P&T.		Does not reduce toxicity, mobility, or volume as much as other alternatives.	Does not address P&T or ground water contamination in Area #1.	Risks to workers and community due to installation of cap.	Installation problems due to residents.	
Alternative 6 Multi-layer Cap over Area #3; (Entire Area); Vault Sediment Removal; GC	N	Does not address contaminated ground water. No P&T.		Does not reduce toxicity, mobility, or volume as much as other alternatives.	Does not address P&T or ground water contamination in Area #1.	Risks to workers and community due to installation of cap.	Installation problems due to residents.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Old City of York Landfill, PA
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 7 Multi-layer Cap Area #1and Area #3; Vault Sediment Removal; P&T, GC	Y combination of Alt . 3 and Alt. 7							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Onalaska Municipal Landfill, WI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References:____________________)

If yes, where are they located? In landfill_X_ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes _X_ No ___ TBD ___

Comments: No FS available at time of review.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap	Single Layer Cap: Sprayed Asphalt	N			Not likely that asphalt will provide long-term cap integrity.		
Clay Cap	(Cap Repair) Single Layer Cap: Clay	Y					
Concrete	Single Layer Cap: Asphaltic Concrete	N			Not likely that asphalt will provide long-term cap integrity.		
Concrete	Single Layer Concrete	N			High potential for landfill settlement would likely crack the concrete.		
Multi-layer Cap	Multi-layer Cap: Clay Geomembrane	Y					
Multi-layer Cap	Multi-layer Cap: Clay	Y					
Multi-layer Cap	Multi-layer Cap: Synthetic Membrane	Y					
Soil Cover	Native Soil Cover	Y					

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Sealant	Surface Sealing	N			Sealants and stabilizers not likely to provide long-term cap integrity.		
Vertical/Horizontal Barriers							
Grout Injection	Horizontal Barriers	N			Integrity of grouts and slurry difficult to establish.		
Liner		N			Integrity of grouts and slurry difficult to establish.	Liner installation would require excavation of entire landfill. Storage space is not available onsite.	
Landfill Disposal							
Offsite Hazardous Landfill		Y					
Onsite Hazardous Landfill		N				Not applicable since surrounding area is in Mississippi River 100 year floodplain.	
Bioremediation							
Bioremediation (in-situ)	In-situ Bio-Reclamation	Y					

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Thermal Treatment							
In-situ Vitrification		N			Not applicable to heterogeneous wastes in landfill. Would likely cause landfill fire.		
Offsite Incineration (unspecified)		Y					
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low Temperature Volatilization	Y					
Chemical/Physical Extraction							
In-situ Soil Flushing		N			Not applicable to landfills due to heterogeneity of soils and refuse.		
In-situ Vacuum Extraction (SVE)	Soil Vapor Extraction	N			May cause landfill fires and high air extraction rate is used. Vapor extraction applicable only to VOCs. Semi-VOCs and inorganic contamination would remain.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Onalaska Municipal Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Oxidation		N				Difficult to implement and achieve good mixing in-situ.	
Oxidation/ Reduction	Chemical Reduction	N				Difficult to implement in landfill.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Onalaska Municipal Landfill, WI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D____ None___ TBD___ (Page or Section References: __Pgs. 48-49 ROD.)

Comments: Landfill was capped with 2 feet, clay in soil layer in 1980 (pg. 24 ROD) 2 operable units. First operable unit deals with the landfill, the second operable unit deals with ground water contaminated plume and contaminated soil. The ground water alternative includes pump and treat (P&T). Although the remedial alternatives are discussed separately for each operable unit. In some instances the implementation of any one remedy for the ground water operable unit may directly influence the selection of a remedy for the landfill operable unit (pg. 31 ROD).

Remedial technologies for hot sport contaminated soils were evaluated under ground water remedies.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Clay Cap Cap Repair and Upgrade	N	Does not provide adequate protection of human health and the environment since freeze/ thaw, erosion, and animal burrowing will continue to damage the cap, pg.32 ROD.	Does not meet the current section NR 504.07, WAC landfill requirements for landfill closures.		Does not provide long-term effectiveness or permanence since no frost protection layer is provided for the cap.			
Multi-layer Cap (Landfill Only); In-situ Bio-remediation (Hot Spot Contaminated Soils); GC	Y							
Multi-layer Cap (Landfill and Contaminated Soil Zone); GW	N							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Onalaska Municipal Landfill, WI
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Offsite Thermal Treatment (Hot Spot Contaminated Soils)	N					High adverse impacts for comparable treatment.		Highest

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Ramapo Landfill, NY
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes___ No_X_ TBD___ (Page or Section References___________________)
If yes, where are they located? In landfill___ Periphery___
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III analysis)? Yes___No___TBD____

Comments:

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	RCRA Cap	Y	N	Highest Cost capping option.			
Multi-layer Cap	Part 360 Cap	Y	Y				New York State Part 360 Solid Waste Regulation.
Multi-layer Cap	Modified Part 360 Cap	Y	Y				
Soil Cover		Y	Y				
Vertical/Horizontal Barriers							
Slurry Wall	Upgradient Slurry Wall	N			Not effective due to site conditions.		
Slurry Wall	Downgradient Slurry Wall	Y	N			Not anticipated to be implementable to required depth.	
Sheet Pile	Upgradient Sheet Pile	N			Not effective due to site conditions.		
Sheet Pile	Downgradient Sheet Pile	Y	N			Not anticipated to be implementable to required depth.	
Grout Curtain	Upgradient Grout Curtain	N			Not effective due to site conditions.		

[1]Some FSs contained multiple screening steps. Ph I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Ramapo Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Grout Curtain	Downgradient Grout Curtain	Y	N			Not anticipated to be implementable to required depth.	
Grout Injection	Bedrock Grouting	N			Not effective due to site conditions.		
Landfill Disposal							
Offsite RCRA		N				Excavation of large landfill not practical.	
Bioremediation							
Ex-situ Bioremediation	Surficial Biological Treatment	N				Excavation of large landfill not practical.	
In-situ Bioremediation	Bioreclamation	N				Depth of fill required makes treatment not feasible.	
Chemical Destruction/Detoxification							
Chemical Destruction/ Detoxification (unspecified)	Surficial Chemical Treatment (ex-situ)	N				Excavation of large landfill not practical.	
Thermal Treatment							
Offsite Incineration (unspecified)		N				Depth of fill makes treatment not feasible.	
In-situ Vitrification	Vitrification	N				Depth of fill makes treatment not feasible.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Ramapo Landfill, NY
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing		N				Depth of fill makes treatment not feasible.	
Immobilization							
Stabilization/ Solidification	Ex-situ Stabilization/ Solidification	N				Excavation of large landfill not practical.	
Stabilization/ Solidification	In-situ Stabilization/ Solidification	N				Depth of fill makes treatment not feasible.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Ramapo Landfill, NY
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D____ None _X__ TBD___ (Page or Section References: ____________________)

Comments: Multi-media cap meeting all requirements of the New York State Part 360 Solid Waste Regulations.

A leachate collection and treatment operation was set up in 1984 and 1985 (pg. 3 ROD).

Landfill gas emissions will be controlled if necessary (pg. 2 ROD).

The contingency alternative for the site includes the other capping option. The landfill side slope will be capped using a multi-media system without an impermeable membrane, if confirmatory studies demonstrate that this approach meets remedial action objectives (pg. 23 ROD).)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Ground Water Extraction Wells; P&T	N	No provision for landfill cap and therefore does not reduce the generation of leachate, prevent human and animal contact with contamination, prevent erosion of contaminated surface soils, nor provide a means of treating landfill gas emissions.	Does not meet New York State Part 360 action specific ARAR.		Does not provide for control or remediation of site contamination.			

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Ramapo Landfill, NY
DETAILED PHASE ANALYSIS(Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multi-layer (Landfill) Cap; P&T; GC; and LC	N Contingency Alternative					Potential hazard to the surrounding community and environment may include airborne dust and particulate emission and an increased noise level.	More potential for design and construction problems; High administrative requirements, periodic surveillance and repairs.	Higher cost than selected remedy.
Multi-layer (Landfill) Cap with Soil Cover on Side Slopes; P&T; GC; and LC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Rasmussen's Dump, MI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes___ No_X_ TBD___ (Page or Section References: ________________)
If yes, where are they located? In landfill___ Periphery___
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III analysis)? Yes___No___TBD___

Comments: Remedial technologies evaluated for 4 source control areas: 1) Top of Municipal landfill, 2) NE Buried Drum Area, 3) Industrial Waste Area, 4) Probable Drum Storage/leakage/Disposal Area. Matrix reflects integrated remedies.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Clay Cap		Y	Y				
Multi-layer Cap		Y	Y				
Vertical/Horizontal Barriers							
Slurry Wall		N			Ground water does not flow through waste areas. Vertical barrier ineffective in containing ground water.		
Grout Curtain	Block Displacement Grouting	N			Ineffective below water table.	Waste areas are either too shallow or too deep. Uncertain geology.	Experimental process with mixed success. Would require cap and leachate system (pg. 15 PS).
	Vitrified Wall Barrier	N			Ground water does not flow through waste areas. Vertical barrier ineffective in containing ground water.	Lack of continuous clay layer. Lack of depth to bedrock.	Vertical barriers only effective if used in conjunction with removal and treatment system (pg. 14 PS).

