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Compilation of Current Practices at Land Disposal Facilities

Summary of Liner and Leak Detection Designs, Action Leakage Rates, Response Action Plans, and Management of Liquids in Landfills

EPA

COMPILATION OF CURRENT PRACTICES AT LAND DISPOSAL FACILITIES

SUMMARY OF LINER AND LEAK DETECTION DESIGNS, ACTION LEAKAGE RATES, RESPONSE ACTION PLANS, AND MANAGEMENT OF LIQUIDS IN LANDFILLS

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TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This report summarizes the results of a nationwide evaluation of hazardous waste land disposal facility permits/Part B permit applications regarding liners, leak detection systems, and the treatment of liquids and use of absorbents at landfills. The findings of this report will support the development of final U.S. Environmental Protection Agency (EPA) regulations in these areas.

The evaluation was conducted in January, 1991 by phone interviews of all ten EPA Regions, by visits to eight regions, and by information supplied by a ninth region. The focus of this evaluation was to identify current designs and operational practices of land disposal facilities vis-a-vis rules proposed by EPA in 1986 and 1987[1] in order to 1) identify current practices to determine consistency with the proposed rules and to identify good/new concepts, 2) gather information on field experiences, 3) identify potential problems and conflicts, and help in evaluation of technical and economic impacts. The designs and operational practices of facilities included in this evaluation are summarized by this report.

Section 2.0 of this report describes how the evaluation was conducted and lists the facilities included in the study. Section 3.0 of the report summarizes the evaluation findings. The appendices include: acronyms (Appendix A); a sample evaluation questionnaire (Appendix B); RCRIS/HWDMS list of "operating" hazardous waste land disposal facilities (Appendix C); and detailed information on facilities evaluated by this report (Appendix D).

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[1] Proposed in the Federal Register on:
May 29, 1987 -- Liners and Leak Detection Systems [52 FR 20218]
March 28, 1986 and April 17, 1987 -- Double Liners and Leachate Collection and Removal Systems [51 FR 10706 and 52 FR 12566]
December 24, 1986 and June 24, 1987 -- Disposal of Containerized Liquids and Sorbents in landfills [51 FR 46824 and 52 FR 23695]

2.0 FACILITIES INCLUDED IN THE EVALUATION

EPA prepared a questionnaire (Appendix B) that was used as a guide in gathering information on certain disposal facilities. The questionnaire inquired about the design and operation of liners and leak detection systems associated with landfills, surface impoundments, and waste piles. This qustionnaire also inquired about: materials used to construct the liners and leak detection systems; the performance of leak detection systems; how facilities manage leachate; action leakage rates (ALRs) established for the land disposal units; and facility response action plans (RAPs).

In addition, the questionnaire included information on how hazardous waste landfills manage liquid wastes. Specifically, the questionnaire asked about restrictions imposed on landfills managing hazardous wastes containing free liquids, and about the types of absorbents used in treating wastes and cleaning up spills. In addition, the questionnaire asked about the types of tests facilities use in evaluating the performance of sorbent-treated wastes and the biodegradability of absorbents.

2.1 Selection of Candidate Facilities

EPA identified potential facilities for the evaluation from a list of all 256 "operating" RCRA hazardous waste land disposal facilities contained in RCRIS/HWDMS (Appendix C). Potential candidate facilities operate hazardous waste landfills, surface impoundments, waste piles, or some combination of these units. Land treatment units were not evaluated, so the 25 facilities with only land treatment disposal units were eliminated from consideration. Also eliminated were seven of the remaining facilities that continue to operate pending the conclusion of the permit denial process (i.e., those facilities with "permit denied" or with "intent to deny") and 27 of the remaining facilities where Part B permit applications were requested but not received. This left 197 candidate facilities.

With the goal of evaluating about 50 facilities (about 25% of the total), a list of candidate facilities was randomly selected from the remaining 197 facilities. This list was then refined, after discussions between EPA Headquarters and the regions and during the regional visits, by deleting facilities that either were closing/closed or that withdrew their permit applications. The deleted facilities were replaced by facilities having "new" land disposal units. All remaining facilities with landfills were evaluated regarding their management of liquid wastes.

The chosen facilities were not intended to represent a scientifically rigorous sample of operating hazardous waste land disposal facilities, but rather, to provide a good representation of the management of liquids in landfills, and the newer land disposal unit designs and operations, which is appropriate since the double liner/leak detection system rules under consideration will only apply to new (including retrofitted) units.

2.2 List of Survey Facilities

Ultimately, useful information from 41 facilities (21% of the total) was obtained and summarized in this report. These facilities are shown in Table 1. This list contains 29 facilities with landfills, 15 with surface impoundments, and 3 with waste piles. The list also included a good mix of commercial (24) and noncommercial (17) facilities.

At the 41 facilities, a total of 105 land disposal units were evaluated: 64 landfills, 38 surface impoundments, and 3 waste piles.

Table 1
List of Survey Facilities[2]

Region	EPA ID#	Name/Location	Unit Types	Commercial
2	NJD002385730	Dupont E.I. DeNemours & Co., Deepwater	LF	Y
2	NYD049836679	Chem Waste Management Chemical Services, Model City	LF	Y
2	NYD066832023	General Electric - Noryl Products Dept., Waterford	LF	N
2	NYD080336241	BFI/CECOS International Inc., Niagra Falls	LF	Y
2	PRD980594618	Union Carbide Caribe,Inc.	LF	N
3	WVD004325353	Union Carbide Corp., Sisterville Plant	SI	N
3	WVD004341491	American Cyanamid Co., Willow Plant	SI	N
3	PAD004344222	Bethlehem Steel Corp., Johnstown Plant	LF	N
4	ALD000622464	Chem Waste Management, Emelle	LF	Y
4	FLD057231821	American Cyanamid Co.	SI	N
4	TND003337292	Olin Chemicals Corp., Charlestown	SI	N
4	ALD001221902	CIBA GEIGY Corp., McIntosh	LF	Y
4	ALD008161176	AKZO Chem American	SI	N
5	IND078911146	Adams Center Landfill	LF	Y
5	OHD045243706	Envirosafe of Ohio	LF, WP	Y
5	ILD000805812	Peoria Disposal	LF	Y
5	ILD980700728	BFI/CECOS International, Inc.	LF	Y
5	MND000686196	Burlington Northern Tie Plant	WP	N
5	ILD010284248	CID Landfill	LF	Y
5	IND980503890	Heritage Environmental Services	LF	Y
5	ILD006278170	Allied-Signal Inc., Metropolis	SI	N
6	TXD069452340	Texas Ecologists Inc.	LF	Y
6	TXD008123317	Dupont E.I. De Nemours & Co., Victoria	LF	N
6	LAD008161234	Rhone-Poulenc Basic Chem Co. (Stauffer)	SI	Y
6	TXD000835249	Gulf Coast Waste Disposal	LF	Y
6	LAD008080681	Olin Corporation	LF	N
6	LAD000777201	Chem Waste Management, Lake Charles	LF	Y
6	ARD213820707	U.S. Army Pine Bluff Arsenal	LF, SI	N
6	OKD990695991	Agricultural Minerals Corp., Verdigris	SI	N
7	KSD070902952	Chem Waste Management of Kansas, Inc.	LF	Y
8	UTD991301748	USPCI Grassy Mountain Facility	LF, SI	Y

Table 1
List of Survey Facilities (continued)[2]

Region	EPA ID#	Name/Location	Unit Types	Commercial
8	UTD982598898	Envirocare of Utah, Inc.	LF	Y
8	MTD000716787	Burlington Northern Paradise Tie Plant	WP	N
9	CAD0000633164	IT Corp. Imperial Valley (GSX Corp.)	LF	Y
9	CAT000646117	Chem Waste Management, Kettleman	LF, SI	Y
9	CAT980675276	IT Corp. Petroleum Waste Inc. (GSX Corp.)	LF	Y
9	CAT980011646	PG&E Morro Bay Power Plant	SI	N
9	CAT080011653	PG&E Moss Landing Power Plant	SI	N
9	NVT330010000	U.S. Ecology Inc. Chem Site	LF	Y
10	IDD073114654	Envirosafe Services of Idaho	LF, SI	Y
10	ORD089452353	Chem Waste Management of Northwest	LF, SI	Y

[2] 41 Facilities were included in the survey. 29 facilities have landfills, 15 facilities have surface impoundments, and 3 facilities have waste piles. 24 facilities were commercial.

3.0 SUMMARY OF FINDINGS

This section of the report summarizes the findings of the evaluation with respect to the following issues: designs of liners and leak detection systems, leak detection sensitivity, establishment of action leakage rates, submittal and content of response action plans, and the management of liquids in hazardous waste landfills. A brief review of the proposed EPA requirements affecting each issue precedes discussion of the findings. Appendix D.1 contains detailed information about the liner and leachate collection and removal systems (LCRS)/leak detection system (LDS) designs for 28 facilities with a total of 57 landfill units, 12 facilities with a total of 34 surface impoundments, and 3 facilities with a total of 3 waste piles. Appendix D.2 also contains information on LDSs as well as management of liquids in landfills. Appendix D.3 contains examples of facility response action plans.

3.1 Liners and Leak Detection Systems

Background

RCRA as amended by HSWA set forth minimum technological requirements for hazardous waste landfills, surface impoundments, and waste piles in sections 3004(o) and 3015. The EPA codified these requirements in the July 15, 1985 Federal Register (50 FR 28702). The minimum technological requirements require certain landfills, surface impoundments, and waste piles to have two liners and leachate collection system above the liner (for landfills) and between the liners. In the March 28, 1986 Federal Register, EPA proposed minimum criteria for the design of liners and LCRS. The liner design criteria required: a flexible membrane liner (FML) for the top liner, and a bottom liner consisting of either a compacted soil material liner (permeability less than or equal to $1x10^{-7}$ cm/sec) or a composite liner (FML over a compacted soil liner).

In the May 29, 1987 Federal Register, EPA proposed rules requiring new landfills, surface impoundments, and waste piles treating, storing, or disposing of hazardous waste to utilize an approved leak detection system. The proposal specified minimum design criteria for leak detection systems for these units. The minimum design criteria consisted of: a bottom slope of the drainage layer of 2% or more; granular drainage layer hydraulic conductivity of 1 cm/sec or more; granular drainage layer thickness of to 12 inches or more; synthetic drainage layer hydraulic transmissivity of $5x10^{-4}$ m^2/sec or more; and sump capacity and daily monitoring requirements. The design must be capable of detecting a top liner leak of 1 gal/acre/day (gpad) or more within

one day after the leak occurs. These proposed leak detection criteria were based on the use of a composite bottom liner for landfills and surface impoundments, and therefore would alter the March 28, 1986 (51 FR 10706) proposal to eliminate the compacted soil material bottom-liner option.

3.1.1 Liner and Leak Detection Designs

Six types of liner and drainage system designs were identified for hazardous waste landfills, surface impoundments, and waste piles. Table 2 summarizes the types of designs used.

Twenty-four facilities comprising 34 landfill units incorporate a liner-drainage layer design consisting of two liners and a primary LCRS above the top liner and a secondary LCRS between the top and bottom liners. The secondary LCRS is generally designated as the LDS by these facilities. Sixteen of the facilities have composite bottom liners. Five facilities comprising 19 landfill units used three liners with two drainage layers. These designs had a primary LCRS above the uppermost liner and the secondary LCRS (also designated as the LDS) either above an intermediate or bottom liner system. Finally four facilities comprising four landfill units utilized a design with three liners and three drainage layers. In these designs the primary LCRS was again located above the top liner. However, an additional drainage layer was located between the top liner and intermediary liner, besides the drainage layer located above the bottom liner system. Three of the facilities specified the drainage layer above the bottom liner as the LDS.

Four combinations of liners and drainage layers were identified for 1 hazardous waste surface impoundments. The most prevalent design (six facilities with 26 impoundments) incorporated two liners and one drainage layer. The single drainage layer was located between the liners and served as the LDS. Two facilities designed impoundments with two liners and two drainage layers. The drainage layer above the top liner served as the primary LCRS while the drainage layer between the liners functioned as the LDS. Although identified as impoundments by the facilities, these impoundments are similar to landfills. Three facilities used impoundments with three liners with either one or two drainage layers present. The three facilities did not originally design the impoundments with the three liners, but were apparently retrofitting the impoundments to meet minimum technological requirements.

Table 2

Summary of Designs Utilized for Landfills, Surface Impoundments, and Waste Piles

No. of Liner Systems	No. of Drainage Layers	No. of Facilities / No. of Units		
		Landfills	Surface Impoundments	Waste Piles
1	1	---	---	1/1
2	1	---	6/26	---
2	2	20/34	2/2	2/2
3	1	---	1/1	---
3	2	5/19	2/4	---
3	3	4/4	---	---

Only 3 facilities with waste piles designs were included in the evaluation. Two facilities had piles equipped with two liners and two drainage layers. These designs specified a LCRS above the top liner and another LCRS (also functioning as the LDS) beneath the top liner. The other facility had a waste pile with only one liner system with a LCRS located above the liner.

The types of liner system designs utilized by land disposal facilities were analyzed. Table 3 summarizes data on liner system designs used by facilities with hazardous waste landfills, surface impoundments, and waste piles.

Landfill facilities were almost evenly divided in their use of FML liners and composite (FML over soil) liners for their top liner system. FML types used by landfill facilities included high-density polyethylene (HDPE), polyvinylchloride (PVC), and chloro-sulfanated polyethylene. The FML's width ranged from 30 to 100 mils, with 60 mils specified most often. Those facilities using a composite liner for their top liner specified compacted clay (permeability less than $1x10^{-7}$ cm/sec) as the soil component. The thickness of the clay ranged from 18 in. to 4.5 feet. The thickness of the soil component was not restricted at most facilities. In addition, some facilities were using bentonite mats as the soil component of their composite top liner. These bentonite mats were constructed of a geotextile and bentonite. One facility reported the permeability of their bentonite mat as $1x10^{-9}$ cm/sec.

Landfill facilities were equally divided in their use of FML liners and composite (FML over soil) liners for their intermediary liner system. The thickness of the soil component for intermediary composite liners ranged from 1 to 3 feet.

The majority of landfill facilities (24) utilized composite bottom liner systems. Twenty-three of the 24 landfill facilities specified 3 ft. of clay with permeability less than or equal $1x10^{-7}$ cm/sec as the soil component.

Several landfill facilities also specified sand blankets underneath the bottom liner system to function as an underdrain and relieve ground-water pressure on their liner foundation.

The majority of surface impoundment facilities (8) used single FMLs as their top liner. The thickness of these FMLs ranged from 36 to 100 mils. Two facilities accounting for 18 impoundments used composite top liners. The thickness of the soil component (clay) was 18 inches. There was no information to determine whether any restrictions existed on the thickness

Table 3

Summary of Liner System Designs Utilized for Landfills, Surface Impoundments, and Waste Piles

Unit	Liner System	No. of Facilities/No. of Units		
		Single FML	Composite* (FML Over Soil)	Soil Only
Landfill				
	Top	14/25	16/32	---
	Intermediary	5/19	4/4	---
	Bottom	2/2	24/51	2/4
Surface Impoundment				
	Top	8/14	2/18	1/1
	Intermediary	2/4	1/1	---
	Bottom	3/6	7/25	2/2
Waste Pile				
	Top	2/2	---	---
	Bottom	---	3/3	---

* Includes FML over bentonite mats.

of the soil component. One facility used a soil liner as the top liner at its impoundment. The soil liner consisted of 5 feet of compacted and enhanced soils.

Most surface impoundment facilities in the evaluation 7 out of 12 used composite bottom liners. The soil component was generally 3 feet of clay having permeability less than or equal to $1x10^{-7}$ cm/sec. Two facilities using a soil liner as the bottom liner specified clay or compacted and enhanced soils ranging from 3 to 10 feet thick, respectively. The other three facilities used single FML liners.

All three waste pile facilities used composite bottom liners. The soil component of these composite liner systems was at least 3 feet thick for each pile. Two of the waste piles having top liners specified a single FML as the top liner.

Table 4 summarizes the various drainage layer designs utilizing granular materials (e.g., sand, gravel, or crushed stone), geonet (e.g., Tensar^{R} or Polynet^{R}), or a combination of granular materials and geonet identified by the evaluation.

Most landfill facilities (12) used granular materials for their top LCRS located above the top liner system. The majority of landfill facilities (12 out of 21) used geonet in their LDS. Those landfill facilities (6) using a combination of granular materials and geonet in their LCRSs and LDSs specified a layer of granular materials at the landfill bottom and geonet on the embankments or sidewalls.

Although most surface impoundment facilities (5) in the evaluation used only granular materials in their LDS, the margin over those facilities using geonet (3) or a combination of geonet and granular materials (3) was small.

All three waste pile facilities specified granular materials for the piles' LCRS. The two facilities with waste piles having LDSs specified only granular materials or geonet for the piles' LDS.

The evaluation reviewed the designs of LDS for hazardous waste landfills, surface impoundments, and waste piles. Table 5 summarizes the LDS design specifications utilized by facilities with landfills, surface impoundments, and waste piles (those specifications that were

Table 4

Summary of Drainage Layer Designs Utilized for Landfills, Surface Impoundments, and Waste Piles

Unit	Drainage Layer	No. of Facilities/No. of Units		
		Granular	Geonet	Both*
Landfill				
	Top LCRS	12/19	8/26	6/6
	LDS	9/13	12/39	5/5
	Second LDS	---	4/4	---
Surface Impoundment				
	Top LCRS**	2/2	---	---
	LDS	5/11	3/19	3/3
	Second LDS	---	2/4	---
Waste Pile				
	Top LCRS	3/3	---	---
	LDS	1/1	1/1	---

* Facilities using both granular and geonet drainage materials generally specified granular drainage materials on the unit's bottom and geonet drainage materials on the unit's embankments or sidewalls.

** Units equipped with a top LCRS are disposal impoundments.

Table 5

Summary of LDS Design Specifications Utilized for Landfills, Surface Impoundments, and Waste Piles

Specification	No. of Facilities/No. of Units		
	Landfills	**Surface Impoundments**	**Waste Piles**
Minimum Bottom Slope			
<1%	---	1/1	---
1%	1/1	2/2	---
2%*	18/44	4/11	---
2.5%	1/2	---	---
3%	1/1	---	---
4%	1/1	---	---
5%	---	1/15	---
Not Specified	7/8	4/4	2/2
Granular Layer Hydraulic Conductivity			
1 cm/s*	---	---	---
1 x 10^{-1} cm/s	3/3	1/2	---
1 x 10^{-2} cm/s	3/3	5/9	---
Not Specified	11/13	3/4	2/2
Granular Layer Thickness			
12 inches*	12/16	4/8	---
<12 inches	---	3/4	---
Not Specified	2/2	1/1	1/1
Synthetic Drainage Layer Transmissivity			
5 x 10^{-4} m^2/s*	3/3	1/1	---
>5 x 10^{-4} m^2/s	3/12	---	---
<5 x 10^{-4} m^2/s	2/3	1/3	---
Not Specified	13/26	4/18	1/1

Table 5 (continued)

Summary of LDS Design Specifications Utilized for Landfills, Surface Impoundments, and Waste Piles

Specification	No. of Facilities/No. of Units		
	Landfills	**Surface Impoundments**	**Waste Piles**
Minimum Layers of Synthetic Drainage Net Specified			
1	---	---	---
2	1/1	1/3	---
3	---	---	---
Other	---	---	---
Not Specified	19/43	3/17	1/1
Thickness of Net Specified	---	2/2	---

* Specification proposed in May 29, 1987, Federal Register [52 FR 20218].

proposed for LDSs by USEPA in the May 29, 1987 Federal Register [52 FR 20218] are identified by astericks).

Most facilities (22 out of 30 that specified) reported a minimum bottom slope of 2% for their LDSs. Minimum bottom slopes ranged from 1 to 4% for landfills and from less than 1 to 5% for surface impoundments.

Twelve facilities utilizing granular materials for their landfills or surface impoundments LDSs specified the hydraulic conductivity of the granular materials. Eight of these facilities indicated that the hydraulic conductivity of the materials was $1x10^{-2}$ cm/sec or greater. Four other facilities identified the hydraulic conductivity of their granular materials as $1x10^{-1}$ cm/sec.

Nineteen facilities specified the thickness of their LDS granular materials. Sixteen of these facilities indicated that the thickness of the LDS granular materials was 12 inches. Two other facilities used less than 12 inches of granular materials in their LDS, but these facilities also employed geonet in their LDS designs. Only one facility specified less than 12 inches for a LDS composed entirely of granular materials.

Most facilities using geonet in the unit's LDS (18 out of 28) did not specify the transmissivity of the geonet. Four facilities did indicate that the transmissivity of the geonet used in their LDS was greater than or equal to $5x10^{-4}$ m^2/sec. Other transmissivities identified ranged from $6x10^{-4}$ to $3x10^{-6}$ m^2/sec.

Very few facilities specified the minimum number of layers of geonet used in their LDS. Two facilities indicated that 2 layers of geonet would be used for their LDSs, while two other facilities specified the thickness of geonet in their LDSs.

Very few facilities also specified any LDS performance standards (e.g., the size of the leak the LDS could measure or the shortest time the system could detect a leak). Table 6 summarizes LDS performance standards for hazardous waste landfills, surface impoundments, and waste piles.

Only four landfill facilities specified the minimum leak detection capability of their LCRS serving as the leak detection system. These detection capabilities ranged from 1 gallon per acre-day (gpad) to 15 gpad. Some minimum leak detection capabilities are specified in terms of the amount of time necessary to determine if a leak is present. These detection capabilities ranged

Table 6

Summary of LDS Performance Standards for Landfills, Surface Impoundments, and Waste Piles

Specification	No. of Facilities/No. of Units		
	Landfills	**Surface Impoundments**	**Waste Piles**
Leak Detection Sensitivity			
1 gpad*	1/1	---	---
Other	1/1	---	---
Not Specified	26/55	12/34	3/3
Leak Detection Time			
1 day*	---	---	---
Other	2/4	3/10	---
Not Specified	26/53	9/24	3/3

* Specification proposed in May 29, 1987, Federal Register [52 FR 20218].

from 25 minutes to 7.4 hours for landfills depending on the time it took for complete saturation of the drainage layer or the travel time to the furthest sump.

Three surface impoundment facilities identified the minimum leak detection capability of their impoundments. These detection capabilities ranged from 3.4 hours to 50 days depending on the time for saturation of the drainage layer or based on the travel time through the drainage layer to the furthest sump.

Seventeen landfill facilities specified the maximum leachate levels allowed in the leak detection system. Twelve landfill facilities specified maximum leachate levels in the leak detection system that correspond to 1 ft. head on the upper liner. Two landfill facilities specified the maximum level as one foot in the leak detection system. One landfill facility designated the maximum leachate levels using both methods described above. Two other landfill facilities defined the maximum leachate levels allowed in their leak detection system as specific levels (i.e., inches) of fluids in their sumps. Only one impoundment facility specified the maximum level in the LDS as 1 foot head.

Only 3 landfill facilities specified the minimum removal capacity for their landfill LDS. The removal capacities were 3.6 gallons per minute (gpm) for one landfill leak detection system, 76 gpm for each cell for another system, and 623 gpad for another landfill leak detection system.

Most landfill facilities were required to monitor their leak detection systems daily (e.g. inspecting the leak detection sumps). Some facilities were required to monitor their leak detection systems weekly and after storm events.

More than half of the landfill facilities in the evaluation were required to analyze leachate removed from their land disposal units. The analysis performed on the leachate ranged from testing for pollutant indicator parameters (such as pH, specific conductance, total organic carbon (TOC), total halogenated organics (TOX), total dissolved solids (TDS)) to testing for 40 CFR Part 261 Appendix VIII constituents. Facilities were also required to test leachate in accordance with their waste analysis plans. Some facilities were not required to test their leachate if they chose to manage it as hazardous waste.

One facility obtained a surface impoundment retrofitting variance under section 3005(j) of RCRA. This impoundment is situated on top of 15 feet of clay with one rubber liner

(unspecified thickness) and a leak detection system consisting of lysimeters and sumps. The sumps are located 20 feet. below the impoundment with riser pipes to the surface. The facility monitors the lysimeters and sumps to determine whether the impoundment is leaking. Any leachate is analyzed for fluorides and pH.

3.1.2. Action Leakage Rates

Background

In the May 29, 1987 Federal Register, EPA proposed that owners and operators of landfills, surface impoundments, and waste piles must establish an Action Leakage Rate (ALR) for these units. The ALR is the rate of leakage into the LDCRS that triggers a response action on the part of the owner/operators. EPA proposed an ALR in the range of 5 to 20 gallons per acre per day.

On May 29, 1987, EPA also proposed that facilities should determine a value representing a rapid and extremely large leak (RLL). The RLL is the maximum design leakage rate that the LDCRS can remove under gravity flow conditions without exceeding specified limits of fluid head in the LDS. Leaks over the RLL were proposed to also require response actions on the part of the owner or operator of the unit.

Most facilities included in the evaluation did not specify ALRs for land disposal unit. Of the 37 facilities with leak detection systems included in the evaluation, seven facilities had established ALRs for their land disposal units. These facilities measured flow into the LDS (to determine if the ALR was exceeded) and compared liquid flow rates to two trigger levels: a daily average ALR, evaluated on a weekly basis; and a daily maximum ALR. Table 7 summarizes the number of facilities and units that have established trigger levels (i.e., action leakage rates, intermediate leakage rates, and rapid and extremely large leakage rates) that initiate response actions.

The majority of facilities with landfills did not establish trigger levels for the units. There were 29 facilities with landfills in the evaluation (with 59 landfills); of these facilities, eight (with 25 landfills) had established ALRs. Six facilities (including 14 landfills) that had developed ALRs had also developed a three-tiered scheme including intermediate leakage rates (ILRs) and RLLs for the landfills at their facilities. One facility with a landfill designed with three liners (two

Table 7

Summary of Trigger Levels for Response Actions

Trigger Level	No. of Facilities/No. of Units		
	Landfills	Surface Impoundments	Waste Piles
Action Leakage Rate	7/25	3/24	---
Intermediate Leakage Rate	5/13	3/24	---
Rapid and Extremely Large Leakage Rate	5/13	3/24	---

composite liners and one FML) specified trigger levels (ALRs, ILRs, and RLLs) for the LCRS beneath the landfill's primary composite liner and for the LDS above the FML (bottom-most liner of the landfill).

The values for trigger levels varied widely between landfill units at different facilities. ALRs for landfills examined in the study ranged from 5 gpad to 114 gpad. Values for ILRs ranged form 156 gpad to 890 gpad. RLLs ranged from 1500 to 8900 gpad.

The majority of the facilities with surface impoundments evaluated in the study did not specify trigger levels. Of the 15 facilities with surface impoundments with a LDCRS (representing 36 impoundments), only three facilities established trigger levels; however, these three facilities accounted for 24 surface impoundments.

All three surface impoundment facilities with trigger levels established ALRs, ILRs, and RLLs for the impoundments. Two of these facilities (nine surface impoundments) had both a daily average ALR of 20 gpad (calculated weekly) and a daily maximum ALR of 50 gpad. ILRs for these units ranged from 300 to 890 gpad: RLLS ranged from 1500 to 8900 gpad.

None of the three waste piles in the evaluation had any trigger levels.

3.1.3 Response Action Plans

Background

In the May 29, 1987 Federal Register EPA proposed regulations requiring owners and operators of facilities to submit response action plans (RAPs) to address accumulations of liquids into the leak detection systems of landfills, surface impoundments, and waste piles (52 FR 20218). A RAP was proposed to address two situations: leakage rates into the leak detection system above the RLL, and leakage rates below the RLL but above the ALR for the unit. For leakage rates above the ALR but below the RLL, the RAP can be developed after detection of leaks in this range. A RAP for leakage rates above the RLL must be approved prior to the acceptance of waste. The May 29, 1987 proposal requires the owner/operator of a surface impoundment, landfill, or waste pile to develop a RAP that will:

(1) characterize the reason for leakage;

(2) assess current conditions of the double liner system;

(3) assess the potential for migration out of the unit;

(4) review various responses and their effectiveness; and

(5) recommend a response.

According to the data obtained from the evaluation, only a limited number of landfills have submitted RAPs. Seven facilities with landfills have submitted RAPs that will address leakage from 25 landfills.

In general, no response actions were required at landfills if the leakage rate for the unit was below the ALR. An exception was one facility RAP that required any damage to the liner system that resulted in leak rates under the ALR be repaired. Another facility RAP also called for reporting requirements if a daily leakage rate was more than 50 percent higher than the previous day's rate.

The facilities with landfills had similar response actions specified for leakage rates above the ALR but below the ILR (if an ILR was specified). All of the facilities required verbal notification to EPA and the implementing state agency within a specified timeframe (typically one day). Additional action was required for all but one of the facilities if the leakage rate exceeded the ALR for two consecutive monitoring periods. This additional action included: written notification to EPA and the state, increasing the pumping rate and monitoring rate to every day or every other day; and submitting a written report to EPA and the state within 60 days on the progress of efforts to reduce the leakage rate to below the ALR and proposed future actions. The RAPs from four facilities also specified that any visible damage to the liner must be repaired. One facility's RAP specified that leachate collected must be analyzed for total organic carbon, total dissolved solids, and pH.

Response actions were similar for leakage rates from landfills that were above the ILR but below the RLL. All of the landfill RAPs specified verbal notification to EPA and the state if the ILR was exceeded (usually within one day). Six of the facilities (including 13 landfills) were also required to perform the following if the ILR was exceeded for two consecutive monitoring periods: provide written notice to EPA and the state within seven days; increase pumping and monitoring frequency to a daily or every-other-day basis; and repair any visible leaks to the liner system. The facilities were also required to provide for a third-party assessment by a registered, professional engineer if the leakage rate continued to exceed the ILR. Four facilities were

required to remove standing water from the landfill. Another facility was required to stop receiving waste within 10 feet of the side slope liner. One facility was required to analyze the leachate collected from the LCRS. Finally, all facilities were required to document any damage to the liner system and provide a written report to EPA and the state within 60 days on actions taken so far and proposed future actions.

Response actions for facilities with landfills were more variable for leakage rates above the landfill's RLL. All of the facilities (except one) were required to notify EPA and the state, increase the pumping and monitoring frequency at the landfill, and provide written notice if the leakage rate exceeded the RLL for more than two consecutive pumping events. All of the facilities were also required to provide for an assessment of the liner system by a registered, professional engineer if the leakage rate exceed the RLL for additional sampling events (usually one). Four facilities were required to remove standing water from their landfills. Three facilities were required to analyze the leachate from the LCDRS. Three facilities were required to cease receiving wastes; two of these facilities were required to achieve leakage rates below the ALR. Repairs of visible damage to the liner system were required at four facilities. Two facilities were required to regrade the slopes of the landfill if the leakage rate could not be reduced below the RLL. One facility was required to remove waste from within 10 feet of the sidewalls. All of the facilities were required to document any damage to the liner system and to submit reports to EPA and the state after sixty days describing actions taken so far and proposed future actions.

Facilities with surface impoundments had RAPs very similar to the RAPs for landfills. Three facilities examined in the evaluation, inclusive of 24 surface impoundments, had RAPs. All of these facilities also had landfills: in all three cases, the RAPs for the landfills and surface impoundments were nearly identical. One facility was required by its RAP to lower the level of waste in its three surface impoundments if the leakage rate exceeds the RLL.

No waste piles included in the study had submitted RAPs.

3.2 Liquids in Landfills

Background

The U.S. EPA has developed several rulemakings to restrict the placement of liquids in landfills. In the May 19, 1980 Federal Register (45 FR 33154), EPA promulgated regulations that

included limitations on the placement in a landfill of both bulk or non-containerized and containerized liquid wastes or waste containing free liquids. EPA later issued regulations clarifying the definition of the term "free liquids" in the April 30, 1985 Federal Register (50 FR 18370). In the April 30, 1985 notice, EPA stated that the absence or presence of free liquids in a containerized or bulk waste would be determined by whether a sample of the waste would pass the Paint Filter Liquids Test (EPA Test Method 9095).

Subsequent to the initial rulemakings, EPA has proposed additional conditions pertaining to the disposal of liquids in landfills in response to Section 3004(c) of the Hazardous and Solid Waste Amendments (HSWA) of 1984. On December 24, 1986 (51 FR 46824), EPA proposed to prohibit the disposal of most containers holding free liquids unless the free liquids had been solidified by the use of an absorbent. EPA specified that the absorbent must not be biodegradable (defined as 71 percent total organic carbon; EPA recommended the use of the Mebius Test for determining TOC) and the absorbent/waste mixture must not release liquids as determined by the Liquids Release Test (EPA Test Method 9096). EPA later clarified its position on the use of absorbents by stating the free liquids may be removed through solidification (i.e., experiencing a chemical change such as stabilization using pozzolanic materials) or the addition of an absorbent (52 FR 23695).

Nearly all of the facilities included in the study had some sort of restrictions on the placement of liquids in landfills. Based on information obtained from Regional offices, only five facilities (consisting of eight landfills) did not have explicit restrictions on the placement of liquids in landfills. These restrictions include outright prohibitions on the placement of bulk liquids and free liquids in the landfill, restrictions on the use of biodegradable absorbents, testing requirements for absorbent-treated liquid wastes, and requirements for absorbents used to clean up spills. These restrictions will be discussed in the following sections.

3.2.1 Prohibitions on Bulk, Noncontainerized, or Free Liquids

Nearly all the landfills evaluated are prohibited from receiving wastes containing free liquids. Six facilities had landfill permits or permit applications that did not specifically reference a prohibition on the receipt of wastes containing free liquids.

In general, only a few facilities were operating landfills that had permit conditions or permit applications that referenced specific prohibitions on the placement of bulk or non-

containerized liquids in the landfill. Six facilities had landfills that were prohibited from receiving both bulk and non-containerized liquids.

3.2.2 Restrictions on Biodegradable Absorbents

Several facilities were restricted from using biodegradable absorbents. Fourteen facilities had restrictions on the types of absorbents that could be used to treat liquid wastes. The most common restriction involved specification of a list of acceptable absorbents: This occurred at eight facilities (covering 14 landfills). Other absorbents specified in permits or permit applications included pozzolanic materials (four facilities), cement (three facilities), and cement kiln dust (three facilities). Other absorbents that were permissible for wastes destined for the landfills included in the study were fly ash, clays, and caliche.

Three facilities were required to test the absorbent to determine if it was biodegradable. These facilities were required to test the absorbent for its total organic carbon (TOC) content. One facility was not allowed to use absorbents containing over one percent TOC; the other two facilities were required to test the absorbent for TOC using the Mebius Test, although no acceptable TOC percentage limits were specified.

3.2.3 Testing Requirements for Absorbent-Treated Liquid Wastes

For most facilities in the evaluation, the presence of free liquids was determined by testing the waste. A total of seven different tests were specified. The most commonly required test used to detect free liquids was the Paint Filter Liquids Test (PFLT); this procedure was required at 19 facilities and 36 landfills. The load bearing Capacity Test was required at four facilities (including five landfills). The Stabilization Evaluation Test (SET) was required to measure the effectiveness of absorbents at two facilities. Other methods required for absorbent-treated wastes were the Liquids Release Test (LRT), a compaction test (with a maximum liquid loss limit of 5 percent), moisture content, and an Unconfined Compressive Strength Test (UCS).

3.2.4 Special Requirements for Absorbents Used to Clean Up Spills

Most of the facilities examined did not have any special requirements for absorbents used to clean up spills. One facility was required to maintain supplies of oil dry, vermiculite, and fly ash to clean up spills. Two facilities were required to maintain supplies to clean up spills, but

specific absorbents were not stipulated. One facility was required to use an "appropriate stabilization agent", but no specifics were provided in the information collected.

APPENDIX A
ACRONYMS

ACRONYMS USED IN TEXT

ALR	Action Leakage Rate
DALR	Daily Average Leakage Rate
DEC	New York Department of Environmental Conservation
DEQ	Oregon Department of Environmental Quality
DHS	California Department of Health Services
FML	Flexible Membrane Liner
FR	Federal Register
GPAD	Gallons per Acre per Day
GPD	Gallons per Day
HWDMS	Hazardous Waste Data Management System
HDPE	High Density Polyethylene
ILR	Intermediate Leakage Rate
KDHE	Kansas Department of Health and Environment
LCRS	Leachate Collection and Removal System
LCS	Leachate Collection System
LDCRS	Leachate Detection Collection and Removal System
LDS	Leachate Detection System or Leak Detection System
LF	Landfill
LRT	Liquids Release Test
PFLT	Paint Filter Liquids Test
PLCS	Primary Leachate Collection System
PVC	Polyvinylchloride
RAP	Response Action Plan
RCRA	Resource Conservation and Recovery Act
RCRIS	RCRA Information System
RLL	Rapid and Extremely Large Leak
SET	Stabilization Evaluation Test
SI	Surface Impoundment
SLCS	Secondary Leachate Collection System
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
UCS	Unconfined Compressive Strength
UCST	Unconfined Compressive Strength Test
WAP	Waste Analysis Plan
WP	Waste Pile

APPENDIX B
LAND DISPOSAL QUESTIONNAIRE

LAND DISPOSAL QUESTIONNAIRE

FACILITY NAME: _____

RCRA ID: _____

UNIT TYPE: [SI] [LF] [WP] (Circle Only One)

UNIT NAME or NUMBER (As referenced in the permit or Part B). _____ (One Unit Only)*

Number of Units (SIs, LFs, WPs) with Double-Liner Designs at this facility (A separate "Land Disposal Questionnaire" should be filled out for each of these units)***. _____

Is there a map that shows the latitude and longitude of the facility? Yes ☐ No ☐

If yes, what is the latitude and longitude at some point near the center of the facility?

Latitude _____
Degrees Minutes Seconds

Longitude _____
Degrees Minutes Seconds

What is the latitude and longitude reported on the Part A?

Latitude _____
Degrees Minutes Seconds

Longitude _____
Degrees Minutes Seconds

LIQUIDS IN LANDFILLS

Any restrictions on "biodegradable" sorbents? Yes ☐ No ☐

If yes, how is "biodegradable" defined?
1%, 3% 10%, or other max TOC (or "non-C" carbon)? Yes ☐ No ☐

If yes, specify: _____

_____

List of acceptable sorbents (e.g., bentonite/clays/diatomaceous earth, based on their silicon-aluminum structure; fly ash; rice hulls; cement kiln dust)? Yes ☐ No ☐

*You may use one questionnaire for a number of units that have the exact same design.

FACILITY: _____

UNIT: _____

If yes, list: _____

_____

List unacceptable sorbents (e.g. saw dust, wood fibers, wood pulps; corn cobs; poultry feathers)?

Yes ☐ No ☐

If yes, list: _____

_____

Tests required: Mebius test (to measure TOC)? Yes ☐ No ☐

ASTM (Methods G21-70 & G22-76) microbial activity tests:

Resistance to fungal and bacterial growth? Yes ☐ No ☐

ASTM polymeric absorbent test? Yes ☐ No ☐

Other test? Yes ☐ No ☐

If yes, specify: _____

_____

Any testing required for sorbent-treated liquid wastes? Yes ☐ No ☐

If yes, is it the Paint Filter Liquids Tests? ☐ Liquids Release (Pressure) Test? ☐ or other test? ☐

Specify: _____

_____

If Liquids Release (Pressure) Test, are any parameters specified?

Test duration (e.g., 10, 20, or 30 minutes)? Yes ☐ No ☐

If yes, specify: _____

Test pressure (e.g., 45 or 50 psi; or based on waste density and depth)? Yes ☐ No ☐

If yes, specify: _____

Sample size (e.g., 100 grams)? Yes ☐ No ☐

If yes, specify: _____

Sample column height (e.g., 10 cm)? Yes ☐ No ☐

If yes, specify: _____

White or colored filter paper specified? _____

If LRPT, what is test criteria (moisture/wet spot on filter paper, liquid passing through, change in weight of filter paper, etc)?

_____

_____

Are there any special requirements for absorbents (pillows, booms, etc.) used to clean up spills?

Yes ☐ No ☐

If yes, specify: _____

_____

LINER/LEAK DETECTION SYSTEMS

Sketch the liner system design, showing any specifications for:

- Material type (e.g., recompacted clay, HDPE, Hypalon, gravel, synthetic mesh)
- Thickness (e.g., mils for synthetics, inches for gravel, or feet for clay); specific number, minimum or maximum [esp. maximum for clay layer of top composite liner]
- Permeability or transmissivity [max for clays/soils, minimum for gravels and synthetic mesh]
- Slope (minimum and/or maximum)
- Location of leak detection system when 3 or more liners

For example

Minimum 6 mil HDPE	LINER
Minimum 12 inches Minimum 10^{-1}cm/s Gravel Minimum 2% Slope	LDS/LCRS
Minimum 6 mil HDPE	
Recompacted Clay: Minimum 3 feet Maximum 10^{-7}cm/s	LINER

Length of run or distance between drainage tile or sumps specified? Yes ☐ No ☐

Minimum leak detection capability (design performance standard; e.g., capable of detecting a leak of one gallon/acre/day, or 10gpad, within one day) specified? Yes ☐ No ☐

If yes, what is specified? _____

Minimum removal capacity (gallon/minute) specified? Yes ☐ No ☐

If yes, what is specified? _____

Maximum level of leachate in Leak Detection System specified (e.g., one foot head)? Yes ☐ No ☐

FACILITY: _____

UNIT: _____

LINER/LEAK DETECTIONS SYSTEMS (CONT'D.)

If yes, what is specified? _____

Is this a design performance standard? _____ An operational standard? _____ Or both? _____

Is a composite liner being allowed for the top liner? Yes ☐ No ☐

If yes, is the thickness of the liner restricted (e.g., clay layer may not exceed 3 feet)? Yes ☐ No ☐

Restricted to what thickness? _____

Is a composite bottom liner being specified? Yes ☐ No ☐

Is there a construction QA Plan for liners? Yes ☐ No ☐ For leak detection system? Yes ☐ No ☐

Is the quality of leachate (e.g., Appendix IX analysis) required to be analyzed? Yes ☐ No ☐

What frequency of monitoring/inspection is specified (e.g., daily monitoring/weekly analysis/monthly reporting during the active life; weekly/monthly/quarterly during post-closure)? _____

_____

Action Trigger level specified? Yes ☐ No ☐

If yes, what is it? _____

Response actions specified? Yes ☐ No ☐

If yes, describe: (or attach pertinent sections of Part B) _____

APPENDIX C
RCRIS/HWDMS LIST OF OPERATING HAZARDOUS WASTE LAND DISPOSAL FACILITIES

DATA REQUEST FOR EPA/OSW/OPPI/IMS
PREPARED BY DPRA. REQUEST NUMBER R901207
DATA SOURCES: HWDMS VERSION 6.5 AND RCRIS VERSION 2.0.0
AS OF 12/18/90

OPERATING LAND DISPOSAL FACILITIES

REGION	FACILITY ID	FACILITY NAME	PERMIT STATUS	TYPE OF UNIT	COMMERCIAL
01	CTD000604488	CECOS TREATMENT CORP	PERMIT ISSUED	WP,,,	Y
	CTD001165703	WATERBURY BUCKLE CO INC	APPL REQUESTED	,,LF,	
	CTD001453711	GENERAL ELECTRIC	APPL REQUESTED	,SI,,	
	CTD002593416	POWER SEMICONDUCTORS INC	APPL REQUESTED	,SI,,	
	CTD003935905	PRATT & WHITNEY	PERMIT ISSUED	,SI,LF,	
	MED990813479	ME METAL FINISHING SILVEX	APPL REQUESTED	,SI,,	
02	NJD002173276	AMERICAN CYANAMID COMPANY	PERMIT ISSUED	,SI,,	
	NJD002173946	DUPONT E I DE NEMOURS & CO POMPTON LAKES	PERMIT ISSUED	,SI,,	
	NJD002194843	INT'L FLAVORS & FRAGRANCES-UNION BEACH	APPL COMPLETE	,SI,,	
	NJD002385730	DUPONT E I DE NEMOURS & CO DEEPWATER	PERMIT ISSUED	,SI,LF,	Y
	NJD045445683	AMERADA HESS CORP - PT. READ. RACK	PERMIT ISSUED	,,,LT	
	NYD000631994	UNIV OF ROCHESTER	APPL RECEIVED	WP,,,	
	NYD000818419	CIBA-GEIGY	PERMIT ISSUED	,SI,LF,	
	NYD001701382	MOODNA CREEK DEVEL. (MAJESTIC WEAVING)	APPL REQUESTED	,SI,,	
	NYD043815703	FRONTIER CHEMICAL WASTE PROCESS	APPL RECEIVED	,SI,,	Y
	NYD049836679	CWM CHEMICAL SERVICES	PERMIT ISSUED	,SI,LF,LT	Y
	NYD066832023	GENERAL ELECTRIC - NORYL PRODUCTS DEPT	PERMIT ISSUED	,SI,LF,	
	NYD080336241	CECOS INTERNATIONAL INC.	PERMIT ISSUED	,SI,LF,	Y
	NYD980534390	PVS CHEMICAL INCORP. (NEW YORK)	APPL REQUESTED	,SI,,	
	PRD091017228	COMMONWEALTH OIL REFINING COMPANY INC	APPL REQUESTED	,SI,,	
	PRD980594618	UNION CARBIDE CARIBE, INC.	PERMIT ISSUED	,SI,LF,	
	VID980536080	HESS OIL VIRGIN ISLANDS CORP.	PERMIT ISSUED	,,,LT	
03	DED002329738	STAR ENTERPRISE	PERMIT ISSUED	,,LF,LT	
	MDD000731356	HAWKINS POINT DISPOSAL SITE NO 2	PERMIT ISSUED	,,LF,	Y
	MDD003093515	S C M CORP-ADRIAN JOYCE WORKS	APPL RECEIVED	WP,SI,,	
	MDD069396711	ALLIED CHEMICAL - BALTIMORE	PERMIT ISSUED	WP,,,	
	PAD002289700	ATLANTIC REFINING AND MARKETING CORP	PERMIT ISSUED	WP,,,LT	
	PAD002330165	EAST PENN MANUFACTURING CO INC	PERMIT ISSUED	WP,,,	
	PAD004344222	BETHLEHEM STEEL CORP-JOHNSTOWN PLT	APPL COMPLETE	,,LF,	
	PAD030068282	MOLYCORP INC WASHINGTON PLT	APPL RECEIVED	,SI,,	
	PAD085690592	WASTE CONVERSION INC	PERMIT ISSUED	WP,,,	Y
	PAD980707624	ENVIROSAFE SERVICES OF PENNSYLVANIA INC	APPL COMPLETE	WP,SI,LF,	
	PAD981110760	SOLIDTEK OF PENNSYLVANIA	INTENT TO DENY	,,LF,	
	PAD990753089	GENERAL BATTERY CORP	PERMIT ISSUED	WP,,,	
	PAT440012177	GENERAL BATTERY ALSACE TWN LANDFILL	PERMIT DENIED	,,LF,	
	PA5213820892	U S ARMY - TOBYHANNA DEPOT	APPL REQUESTED	WP,,,	
	VAD000731133	COLONIAL PIPELINE CO	APPL RECEIVED	,,,LT	
	VAD003160015	ROYSTER CO	APPL COMPLETE	WP,,,	
	VAD980832836	VEGA PRECISION LABS	APPL REQUESTED	,SI,,	
	WVD000800441	SHARON STEEL CORP-FAIRMONT COKE WORKS	APPL RECEIVED	,,LF,	
	WVD004325353	UNION CARBIDE CORP SISTERSVILLE PLANT	PERMIT ISSUED	,SI,LF,	
	WVD004336343	P P G INDUSTRIES-NATRIUM PLANT	PERMIT ISSUED	,SI,,	
	WVD004341491	AMERICAN CYANAMID CO - WILLOW PLANT	PERMIT ISSUED	,SI,,	
	WVD005005509	RHONE POULENC AG CO INSTITUTE	PERMIT ISSUED	,SI,LF,	
	WVD056866312	MOBAY CHEM CO	PERMIT ISSUED	WP,SI,,	
	WVD980554885	UNION CARBIDE CORP HOLZ IMPOUNDMENT	PERMIT ISSUED	,SI,,	

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AS OF 12/18/90

OPERATING LAND DISPOSAL FACILITIES

REGION	FACILITY ID	FACILITY NAME	PERMIT STATUS	TYPE OF UNIT	COMMERCIAL
03	WVD980555239	OLIN CORP - MOUNDSVILLE PLANT	PERMIT ISSUED	WP,,,	
04	ALD000622464	CHEM WASTE	PERMIT ISSUED	,SI,LF,	Y
	ALD000827154	M&T CHEMICALS INC	PERMIT ISSUED	,SI,,	
	ALD001221902	CIBA GEIGY CORPORATION	PERMIT ISSUED	WP,SI,LF,	Y
	ALD003397569	AMERICAN CAST IRON PIPE CO.	PERMIT ISSUED	WP,,,	
	ALD004009320	HUNT OIL CO TUSCALOOSA REFINERY	PERMIT ISSUED	,,,LT	
	ALD004019048	MONSANTO CO ANNISTON FACILITY	PERMIT ISSUED	WP,SI,LF,	
	ALD008161176	AKZO CHEM AMER (STAUFFER)	PERMIT ISSUED	,SI,,	
	ALD008188708	OLIN CORP/MCINTOSH PLT	PERMIT ISSUED	,SI,LF,	
	ALD057213811	LEE BRASS CO	APPL REQUESTED	WP,,,	
	FLD004092839	GULF COAST RECYCLING, INC.	APPL RECEIVED	WP,,,	
	FLD043860451	GATES ENERGY PRODUCTS INC	PERMIT ISSUED	WP,SI,LF,	
	FLD057231821	AMERICAN CYANAMID CO	PERMIT ISSUED	,SI,,	
	FL6170024412	USN AIR STAT JACKSONVILLE	PERMIT ISSUED	WP,SI,,	
	FL9170024567	USN PUBLIC WORKS CTR	PERMIT ISSUED	,SI,,	
	GAD003324985	MERCK & CO INC	PERMIT ISSUED	,SI,,	
	GAD040690737	OLIN CHEMICALS GRP - AUGUSTA PLANT	PERMIT ISSUED	,SI,LF,	
	GAD070330576	GNB INC	PERMIT ISSUED	WP,,,	
	GAD991275124	SO-GREEN CORP	PERMIT ISSUED	WP,SI,,	Y
	GA7170023694	USMC LOGISTICS BASE 555	PERMIT ISSUED	,SI,,	
	GA8570024606	LOCKHEED-GEORGIA CO USAF PLT 86	PERMIT ISSUED	,SI,LF,	
	KYD000615898	ASHLAND PETROLEUM CO LANDFILL	PERMIT ISSUED	,,LF,	
	KYD003924198	EI DUPONT DE NEMOURS & CO.	PERMIT ISSUED	,SI,,	
	KYD045735305	FLORIDA TILE	APPL RECEIVED	,SI,,	
	KYD991277112	NEWPORT STEEL CORP WILDER PLANT	PERMIT ISSUED	,,LF,	
	MSD004448775	WOODSHAFT	PERMIT ISSUED	,SI,,	
	MSD007027543	KOPPERS INDUSTRIES, INC.	PERMIT ISSUED	,SI,,	
	MSD008186587	MORTON INTERNATIONAL, INC.	PERMIT ISSUED	,SI,LF,	
	MSD054179403	CHEVRON	PERMIT ISSUED	WP,,,	
	MSD079461406	AMERADA HESS CORP	PERMIT ISSUED	,,,LT	
	MSD083543009	ROGERS RENTAL & LANDFILL COMPANY	PERMIT ISSUED	,,,LT	
	MSD980600084	INTERNATIONAL PAPER CO	PERMIT ISSUED	,SI,,	
	NCD001810365	SANDOZ CHEMICALS CORPORATION	PERMIT ISSUED	,SI,LF,	
	SCD046503132	STOLLER CHEM CO/MIL DIV	PERMIT ISSUED	WP,SI,,	Y
	SCD048372023	LOCKHEED GEORGIA CO/CHARLESTON PLT	PERMIT ISSUED	,SI,,	
	SCD067002147	GENERAL ELEC CO/FLORENCE PLT	PERMIT ISSUED	,SI,,	
	SCD070375985	GSX	PERMIT ISSUED	,,LF,	Y
	SCD990704470	WOLVERINE BRASS	PERMIT ISSUED	WP,SI,,	
	TND003337292	OLIN CHEMICALS CORP	PERMIT ISSUED	,SI,,	
	TND003376928	TN EASTMAN DIV EASTMAN KODAK	PERMIT ISSUED	WP,SI,,	Y
	TND042205971	SANYMETAL PRODUCTS INC	PERMIT ISSUED	,SI,,	
	TND069080513	UNIVERSAL FASTENERS INC	PERMIT ISSUED	,SI,,	
	TND095050019	YALE SECURITY, INC.	PERMIT ISSUED	,SI,,	
	TN0890090004	US DOE K-25 SITE	PERMIT ISSUED	,SI,,	
	TN3890090001	US DOE Y 12 PLANT	PERMIT ISSUED	WP,,LF,	
05	ILD000667139	BRIGHTON LANDFILL	APPL RECEIVED	,,LF,	

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OPERATING LAND DISPOSAL FACILITIES