[1]Some FSs contained multiple screening steps. Ph I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Landfill Disposal							
Offsite Landfill (unspecified)	Offsite Disposal	Y	N			No landfill will accept waste due to the nature of the contaminants.	
Onsite Landfill (for drums)		Y	Y				
Onsite Landfill (unspecified)	Onsite Landfill	Y	N			Insufficient space to meet set-back requirements for facility.	(Pg. 57 PS).
Bioremediation							
Bioremediation (unspecified)	Anaerobic Biodegradation	Y	N		Sensitivity to non-uniform waste streams and long retention times.		
Ex-situ Bioremediation	Rotary Biological Contractors - Aerobic (RBCs)		N			Shaft breakage and failure have been chronic problems.	
Ex-situ Bioremediation	Trickle Filter System (Aerobic)		N			Extremely sensitive to temperature and difficult to control.	
In-situ Bioremediation			N		Contaminants may be widely and intermittently dispersed. Pilot testing required to determine effectiveness.	Process control is poor.	Final results may take years to achieve (pg. 21 PS).

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Rasmussen's Dump, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical Destruction/Detoxification							
Dehalogenation	Dechlorination	N		High costs associated with process and handling of by-products. Other options more cost effective.		Testing is required to demonstrate process.	
Thermal Treatment							
Offsite Incineration (unspecified)	Offsite Incineration	Y	N			Significant administrative actions required. Limited vendors accepting dioxin wastes.	
Onsite Incineration (unspecified)	Onsite Incineration	Y	N			Significant administrative coordination-residuals disposal presents risks to ground water.	
In-situ Vitrification	Vitrification	N			Long-term leaching of organics is uncertain Control of VOCs during process may be difficult. Equipment is unproven on a large scale basis.	Topography of area is not appropriate. Areas are too shallow for effective electrode placement.	

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Chemical/Physical Extraction							
In-situ Soil Flushing		N			Geology may impede process and create potential for further contamination.		(Pg. 18 PS).
Ex-situ Soil Washing		Y	N		Not effective for drummed or concentrated wastes.	Risks to community and workers due to fugitive emissions. Required extensive pilot testing to establish effectiveness. No vendors for regeneration of PCB/dioxin carbon units.	
In-situ Vacuum Extraction (SVE)	In-situ Treatment Vacuum Extraction	Y	N		Not effective for PCBs, dioxins or other contaminated wastes.	Overlying wastes must be excavated and treated by other methods.	Not retained in lieu of equally effective and more comprehensive options (pg.55 PS).
Immobilization							
Solidification/ Stabilization	Solidification	Y	N			Not implementable on a site-wide basis.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Rasmussen's Dump, MI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Other							
Aeration	Soil Aeration	Y	N		Technology is ineffective for PCBs and dioxins; would not comply with establish treatment standards for THOCs. Pilot testing required to determine effectiveness.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Rasmussen's Dump, MI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C__X__ D____ None___ TBD___

(Page or Section References: _Table 9-2, FS: RCRA C is relevant and appropriate.)

Comments: GW remedies considered separately from source control. Site wide remedies derived from detailed screening of alternative for each of 4 sites areas; the presence of dioxins and lack of vendor equipment influenced the selection of final site-wide alternatives. Excavated drums sent for offsite disposal at RCRA facility.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Clay Cap with No Further Excavation and Restricted Access; P&T	N	Contaminant located closest to ground water table could be mobilized. Potential future threats if cap fails.		No toxicity reduction - mobility reduction dependent of cap maintenance.	Failure of alternative could lead to future risks. Technology less effective than multimedia caps.			TPW $2.99M.
Clay Cap with Further Excavation and Restricted Access	N	Clay cap not as protective (i.e. reduce infiltration) as multimedia.		Same as above. No GW P&T alternative to reduce toxicity or mobility.	Same as above. Continued ground water contamination migration technology less effective than multimedia caps.	Higher inhalation exposure during excavation.	Excavation alternative is more costly than those without.	TPW $4.54M.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Rasmussen's Dump, MI
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH FEDERAL ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Multimedia Cap with No Further Excavation and Restricted Access; Drum Removal and Offsite Disposal at RCRA Facility; P&T	Y							
Multimedia Cap with Further Excavation and Restricted Access	N			No ground water P&T alternative to reduce toxicity or mobility.	Continued ground water contamination migration.	Higher inhalation exposure during excavation.		TPW $5.29M .

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes__X__ No___ TBD___ (Page or Section References__ROD Declaration.)
(saturated waste area)

If yes, where are they located? In landfill__X__ Periphery___

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III analysis)? Yes__X__No___TBD____

Comments: The FS was updated by comments that followed one month after the FS publication. These comments are significant and must be used in conjunction with the FS to get proper effectiveness data for Phase II. The initial remedial action objectives presented in the FS were not acceptable.

Hazardous waste was dumped at the landfill by an industrial plastics and rubber company.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap	Sprayed, Paved Asphalt Cap	N			Not likely to maintain structural integrity over time. Susceptible to cracking.		
Clay Cap	Single-Layer	Y	N	More expensive than cap repair.	Not effective in meeting current reliability standards in Wisconsin.	Permits may be required.	No added benefits from added cost.
Concrete		N			Cracking over time is likely.		
Multi-layer Cap	Clay and Soil	Y	Y				
Multi-layer Cap	Synthetic Geomembrane	Y	N	More expensive than multi-layer cap repair.			More expensive than multi-layer clay cap, but this option may be needed if hazardous waste requirements apply.
Multi-layer Cap	Clay and Geomembrane	Y	Y				

[1]Some FSs contained multiple screening steps. Ph I (Phase I) provideS the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
	Cap Repair/ Upgrade	Y	Y				
Vertical/Horizontal Barriers							
Slurry Wall		Y	Y				
Sheet Pile		N			Barrier integrity is unpredictable.		
Grout Curtain		N			Not applicable due to unconsolidated deposits.		
Liners		N				Not feasible to remove all waste to install liner.	
Grout Injection		N			Not applicable due to unconsolidated deposits.		
Landfill Disposal							
Offsite Hazardous Landfill		N				Not feasible due to large volume of soils and waste to be removed.	
Onsite Hazardous Landfill		N				Site not likely to be approved. Not feasible due to large volume of soils and waste to be removed.	

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Bioremediation							
In-situ Bioremediation		N			Not feasible due to heterogeneous nature of landfill. Not all compounds can be treated.		
Chemical Destruction/Detoxification							
Oxidation/ Reduction		N			Not all compounds can be treated.	Not possible due to heterogeneous nature of landfill.	
Thermal Treatment							
Offsite Incineration (unspecified)		N				Not feasible to excavate all soils and incinerate offsite.	
In-situ Vitrification		N				Not implement-able due to saturated soil conditions.	
Thermal Desorption							
Low Temperature Thermal Desorption/ Stripping	Low-temperature volatilization	N				Not possible to excavate all soils and waste.	
Chemical/Physical Extraction							
In-situ Soil Flushing	In-situ	N			Not all compounds can be treated.	Not possible due to heterogeneous nature of landfill.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
	Solvent Extraction	N			Not feasible to excavate all soils and waste.		
In-situ Soil vapor Extraction		Y	N	Medium to High.	Expected to have limited effect on ground water. Does not treat all contaminants of concern.	Substantial requirements for air permits must be met.	
Immobilization							
Stabilization/ Solidification	Chemical Stabilization	N			Not likely to be effective over time.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D_X_ None____ TBD____

(Page or Section References: Pg. 35 of the ROD states that RCRA C is not applicable because the landfill was closed before RCRA C statutes came into effect. It also says, however, that some of the RCRA C requirements are relevant and appropriate.)

Comments: The selected remedy, Alternative 7A, was added after the original alternatives were presented in the FS. The selected remedy satisfies RCRA Subtitle D and WAC NR 504.07 ARARs.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Cap Repair and Upgrade GC will be considered	N	Is not overall protective of human health and the environment.	Doesn't meet chemical-specific ground water ARARS.	No treatment.	Potential long-term ground water contamination.			
Alternative 3 Multi-layer (Solid Waste) Cap; GC	N	Doesn't prevent ground water contamination.	Doesn't meet chemical-specific ground water ARARs.	No treatment.				
Alternative 4A Multi-layer (Solid Waste) Cap; Physical Barrier; GC	N	Only partial prevention of ground water contamination.	Doesn't meet chemical-specific ground water ARARs.	No treatment.				High cost.
Alternative 4B Multi-layer (Solid Waste) Cap; Physical Barrier and Consolidation of Waste; GC	N	Only partial prevention of ground water contamination.	Doesn't meet chemical-specific ground water ARARs.	No treatment.				High cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternate 5 Multi-layer (Solid Waste) Cap; GC; P&T	N	Only partial prevention of ground water contamination.	Doesn't meet state water quality standards.	No treatment.				
Alternate 6A Multi-layer (Solid Waste) Cap; Physical Barrier; GC; P&T	N					Long construction period.	Maintenance problems with barrier.	High cost.
Alternate 6B Multi-layer (Solid Waste) Cap; Physical Barrier and Consolidation of Waste; GC; P&T	N					Long construction period.		High cost.
Alternate 7 Multi-layer (Solid Waste) Cap; Consolidation of Waste; GC; P&T	N					Long construction period.		Medium cost.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Stoughton City Landfill, WI
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 7A Multi-layer (Solid Waste) Cap; Consolidation of Waste; Contingency Basis for Ground Water Pump & Treat; GC	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Strasburg Landfill, PA
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes ___ No _X_ TBD ___ (Page or Section References: ________________)
If yes, where are they located? In landfill_____ Periphery_____
Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes ___ No ___ TBD ___

Comments: Over twenty leachate seeps have been identified on the eastern, western and southern slopes of the landfill. This ROD covers the third Operable Unit for this site. The first OU was concerned with designing a leachate collection system at the site. That leachate collection system is no longer adequate for the needs of this site. It is also important to note that this site was covered upon its closure, but the cover has since been torn in many places and is no longer adequate, primarily due to poor construction, and a failure to place adequate soil over the cover. Furthermore, only a general study of capping was done in the FS, as shown in the Groundwater "Containment/Diversion" section and the Leachate Collection "Capping and Recapping" section. It appears that a multi-layer cap of soil, clay and synthetic membrane was predetermined.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Asphalt Cap		N				Not applicable due to site topography.	
Chemical Sealants		N					No discussion provided in FS.
Clay Cap	Single Layer Clay Cap	N			Only effective in a multi-layer cap.		
Concrete Cap		N				Not applicable due to site topography.	
Multi-layer Cap	Multi-Layer Cap with Loam and Clay	Y	N	High cost.		Long-term maintenance required.	
Multi-layer Cap	Loam over Sand over Synthetic Membrane	Y	N	High cost.		Time consuming installation.	Self-repairing ability of clay is lost with this type of multi-layer cap.

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Multi-layer Cap	Loam over Sand over Synthetic Mambrane over Clay “RCRA Cap”	Y	Y				
Soil Cover		N			Only to be used in a multi-layer cap.	Not applicable due to site topography.	
Synthetic		N			Only to be used in a multi-layer cap.		
	Cap Repairs	Y	N		Not effective when used alone. Unable to locate areas in need of repair.		
Vertical/Horizontal Barriers							
Slurry Wall		N			Not effective due to conditions that seriously impede subsurface barriers. Depth of installation is limited by bedrock.		
Sheet Pile		N			Not effective due to conditions that seriously impede subsurface barriers. Depth of installation is limited by bedrock.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Strasburg Landfill, PA
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Grout Curtain		N			Not effective due to conditions that seriously impede subsurface barriers. Depth of installation is limited by bedrock.		

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Strasburg Landfill, PA
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C_X_ D___ None____ TBD___ (Page or Section References: ROD, pg. 39.)

Comments: Different source control technologies were not compared or analyzed in Phase III of the FS. Alternatives differed and were analyzed and compared according to gas collection systems, leachate collection systems, and leachate treatment systems. Groundwater is considered to be another operable unit and may be studied in an additional ROD but is not studied in this FS/ROD. In short, capping with a Multi-Layer synthetic, soil and clay cap, has been chosen in Phase II as the source control for this site. It is important to note that the community would not accept Alternative 2 because it does not contain a leachate collection system. Alternative 3 is acceptable as long as a diligent monitoring program is continued. Costs of all alternatives were relatively the same.

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 2 Source Containment (SC), and Landfill Gas Emissions Collection (LGC)	N	Would not protect human health and the environment due to gas ventilation without treatment. Landfill generated leachate still threatens ground water.		No reduction of toxicity, mobility or volume.	Capping may prevent leachate contamination in the long-term but it is uncertain. Air exposure risks due to lack of gas ventilation treatment.			
Alternative 3 SC, LGC and Secondary Leachate Collection, Treatment and Discharge (LC)	Y							

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Strasburg Landfill, PA
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4 SC, LGC, and LGC Treatment	N	Landfill generated leachate still threatens ground water			Capping may prevent leachate contamination in the long-term but it is uncertain.		Modeling and field pilot studies needed for landfill gas collection treatment system.	
Alternative 5 SC, LGC, and LGC Treatment, and LC	N						Modeling and field pilot studies needed for landfill gas collection treatment system.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Wildcat Landfill, DE
SCREENING PHASE

Hot Spot Analysis: Are they present? Yes _X_ No ___ TBD ___ (Page or Section References:_____________)

If yes, where are they located? In landfill__X__ Periphery_____

Are they subject to separate/different treatment than landfill contents (from ROD or Phase III Analysis)? Yes _X_ No __ TBD __

Comments: FS not available at the time of review. Reasons for technologies that did no pass Phase II screening could not be identified because the reason for screening was not in the analysis.

From the Background documents, an apparent area of concern or "Hot Spot" is the drum storage area.

TECHNOLOGY	FS NAME	TECH. RETAIN[1] Ph.I	Ph.II	COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Capping							
Multi-layer Cap	Soil/Clay Capping	Y	Y				
Soil Cover	Soil Capping	Y	Y				
Multi-layer Cap		Y	N				See FS comment.
Vertical/Horizontal Barriers							
Slurry Wall	Vertical Barrier: Slurry Wall	N			Must be used in conjunction with multi-layer cap to avoid bathtub effect since organic silt subsoil exists.		
Sheet Pile	Vertical Barrier: Sheet Piling	N			Interlocks difficult to seal. Leakage may occur.		
Grout Curtain	Vertical Barrier: Grout Curtain	N			Difficult to control and determine integrity.		

[1]Some FSs contained multiple screening steps. Ph. I (Phase I) provides the results of the first screening conducted. Ph. II (Phase II) provides the results of the final screening step if multiple steps occurred.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Wildcat Landfill, DE
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Block Displacement	Horizontal Barrier	N				Difficult to control injection through landfill and to determine integrity. Still experimental.	
Grout Injection	Horizontal Barrier: Grout Injection	N			Still Experimental.	Still experimental.	
Landfill Disposal							
Onsite Hazardous Landfill	RCRA-Type Landfill (Drum Disposal)	N				Wetlands are not suitable for siting landfill.	
Onsite Nonhazardous Landfill	Non-RCRA Landfill (Drum Disposal)	N				Wetlands are not suitable for siting landfill.	
Offsite Hazardous Landfill	(Drum Disposal)	N				Remediation will not be completed before Land ban goes into effect.	
Offsite Nonhazardous Landfill	Non-RCRA Landfill (Drum Disposal)	N				Illegal.	
Thermal Treatment							
Offsite Incineration (unspecified)	(Drum Disposal)	Y	Y				

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Wildcat Landfill, DE
SCREENING PHASE (Continued)

TECHNOLOGY	FS NAME	TECH. RETAIN Ph.I/Ph.II		COST	EFFECTIVENESS	IMPLEMENT.	COMMENTS
Onsite Incineration (unspecified)	(Drum Disposal)	N				RI indicates that small number of drums will not justify this opinion.	

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Wildcat Landfill, DE
DETAILED PHASE ANALYSIS

RCRA Subtitle Classification: C___ D___ None X__ TBD___ (Page or Section References:_______)

Comments: This ROD addresses the first of two operable units and is made up of the landfill proper and the adjacent areas. The second operable unit consists only of the pond that is located along the northwestern border of the landfill (pg. ROD).

In accordance with recent EPA guidance, none of the alternatives in the detailed analysis include treatment due to the size of the landfill (approx. 44 acres) and the absence of any hot spots on the site. These site specific factors make treatment impractical (pg. 21 ROD).

Although the ROD clearly states the absence of any “Hot Spots,” the drum storage area would be considered a “Hot Spot” by the definition of this study.

The State of Delaware Solid Waste Disposal Regulations of 1974 and federal RCRA closure and capping requirements (40 CFR 264.310) are relevant and appropriate. The state solid waste disposal regulations require a cap with a minimum 2-feet of compacted soil with a minimum 2 per cent slope on the final grade. Alternatives satisfy the slope requirement, but none the 2 feet compacted soil requirement. However, the soil and soil/clay caps are both 1.5 feet thick with an added thickness provided by the grading fill that ranges from 0 to 4 feet (pg. 30 ROD).

The soil requirements of the Delaware solid waste regulations may not be practical at the site for three reasons: 1. the weight of the cap would likely alter the existing site dynamics by causing subsidence of the landfill materials deeper into the underlying wetland sediments, 2. the intent of the two feet of compacted cover is to reduce infiltration into the waste materials but at the site this is not a concern since the landfill is already located within a wetlands area, and 3. the on site risks associated with the site from direct contact with exposed wastes and this risk would be more cost-effectively reduced by a soil cap. The relevant and practicable intents of the capping option at the site would be better accomplished by a soil cap containing 1.5 feet of compacted soil and 0.5 feet of topsoil. The essential 2 feet cover requirement is, thus, met (pg. 31 ROD).