REGION	FACILITY ID	FACILITY NAME	PERMIT STATUS	TYPE OF UNIT	COMMERCIAL
05	ILD000805812	PEORIA DISPOSAL CO	PERMIT ISSUED	WP,SI,LF,	Y
	ILD005263157	NORTHWESTERN STEEL & WIRE CO	PERMIT ISSUED	,,LF,	
	ILD005476882	MARATHON OIL CO ROBINSON REFINERY	PERMIT ISSUED	,SI,,LT	
	ILD006278170	ALLIED CORP METROPOLIS WORKS	PERMIT ISSUED	,SI,,	
	ILD006280606	LACLEDE STEEL CO ALTON WORKS	PERMIT DENIED	WP,,,	
	ILD010284248	CID-LANDFILL	PERMIT ISSUED	,SI,LF,	Y
	ILD980503213	INLAND METALS REFINING CO INC	APPL REQUESTED	WP,SI,,	
	ILD980700728	BROWNING FERRIS IND OF ILLINOIS INC	PERMIT ISSUED	,,LF,	Y
	IND000717959	GENERAL BATTERY CORP	APPL REQUESTED	WP,,,	
	IND000772707	WILLCUTT LDFL	APPL REQUESTED	,,LF,	
	IND016584641	MIDWEST STEEL CO	PERMIT ISSUED	,SI,LF,	
	IND072036114	ALLEGHENY LUDLUM STEEL CORP	APPL REQUESTED	,,LF,	
	IND077005916	GARY DEVELOPMENT CO INC	APPL REQUESTED	,,LF,	
	IND078911146	ADAMS SAN LDFL	PERMIT ISSUED	,,LF,	Y
	IND082287632	INGRAM RICHARDSON CO	APPL REQUESTED	,SI,,	
	IND980503775	HERITAGE ENVIRONMENTAL SERVICES	APPL REQUESTED	,,LF,	Y
	IND980503890	HERITAGE ENVIRON SERV INC ILND	PERMIT ISSUED	,,LF,	Y
	MID000724724	DOW CHEMICAL CO MICHIGAN DIV MIDLAND LOC	PERMIT ISSUED	,SI,,	
	MID000809632	DOW CORNING CORP MIDLAND PLT	PERMIT ISSUED	,,LF,	
	MID048090633	WAYNE DISPOSAL INC SITE #2	PERMIT ISSUED	,,LF,	Y
	MID980568711	FORD MOTOR CO ALLEN PARK CLAY MINE	PERMIT ISSUED	,,LF,	
	MID980617435	DOW CHEMICAL CO SALZBURG LANDFILL	PERMIT ISSUED	,,LF,	
	MID990687964	LAKE STATES WOOD PRESERVING	APPL REQUESTED	,SI,,	
	MND000686071	KOCH REFINING CO	PERMIT ISSUED	,,,LT	
	MND000686196	BURLINGTON NORTHERN TIE PLANT	PERMIT ISSUED	WP,,,	
	MND006156590	FEDERAL CARTRIDGE CORP	DRAFT PERMIT	,,LF,	
	MND041775008	NORTH STAR STEEL CO	PERMIT ISSUED	WP,,,	
	MND980824890	FMC CORP NORTHERN ORDNANCE DIV	PERMIT ISSUED	,,LF,	
	OHD000724088	EAGLEBROOK OF OHIO INC	PERMIT ISSUED	WP,,,	Y
	OHD000810242	RMI CO SODIUM PLT	PERMIT ISSUED	WP,,,	
	OHD000816843	COMMERCIAL OIL SERVICE INC	APPL REQUESTED	,SI,,	Y
	OHD000817114	KOPPERS COMPANY INC	APPL REQUESTED	WP,SI,,	
	OHD045243706	ENVIROSAFE SER OTTER CREEK RD	PERMIT ISSUED	WP,SI,LF,	Y
	OHD055522429	ERIEWAY INCORPORATED	PERMIT ISSUED	WP,,,	Y
	OHD068901610	TELEDYNE MONARCH RUBBER PLANT 1	APPL RECEIVED	,SI,,	
	OHD980700942	ECOLOTEC INC	PERMIT ISSUED	WP,,,	Y
	OHD981529688	AMOCO PERFORMANCE PRODUCTS INC	PERMIT ISSUED	,SI,,	
06	ARD049658628	MOUNTAIN PINE PRESSURE TREATING	PERMIT DENIED	,SI,,	
	AR0213820707	US ARMY PINE BLUFF ARSENAL	PERMIT ISSUED	,SI,LF,	
	LAD000618256	CECOS INTERNATIONAL, INC.	PERMIT ISSUED	,SI,LF,	Y
	LAD000757385	IT CORPORATION OF LOUISIANA	PERMIT ISSUED	WP,,LF,	Y
	LAD000777201	CHEMICAL WASTE MANAGEMENT INC	PERMIT ISSUED	,SI,LF,	Y
	LAD001700756	MONSANTO COMPANY	PERMIT ISSUED	,SI,,	
	LAD008080350	CITGO PETROLEUM CORPORATION	PERMIT ISSUED	,SI,,LT	
	LAD008080681	OLIN CORP LAKE CHARLES PLT RESIDUE BUR	PERMIT ISSUED	WP,SI,LF,	
	LAD008086506	PPG INDUSTRIES INC.	PERMIT ISSUED	,SI,,	

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AS OF 12/18/90

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REGION	FACILITY ID	FACILITY NAME	PERMIT STATUS	TYPE OF UNIT	COMMERCIAL
06	LAD008161234	RHONE-POULENC BASIC CHEM CO	PERMIT ISSUED	,SI,,	Y
	LAD008175390	AMERICAN CYANAMID FORTIER PLANT	PERMIT ISSUED	,SI,,	
	LAD008187080	DOW CHEMICAL USA LOUISIANA DIV	PERMIT ISSUED	,,LF,	
	LAD034199802	CHEVRON CHEMICAL CO#	PERMIT DENIED	,SI,LF,LT	
	LAD056024391	B P OIL, INC.	PERMIT ISSUED	,SI,,LT	
	LAD057117434	GEORGIA-GULF	PERMIT ISSUED	,SI,,	
	LAD062666548	PIONEER CHLOR ALKALI CO INC	PERMIT ISSUED	,SI,,	
	LAD065465146	STAR ENTERPRISE	PERMIT ISSUED	,,,LT	
	LAD081999724	MARATHON OIL CO LOUISIANA REFINING DIV	PERMIT ISSUED	,SI,,LT	
	LAD990683716	CONOCO INC LAKE CHARLES REFINERY	PERMIT ISSUED	,SI,LF,LT	
	LA4800014587	US NASA MICHOUD ASSEMBLY	PERMIT ISSUED	,SI,,	
	NMD000333211	GIANT REFINERY	PERMIT ISSUED	,,,LT	
	NMD048918817	NAVAJO REFINING CO	PERMIT ISSUED	,SI,,LT	
	NM4890139088	US DOE WASTE INSTALLATION PILOT PLANT	APPL REQUESTED	,,LF,	
	OKD000396549	KERR-MCGEE REFNG CORP	PERMIT ISSUED	,SI,,LT	
	OKD004998225	OKMULGEE REFINERY	APPL REQUESTED	,SI,LF,LT	
	OKD007233836	CONOCO INC PONCA CITY	PERMIT ISSUED	,SI,LF,LT	
	OKD045349982	ALPHA OIL COMPANY	PERMIT DENIED	,SI,,LT	
	OKD057705972	TOTAL PETROLEUM CORP	PERMIT ISSUED	,,,LT	
	OKD058078775	SUN REFNG & MKTNG TULSA REFNRY	PERMIT ISSUED	,,,LT	
	OKD065438376	US POLLUTION LONE MOUNTAIN	PERMIT ISSUED	WP,SI,LF,	Y
	OKD091598870	OKLAHOMA REFINING COMPANY-CYRIL PLANT	APPL RECEIVED	,SI,,LT	
	OKD980879712	HAYSTACK FACILITY	APPL RECEIVED	,SI,LF,LT	
	OKD990695991	AGRICULTURAL MINERALS CORP VERDIGRIS PLT	PERMIT ISSUED	,SI,,	
	OKD990750960	SINCLAIR OIL CORP	PERMIT ISSUED	,,,LT	
	TXD000449397	QUANEX CORP GULF STATES DIV	PERMIT ISSUED	,SI,,LT	
	TXD000741702	JCS CO INC	APPL REQUESTED	WP,SI,,	
	TXD000751107	JERRELL B THOMPSON INC	APPL REQUESTED	WP,SI,,	
	TXD000751172	BP CHEMICALS INC	PERMIT ISSUED	,SI,LF,	
	TXD000761254	CHEMICAL WASTE MGT OF CORPUS CHRISTI	PERMIT ISSUED	,,LF,	Y
	TXD000761262	CHEMICAL WASTE MGMT BAYOU FARMS	APPL COMPLETE	,SI,LF,	
	TXD000778621	ATCHISON TOPEKA & SANTA FE RR	PERMIT ISSUED	,SI,,	
	TXD000782698	EXXON CO-BAYTOWN REFINERY & CHEMICAL	PERMIT ISSUED	,,,LT	
	TXD000807859	SOUTHWESTERN REFINING CO	PERMIT ISSUED	,,,LT	
	TXD000835249	GULF COAST WASTE DISPOSAL AUTH	PERMIT ISSUED	,,LF,LT	Y
	TXD001700806	MONSANTO CO	PERMIT ISSUED	,SI,LF,	
	TXD006451090	GNB BATTERIES INC	PERMIT ISSUED	WP,,,	
	TXD007330202	TEXAS EASTMAN COMPANY	PERMIT ISSUED	,SI,LF,	
	TXD007365984	E-SYSTEMS INC	PERMIT ISSUED	,SI,,	
	TXD007378995	TEXACO REFNG & MKTNG	PERMIT ISSUED	,,,LT	
	TXD008013468	FINA OIL & CHEM CO-COSDEN CHEM	PERMIT ISSUED	WP,,LF,LT	
	TXD008081101	E I DUPONT DE NEMOURS	PERMIT ISSUED	,SI,,	
	TXD008091290	CROWN CENTRAL PETROLEUM CORP	PERMIT ISSUED	,SI,,	
	TXD008092793	DOW CHEMICAL CO	PERMIT ISSUED	,,LF,	
	TXD008096158	ETHYL CORPORATION	PERMIT ISSUED	,SI,LF,	
	TXD008097529	STAR ENTERPRISE	PERMIT ISSUED	,SI,,LT	

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AS OF 12/18/90

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06	TXD008113441	CELANESE ENGINEERING RESINS	PERMIT ISSUED	,SI,LF,	
	TXD008119414	STRUCTURAL METALS INC	PERMIT ISSUED	,,LF,	
	TXD008123317	E I DUPONT DE NEMOURS	PERMIT ISSUED	,SI,LF,	
	TXD010794097	UNION OIL OF CALIF	PERMIT ISSUED	,SI,,	
	TXD026040709	HOECHST CELANESE CHEMICAL GROUP, INC.	PERMIT ISSUED	,SI,LF,	
	TXD026896290	SHELL OIL CO ODESSA REFINERY	PERMIT ISSUED	,SI,,LT	
	TXD027070655	WOOD INDUSTRIES	APPL REQUESTED	WP,,,	
	TXD041515420	UNION CARBIDE CHEMICALS AND PLASTICS CO.	PERMIT ISSUED	,,LF,	
	TXD047467113	USX	PERMIT ISSUED	,,LF,	
	TXD048210645	PHILLIPS PETROLEUM CO SWEENY REFINERY	PERMIT ISSUED	,SI,,LT	
	TXD050309012	AMOCO CHEMICALS CO	PERMIT ISSUED	,,LF,	
	TXD051161990	CHAMPLIN REFNG & CHEM	PERMIT ISSUED	WP,SI,,	
	TXD054256391	CHEVRON OIL CO8	PERMIT ISSUED	,,,LT	
	TXD055141378	ROLLINS ENVIRONMENTAL SERVICES TX INC	PERMIT ISSUED	,SI,LF,	Y
	TXD057111403	KERR-MCGEE CHEMICAL CORP	PERMIT ISSUED	,SI,,LT	
	TXD058260977	MOBAY CORPORATION	PERMIT ISSUED	WP,SI,,	
	TXD059685339	DIAMOND SHAMROCK CORP MCKEE PLANTS	PERMIT ISSUED	,,,LT	
	TXD065099160	FINA OIL & CHEMICAL CO	PERMIT ISSUED	,SI,,	
	TXD066349770	TYLER PIPE INDUSTRIES INC	PERMIT ISSUED	,SI,LF,	
	TXD066362559	CHAPARRAL STEEL CO	PERMIT ISSUED	,,LF,	
	TXD066368879	W J SMITH WOOD PRESERVING CO	APPL COMPLETE	,SI,,	
	TXD067285973	SHELL CHEMICAL CO DEER PARK COMPLEX	PERMIT ISSUED	WP,SI,LF,	
	TXD069450278	HOECHST CELANESE CORP	PERMIT ISSUED	,SI,,	
	TXD069452340	TEXAS ECOLOGISTS INC	PERMIT ISSUED	,SI,LF,	Y
	TXD072181381	AMOCO OIL COMPANY LAND FARM 1 2	PERMIT ISSUED	,,,LT	
	TXD078432457	HOECHST CELANESE CHEMICAL GROUP, INC.	PERMIT ISSUED	,SI,,	
	TXD082688979	LYONDELL PETROCHEMICAL	PERMIT ISSUED	,,,LT	
	TXD088474663	KOCH REFINING CO	PERMIT ISSUED	,,,LT	
	TXD980626774	PHILLIPS PETROLEUM CO BORGER REFINERY	PERMIT ISSUED	,SI,LF,	
	TXD980748107	ENVIROSAFE SERVICES OF TEXAS INC	APPL COMPLETE	WP,,LF,	Y
	TXD981905292	LONE STAR - ROTAC,INC	PERMIT ISSUED	,,LF,	
	TXD990709685	STANDARD INDUSTRIES	PERMIT ISSUED	,SI,LF,	
	TXD990709966	DIAMOND SHAMROCK	PERMIT ISSUED	,SI,,LT	
	TXD990797714	MOBIL OIL CORP	PERMIT ISSUED	,,LF,	
	TX3213820738	US ARMY RED RIVER ARMY DEPOT	PERMIT ISSUED	WP,SI,,	
07	IAD000830018	DEXTER CO	APPL REQUESTED	,,LF,	
	KSD087418695	TOTAL PETROLEUM INC	PERMIT ISSUED	,SI,,LT	
	MOD030712822	SCHUYLKILL METALS CORP	PERMIT ISSUED	WP,,,	
	NED000687186	SAFETY-KLEEN CORP 5-065-01	APPL RECEIVED	WP,,,	Y
08	COD991300484	HIGHWAY 36 LAND DEVELOPMENT CORP	DRAFT PERMIT	,SI,LF,	Y
	MTD000716787	BURLINGTON NORTHERN PARADISE TIE PLANT	PERMIT ISSUED	WP,SI,,LT	
	MTD000818096	CONOCO LANDFARM	PERMIT ISSUED	,,,LT	
	MTD010380574	EXXON BILLINGS REFINERY	PERMIT ISSUED	,,,LT	
	UTD093119196	PETROCHEM RECYCLING (FORMERLY EKOTEK)	PERMIT DENIED	WP,,,	
	UTD991301748	USPCI GRASSY MOUNTAIN FACILITY	PERMIT ISSUED	,SI,LF,LT	Y
	UT3750211259	DUGWAY PROVING GROUNDS - US ARMY	APPL RECEIVED	,SI,,	

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AS OF 12/18/90

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08	WYD991301086	AMOCO PIPELINE TANK FARM	PERMIT ISSUED	,,,LT	
09	AZD009005422	HUGHES AIRCRAFT CO USAF PLT 44	PERMIT ISSUED	,SI,,	
	AZT000623702	INTL BUSINESS MACHINES CORP	APPL RECEIVED	,SI,,	
	CAD000633164	G S X CORP IMPERIAL FACILITY	PERMIT ISSUED	,SI,LF,LT	Y
	CAD009114919	CHEVRON USA INC RICHMOND REFINERY	PERMIT DENIED	,,,LT	
	CAD020748125	CASMALIA DSPL	DRAFT PERMIT	,SI,LF,LT	Y
	CAD085595551	WOTEN AVIATION SERVICES INC	APPL REQUESTED	,SI,,	
	CAD980675276	GSX SERVICES PETROLEUM WASTE INC	PERMIT ISSUED	,,LF,	Y
	CAT000646117	CHEMICAL WASTE MGMT - KETTLEMAN	PERMIT ISSUED	,SI,LF,LT	Y
	CAT080011562	PG&E HUMBOLDT BAY POWER PLANT	PERMIT ISSUED	,SI,,	
	CAT080011646	PG&E MORRO BAY POWER PLANT	PERMIT ISSUED	,SI,,	
	CAT080011653	PG&E MOSS LANDING POWER PLANT	PERMIT ISSUED	,SI,,	
	CAT080011695	PG&E PITTSBURG POWER PLANT	PERMIT ISSUED	,SI,,	
	CA7170024775	MARE ISLAND NAVAL SHIPYARD	PERMIT DENIED	,SI,LF,	
	HIT160010005	CHEVRON USA INC HAWAIIAN REFINERY	PERMIT ISSUED	WP,SI,,LT	
	NVT330010000	US ECOLOGY INC CHEM SITE	PERMIT ISSUED	,,LF,	Y
10	IDD073114654	ENVIROSAFE SERVICES OF IDAHO- SITE B	PERMIT ISSUED	WP,SI,LF,	Y
	ORD089452353	CHEM WASTE MGMT OF THE NORTHWEST INC	PERMIT ISSUED	,SI,LF,LT	Y
	WAD009242314	OCCIDENTAL CHEMICAL CORP	PERMIT ISSUED	WP,,,	
	WAD009250366	B P OIL COMPANY- FERNDALE REFINERY	PERMIT ISSUED	WP,SI,,LT	
	WAD009275082	SHELL OIL CO- ANACORTES	PERMIT ISSUED	,,,LT	
	WAD009276197	TEXACO REFINING & MARKETING INC	PERMIT ISSUED	,,,LT	
	WAD027530526	BAY ZINC COMPANY INC	PERMIT ISSUED	WP,,,	
	WAD041337130	BOEING CO- AUBURN	PERMIT ISSUED	WP,,,	
	WAD069548154	ARCO PETROLEUM PRODUCTS CO CHERRY PT REF	PERMIT ISSUED	,SI,,LT	
	WAD980978464	GRANT COUNTY WASTE MANAGEMENT FACILITY	APPL RECEIVED	,SI,LF,	

APPENDIX D
DETAILED INFORMATION ON FACILITIES INCLUDED IN SURVEY

APPENDIX D.1
DESIGNS OF LINER AND LEAK DETECTION SYSTEMS

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR LANDFILLS

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
Dupont-Deepwater, NJ (see Pg. D-8)	24" gravel, $1x10^2$		45 mil Hypalon		6" gravel 6" sand Permeability not identified							45 mil Hypalon 36" clay 10^{-7} cm/s	
Chem Waste Mgmt - Model City, NY (see pg. D-9)	12" stone 12" gravel, 0.5	Geonet, 1×10^{-3}		80 mil HDPE 18" clay		Polynet, 1×10^{-3} (2 layers)						80 mil HDPE 36" clay 10^{-7} cm/s	
GE - Waterford, NY (see pg. D-10)	12" stone 12" stone			80 mil HDPE 30" clay	12" stone (bottom only)	Geonet (sides) transmissivity not identified						80 mil HDPE 36" clay 10^{-7} cm/s	
BFI/CECOS - Niagara Falls, NY (Landfill No. 6) (see pg. D-11)	12" unspecified type (bottom only)	Geonet (sides)		80 mil HDPE 4'6" clay	12" unspecified type (bottom only)	Geonet (sides) transmissivity not identified						80 mil HDPE 4'6" clay 10^{-7} cm/s	
BSC - Johnstown, PA (see pg. D-12)	12" unspecified type (bottom only)	Geonet (sides)	50 mil PVC		12" unspecified type (bottom only)	Geonet (sides) transmissivity not identified						50 mil PVC 36" clay 10^{-7} cm/s	
Chem Waste Mgmt - Emelle, AL (see pg. D-13)				60 mil liner unspecified 1'6" chalk	12" sand, $1x10^2$ (bottom only)	Geonet (sides) transmissivity not identified						60 mil unspecified 36" clay 10^{-7} cm/s	
CIBA-GEIGY - McIntosh, AL (Landfill No. 1) (see pg. D-14)	12" sand, $1x10^2$		80 mil HDPE		12" sand, $1x10^2$ (bottom only)							36" clay $1x10^{-7}$ cm/s 60 mil HDPE	
CIBA-GEIGY - McIntosh, AL (Landfill No. 2) (see pg. D-15)	12" sand, $1x10^1$ (bottom only)	Geonet (side)		80 mil HDPE unspecified, prefabricated bentonite mat	12" gravel, $1x10^1$ (bottom only)	Geonet (sidewalls) transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Adams Center Landfill, IN (see pg. D-16)	12" unspecified type			60 mil HDPE 18" clay		Geonet, transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Envirosafe of Ohio (see pg. D-17)	18" sand			80 mil HDPE 24" clay	12" gravel Permeability not identified							60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Peoria Disposal, IL Landfill C-1 (see pg. D-18)	12" sand		60 mil HDPE		12" sand Permeability not identified							60 mil HDPE 36" clay	

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR LANDFILLS (Continued)

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
Peoria Disposal, IL Landfill C-2 (see pg. D-19)		Mesh Filter Drain		60 mil HDPE Unspecified, Bentonite		Mesh Filter Drain,[2] transmissivity not identified		60 mil HDPE Unspecified, Bentonite				80 mil HDPE 36" clay	
BFI/CECOS, IL (see pg. D-20)		Geotextile Filter	80 mil HDPE			Geotextile Filter, transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
CID Landfill, IL (see pg. D-21)	12" unspecified type			100 mil HDPE Unspecified, bentonite mat	Unspecified drainage material[2]		60 mil HDPE					60 mil HDPE 36" clay $1.9x10^{-8}$ cm/s	
Heritage Environmental Services, IN (see pg. D-22)			30 mil HDPE		12" sand Permeability not identified							30 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Texas Ecologists, Inc., TX (5 cells) (see pg. D-23)	12" gravel, $1x10^{-3}$			80 mil HDPE Unspecified, Bentonite mat		Geonet[2], transmission not identified	40 mil HDPE					80 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Dupont-Victoria, TX (see pg. D-24)	12" washed river rock, $1x10^{-1}$		36 mil Hypalon		12" washed river rock, $1x10^{-1}$							36 mil Hypalon 36" clay $1x10^{-7}$ cm/s	
Gulf Coast Waste Disposal, TX (see pg. D-25)	Unspecified thickness, gravel			Unspecified thickness, HDPE 24" clay	Unspecified thickness gravel							36 mil Hypalon 36" clay $1x10^{-7}$ cm/s	
Olin Corporation, LA (see pg. D-26)	24" sand, permeability not identified	Drainage net, transmissivity not identified		60 mil HDPE 36" clay		Drainage net, transmissivity not identified		60 mil HDPE 36" clay $1x10^{-7}$ cm/s		Drainage Net, transmissivity not identified			24" clay $1x10^{-7}$ cm/s
Chem Waste Mgmt - Lake Charles, LA (Cells 6 and 7) (see pg. D-27)	12" gravel, 1.6			60 mil HDPE 1'6" clay		Drainage net, transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
U.S. Army Pine Bluff Arsenal, AR (H.W. Mgmt. Landfill Facility) (see pg. D-28)	12" sand, permeability not identified		36 mil Hypalon		12" sand, permeability not identified								36" clay $1x10^{-7}$ cm/s

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR LANDFILLS (Continued)

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
U.S. Army Pine Bluff Arsenal, AR (HW Landfills Nos. 1 & 2) (see pg. D-29)	12" sand, permeability not identified		30 mil Hypalon		12" sand, permeability not identified								36" clay $1x10^{-7}$ cm/s
Chem Waste Mgmt. of Kansas (see pg. D-30)	12" sand (bottom), $1x10^{2}$	Geonet (sides), $5x10^{4}$		60 mil HDPE 18" clay		Geonet, 5×10^{-4}		60 mil HDPE 36" clay $1x10^{-7}$ cm/s		Geonet, $5x10^{4}$	40 mil HDPE		
USPCI - Grassy Mountain, UT (Landfill No 5) (see pg. D-31)		Tensar DN-1, transmissivity not identified	80 mil HDPE			Tensar DN-1, transmissivity not identified	60 mil HDPE			Tensar DN-3, $5x10^{4}$		60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Envirocare of Utah, Inc. (see pg. D-32)		Tensar DN-1, $5x10^{4}$	80 mil HDPE			Tensar DN-1, $5x10^{4}$	60 mil HDPE			Tensar DN-1, $5x10^{4}$		60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
IT Corp. - Imperial Valley, CA (LC-1, LC-2, and LC-3) (see pg. D-33)		Drainage net, transmissivity not identified	80 mil HDPE			Drainage net, transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Chem Waste Mgmt - Kettleman Hills, CA (7 cells) (see pg. D-34)		Geonet, transmissivity not identified	60 mil HDPE			Geonet, transmissivity not identified						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
IT Corp. Petroleum Waste, CA (Landfill 28) (see pg. D-35)		HDPE drainage net, $1x10^{4}$		40 mil PVC 36" clay		HDPE Drainage net[3], $1x10^{4}$	40 mil PVC					40 mil PVC 36" clay	
IT Corp Petroleum Waste, CA (10 other landfill cells) (see pg. D-36)		HDPE drainage net, $6x10^{4}$		80 mil HDPE 36" clay		HDPE Drainage net[3], $6x10^{4}$	80 mil HDPE					80 mil HDPE 36" clay $1x10^{-7}$ cm/s	

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR LANDFILLS (Continued)

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
U.S. Ecology, Inc. - Nevada Chem Site (see pg. D-37)		Tensar DN-3, $7x10^{-4}$	80 mil HDPE			Tensar DN-3, $7x10^{-4}$		100 mil HDPE 6" bentonite 6" soil			40 mil HDPE		
Envirosafe Services of Idaho (Trenches 5 and 14) (see pg. D-38)			80 mil HDPE		12" gravel, $1x10^{-2}$ (Trench 5) $1x10^{-1}$ (Trench 14)							60 mil HDPE 36" clay $1x10^{-7}$ cm/s	
Chem Waste Mgmt of Northwest, OR (L-12 and L-13) (see pg. D-39)				60 mil HDPE 18" clay		Synthetic drainage material, $3x10^{-4}$						60 mil HDPE 36" clay $1x10^{-7}$ cm/s	

[1] 36" compacted clay is placed on top of 60 mil HDPE FML.