Modified Alternative : The major differences in the modified alternative is that only those areas on the site which pose a direct contact risk will be capped and that the cap will meet the intent of the Delaware solid waste regulations. The two-foot compacted soil requirement. This alternative was discussed in Chapter six of the FS, which was not available at time of the review. (pg. 34 ROD).

Also, the modified alternative was only mentioned and evaluated on the costs criteria on page 32 of the ROD.

SITE-SPECIFIC DATA COLLECTION FORM
SITE NAME: Wildcat Landfill, DE
DETAILED PHASE ANALYSIS (Continued)

TECHNOLOGIES EVALUATED	SELECTED (Y/N)	OVERALL PROTECTION	COMPLIANCE WITH ARARS	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	LONG-TERM EFFECTIVENESS	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Surface Control; Drum Removal	N		Does not meet the landfill closure requirements because it does not contain a landfill cover.		Potential exists for direct contact with landfill contents.			
Containment with Soil Cap; Drum Removal	N See Comments							
Containment with Soil Cap; Drum Removal or Offsite Incineration	Y							
Containment with Soil/Clay Cap; Drum Removal	N							Highest cost.

H4. Application of the CERCLA Municipal Landfill Presumtive Remedy to Military Landfills (EPA, 1996)

United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Directive No.9355.0-67FS
EPA/540/F-96/020
PB96-963314
December 1996

EPA

Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills

Federal Facilities Restoration and Reuse Office
Mail Code 5101
Quick Reference Fact Sheet

Presumptive remedies are preferred technologies for common categories of sites based on historical patterns of remedy selection and the U.S. Environmental Protection Agency's (EPA's) scientific and engineering evaluation of performance data on technology implementation. By streamlining site investigation and accelerating the remedy selection process, presumptive remedies are expected to ensure the consistent selection of remedial actions and reduce the cost and time required to clean up similar sites. Presumptive remedies are expected to be used at all appropriate sites. Site-specific circumstances dictate whether a presumptive remedy is appropriate at a given site.

EPA established source containment as the presumptive remedy for municipal landfill sites regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) in September of 1993 (see the directive *Presumptive Remedy for CERCLA Municipal Landfill Sites*). The municipal landfill presumptive remedy should also be applied to all appropriate military landfills. This directive highlights a step-by-step approach to determining when a specific military landfill is an appropriate site for application of the containment presumptive remedy. It identifies the characteristics of municipal landfills that are relevant to the applicability of the presumptive remedy, addresses characteristics specific to military landfills, outlines an approach to determining whether the presumptive remedy applies to a given military landfill, and discusses administrative record documentation requirements.

PURPOSE

This directive provides guidance on applying the containment presumptive remedy to military landfills. Specifically, this guidance:

- Describes the relevant characteristics of municipal landfills for applicability of the presumptive remedy;
- Presents the characteristics specific to military installations that affect application of the presumptive remedy;
- Provides a decision framework to determine applicability of the presumptive remedy to military landfills; and
- Provides relevant contacts/specialists in military wastes, case histories, administrative record documentation requirements, and references.

BACKGROUND

Municipal landfills are those facilities in which a combination of household, commercial and, to a lesser extent, industrial wastes have been co-disposed. The presumptive remedy for municipal landfills – source containment – is described in detail in the directive *Presumptive Remedy for CERCLA Municipal Landfill Sites*. Highlight 1 outlines the components of the containment presumptive remedy. Highlight 2 lists the characteristics of municipal landfills that are compatible with the presumptive remedy of containment.

Highlight 1

Components of the Containment Presumptive Remedy

- Landfill cap
- Source area groundwater control to contain plume
- Leachate collection and treatment
- Landfill gas collection and treatment
- Institutional controls to supplement engineering controls

> ***Highlight 2***
>
> **Appropriate Municipal Landfill Characteristics for Applicability of the Presumptive Remedy**
>
> - Risks are low-level, except for "hot spots"
> - Treatment of wastes is usually impractical due to the volume and heterogeneity of waste
> - Waste types include household, commercial, nonhazardous sludge, and industrial solid wastes
> - Lesser quantities of hazardous wastes are present as compared to municipal wastes
> - Land application units, surface impoundments, injection wells, and waste piles are not included

The presumptive remedy process involves streamlining of the remedial investigation/feasibility study (RI/FS) or, for non-time-critical removals, an Engineering Evaluation/Cost Analysis (EE/CA) by:

- Relying on existing data to the extent possible rather than characterizing landfill contents (limited or no landfill source investigation unless there is information indicating a need to investigate hot spots);
- Conducting a streamlined risk assessment; and
- Developing a focused feasibility study that analyzes only alternatives consisting of appropriate components of the presumptive remedy and, as required by the National Contingency Plan, the no action alternative.

Several directives, including *Presumptive Remedy for CERCLA Municipal Landfill Sites, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, and *Streamlining the RI/FS for CERCLA Municipal Landfill Sites,* provide a complete discussion of these streamlining principles.

USE OF THIS GUIDANCE

EPA anticipates that the containment presumptive remedy will be applicable to a significant number of landfills found at military facilities. Although waste types may differ between municipal and military landfills, these differences do not preclude use of source containment as the primary remedy at appropriate military landfills.

Additionally, EPA continues to seek greater consistency among cleanup programs, especially in the process of selecting response actions for sites regulated under CERCLA and corrective measures for facilities regulated under the Resource Conservation and Recovery Act (RCRA). In general, even though the Agency's presumptive remedy guidances were developed for CERCLA sites, they should also be used at RCRA Corrective Action sites to focus RCRA Facility Investigations, simplify evaluation of remedial alternatives in the Corrective Measures Study, and influence remedy selection in the Statement of Basis. For more information, refer to the *RCRA Corrective Action Plan,* the proposed *Subpart S regulations,* and the *RCRA Corrective Action Advance Notice of Proposed Rulemaking.*

CHARACTERISTICS OF MILITARY LANDFILLS

The size of the landfill and the presence, proportion, distribution, and nature of wastes are fundamental to the application of the containment presumptive remedy to military landfills.

An examination of 31 Records of Decisions (RODs) that document the remedial decisions for 51 landfills at military installations revealed that no action was chosen for 10 landfills and remedial actions were chosen at 41 landfills (see Appendix). Of these 41 landfills, containment was selected at 23 (56 percent). For the remaining 18 landfills where other remedies were selected, institutional controls only were selected at three landfills, excavation and on-site consolidation were selected at four landfills, and excavation and off-site disposal were selected for 11 landfills.

The military landfills examined in the 51 RODs mentioned above ranged in size from 100 square feet to 150 acres and contained a wide variety of waste types. Of the 41 landfills for which remedial actions were chosen, 14 (34 percent) were one acre or less in size; containment was not selected for any of these landfills. Containment was chosen at 23 (85 percent) of the 27 landfills that were greater than one acre in size. This information suggests that the size of the landfill area is an important factor in determining the use of source containment at military landfills.

The wastes most frequently deposited at these military landfills were municipal-type wastes: household, commercial (e.g., hospital wastes, grease, construction debris), and industrial (e.g., process wastes, solvents, paints) wastes. Containment was the remedy selected at the majority of these sites. Military-specific wastes (e.g., munitions) were found at only 5 of the 51 landfills (10 percent).

Highlight 3 lists typical municipal and military wastes, including:

(1) Wastes that are common to both municipal landfills and military landfills;

(2) Wastes that are usually specific to military bases but that do not necessarily pose higher risks than other industrial wastes commonly found in municipal landfills (i.e., low-hazard military-specific wastes), depending on the volume and heterogeneity of the wastes; and

(3) High-hazard military wastes that, because of their unique characteristics, would require special consideration (i.e., high-hazard military-specific wastes).

The proportion and distribution of hazardous wastes in a landfill are important considerations. Generally, municipal landfills produce low-level threats with occasional hot spots. Similarly, most military landfills present only low-level threats with pockets of some high-hazard waste. However, some military facilities (e.g., weapons fabrication or testing, shipbuilding, major aircraft or equipment repair depots) have a high level of industrial activity compared to overall site activities. In these cases, there may be a higher proportion and wider distribution of industrial (i.e., potentially hazardous) wastes present than at other less industrialized facilities.

PRACTICAL CONSIDERATIONS

Sensitive Environments

Site-specific conditions may limit the use of the containment presumptive remedy at military landfills. For example, the presence of high water tables, wetlands and other sensitive environments, and the possible destruction or alteration of existing habitats as a result of a particular remedial action could all be important factors in the selection of the remedy.

Land Use

Reasonably anticipated future land use is also an important consideration at all sites. However, at military bases undergoing base closure procedures, where expeditiously converting property to civilian use is one of the primary goals, land use may receive heightened attention. Thus, at bases that are closing, it is particularly important for reuse planning to proceed concurrently with environmental investigation and restoration activities. The local reuse group is responsible for developing the preferred reuse alternatives. The Base Realignment and Closure Team should work closely with the reuse group to integrate reuse planning into the cleanup process, where practicable (see the *Land Use in CERCLA Remedy Selection* directive).

Highlight 3
Examples of Municipal-Type and Military-Specific Wastes

Municipal-Type Wastes

Municipal landfills contain predominantly non-hazardous materials. However, industrial solid waste and even some household refuse (e.g., pesticides, paints, and solvents) can possess hazardous components. Further, hazardous wastes are found in most municipal landfills as a result of past disposal practices.

Predominant Constituents

Household refuse, garbage, and debris
Commercial refuse, garbage, and debris
Construction debris
Yard wastes

Found In Low Proportion

Asbestos
Batteries
Hospital wastes
Industrial solid waste(s)
Paints and paint thinner
Pesticides
Transformer oils
Other solvents

Military-Specific Wastes

The majority of military landfills contain primarily nonhazardous wastes. The materials listed in this column are rarely predominant constituents of military landfills.

Low-Hazard Military-Specific Wastes

These types of wastes are specific to military bases but generally are no more hazardous than some wastes found in municipal landfills.

Low-level radioactive wastes
Decontamination kits
Munitions hardware

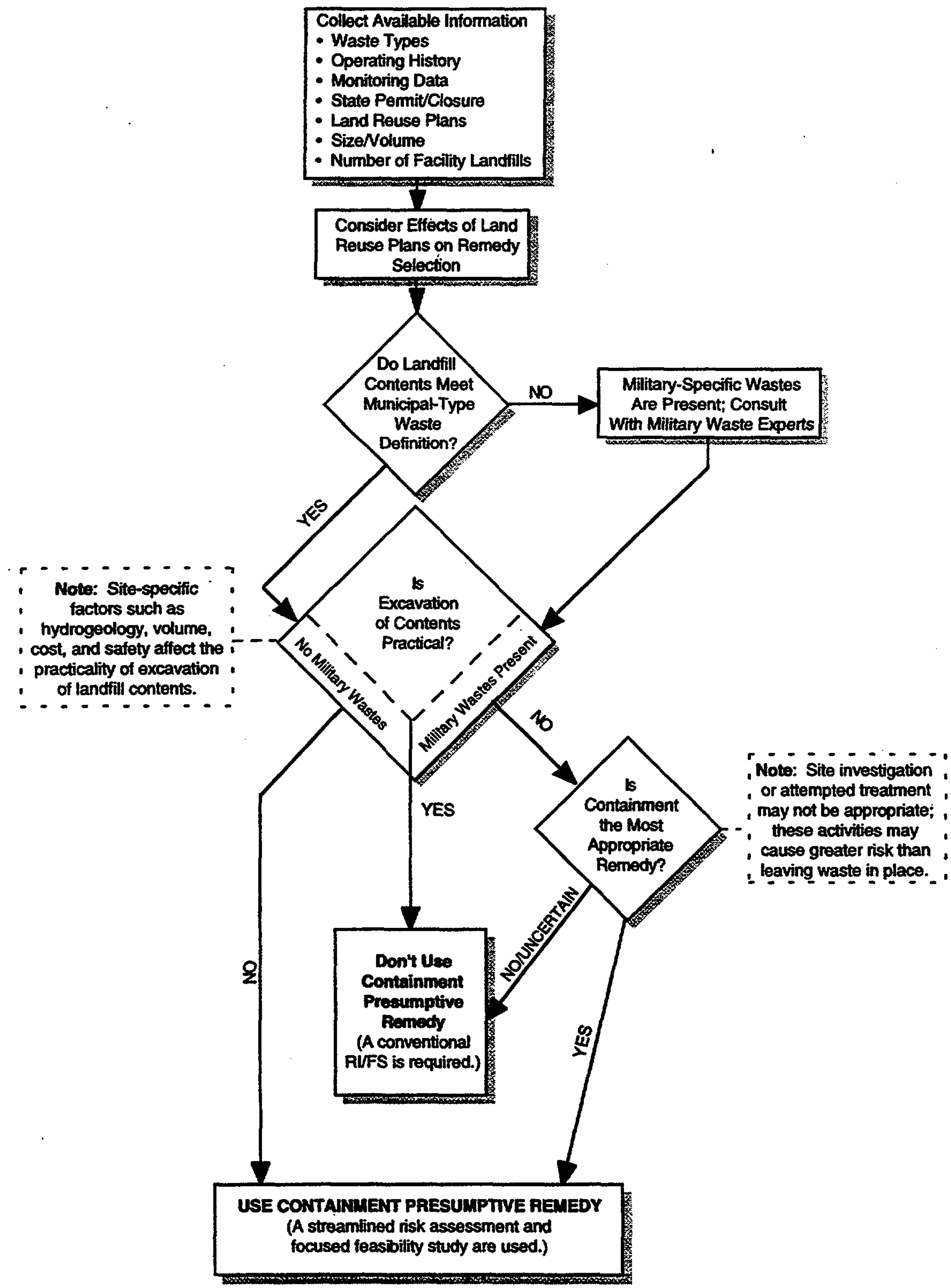
High-Hazard Military-Specific Wastes

These wastes are extremely hazardous and may possess unique safety, risk, and toxicity characteristics. Special consideration and expertise are required to address these wastes.

Military Munitions

Chemical warfare agents
(e.g., mustard gas, tear agents)
Chemical warfare agent training kits
Artillery, small arms, bombs
Other military chemicals
(e.g., demolition charges, pyrotechnics, propellants)
Smoke grenades

Highlight 4
Decision Framework



DECISION FRAMEWORK TO EVALUATE APPLICABILITY OF THE PRESUMPTIVE REMEDY TO MILITARY LANDFILLS

This Section and Highlight 4 describe the steps involved in determining whether the containment presumptive remedy applies to a specific military landfill.

1. What Information Should Be Collected? Determine the sources, types, and volumes of landfill wastes using historical records, state files, closure plans, available sampling data, etc. This information should be sufficient to determine whether source containment is the appropriate remedy for the landfill. If adequate data do not exist, it may be necessary to collect additional sampling or monitoring data. The installation point of contact (environmental coordinator, base civil engineer, or public works office) should be contacted to obtain records of disposal practices. Current and former employees are also good sources of information.

2. How May Land Reuse Plans Affect Remedy Selection? For smaller landfills (generally less than two acres), land reuse plans may influence the decision on the practicality of excavation and consolidation or treatment of landfill contents. Excavation is a remedial alternative that is fundamentally incompatible with the presumptive remedy of source containment.

3. Do Landfill Contents Meet Municipal Landfill-Type Waste Definition? To determine whether a specific military landfill is appropriate for application of the containment presumptive remedy, compare the characteristics of the wastes to the information in Highlights 2 and 3.

4. Are Military-Specific Wastes Present? Military wastes, especially high-hazard military wastes, may possess unique safety, risk, and toxicity characteristics. Highlight 3 presents examples of these types of materials. If historical records or sampling data indicate that these wastes may have been disposed at the site, special consideration should be given to their handling and remediation. Caution is warranted because site investigation or attempted treatment of these contaminants may pose safety issues for site workers and the community. Some high-hazard military-specific wastes could be considered to present low-level risk, depending on the location, volume, and concentration of these materials relative to environmental receptors. Consult specialists in military wastes (see Highlight 5) when determining whether military-specific wastes at a site fall into either the low-hazard or the high-hazard military-specific waste category found in Highlight 3.

Highlight 5
Specialists in Military Wastes

The installation point of contact will notify the major military command's specialists in military wastes (Explosive Ordnance Disposal Team) for assistance with regard to safety and disposal issues related to any type of military items.

Army chemical warfare agents specialists:

- Project Manager, Non-Stockpile Chemical Materiel, Aberdeen Proving Ground, Maryland 21010-5401, (410) 671-1083.

Navy ordnance related items specialists:

- The Navy Ordnance Environmental Support Office, Naval Surface Warfare Center, Indian Head, Maryland 20460-5035, (301) 743-4534/ 4906/4450.

Navy low-level radioactive wastes specialists:

- The Naval Sea Systems Command Detachment, Radiological Affairs Support Office, Yorktown, Virginia 23691-0260, (804) 887-4692.

Air Force ordnance specialists:

- The Air Force Civil Engineering Support Agency, Contingency Support Division, Tyndall AFB, Florida 32403-5319, (904) 283-6410.

Responsibilities for response are clearly spelled out in the regulation *Interservice Responsibilities For Explosive Ordnance Disposal.*

5. Is Excavation of Contents Practical? The volume of landfill contents, types of wastes, hydrogeology, and safety must be considered when assessing the practicality of excavation and consolidation or treatment of wastes. Consideration of excavation must balance the long-term benefits of lower operation and maintenance costs and unrestricted land use with the initial high capital construction costs and potential risks associated with excavation. Although no set excavation volume limit exists, landfills with a content of more than 100,000 cubic yards (approximately two acres, 30 feet deep) would normally not be considered for excavation. If military wastes are present, especially high-hazard military wastes such as ordnance, safety considerations may be very important in determining the practicality of excavation.