[2] LDS is located below second liner system

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR SURFACE IMPOUNDMENTS

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
Union Carbide Corp. - Sisterville, WV (see pg. D-40)			100 mil HDPE		12" sand, no permeability identified							100 mil HDPE 24" clay $1x10^{-7}$ cm/s	
American Cyanimid Co. - Willow, WV (see pg. D-41)	12" sand, $1x10^{-2}$		80 mil HDPE		12" sand, $1x10^{-2}$ (bottom only)	4mm thick HDPE drainage net (sides only) Permeability $6x10^{-2}$ cm/s						80 mil HDPE 24" clay	
American Cyanimid Co , FL (see pg. D-43)			45 mil Hypalon		1" gravel [gravel + drainage net = $1x10^{-2}$]	7" Mirafi 140N drainage net						30 mil PVC Thickness, clay not identified	
Olin Chemicals Corp. - Charlestown, TN (see pg. D-44)	4" 78 gravel 4" concrete sand 4" 78 gravel			Soil Liner only 3' compacted soil 1' enhanced soil 1' compacted soil	4" concrete sand, $1x10^{-2}$ 8" gravel, $1x10^{-2}$								5" enhanced soil $1x10^{-8}$ cm/s 5' compacted soil $1x10^{-4}$ cm/s
AKZO Chem American, AL (see pg. D-45)			36 mil Hypalon		Thickness not identified[1], gravel $1x10^{-2}$			30 mil Hypalon 1' clay			Thickness not identified, polyethylene		
Allied Signal Inc. - Metropolis, IL (see pg. D-46)					Alternative System	Alternative System						Thickness of FML not identified, rubber 15' clay	
Rhone-Poulenc Basic Chemical Co. (Stauffer), LA (2 impoundments) (see pg. D-47)			36 mil Hypalon		10" sand, Permeability not identified							20 mil PVC Clay thickness not identified, Clay $1x10^{-7}$ cm/s	
Agricultural Minerals Corp - Verdigris, OK (see pg. D-48)			60 mil HDPE		6" sand (bottom only), permeability not identified	Filtration cloth (sides only), transmissivity not identified					20 mil PVC		
USPCI Grassy Mountain Facility, UT (see pg. D-49)			80 mil HDPE			Tensar DN-3 Drainage net, $5x10^{-4}$	100 mil HDPE			Geonet, Transmissivity not identified			3' clay

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR SURFACE IMPOUNDMENTS (Continued)

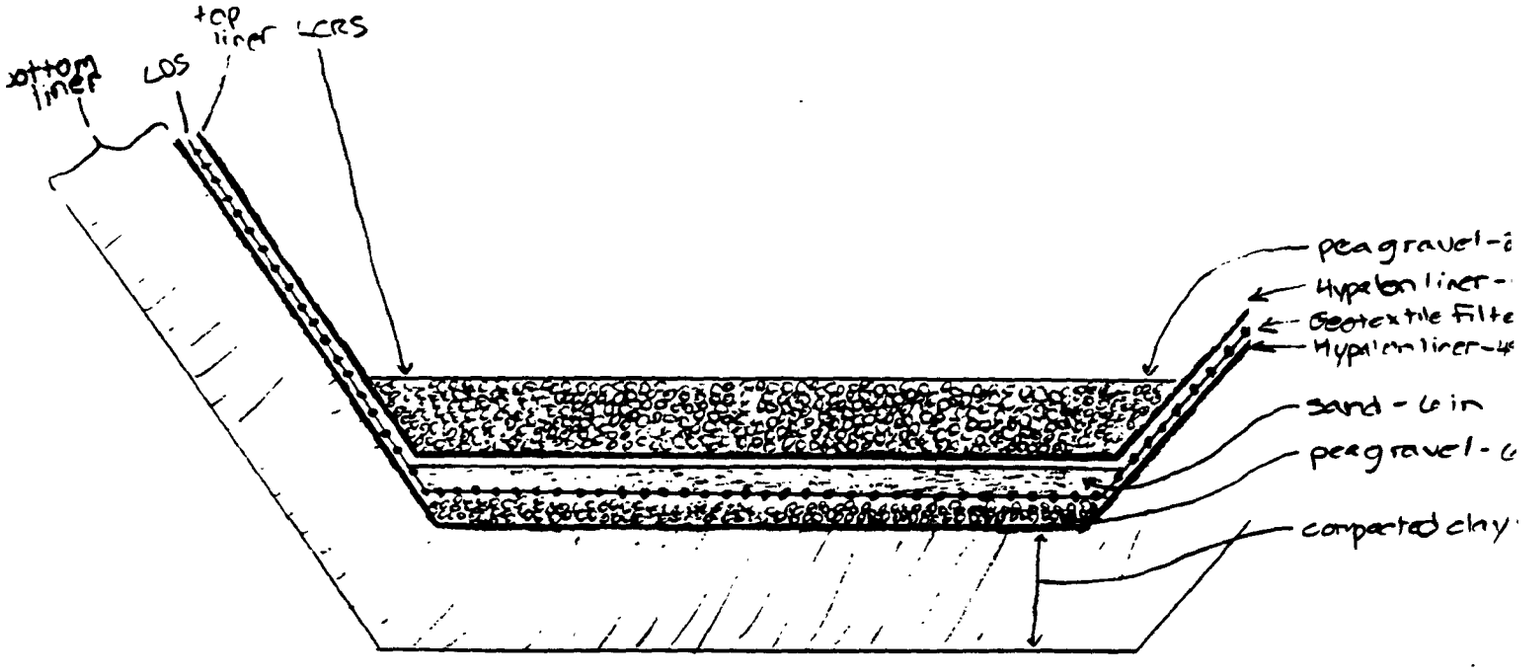
Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
Chem Waste Mgmt - Kettleman, CA (15 impound-ments) (see pg. D-50)				60 mil HDPE 1'6" clay		Geonet Drainage layer						60 mil HDPE 3' clay	
Envirosafe Services of Idaho (Evaporation Ponds 2 and 3) (see pg. D-51)			80 mil HDPE		12" gravel, $1x10^{1}$							60 mil HDPE 3' clay $1x10^{-7}$ cm/s	
Envirosafe Services of Idaho (Evaporation Pond 1 and Collection Ponds 1, 2, and 3) (see pg. D-52)			60 mil HDPE		12" gravel, $1x10^{2}$						40 mil HDPE		
Chem Waste Mgmt. of Northwest, OR (Surface Impoundments P-A, P-B, and P-C) (see pg. D-53)				80 mil HDPE 1'6" clay		2 layers of geonet, $3x10^{4}$	60 mil HDPE			Geonet, $3x10^{4}$		60 mil HDPE 3' clay $1x10^{-7}$ cm/s	

[1] LDS is located beneath second liner system.

SUMMARY OF LINER AND LEAK DETECTION SYSTEMS FOR WASTE PILES

Facility Name	Top LCRS		Top Liner System		Leak Detection System		Second Liner System		Second LDS		Bottom Liner System		
	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Granular Thickness, Perm. (cm/s)	Synthetic Transmissivity (m^2/s)	FML Only Thickness, Type	FML Over Soil Thickness, Type	Soil Only Thickness, Type
Envirosafe of Ohio (see pg. D-54)	6" sand, Permeability not identified		80 mil HDPE		Thickness not identified, sand							80 mil HDPE 3' clay	
Burlington Northern Tie Plant, MN (see pg. D-55)	6" gravel 18" sand Permeability not identified											100 mil HDPE 4' clay	
Burlington Northern Tie Plant - Paradise, MT (see pg. D-56)	12" pea gravel 12" sand, Permeability not identified		100 mil HDPE			Synthetic drainage grid, Transmissivity not identified						40 mil HDPE 3' clay	

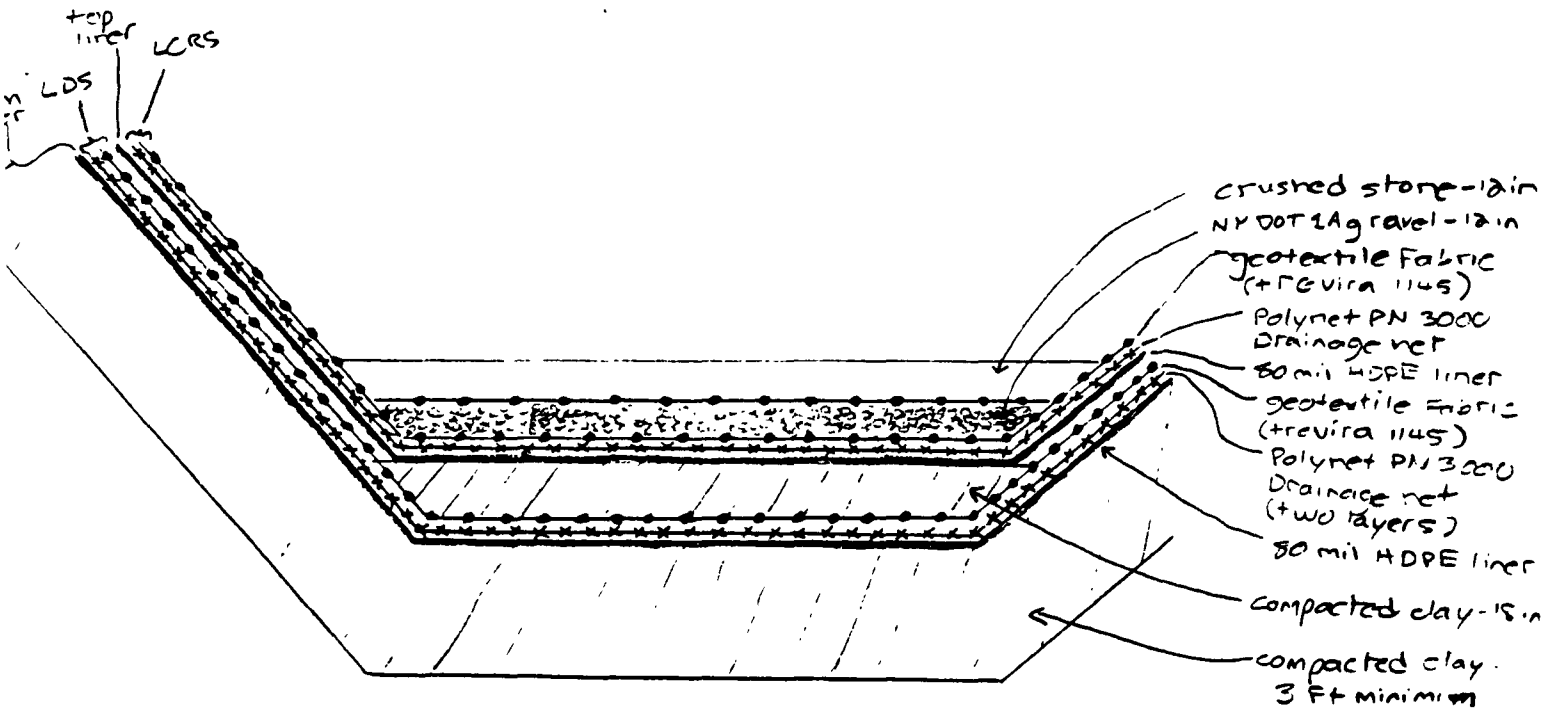
Dupont - Deepwater, NJ
(Landfill)



Key:

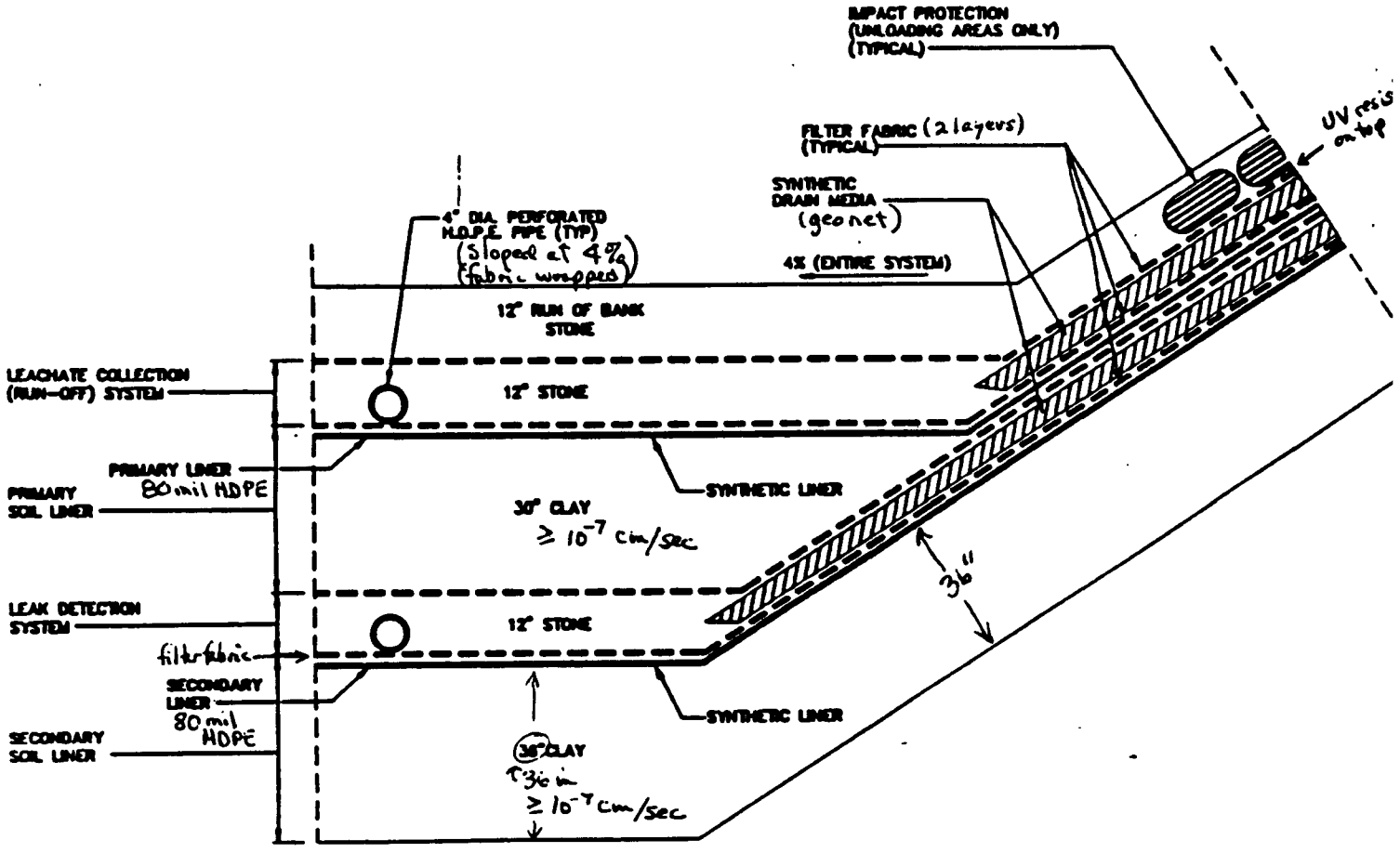
- Hypalon membrane
- geotextile
- compacted clay
- pea gravel (hydraulic conductivity $\geq 1 \times 10^{-2} \frac{cm}{s}$
- sand

Chem Waste Management - Model City, NY
(Landfill)



Key:

- HDPE liner
- geotextile
- geonet (transmissivity $1 \times 10^{-3} m^2/s$)
- compacted clay
- NY DOT gravel (conductivity ≥ 0.5 cm/s)
- crushed stone



LINER / SIDE SLOPE PROTECTION DETAIL

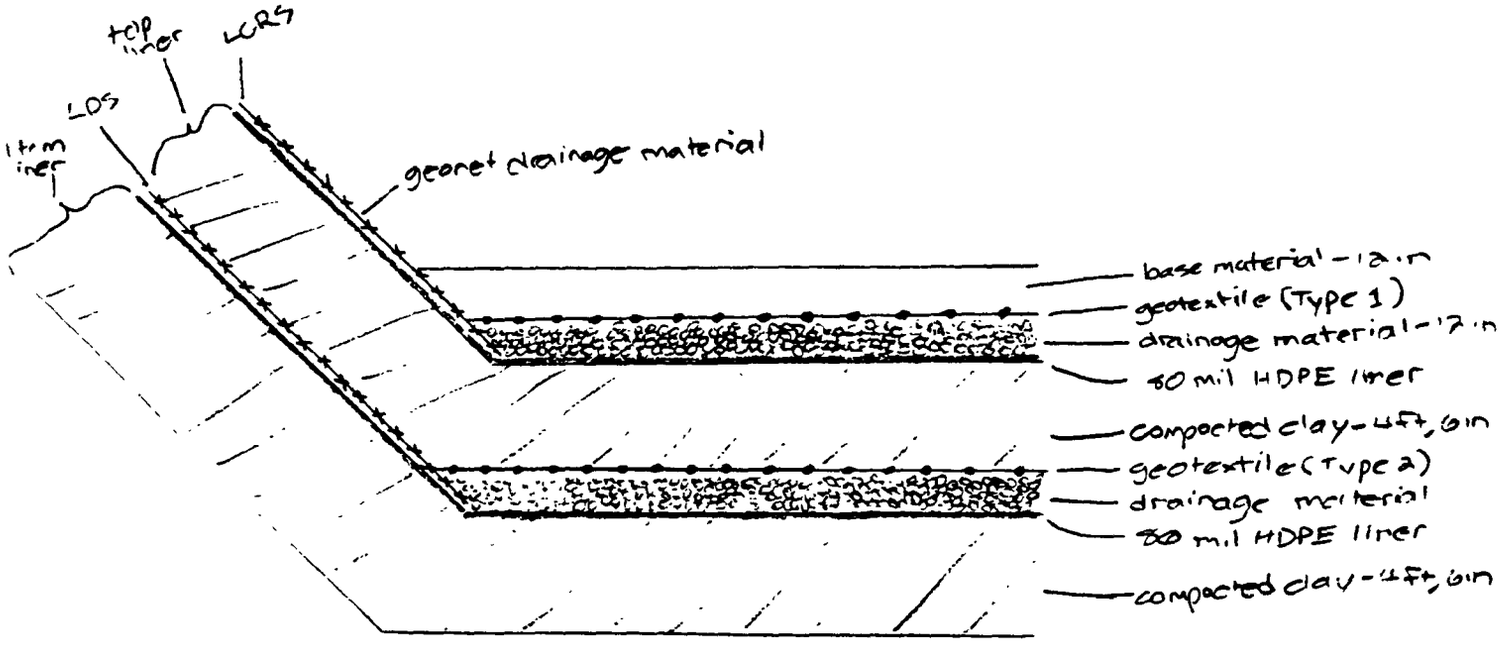
GENERAL ELECTRIC

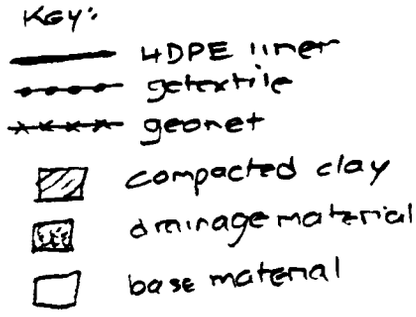
SILICONE PRODUCTS DIVISION WATERFORD NEW YORK, 12188

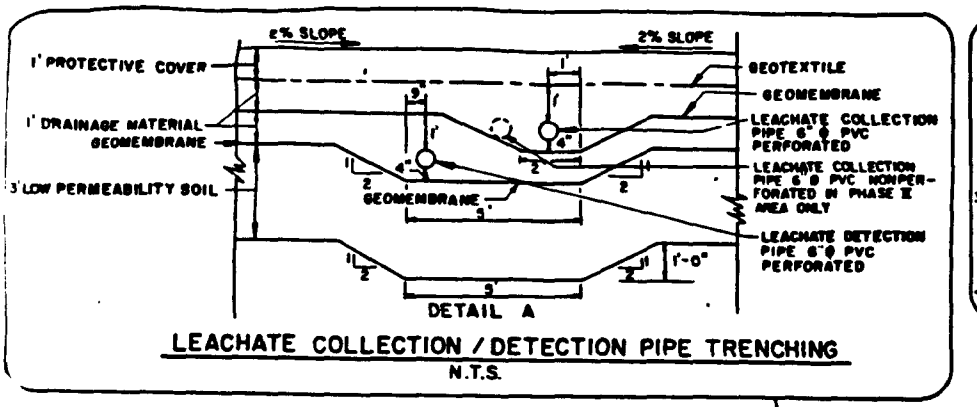
LANDFILL NO 6

BOTTOM LINER SYSTEM

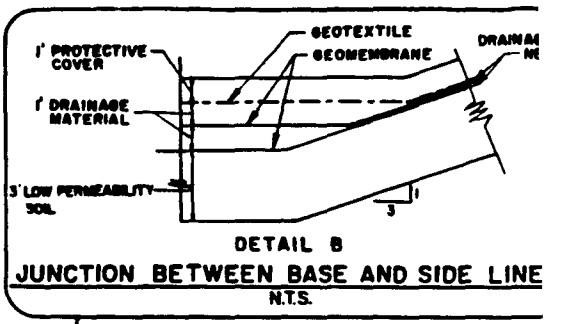
BFI/CECOS - Niagara Falls, NY
(Landfill No. 6)



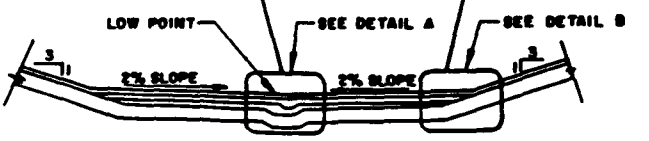




LEACHATE COLLECTION / DETECTION PIPE TRENCHING
N.T.S.



JUNCTION BETWEEN BASE AND SIDE LINE
N.T.S.

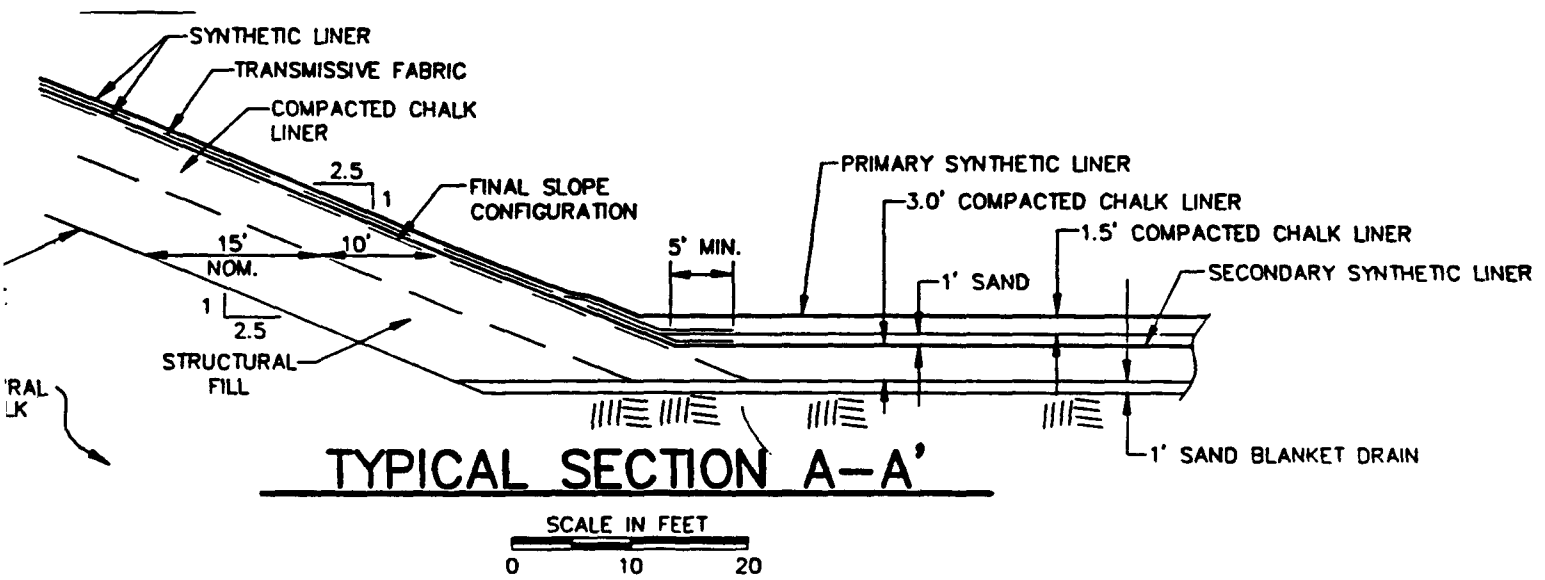


TYPICAL LINER CROSS-SECTION
N.T.S

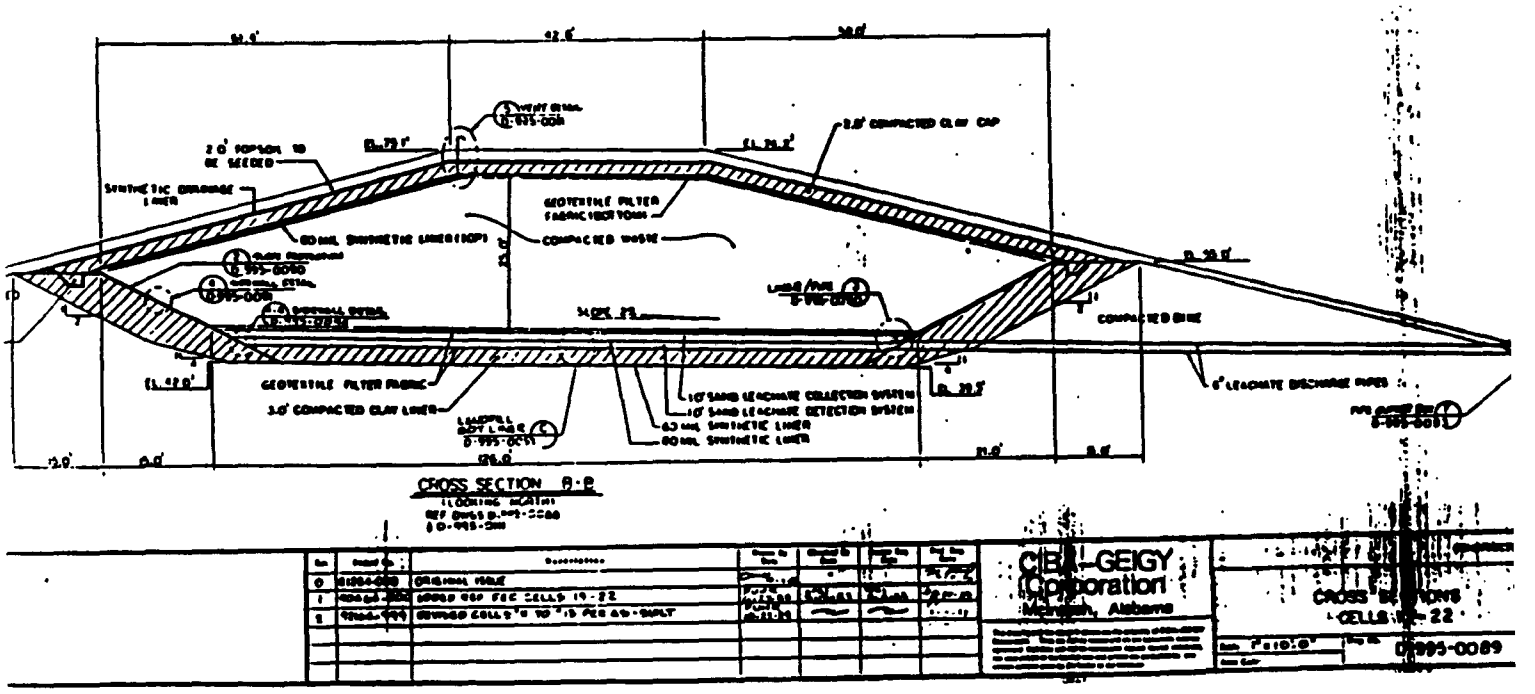
NOTES: 1.- REMOVE DRAINAGE NET IN AREAS WHERE BOTTOM DRAINAGE BERM CONTACTS SIDE LINER SYSTEM

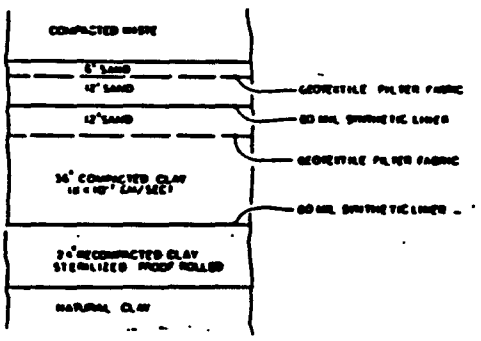
BETHLEHEM STEEL CORPORATION

Chem Waste Management - Emelle, AL
(Landfill)

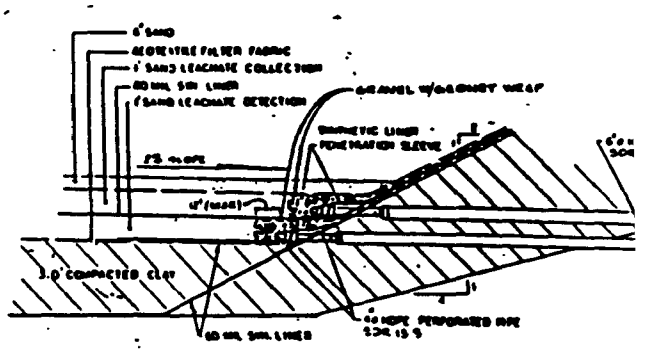


CIBA-GEIGY Corporation - McIntosh, AL
(Landfill No. 1)