If excavation of the landfill contents is being considered as an alternative, the presumptive remedy should not be used. Therefore, a standard RI/FS would be required to adequately analyze and select the appropriate remedial actions.

6. Can the Presumptive Remedy Be Used? The site manager will make the initial decision of whether a particular military landfill site is suitable for the presumptive remedy or whether a more comprehensive RI/FS is required. This determination must be made before the RI/FS is initiated. This decision will depend on whether the site is a potential candidate for excavation, and if not, whether the nature of contamination is such that a streamlined risk evaluation can be conducted.* A site generally is eligible for a streamlined risk evaluation if groundwater contaminant concentrations clearly exceed chemical-specific standards or the Agency's level of risk or if other conditions exist that provide a justification for action (e.g., direct contact with landfill contents due to unstable slopes). If these conditions do not exist, a quantitative risk assessment that addresses all exposure pathways will be necessary to determine whether action is needed. Before work on the RI/FS workplan is initiated, the community and state should be notified that a presumptive remedy is being considered for the site. It is important for all stakeholders to understand completely how the presumptive remedy process varies from the usual clean-up process, and the benefits of using the presumptive remedy process.

TREATING "HOT SPOTS"

The presumptive remedy also allows for the treatment of hot spots containing military-specific (or other) waste. While the analysis, *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*, that justified the selection of source containment as the presumptive remedy for municipal landfill sites did not specifically take into account high-hazard military wastes, the high-hazard materials present in some military landfills may be compared to the hazardous wastes at municipal landfills and could potentially be treated as hot spots. For further information and case studies on treatment of hot spots, see the *Presumptive Remedy for CERCLA Municipal Landfill Sites* directive.

CASE HISTORIES

The case histories below illustrate how use of the municipal landfill presumptive remedy at military landfills follows the decision framework in Highlight 4.

* See *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, which states that if MCLs or non-zero MCLGs are exceeded [a response] action generally is warranted.

The decision to use the presumptive remedy can be made for one landfill or as a part of a site-wide strategy (as in the Loring Air Force Base example below), depending on factors such as the nature of the wastes, size of the landfill, land reuse potential, and public acceptance.

The following case histories present examples of where the containment presumptive remedy was or was not applied, based on site-specific conditions.

Disposal of Municipal-Type Wastes

The **Naval Reactor Facility (NRF)** site in Idaho Falls, Idaho, was established in 1949 as a testing site for the nuclear propulsion program. The three landfill units at the site received solid wastes similar to municipal landfills. These wastes included petroleum and paint products, construction debris, and cafeteria wastes. Historical records do not indicate that any radioactive wastes were disposed of in these landfill units. The selected remedy for the landfills at the site included the installation of a 24-inch native soil cover designed to incorporate erosion control measures to reduce the effects from rain and wind. The remedy also provided for maintenance of the landfill covers, including subsidence correction and erosion control. Monitoring of the landfills will include sampling of soil gas to assess the effectiveness of the cover and sampling of the groundwater to ensure that the remedy remains protective. Institutional controls will also be implemented to prevent direct exposure to the landfill. The NRF site is an example of where the streamlining principles of the presumptive remedy process, including a streamlined risk assessment and a focused feasibility study, were successfully employed.

Co-Disposal of High-Hazard Wastes

At the **Massachusetts Military Reservation**, in Cape Cod, Massachusetts, anecdotal information indicated that munitions had been disposed of at an unidentified location in a landfill that primarily contained municipal-type waste. Ground penetrating radar was utilized to determine if there were any discrete disposal areas containing potential hot spots at this site and found none. Because the munitions waste was not in a known discrete and accessible area, it could not be treated as a hot spot. Consequently, without excavating or treating the munitions waste as a hot spot, the authorities decided to cap the landfill. In this case, the streamlining principles of the presumptive remedy process were applied. For example, site investigation was limited and treatment options were not considered.

Land Reuse Considerations

At **Loring Air Force Base**, a closing base in Limestone, Maine, base landfills 2 and 3 (9 and 17 acres, respectively) consisted primarily of municipal and flightline wastes. The selected remedy for these landfills included a multi-layer cap, passive venting system, and institutional controls. The RODs for the landfills, signed in September 1994, required placing a RCRA Subtitle C cap on the landfills. To construct the RCRA cap, the designers estimated that 400,000 to 600,000 cyds of material would have to be placed on the landfills prior to construction of the cap to ensure proper drainage and slopes.

At Loring, the streamlining principles of the containment remedy, a focused feasibility study, and a streamlined risk assessment were applied for landfills 2 and 3. Additionally, the RODs signed for these landfills specified that excavated material from other parts of the base would be used at the landfills to meet subgrade design specifications. To date, more than 500,000 cyds of contaminated soils have been excavated and used as subgrade for the landfills (after demonstrating compliance with RCRA Land Disposal Restrictions). In addition to cost savings realized by providing subgrade, other benefits have been realized, such as limiting the number of parcels requiring deed restrictions and minimizing locations requiring operation and maintenance. At this base, the landfill consolidation efforts resulted in an estimated total cost savings of $12–20 million while incorporating future land use considerations into the decision process.

The Brunswick Naval Air Station in Brunswick, Maine, contained several landfill sites. One of the first RODs signed, for Sites 1 and 3, called for construction of a 12-acre RCRA Subtitle C cap and a slurry wall, as well as for groundwater extraction and treatment. Subsequently, during the remedy selection process for Site 8, the public objected to containment as the proposed remedy for this relatively small (0.6 acre) site on the grounds that should the base eventually close, containment would create several useless parcels of land. After public comment, the Navy reconsidered, proposing instead to excavate Site 8 and consolidate the removed materials (which consisted of construction debris and soil contaminated with nonhazardous levels of polycyclic aromatic hydrocarbons) as part of the necessary subgrade fill for the landfill cap to be constructed at Sites 1 and 3. In this case, land reuse considerations preempted the selection of a containment remedy.

PRESUMPTIVE REMEDY ADMINISTRATIVE RECORD DOCUMENTATION REQUIREMENTS

As stated earlier, it must be determined whether the military landfill in question contains military-specific wastes, as described in Highlight 3. This should be followed by a determination of whether anything about these wastes would make the engineering controls specified in the presumptive remedy for municipal landfills less suitable at that site. These determinations must be documented in the administrative record, which supports the final decision. This information, in turn, will assist the public in understanding the evaluation of the site as a candidate for use of the presumptive remedy and the advantage it provides. For further reference, the administrative record requirements for all Superfund sites including military landfills are explained in the *Final Guidance on Administrative Records for Selecting CERCLA Response Actions.*

The administrative record must contain the following generic and site-specific information, which documents the selection or non-selection of the containment presumptive remedy.

Generic Information

A. **Generic Documents.** These documents should be placed in the docket for each federal facility site where the containment presumptive remedy is selected. Each EPA Regional Office has copies of the following presumptive remedy documents:
   - *Presumptive Remedy: Policy and Procedures*
   - *Presumptive Remedy for CERCLA Municipal Landfill Sites*
   - *Application of the Municipal Landfill Presumptive Remedy to Military Landfills*
   - *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*

B. **Notice Regarding Backup File.** The docket should include a notice specifying the location of and times when public access is available to the generic file of backup materials used in developing the *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*. This file contains background materials such as technical references and portions of the feasibility studies used in the generic study. Each EPA Regional Office has a copy of this file.

Site-specific Information

Focused FS or EE/CA. Military-specific wastes need to be addressed in site-specific analyses when determining the applicability of the containment presumptive remedy to military landfills. High-hazard military-specific waste materials (e.g., military munitions) require special consideration when applying the presumptive remedy.

As noted on pages 1 and 2 of this directive, the presumptive remedy approach allows you to streamline and focus the FS or EE/CA by eliminating the technology screening step from the feasibility study process. EPA has already conducted this step on a generic basis in the *Feasibility Study Analysis for CERCLA Municipal Landfill Sites*. Thus, the FS analyzes only alternatives comprised of components of the containment remedy identified in Highlight 1. In addition, the focused FS or EE/CA should include a site-specific explanation of how the application of the presumptive remedy satisfies the National Contingency Plan's three site-specific remedy selection criteria (i.e., compliance with state applicable or relevant and appropriate requirements, state acceptance, and community acceptance).

CONCLUSION

This directive provides guidance for the use of the containment presumptive remedy at appropriate military landfills. The remedies selected at numerous military installations indicate that source containment is applicable to a significant number of military landfills. These landfills need not be identical to municipal landfills in all regards. Key factors determining whether the containment presumptive remedy should be applied to a specific military landfill include the size of the landfill; volume and the type of landfill contents; future land use of the area; and the presence, proportion, and distribution of military-specific wastes.

REFERENCES

California Base Closure Environmental Committee, *Integrating Land Use and Cleanup Planning at Closing Bases*, December 1994.