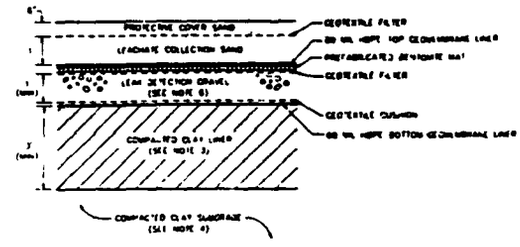




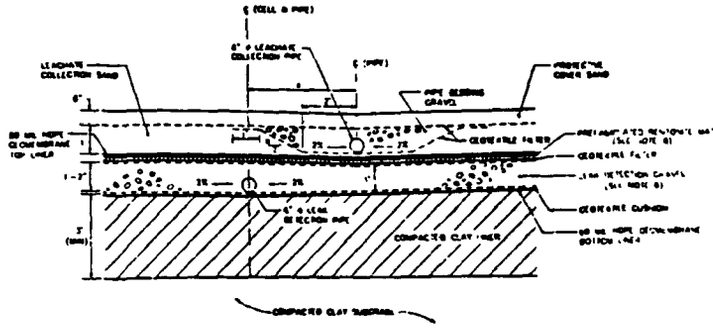
DETAIL (C)
LANDFILL BOTTOM LINER



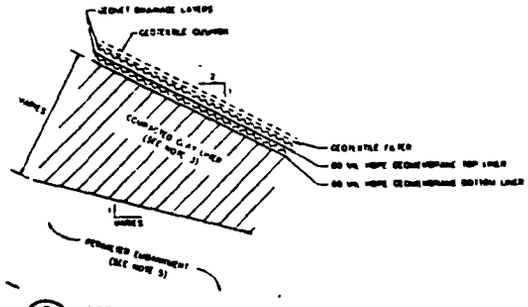
DETAIL (3)
LINER/PIPE INTERFACE



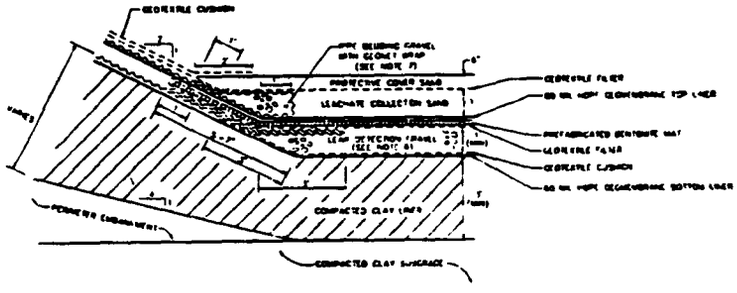
1 DETAIL
LINER SYSTEM ON BASE OF LANDVAULT



4 DETAIL
6 LEACHATE COLLECTION PIPE AND LEAK DETECTION PIPE



2 DETAIL
LINER SYSTEM ON SIDE SLOPE OF LANDVAULT

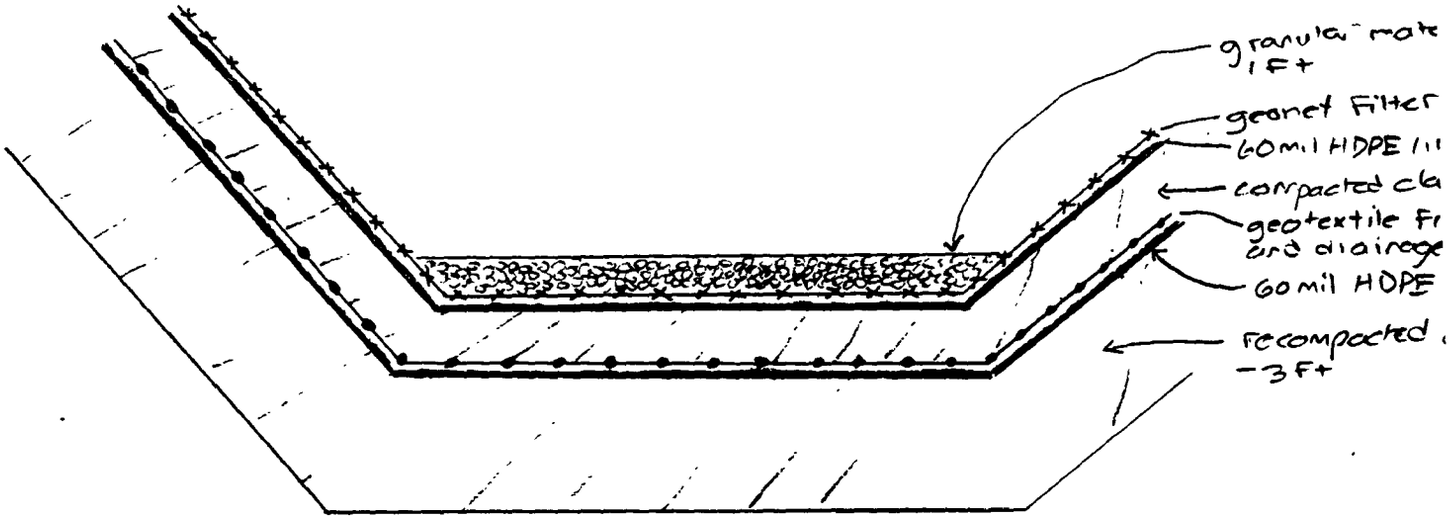


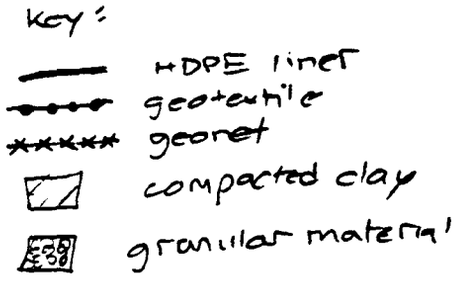
3 DETAIL
LINER SYSTEM TRANSITION AT TOE OF SIDE SLOPE

NOTES

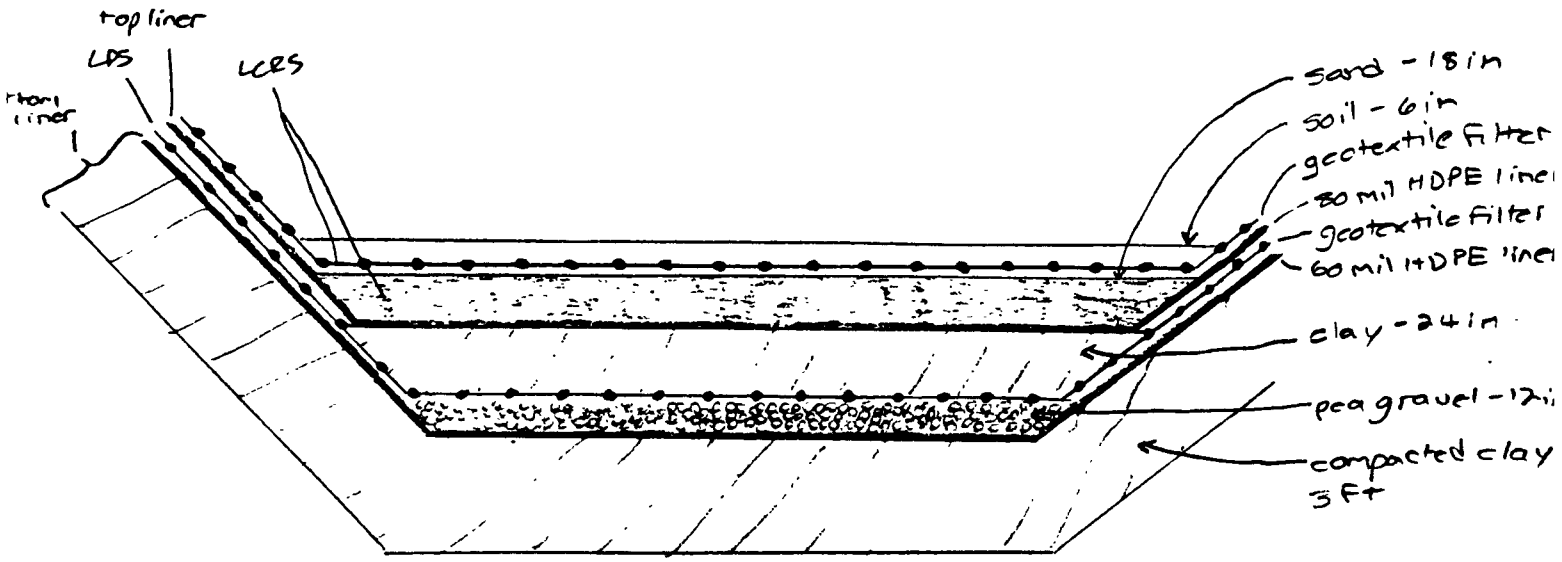
1. DETAILS ARE SHOWN TO THE SCALE NOTED EXCEPT FOR THE GEOMEMBRANES. THESE ARE SHOWN WITH EXAGGERATED THICKNESS FOR CLARITY.
2. THE PERSONNEL MANUFACTURERS AND PRODUCTS DESCRIBED IN THE LINER SYSTEM AND COVER SYSTEM COMPONENT SCHEDULE MAY MEET THE DETAILED MATERIAL REQUIREMENTS OF THE PROJECT SPECIFICATIONS AND ARE LISTED HEREIN FOR CONVENIENCE ONLY. FOR ALL MATERIALS, IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO SHOW STRICT COMPLIANCE OF THE PRODUCTS WITH THE PROJECT SPECIFICATIONS. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE QUALITY CONTROL CERTIFICATES THAT DEMONSTRATE STRICT COMPLIANCE.
3. THE COMPACTED CLAY LINER WILL BE PLACED IN 6 in. LIFTS AND COMPACTED TO AT LEAST 95% OF THE CLAY'S MAXIMUM DRY DENSITY, AS DETERMINED BY THE STANDARD PROCTOR COMPACTION TEST (ASTM D-698), AT A MOISTURE CONTENT EQUAL TO OR GREATER THAN 95% STANDARD PROCTOR OPTIMUM WATER CONTENT. THE MAXIMUM HYDRAULIC CONDUCTIVITY OF THE COMPACTED CLAY LINER WILL BE 1×10^{-7} cm/s. THE TOP SURFACE OF THE COMPACTED CLAY LINER WILL BE GRADED WITH GRANULAR SOIL SMOOTH OR APPROVED EQUAL, APPLIED AT A RATE OF 30 Pa/cm OR AS SPECIFIED BY THE MANUFACTURER.
4. WITHIN THE FOOTPRINT OF THE OVERHEAD LINERS OF THE PERIMETER EMBANKMENT, THE ON-SITE NATIVE SOILS WILL BE EXCAVATED TO THE DEPTH OF REMOVAL OF SOFT CLAY AS REQUIRED BY THE PROJECT SPECIFICATIONS. THE OVEREXCAVATED AREA WILL BE BACKFILLED TO THE GRADE OF THE BOTTOM OF THE COMPACTED CLAY LINER AND BOTTOM OF THE PERIMETER EMBANKMENT WITH A COMPACTED CLAY SUBGRADE MATERIAL MEETING THE PROJECT SPECIFICATIONS. THE CLAY SUBGRADE WILL BE PLACED IN 6 in. COMPACTED INCREMENTED LIFTS AND COMPACTED TO AT LEAST 95% OF THE SUBGRADE SOIL'S MAXIMUM DRY DENSITY, AS DETERMINED BY THE STANDARD PROCTOR COMPACTION TEST (ASTM D-698), AT A MOISTURE CONTENT EQUAL TO OR GREATER THAN 95% STANDARD PROCTOR OPTIMUM WATER CONTENT.
5. THE PERIMETER EMBANKMENT WILL BE CONSTRUCTED USING EITHER COHESIVE OR GRANULAR FILL MATERIALS MEETING THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS. COHESIVE FILL MATERIAL WILL BE COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DRY DENSITY AS MEASURED BY THE STANDARD PROCTOR COMPACTION TEST (ASTM D-698). GRANULAR FILL MATERIAL WILL BE COMPACTED TO A MINIMUM RELATIVE DENSITY OF 85% AS DETERMINED BY ASTM D-3999.
6. DUE TO THE 4% OFFSET BETWEEN THE LEACHATE COLLECTION AND LEAK DETECTION PIPES, THE THICKNESS OF THE LEAK DETECTION GRAVEL VARIES FROM 1' TO 1'-2" BETWEEN THE CENTERLINES OF THE PIPES. THIS RESULTS IN A LEAK DETECTION GRAVEL THICKNESS OF 1' ON ONE SIDE OF THE BASE OF EACH LANDVAULT CELL AND 1'-2" ON THE OTHER SIDE.
7. THE PIPE BEDDING GRAVEL WITH GEONET DRAIN WILL BE TOP-SIZED TO THE LEACHATE COLLECTION PIPE BEDDING GRAVEL THROUGH AN OPENING IN THE GEOTEXTILE FILTER THAT SEPARATES THE LEACHATE COLLECTION SAND FROM THE PIPE BEDDING GRAVEL.
8. THE PREFABRICATED BENTONITE MAT WILL BE PLACED IN AN OVERLAPPED STEP AND WILL BE KEPT IN AN UNHYDRATED STATE UNTIL THE LEACHATE COLLECTION SAND IS PLACED OVER IT.

Adams Center Landfill, IN
(Landfill)





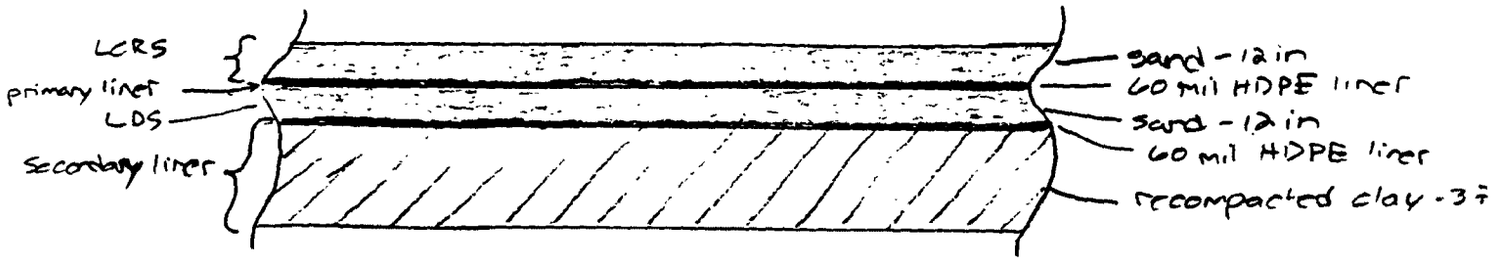
Envirosafe of Ohio
(Landfill)



Key:

- HDPE liner
- geotextile
- clay
- sand
- pea gravel
- soil

Peoria Disposal, IL
(Landfill C-1)



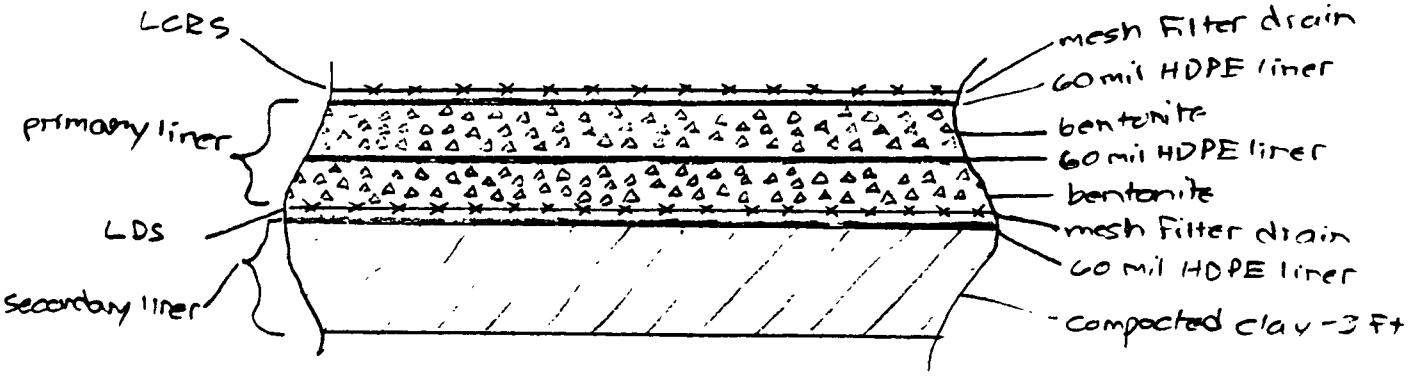
Key:

HDPE liner

recompacted clay

sand

Peoria Disposal, IL
(Landfill C-2)



Key:

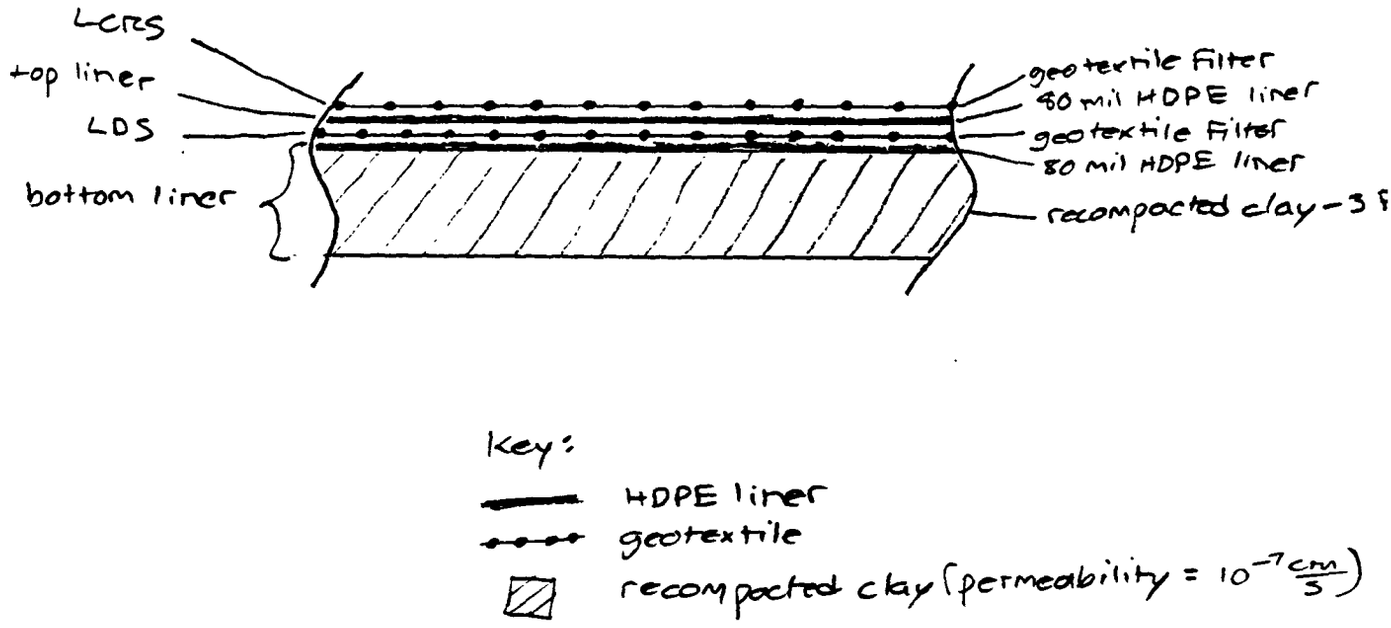
HDPE liner

mesh Filterdrain

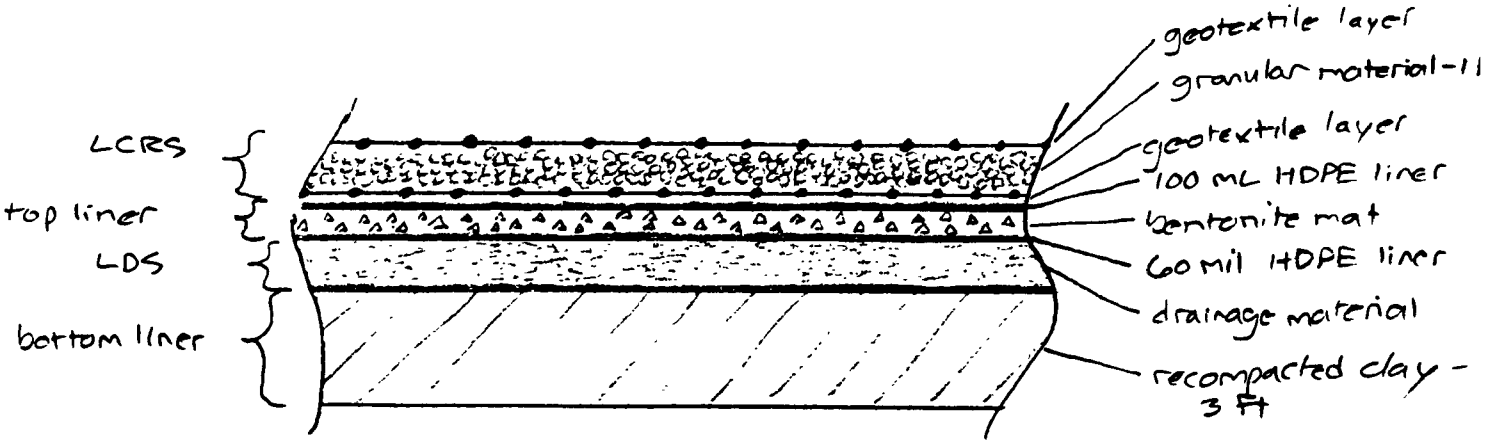
compacted clay

bentonite

BFI/CECOS, IL
(Landfill)



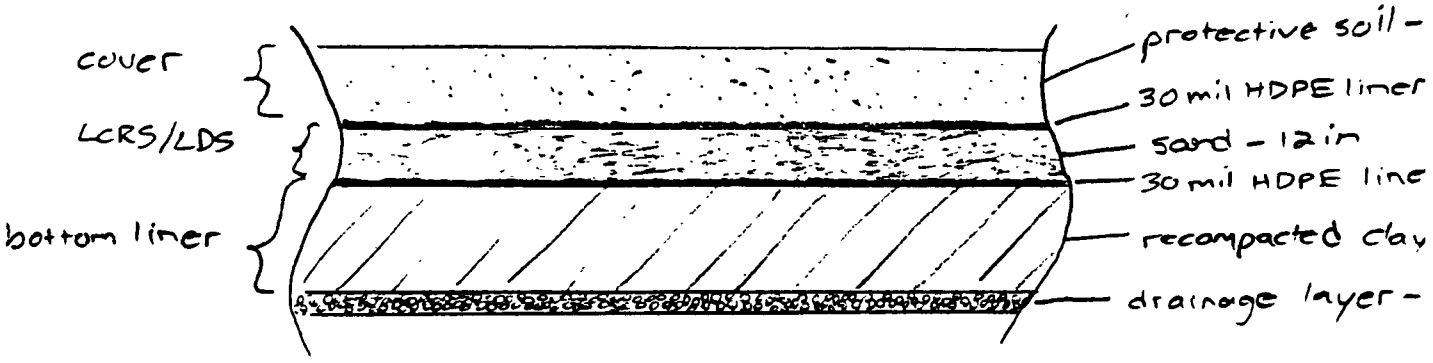
CID Landfill, IL
(Landfill)

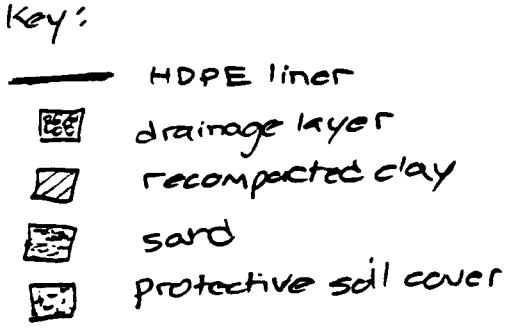


Key:

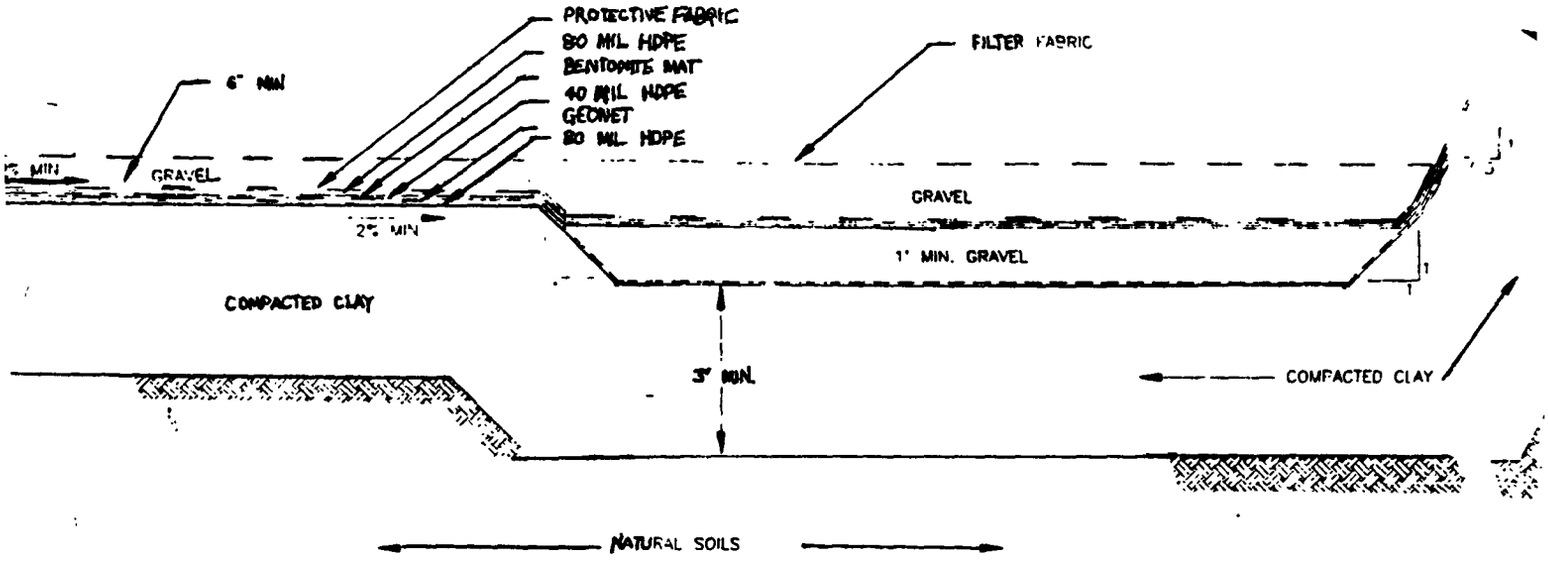
- HDPE liner
- geotextile
- recompacted clay (permeability = $1.9 \times 10^{-8} \frac{cm}{s}$)
- drainage material
- bentonite
- granular material

Heritage Environmental Services, IN
(Landfill)

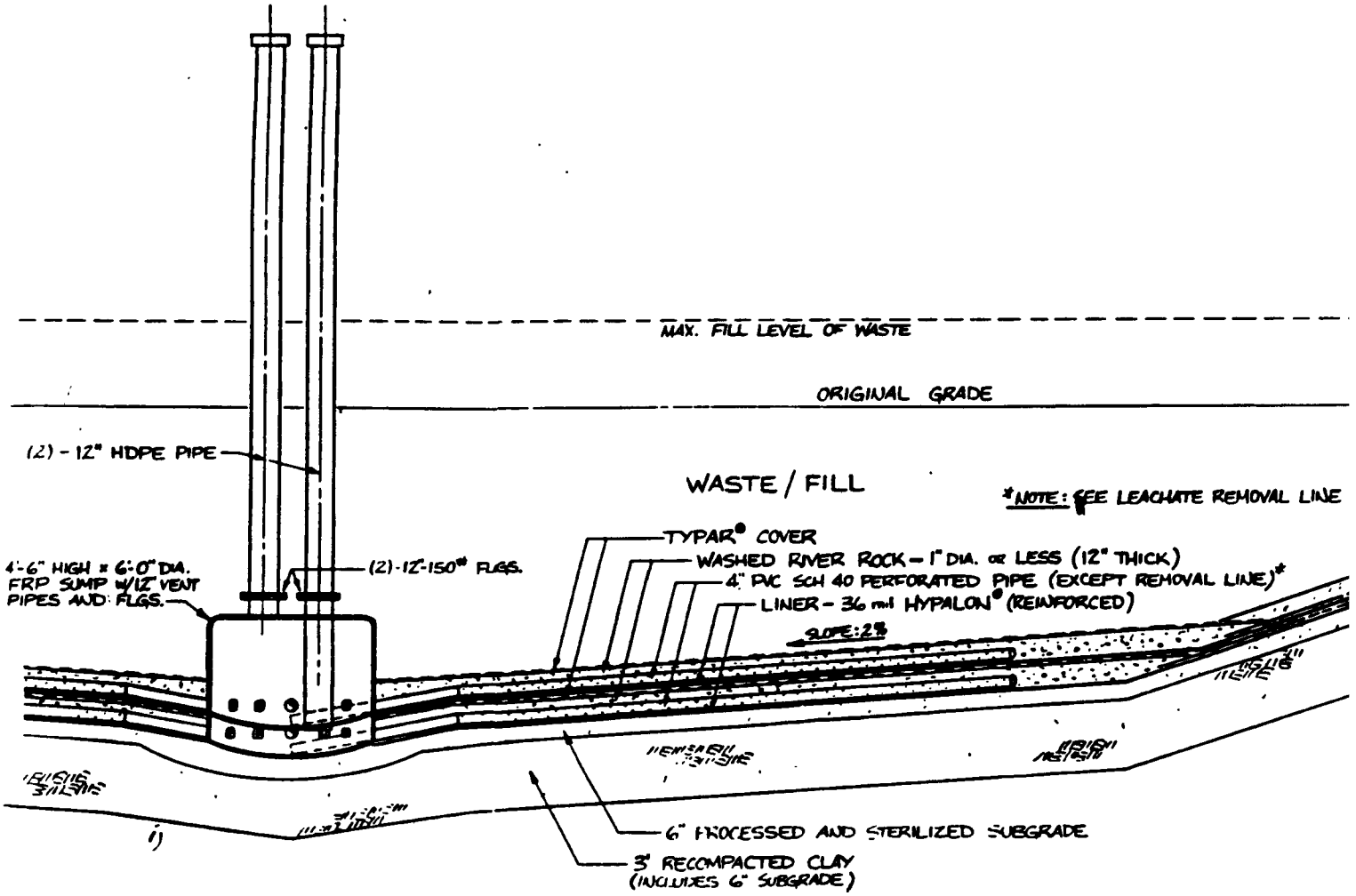




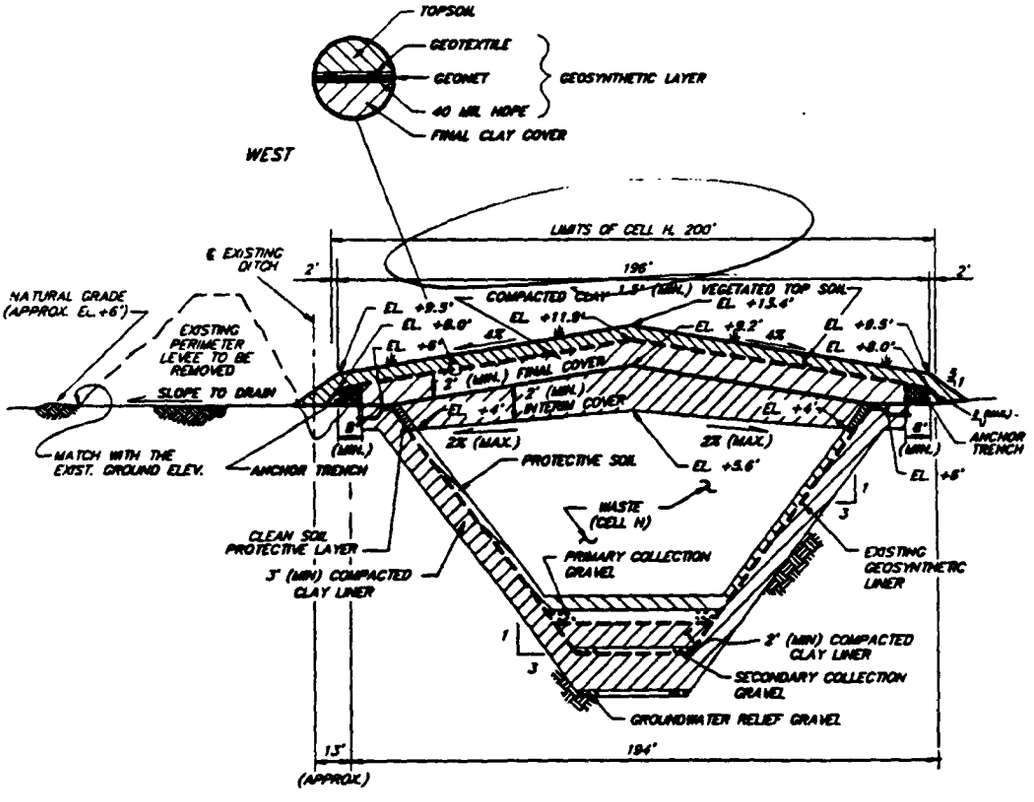
Texas Ecologists, Inc., TX
(5 Cells)



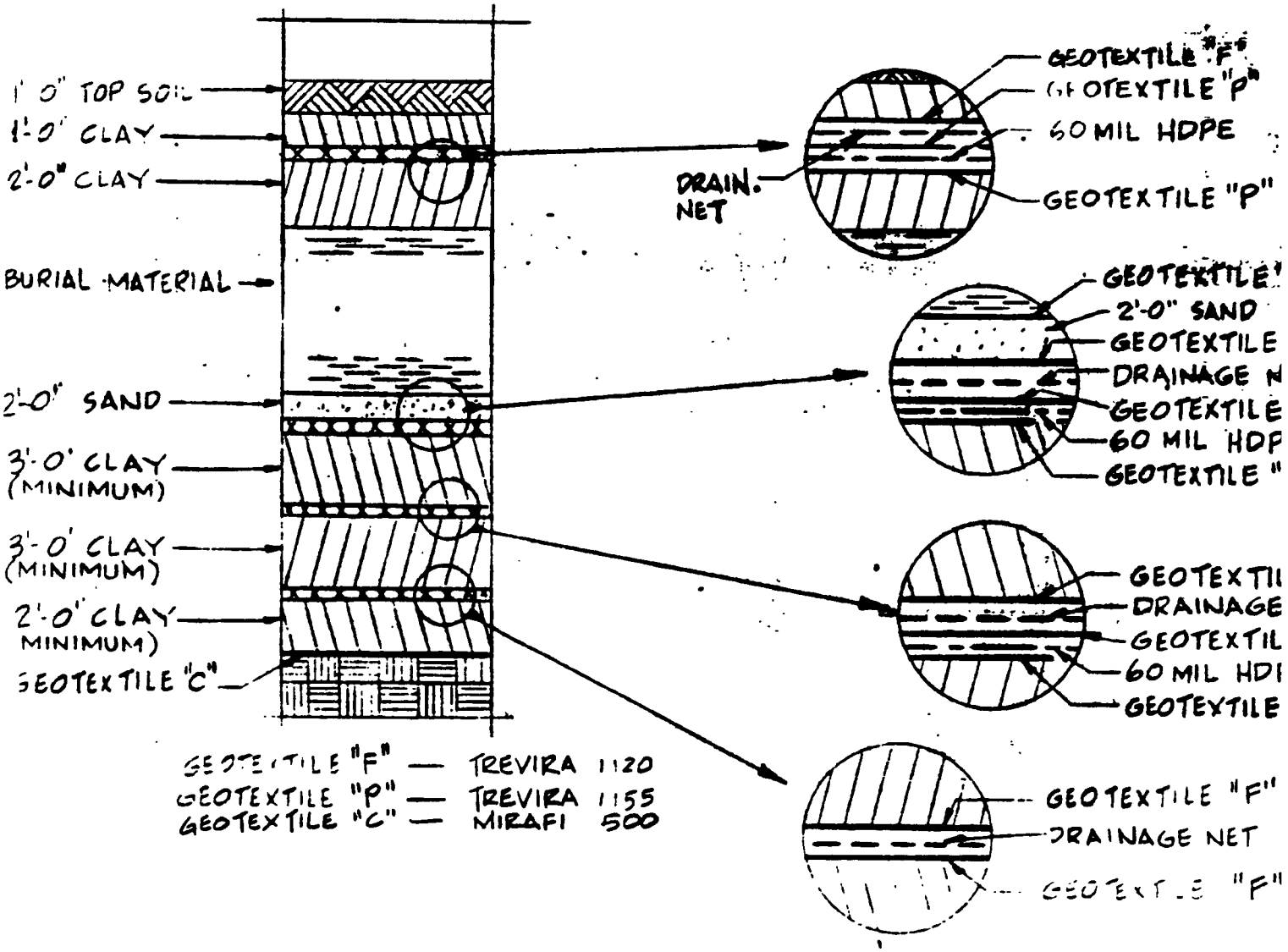
Dupont - Victoria, TX
(Landfill)



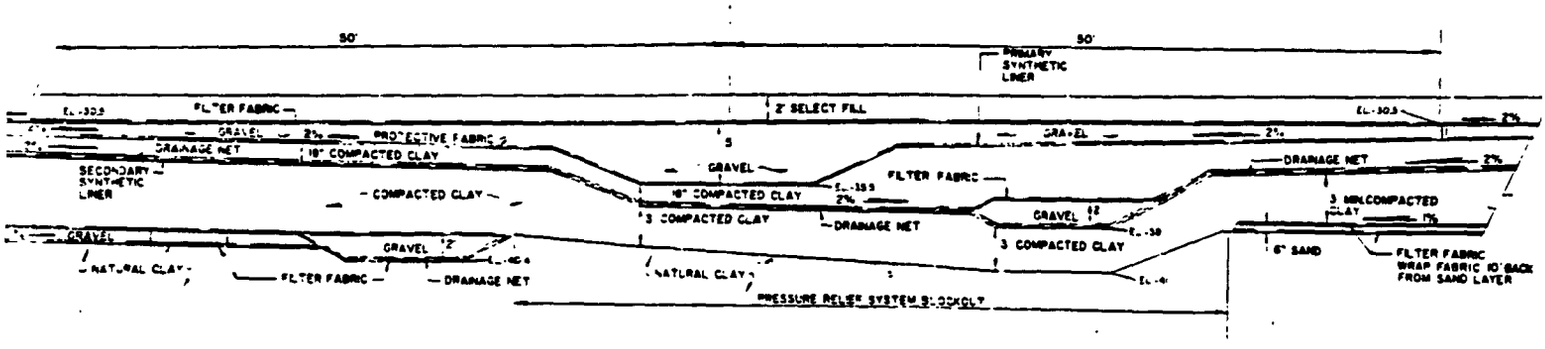
Gulf Coast Waste Disposal, TX
(Landfill)



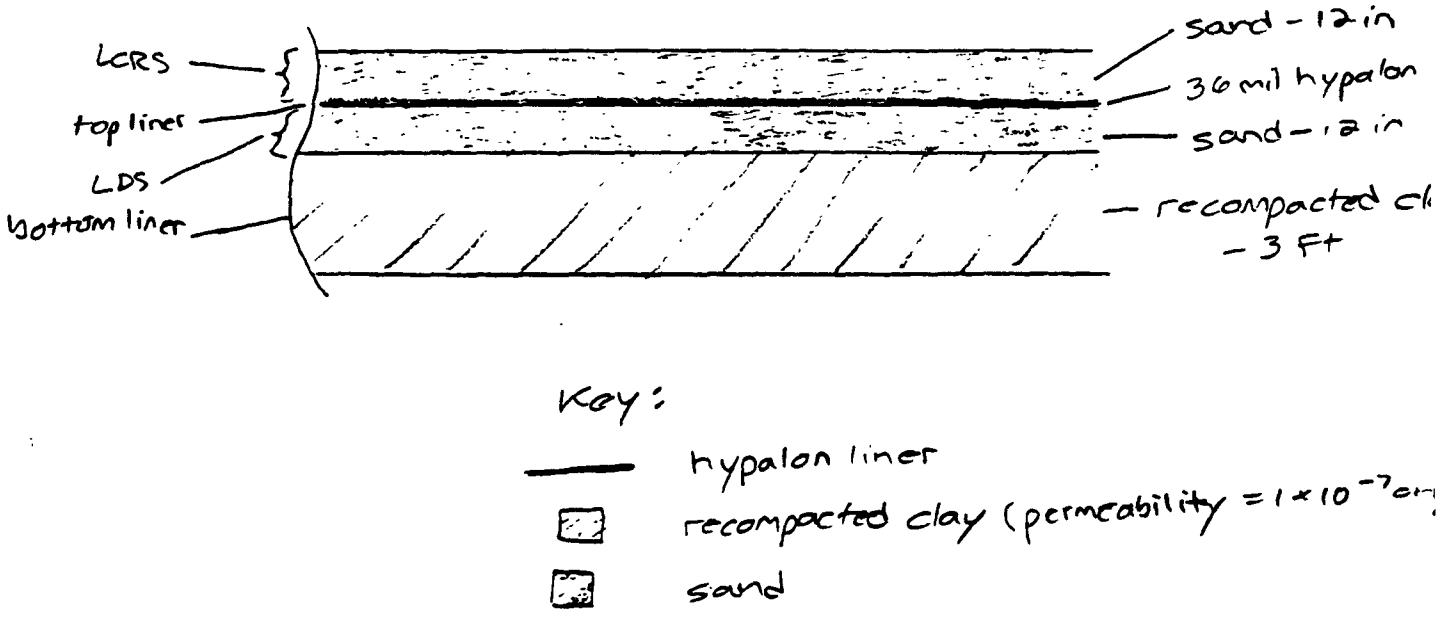
Olin Corporation, LA
(Landfill)

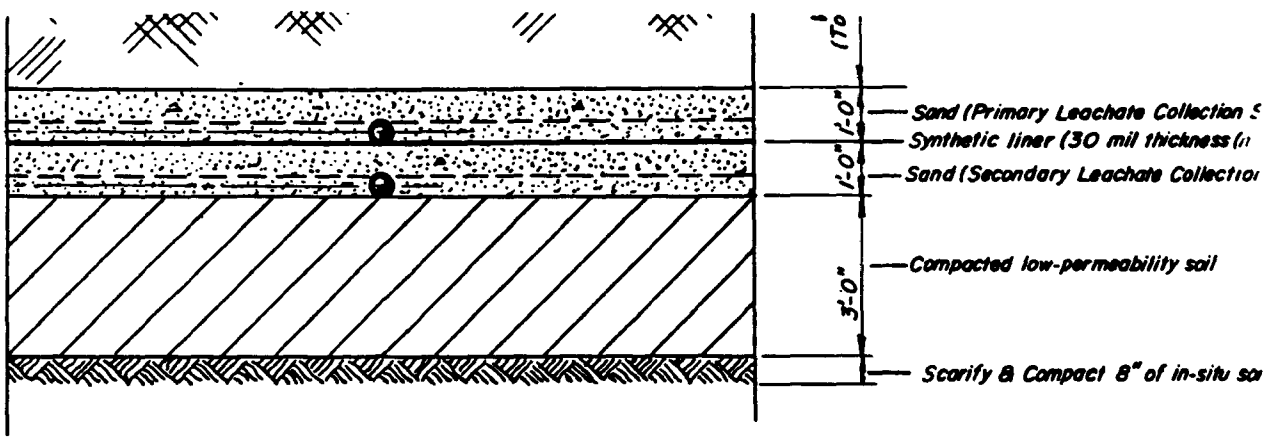


Chem Waste Management - Lake Charles, LA
(Cells 6 and 7)



U.S. Army Pine Bluff Arsenal, AR
(Hazardous Waste Management Landfill Facility)

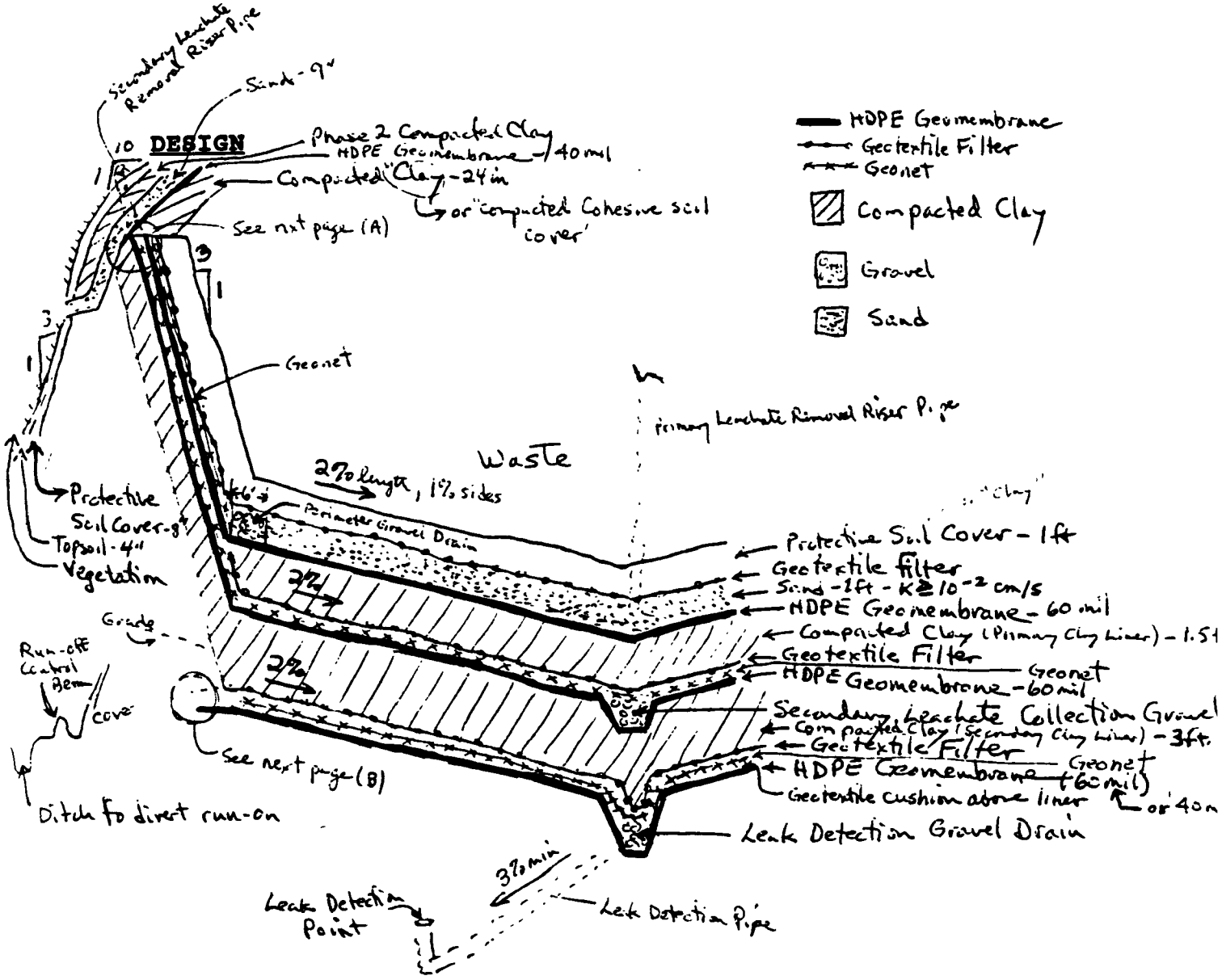


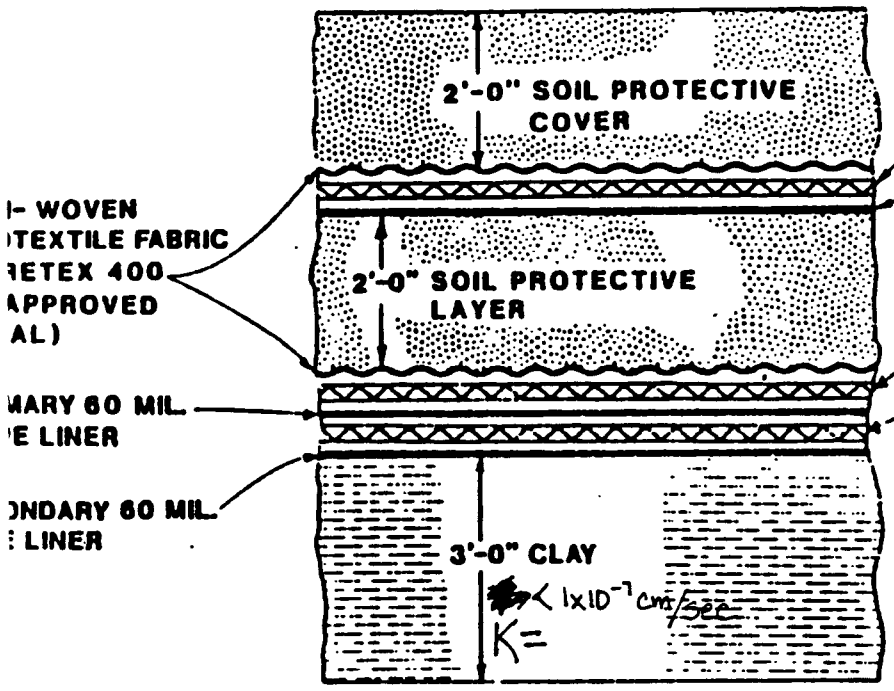


CELL BOTTOM LINER AND FINAL COVER SYSTEM DETAILS

NO SCALE

Chem Waste Management of Kansas, Inc.
(Landfill)





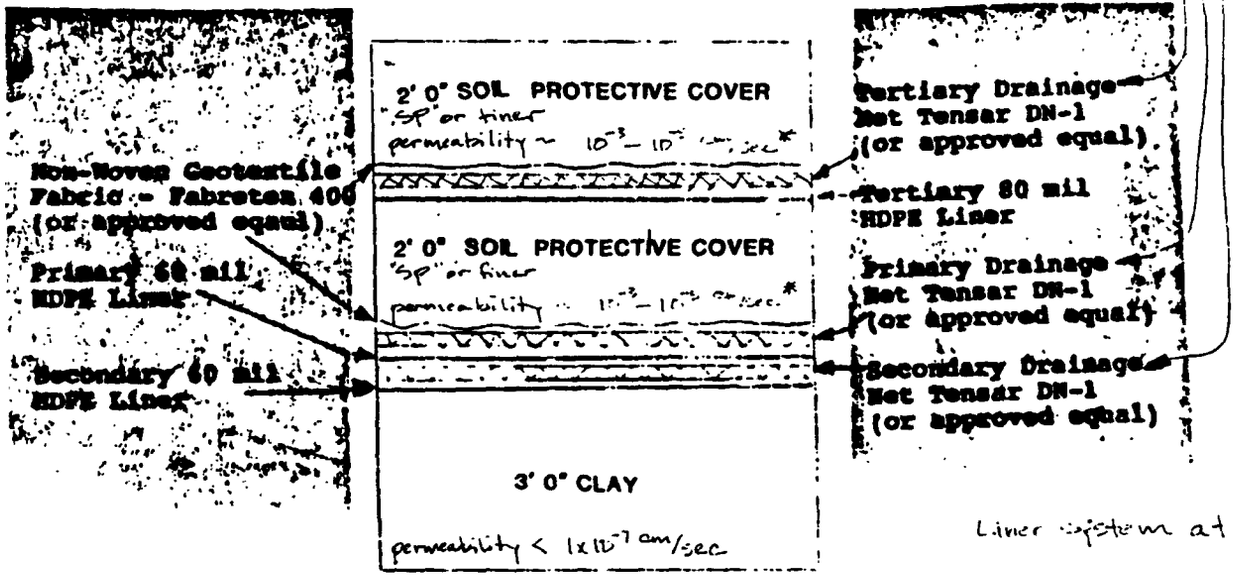
NOTE:

PRIOR TO PLACEMENT OF HDPE LINER, SUBGRADE WILL BE GRADED EVENLY SO AS TO BE FREE OF VOIDS AND SUDI BREAKS IN GRADE. CLAY SURFACE WIL CLEARED OF ALL MATERIALS THAT MA PUNCTURE LINER.