Federal Register, 1996. Volume 61, No. 85, May 1, 1996; *Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities, Advance Notice of Proposed Rulemaking.*

Federal Register, 1990. Volume 55, No. 145, July 27, 1990; 40 CFR Parts 264, 265, 270 and 271; *Corrective Action for Solid Waste Management Units at Hazardous Waste Facilities; Proposed* (proposed Subpart S regulations).

U.S. Environmental Protection Agency, OSWER Directive 93557-04, *Land Use in the CERCLA Remedy Selection*, May 25, 1995.

U.S. Environmental Protection Agency, OSWER Directive 9356.0-03, EPA/540/R-94/081, *Feasibility Study Analysis for CERCLA Municipal Landfill Sites,* August 1994.

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U.S. Environmental Protection Agency, OSWER Publication 9380.3-06FS, *Guide to Principal Threat and Low Level Threat Wastes*, November 1991.

U.S. Environmental Protection Agency, OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, April 22, 1991.

U.S. Environmental Protection Agency, OERR, EPA/540/P-91/001, *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, February 1991.

U.S. Environmental Protection Agency, OSWER Directive 9833.3A.1, *Final Guidance on Administrative Records for Selecting CERCLA Response Actions*, December 3, 1990.

U.S. Environmental Protection Agency, OSWER Directive 9355.3-11FS, *Streamlining the RI/FS for CERCLA Municipal Landfill Sites*, September 1990.

U.S. Department of Navy, *Interservice Responsibilities for Explosive Ordnance Disposal* OPNAVINST 8027.1G (also known as MCO 8027.1D, AR 75-14; or AFR 32-3002), February 14, 1992.

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Brunswick NAS, Sites 1 and 3 (OU1), ME, Region 1 6/16/92	Site 1, 8.5 acres; Site 3, 1.5 acres. Sites are in close proximity and not easily distinguishable; the combined volume of Sites 1 and 3 is 300,000 cy	Household refuse, waste oil, solvents, pesticides, paints, isopropyl alcohol	Metals, VOCs, PAHs, PCBs, pesticides	**Remedy:** Capping (permanent, low-permeability, RCRA Subtitle C cap), of 12 acres with a slurry wall and pump and treat ground water within cap and slurry wall.
Brunswick NAS, Sites 5 and 6 (OU3), ME, Region 1 8/31/93	Site 5, 0.25 acres, 12 cy	Asbestos-covered pipes	Asbestos	**Remedy:** Excavation, containerization, and transport to landfill Sites 1 and 3 for use as fill under cap.
Brunswick NAS, Sites 5 and 6 (OU3), ME, Region 1 8/31/93	Site 6, 1.0 acre, 8,800 - 18,700 cy	Construction debris, and aircraft parts, asbestos pipes	Asbestos	**Remedy:** Excavation, containerization, and transport to Sites 1 and 3 landfill for use as fill under cap.
Brunswick NAS, Site 8 (OU4), ME, Region 1 8/31/93	Site 8, 0.6 acres, 5,600 - 14,000 cy	Rubble, debris, trash, and possibly solvents	Metals, pesticides, PCBs[1]	**Remedy:** Excavation, containerization, and transport to landfill Sites 1 and 3 for use as fill under cap.
Loring AFB, Landfills 2 and 3 (OU2), ME, Region 1 9/30/94	Landfill 2, 9 acres	Domestic waste, construction debris, flightline wastes, sewage sludge and oil-filled switches	PCBs, VOCs, SVOCs, metals, DDT[1]	**Remedy:** Capping (low-permeability cover system which meets RCRA Subtitle C and Maine hazardous waste landfill cap requirements), passive gas venting system and controls, and institutional controls.
Loring AFB, Landfills 2 and 3 (OU2), ME, Region 1 9/30/94	Landfill 3, 17 acres	Waste oil/fuels, solvents, paints, thinners, and hydraulic fluids	VOCs, SVOCs, DDT, PCBs, metals[1]	**Remedy:** Capping (low-permeability cover system which meets RCRA Subtitle C and Maine hazardous waste landfill cap requirements), passive gas venting system and controls, and institutional controls.

[1] Contaminants of Potential Concern

ROD / Site Name, State, Region, ROD Sign Date	Disposal Area, Size, Volume of Waste	Type of Waste Deposited	Contaminants of Concern	Remedy
Newport Naval Education and Training Center, McAllister Point Landfill, RI, Region 1 9/27/93	McAllister Point Landfill, 11.5 acres	Domestic refuse, spent acids, paints, solvents, waste oils, and PCB-contaminated transformer oil	VOCs, PAHs, PCBs, pesticides, phenols, metals	**Remedy**: Capping (RCRA Subtitle C, multi-layer cap), landfill gas management, surface controls, and institutional controls.
Otis Air National Guard, Camp Edwards, Massachusetts Military Reservation, MA, Region 1 1/14/93	Landfill Number 1 (LF-1), 100 acres	General refuse, fuel tank sludge, herbicides, blank ammunition, paints, paint thinners, batteries, DDT, hospital wastes, sewage sludge, coal ash, possibly live ordnance	VOCs, SVOCs, inorganics	**Remedy**: Capping (composite-low-permeability cover system), institutional controls. soil cover inspection, and ground water monitoring.
Pease AFB (OU1), NH, Region 1 9/27/93	LF-5, 23 acres	Domestic and industrial wastes, waste oils and solvents, and industrial wastewater treatment plant sludge	VOCs, PAHs, arsenic and other metals	**Remedy**: Excavation, dewatering and consolidation and regrading of waste under a composite-barrier type cap, institutional controls, and extraction and treatment of ground water with discharge to base wastewater treatment facility.
Fort Dix Landfill Site, NJ, Region 2 9/24/91	Main area, 126 acres	Domestic waste, paints and paint thinners, demolition debris, ash, and solvents	VOCs, metals	**Remedy**: Capping 50-acre portion (New Jersey Administrative Code 7:26 closure plan for hazardous waste), installing gas venting system and an air monitoring system, ground water, surface water, and air monitoring, and institutional controls.
Naval Air Engineering Center (OU3), NJ, Region 2 9/16/91	Site 26, 1500 sq. ft., volume not reported	Oil, roofing materials, building debris	No contamination was detected	**Remedy**: Source: No action.
Naval Air Engineering Center (OU3), NJ, Region 2 9/16/91	Site 27, 6.4 acres	Scrap steel cable	No contamination was detected	**Remedy**: Source: No action.

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Naval Air Engineering Center (OU17), NJ, Region 2 9/26/94	Site 29, 20 acres	Construction debris, metal, asbestos, solvents, other miscellaneous wastes	VOCs, SVOCs, metals	**Remedy**: Source: No action.
Plattsburgh AFB, LF-022, NY, Region 2 9/30/92	LF-022, approx. 13.7 acres, approx. 524,000 cy	Household refuse	Metals, pesticides	**Remedy**: Capping (NY State requirements for solid waste landfills, 12 inch soil cap), and institutional controls.
Plattsburgh AFB, LF-023, NY, Region 2 9/30/92	LF-023, approx. 9 acres, approx. 406,000 cy	Household refuse, debris, car parts	Metals, VOCs, SVOCs, PCB, pesticides	**Remedy**: Capping (NY State requirements for solid waste landfills, low permeability cap), and institutional controls.
U.S. Army Aberdeen Proving Grounds (OU 1), MD, Region 3 6/30/92	Michaelsville Landfill, 20 acres, greater than 100,000 cy	Household refuse, limited quantities of industrial waste, burned sludges, pesticide containers, paint, asbestos shingles, solvents, waste motor oils, grease, PCB transformer oils, possible pesticides	Metals, pesticides, VOCs, PCBs, PAHs	**Remedy**: Capping (multi-layer cap in accordance with MDE requirements for sanitary landfills, using a geosynthetic membrane, 0-2 feet compacted earth material), surface water controls, and gas venting system.
Marine Corps Base, Camp Lejeune (OU1), NC, Region 4 9/15/94	Site 24, 100 acres, volume not reported	Fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, spiractor sludge, construction debris	Pesticides, metals, SVOCs, PCBs	**Remedy**: Source: No action.
Robins AFB (OU1), GA, Region 4 6/25/91	Main area (Landfill No. 4), 45 acres, greater than 100,000 cy	Household refuse, industrial waste	VOCs, metals	**Remedy**: Capping (to maintain a minimum 2-foot cover over the waste materials), renovation of current soil cover including clearing, filling, regrading, adding soil and clay cover material and seeding to maintain a minimum 2-foot cover over the waste material.