Minimum slope of 2% after settlement for each component

Envirocare of Utah, Inc.
(Landfill)

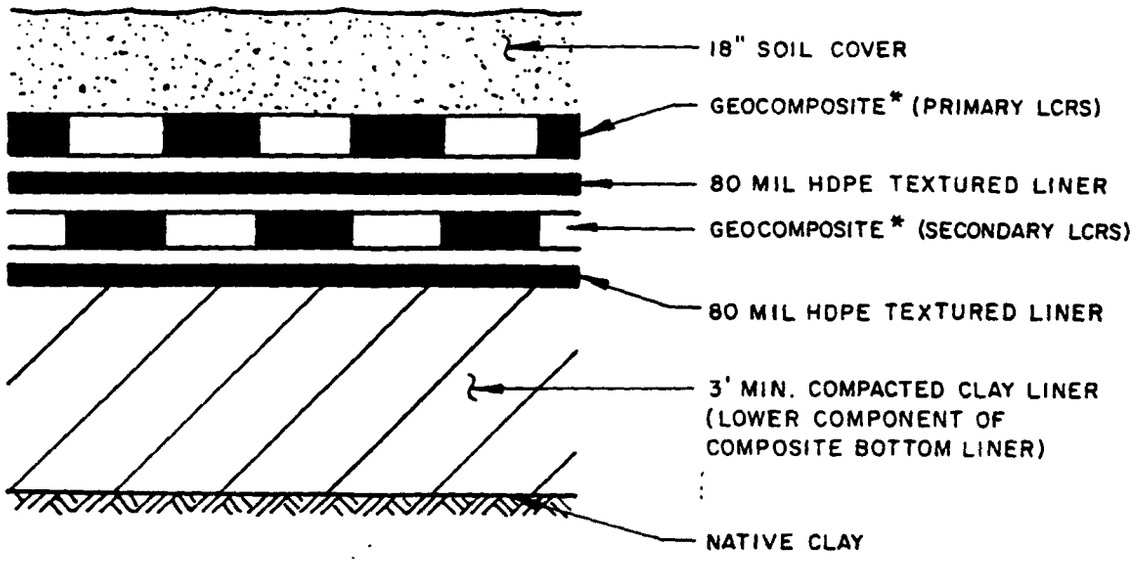
Leak Detection / Collection / Removal layers
Transmissivity = 5×10^{-4} m²/sec



Liner system at a minimum 2%

* Fetter, C.W. Applied Hydrology. 2nd Edition. 1988

IT Corp. - Imperial Valley, CA
(LC-1, LC-2, and LC-3)



*GEOCOMPOSITE CONSISTS OF A DRAINAGE NET WITH GEOTEXTILE FUSED TO BOTH SIDES

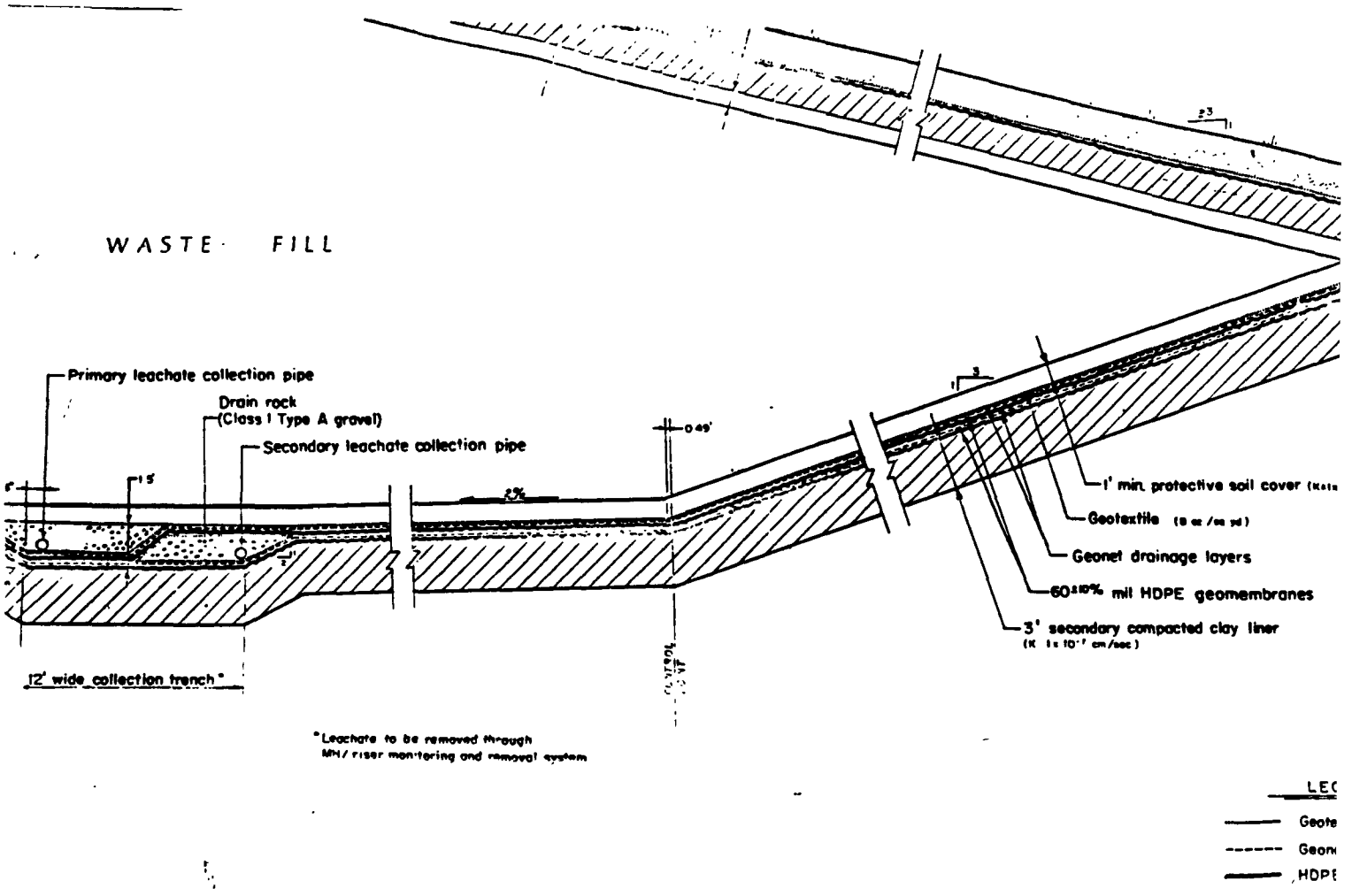
NOT TO SCALE

FIGURE Da-1

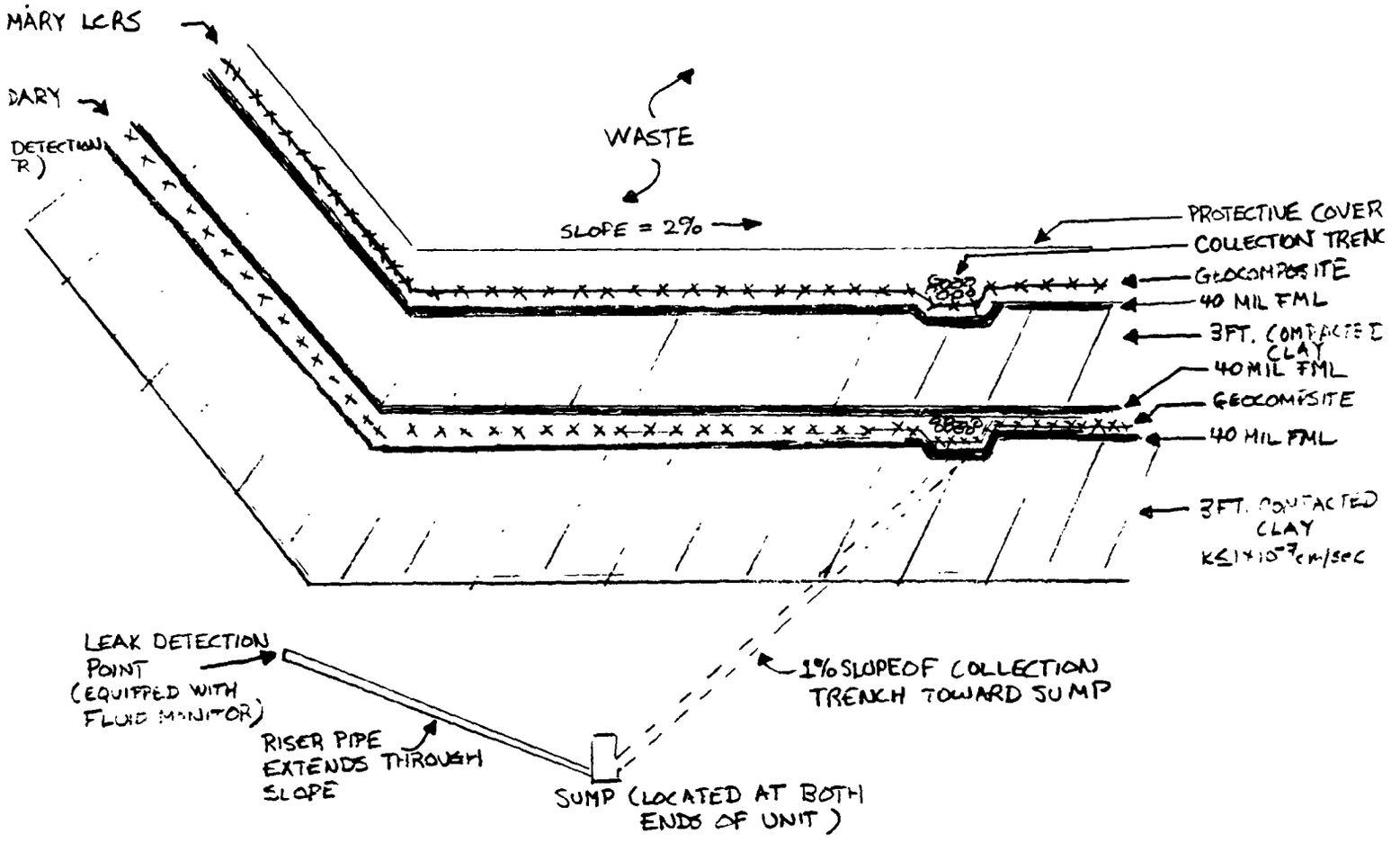
TYPICAL LINER SYSTEM
CROSS SECTION
WASTE MANAGEMENT UNITS LC-2 & LC-3

IT CORPORATION IMPERIAL VALLEY FACILITY

Chem Waste Management - Kettleman Hills, CA
(7 Cells)

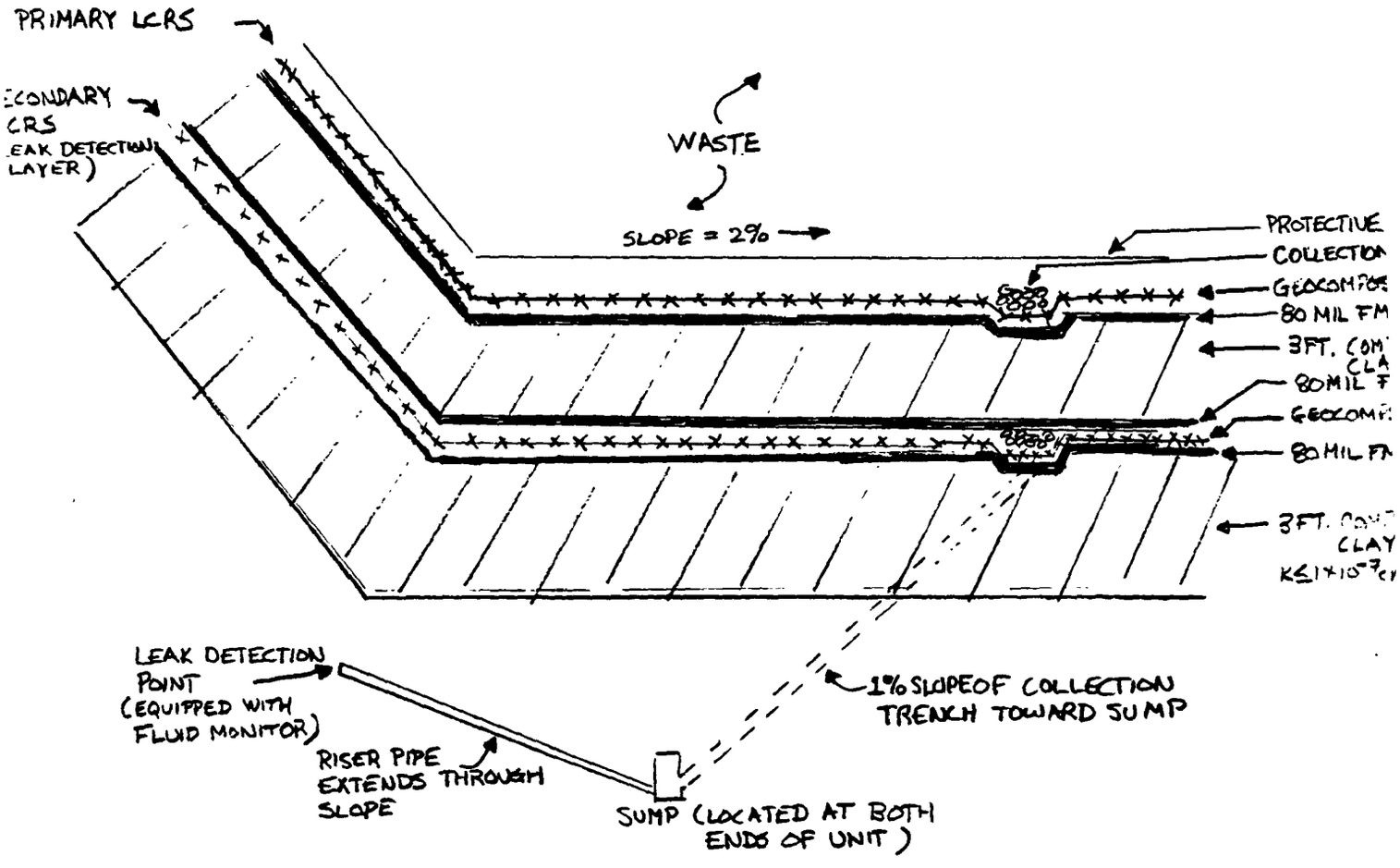


IT Corp. Petroleum Waste, CA
(Landfill 28)



KEY
- HDPE LINER
- GEOCOMPOSITE (GEOTEXTILE + SYNTHETIC DRAINAGE NET + GEOTEXTILE)
- CLAY
- GRAVEL

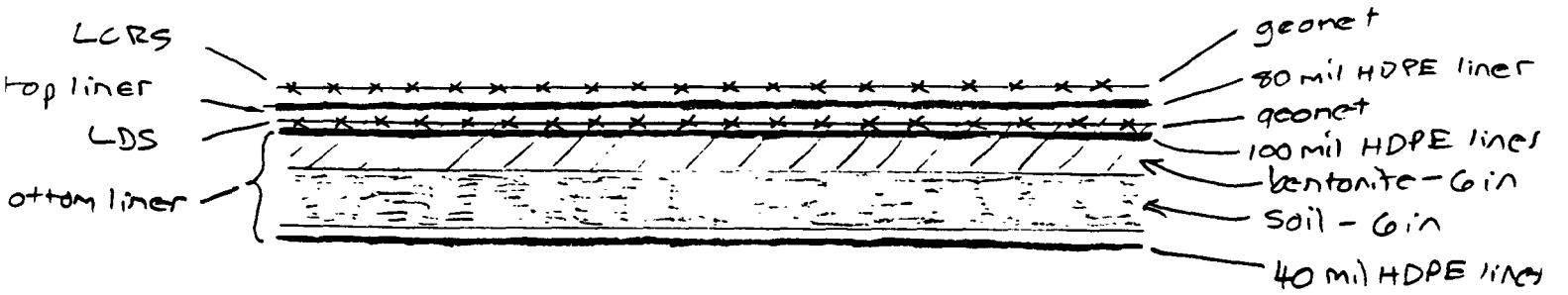
IT Corp. Petroleum Waste, CA
(10 Other Landfill Cells)



KEY

- HDPE LINER
- GEOCOMPOSITE (GEOTEXTILE + SYNTHETIC DRAINAGE NET + GEOTEXTILE)
- CLAY
- GRAVEL

U.S. Ecology, Inc. - Nevada Chem Site
(Landfill)



Key:

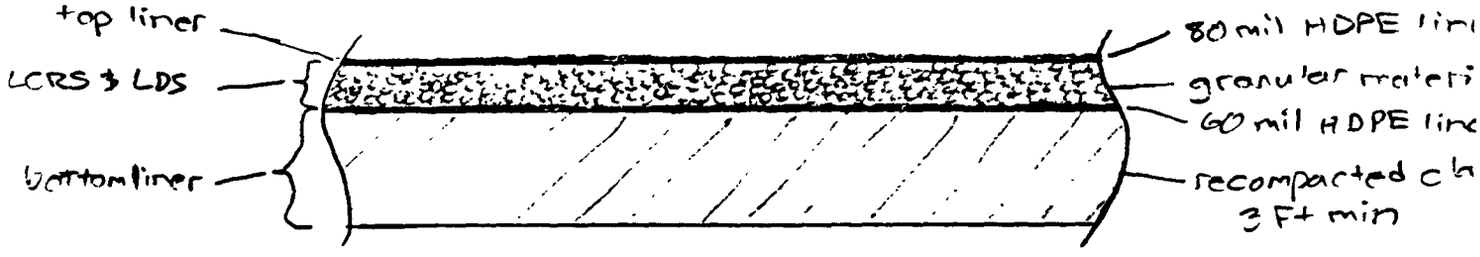
HDPE liner

geonet (transmissivity = 7×10^{-4} m^2/s)

bentonite

soil

Envirosafe Services of Idaho
(Trenches 5 and 14)



Key:

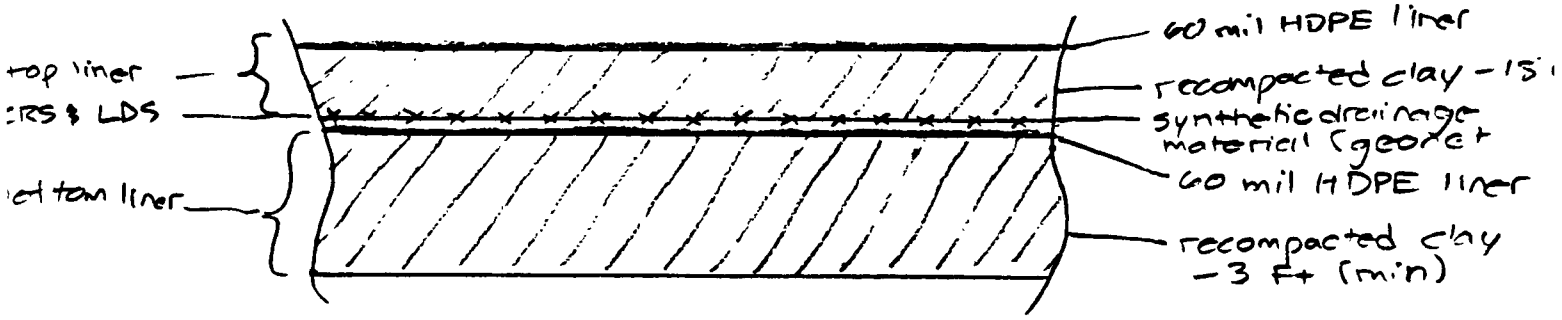
HDPE liner

recompacted clay (permeability = 1×10^{-7} c

granular material (permeability = 1×10^{-2} cm
For trench

(permeability = 1×10^{-1} cm
For trench 1

Chem Waste Management of Northwest, OR
(L-12 and L-13)



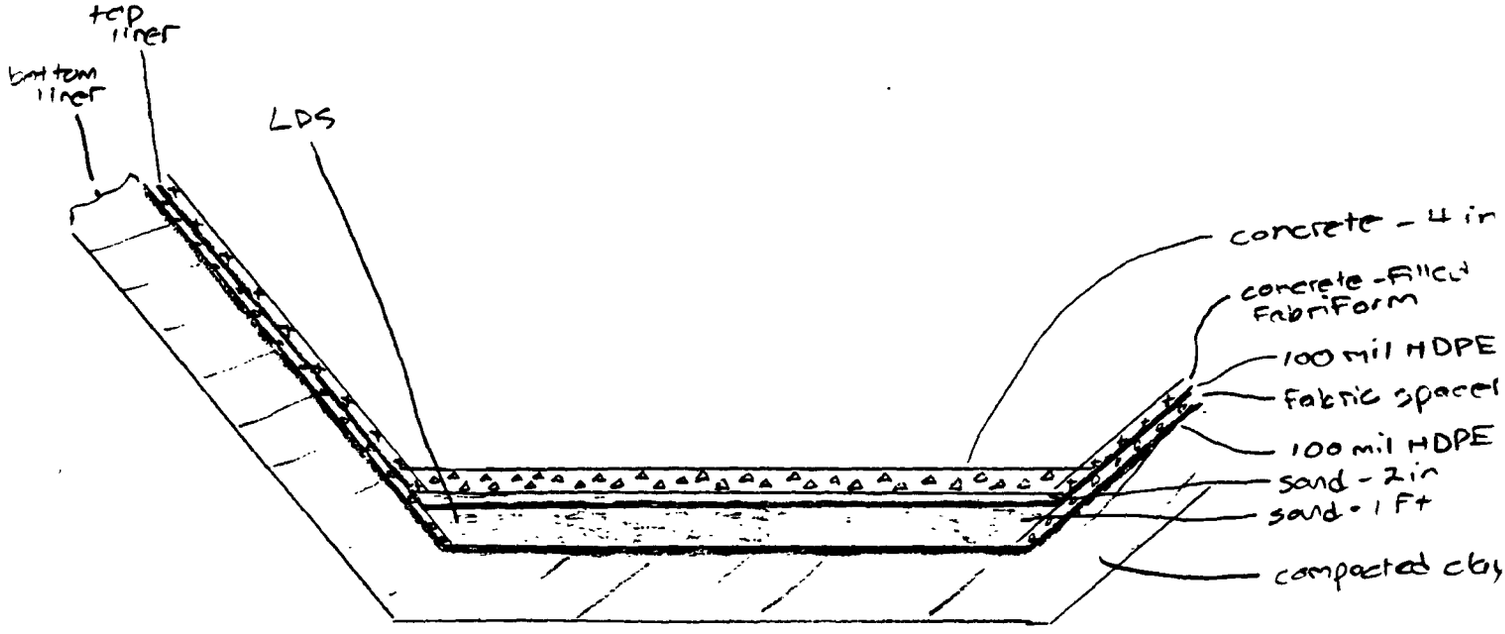
Key:

HDPE liner

geonet (transmissity = 3×10^{-6} m^2/s)

recompacted clay (permeability = 1×10^{-7} m/s)

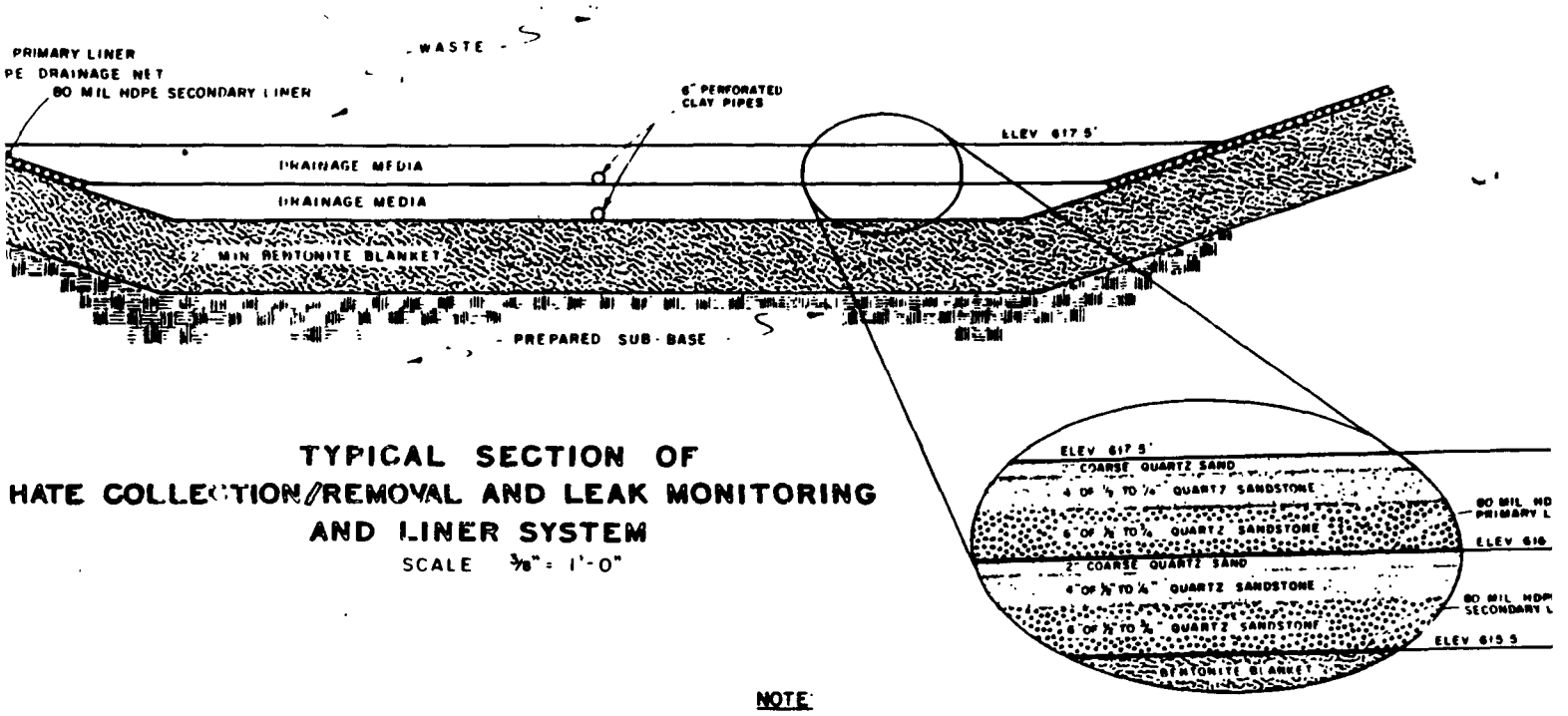
Union Carbide Corp. - Sisterville, WV
(Surface Impoundment)



Key:

- HDPE liner
- compacted clay
- sand
- fabric spacer
- concrete - filled fabriform
- concrete

American Cyanamid Co. - Willow, WV
(Surface Impoundment)

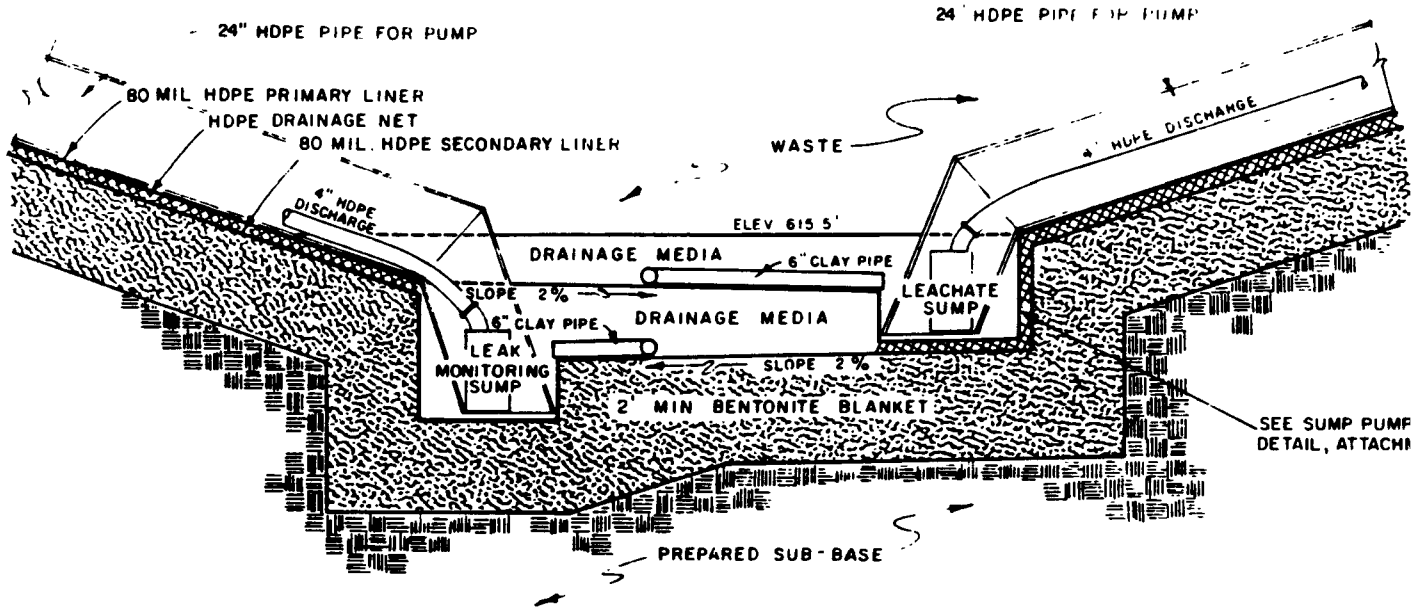


TYPICAL SECTION OF HATE COLLECTION/REMOVAL AND LEAK MONITORING AND LINER SYSTEM

SCALE ⅜" = 1'-0"

NOTE:
DRAINAGE MEDIA LAYERS ARE TO HAVE A MINIMUM PERMEABILITY OF 1×10^{-2} cm/sec.