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Twin Cities AFB Reserve, MN, Region 5 3/31/92	Main area, approx. 2 acres, volume not reported	Household refuse, small amounts of industrial; *some burned waste*	VOCs, metals	**Remedy:** Source: Institutional controls, natural attenuation, ground water and surface water monitoring.
Wright-Patterson AFB, (*Source Control* Operable Unit) OH, Region 5 7/15/93	LF-8, 11 acres, 187,300 cy	General refuse and hazardous materials	PAHs, pesticides, PCBs, VOCs, metals, inorganics	**Remedy:** Capping (low-permeability clay cap that complies with Ohio EPA regulations for sanitary landfills which meet or exceed RCRA Subtitle D requirements), institutional controls, ground water treatment and monitoring.
Wright-Patterson AFB, (Source Control Operable Unit) OH, Region 5 7/15/93	LF-10, 8 acres, 171,600 cy	General refuse and hazardous materials	PAHs, pesticides, PCBs, VOCs, metals, inorganics	**Remedy:** Capping (low-permeability clay cap that complies with Ohio EPA regulations for sanitary landfills which meet or exceed RCRA Subtitle D requirements), institutional controls, ground water treatment and monitoring.
Hill AFB (OU4), UT, Region 8 6/14/94	Landfill 1, 3.5 acres, 140,000 cy	Burned solid waste, small amounts of waste oils and solvents (from vehicle maintenance facility).	VOCs (TCE)	**Remedy:** Capping (clay or multi-media cap), pumping, treating, and discharging ground water to POTW, treating contaminated surface water, soil vapor extraction, implementing institutional controls and access restrictions.
Defense Depot, Ogden (OU1), UT, Region 8 6/26/92	Plain City Canal Backfill Area, 4,000 cy	Electrical wire, glass, ash, charcoal, asphalt, wood, concrete, plastic and metal fragments	Metals, PCBs, dioxins, furans, VOCs	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Chemical Warfare Agent Identification Kit Burial Area, 100 cy	Vials of chemical surety agents, broken glass	Metals, chemical warfare agents	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Riot Control and Smoke Grenade Burial Area, 90 cy	Unfused grenades and grenade fragments, as well as riot control grenades	No contaminants identified	**Remedy:** Excavation, sorting, and off-site disposal in a RCRA permitted facility.

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Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Compressed Gas Cylinder Reburial Area	Two compressed gas cylinders and four smaller steel tanks removed from the Chemical Warfare Agent Identification Kit and Riot Control and Smoke Grenade burial areas	Unknown, possible chemical warfare agents	**Remedy:** Excavation of compressed gas cylinders and disposal by a commercial operator.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Burial Site 3-A: Miscellaneous Items Burial Area, 230 cy	Chemical Warfare Agent Identification Kits containing no CWAs, World War II gas mask canisters, paint, broken glass, wooden boxes, and pieces of iron	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous waste landfill.
Defense Depot, Ogden (OU3), UT, Region 8 9/28/92	Water Purification Tablet Burial Area, 110 cy	Bottles containing halazone water purification tablets	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted industrial waste landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-A, 7500, sq. ft., 3000 cy	Wood, crating materials, paper, greases, debris, medical waste, oils, some burned waste	Pesticides, VOCs, PCBs	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous waste landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-B, (inside 4-E), less than 7,500, sq. ft.	Fluorescent tubes	No contaminants identified	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-C, 6,000 sq. ft	Food products, sanitary landfill waste	Pesticides, VOCs, PCBs	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted landfill.

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Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-D, 2,000 sq. ft.	Methyl bromide cylinders, halazone tablets (jars)	Possibly methyl bromide	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted industrial landfill.
Defense Depot, Ogden (OU4), UT, Region 8 9/28/92	4-E, 7,500 sq. ft., volume not reported	Oils, spent solvents, industrial waste	PCBs, VOCs, pesticides	**Remedy:** Excavation and transportation for off-site disposal in a RCRA permitted hazardous landfill.
Rocky Mountain Arsenal, Shell Section 36 Trenches (OU23), CO, Region 8 5/3/90	Shell Trench Area, 8 acres	Rags, plastic and metal cans, glass jars, piping, pipe fittings, insulation, refuse, insulation, liquid and solid wastes generated from the manufacture of pesticides	VOCs, SVOCs, pesticides[2]	**Remedy:** Capping (physical barrier with a soil and vegetative cover).
Fort Ord Landfills (OU2), CA, Region 9 8/23/94	Landfills, 150 acres	Household and commercial refuse, dried sewage sludge, construction debris, small amounts of chemical waste including paint, oil, pesticides, and epoxy adhesive, electrical equipment	VOCs	**Remedy:** Capping (California Code of Regulations for non-hazardous waste), institutional controls, extraction, treatment, and recharge of ground water.
Riverbank Army Ammunition Plant Site, CA, Region 9 3/24/94	Landfill, 4.5 acres	Paper, oils, greases, solvents, hospital wastes, construction debris, and industrial sludges	Metals	**Remedy:** Capping (a multi-layer cap as specified in Dispute Resolution Agreement), pump and treat ground water, discharge treated water to on-site ponds.

[2] Contaminants identified as emanating from the trenches but not contaminants of concern

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Williams AFB (OU1), AZ, Region 9 5/18/94	Landfill LF-04, 90 acres, 59,000 cy	Dried sewage sludge, domestic trash and garbage, wood, metal, brush, construction debris, some solvents and chemicals	Soil, pesticides, SVOCs, inorganics, including beryllium, lead, zinc	**Remedy**: Capping (a permeable cap with a 24 inch soil cover), stormwater runoff controls, institutional actions, and soil and ground water monitoring.
Williams AFB (OU1), AZ, Region 9 5/18/94	Pesticide Burial Area (DP-13), 0.4 acre	Pesticides	Pesticides, VOCs, metals	**Remedy**: Source: No action.
Williams AFB (OU1), AZ, Region 9 5/18/94	Radioactive Instrumentation Burial Area (RW-11), 100 sq. ft.	Cement; radioactive instruments	Radium (background levels)	**Remedy**: Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF05, 17 acres	General refuse, scrap metal, used chemicals and other scrap material	VOCs, PCBs, metals, PAHs	**Remedy**: Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF07, 35 acres	Base generated refuse, scrap metal, construction rubble, drums of asphalt, empty pesticide containers, small amounts of shop wastes, and asbestos wastes	VOCs, PCBs, metals, PAHs	**Remedy**: Source: No action.
Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF13, 2 acres	Empty drums, metal piping, drums of asphalt, and small quantities of quicklime	VOCs, PCBs, metals, PAHs	**Remedy**: Source: No action.

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Elmendorf AFB (OU1), AK, Region 10 9/29/94	LF59, 2 landfills (.5 acres each)	General refuse and construction debris, and tar seep	VOCs, PCBs, metals, PAHs	**Remedy**: Source: No action.
Fairchild AFB (OU1), WA, Region 10 2/13/93	Southwest area, 12.6 acres, 407,300 cy	Coal ash, solvents, dry cleaning filters, paints, thinners, possibly electrical transformers.	VOCs	**Remedy**: Capping (low-permeability cap designed to meet the closure requirements of Washington State's Minimum Functional Standards for Solid Waste handling and of federal RCRA Subtitle D), SVE/ treatment system, extracting contaminated ground water and treating by air stripping and granular activated carbon, disposal off-site, monitoring off-site water supply wells.
Fairchild AFB (OU1), WA, Region 10 2/13/93	Northeast area, 6 acres, 291,000 cy	Coal ash, solvents, dry cleaning filters, paints, thinners, possibly electrical transformers.	VOCs	**Remedy**: Capping (low-permeability cap designed to meet the closure requirements of Washington State's Minimum Functional Standards for Solid Waste handling and of federal RCRA Subtitle D), SVE/ treatment system, extracting contaminated ground water and treating by air stripping and granular activated carbon, disposal off-site, monitoring off-site water supply wells.
Fort Lewis Military Reservation, Landfill 4 and the Solvent Refined Coal Pilot Plant, WA, Region 10 9/24/93	LF4, 52 acres	Domestic and light industrial solid waste (no landfill records were maintained).	VOCs, metals	**Remedy**: Source: Institutional controls, treat ground water and soil using SVE and air sparging system.
Naval Air Station, Whidbey Island, Ault Field (OU1), WA, Region 10 12/20/93	Area 6 Landfill, 40 acres. Within Area 6 there are 2 distinct areas where wastes were disposed.	Household waste, construction debris, and yard waste	VOCs	**Remedy**: Capping (low-permeability cap to meet Washington State Minimum Functional Standards for non-hazardous closure), air stripping ground water, ground water monitoring, and institutional controls.
Naval Air Station, Whidbey Island, Ault Field (OU2), WA, Region 10 12/20/93	Area 2, 13 acres; Area 3, 1.5 acres. Both treated together due to close proximity.	Solid waste from the base, industrial wastes, and construction and demolition debris	Metals, PAHs	**Remedy**: Source: Institutional controls, ground water monitoring.

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Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-05-1, (350 ft. by 450 ft. by 4-25 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.
Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-05-51, (450 ft. by 100 -175 ft. by 10-15 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.
Naval Reactor Facility, ID, Region 10 9/27/94	Landfill Unit 8-06-53, (900 ft. by 1200 ft. by 7- 10 ft.)	Construction debris, small quantities of paints, solvents, cafeteria wastes, and petroleum products	Metals, VOCs	**Remedy:** Capping (24-inch native soil cover), institutional controls.

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