* ELEVATION SHOWN IS APPROXIMATE QUARTER POINT OF 418 LENGTH OF CELL ELEVATIONS WILL VARY DEPENDENT ON LOCATION OF SECTION



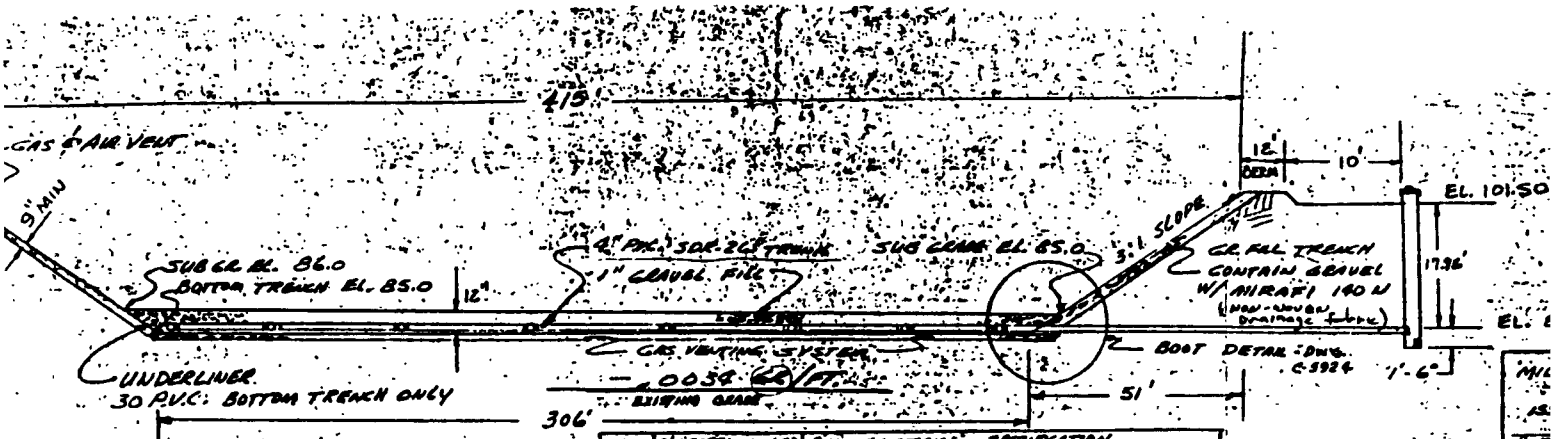
LEACHATE COLLECTION/REMOVAL AND LEAK MONITORING DETAIL

SCALE $\frac{3}{8}$" = 1'-0"

GENERAL NOTES

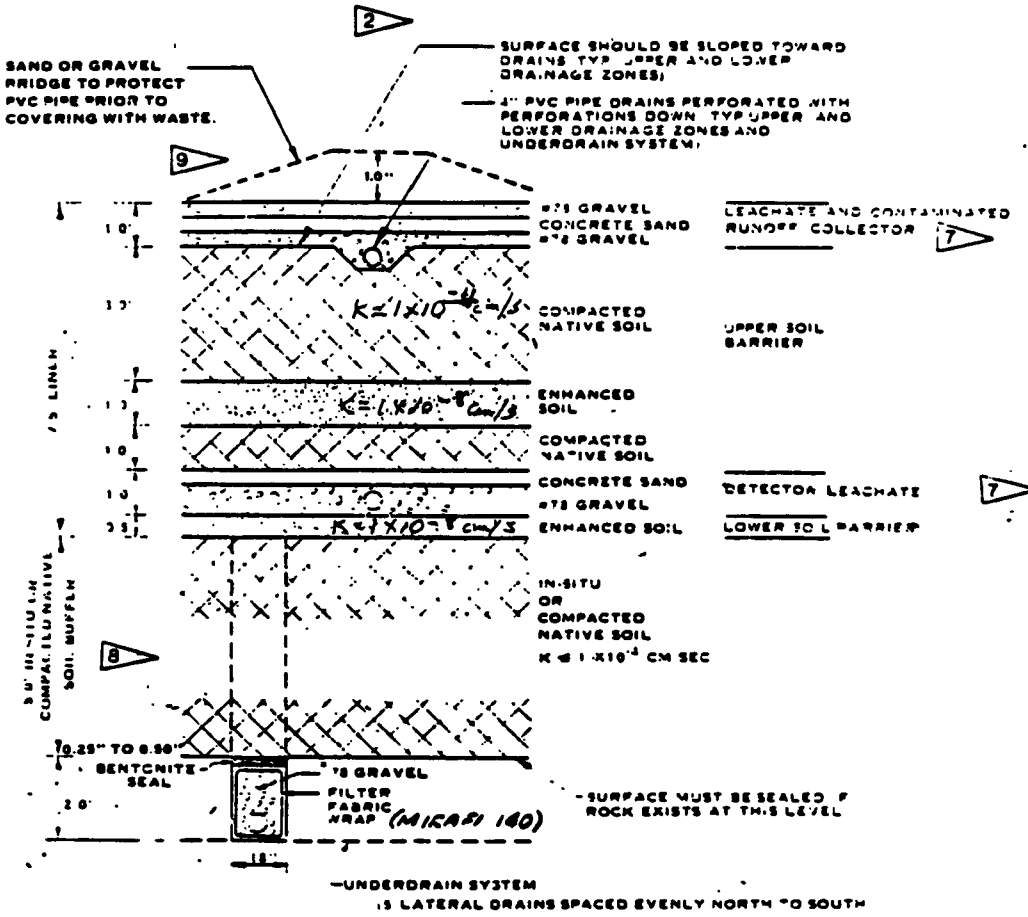
1. ALL SYNTHETIC LINER MATERIAL WILL BE HDPE.
2. DRAINAGE NET WILL BE CONSTRUCTED OF HDPE, HAVING OF A THICKNESS OF 4MM AND MINIMUM TRANSMISSIVITY OF 6×10^{-2} CM/S.
3. DRAINAGE MEDIA HAS TRANSMISSIVITY EQUAL TO OR GREATER THAN 6×10^{-2} CM/S.

American Cyanamid Co., FL
(Surface Impoundment)



BOTTOM LINER SECTION

(NO SCALE)

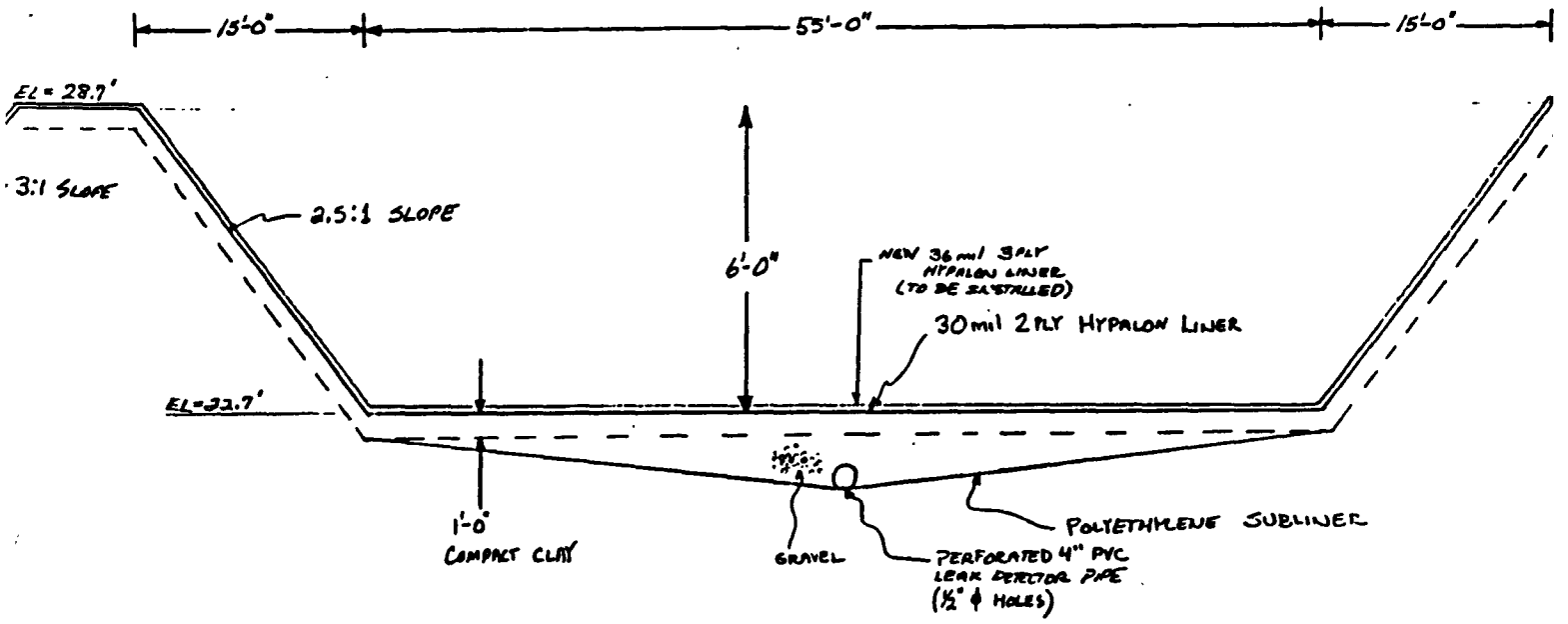


6. THE MAXIMUM SLOPE FOR THE COVER ALLOWED BY RCRA IS 10 (HOR.) : 1 (VERT.), UNLESS IT CAN BE SHOWN THAT PONDING AND EROSION WILL BE MINIMIZED.

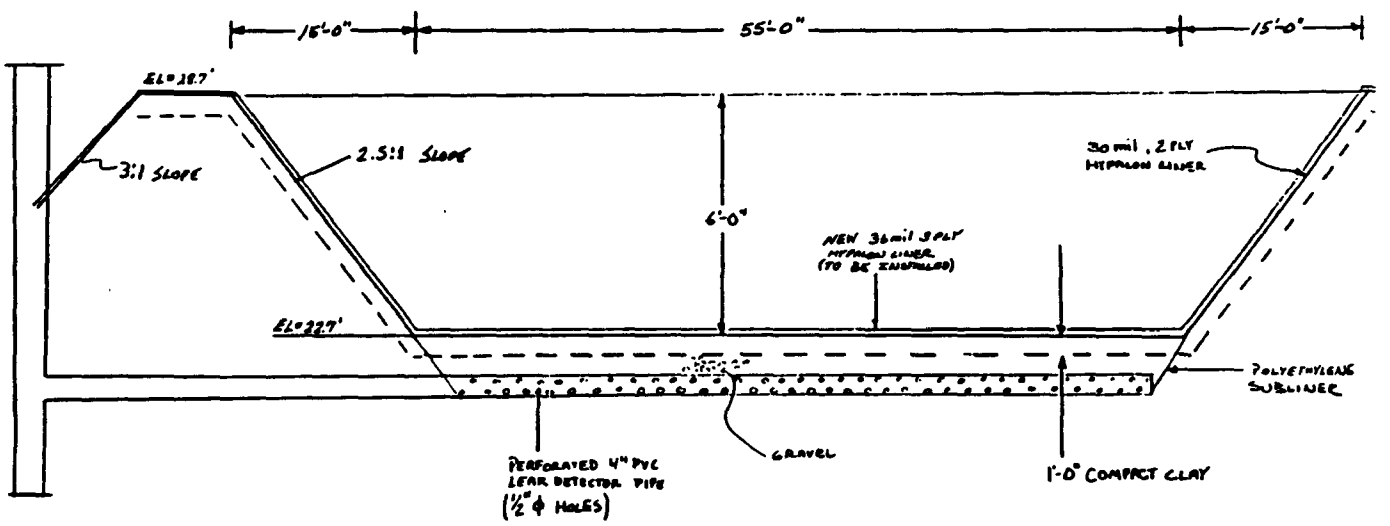
BENCHES ARE SUGGESTED IF SLOPES GREATER THAN 10(HOR): 1(VERT.) ARE BEING CONSIDERED. CONSTRUCTION OF BENCHES DOES NOT SEEM PRACTICAL CONSIDERING THE COVER DESIGN; HOWEVER, SLOPES ON THE ORDER OF 6 (HOR): 1(VERT) CAN GENERALLY BE MAINTAINED WITH MINIMUM EROSION.

7. THE BENTONITE USED FOR COVER CONSTRUCTION DOES NOT NEED TO BE CHEMICALLY STABILIZED SINCE IT WILL NOT BE CONTACTED BY HAZARDOUS WASTES.

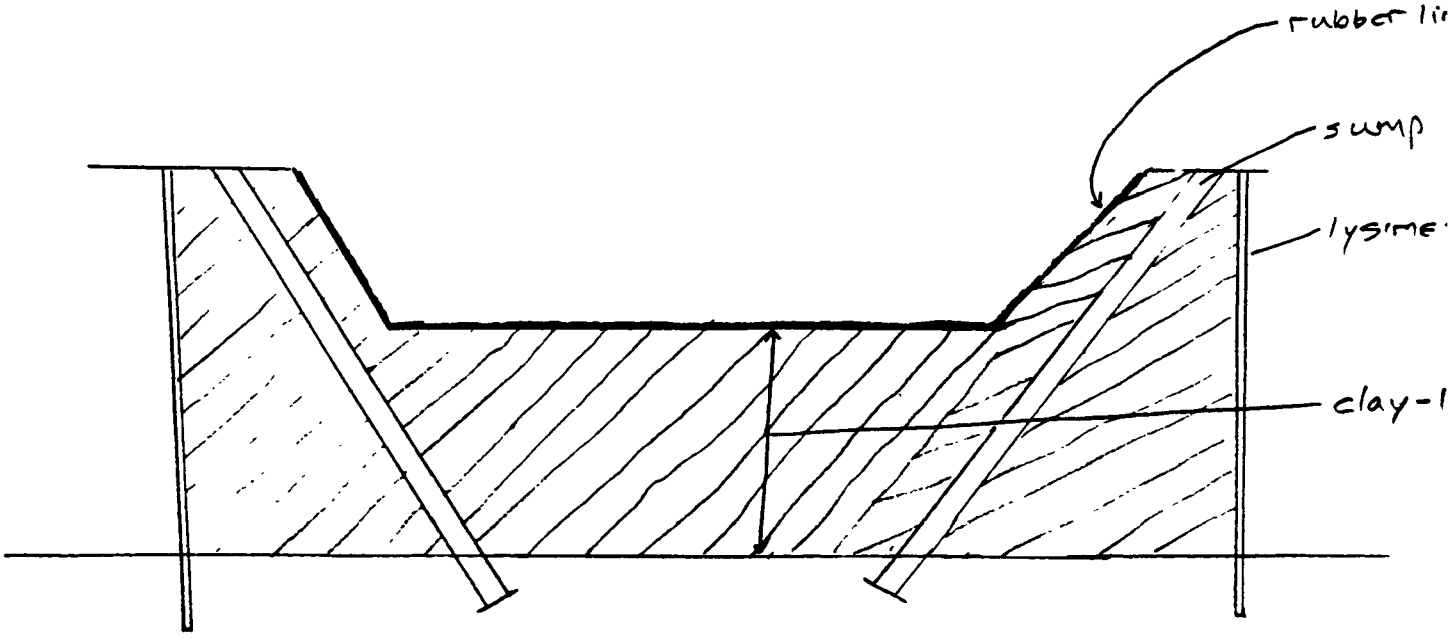
AKZO CHEM American, AL
(Surface Impoundment)



POND CAPACITY = 223,000 GALLONS



Allied-Signal Inc. - Metropolis, IL
(Surface Impoundment)



Key:

rubber liner

clay

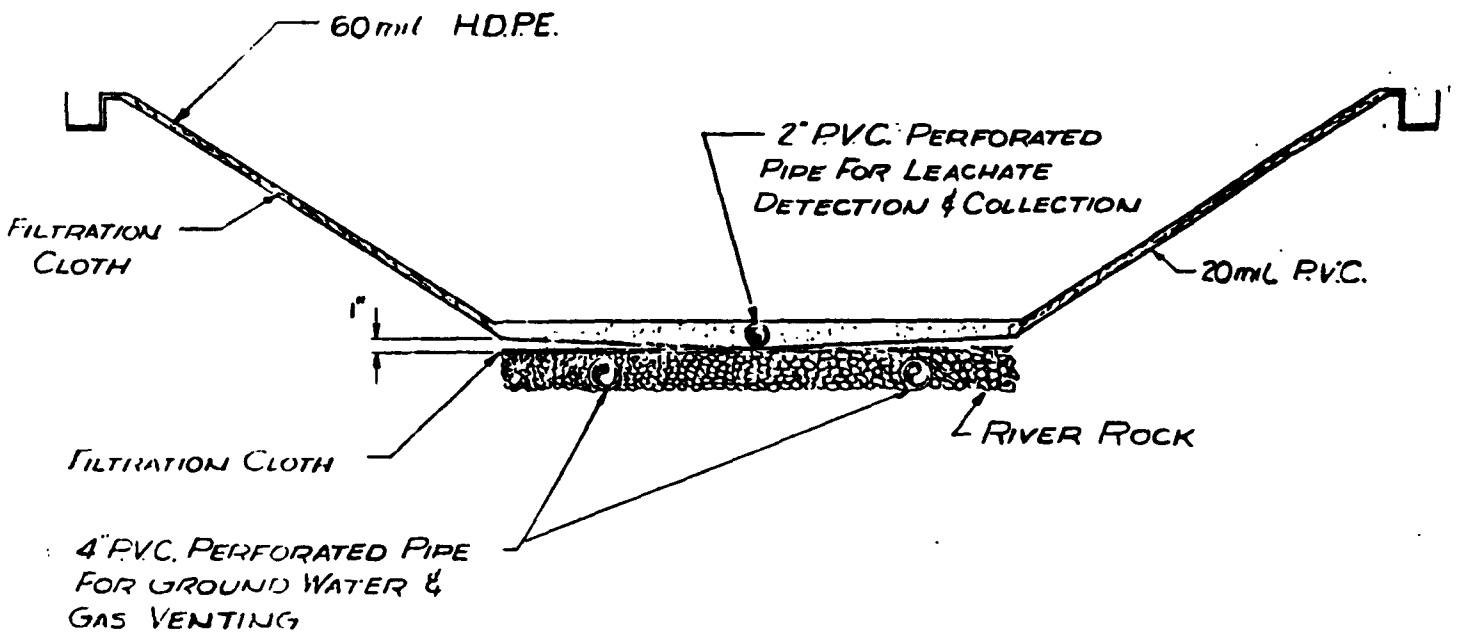
Rhone-Poulenc Basic Chemical Co. (Stauffer), LA
(2 Impoundments)

Key:

synthetic liner

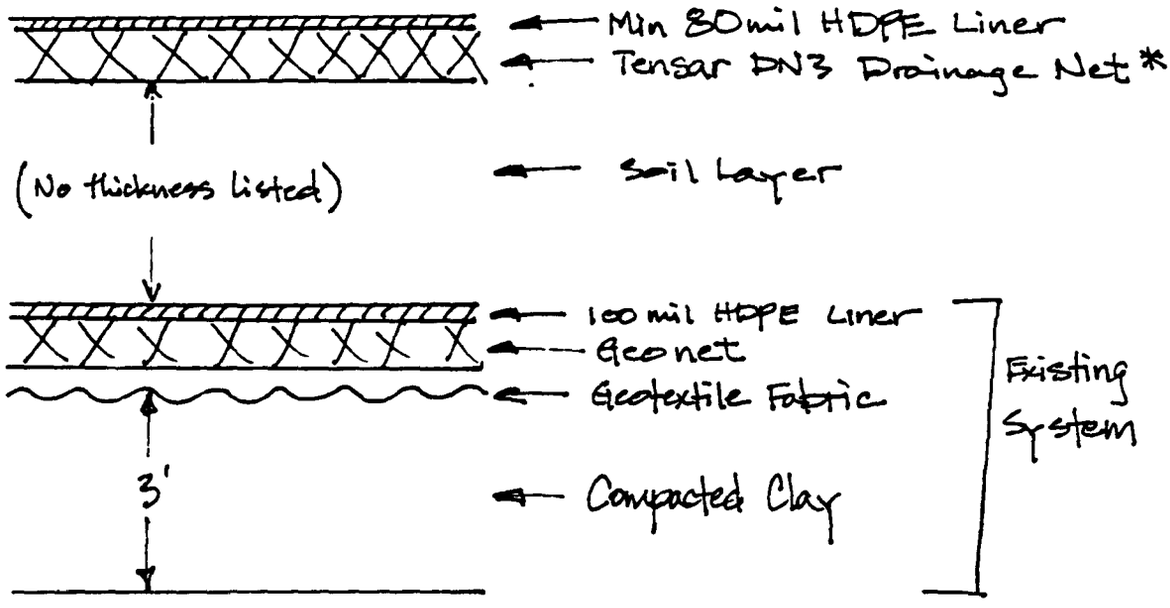
sand

Agricultural Minerals Corp. (Agrico) - Verdigris, OK
(Surface Impoundment)



NOTE:
1. ALL PIPE WRAPPED WITH FILTRATION CLOTH
2. POND BOTTOM SLOPES 1/8" PER FT. FROM EAST TO WEST DRAINAGE DITCH

USPCI Grassy Mountain Facility, UT
(Surface Impoundment)

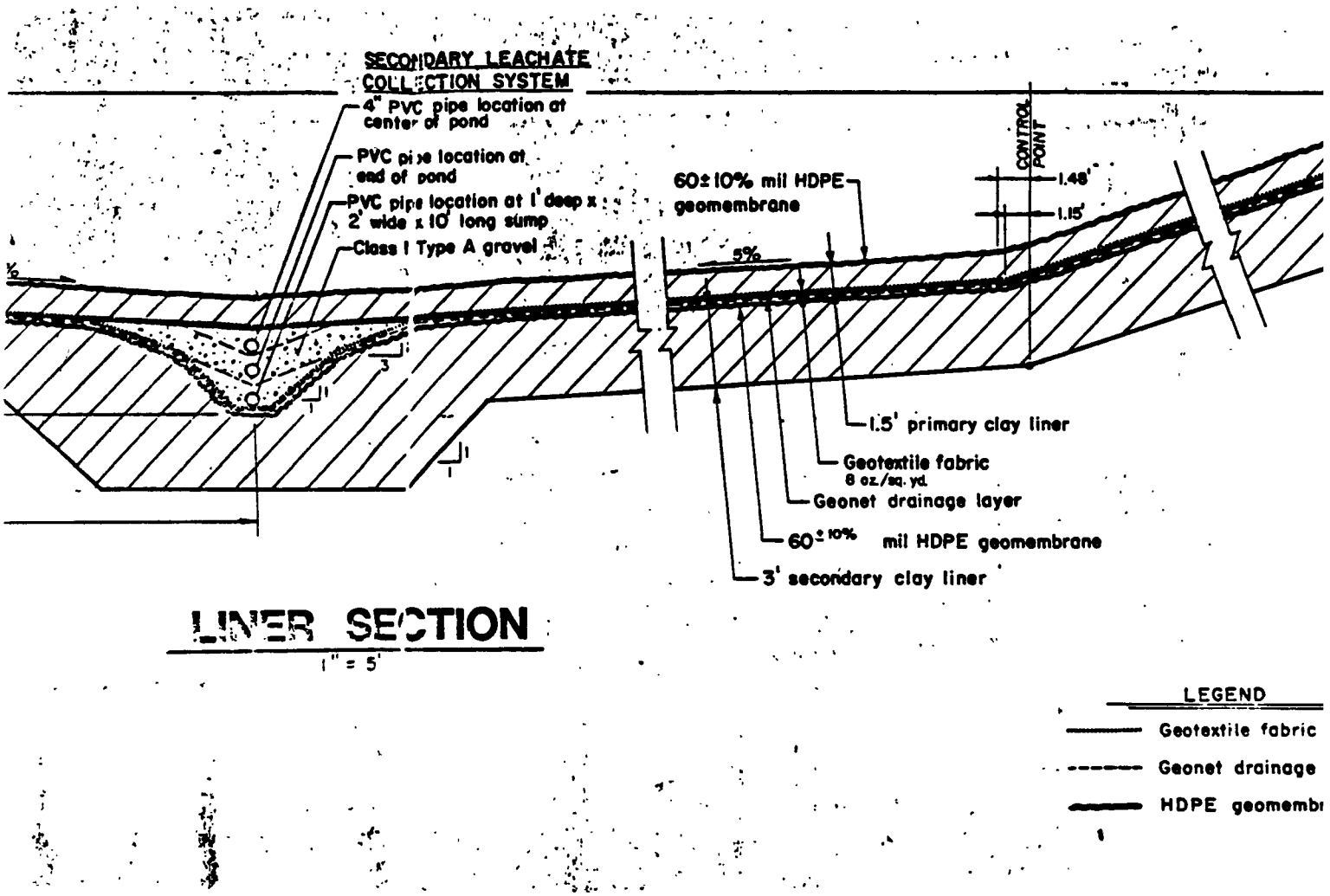


* Transmissivity for Tensar DN3 Drainage Net

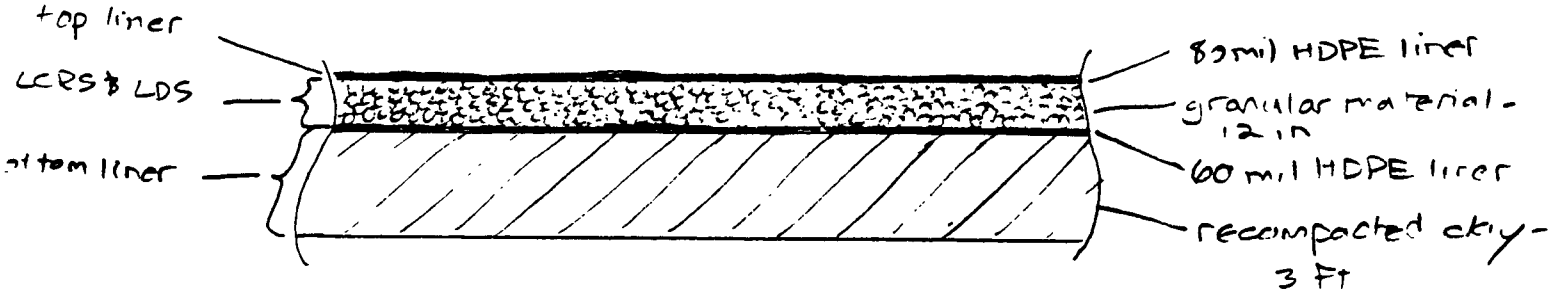
$T => 5 \times 10^{-4}\ m^2/sec$

- No transmissivity or permeabilities listed for other layers.
- No slopes given for liner system.

Chem Waste Management - Kettleman, CA
(15 Impoundments)



Envirosafe Services of Idaho
(Evaporation Ponds 2 and 3)



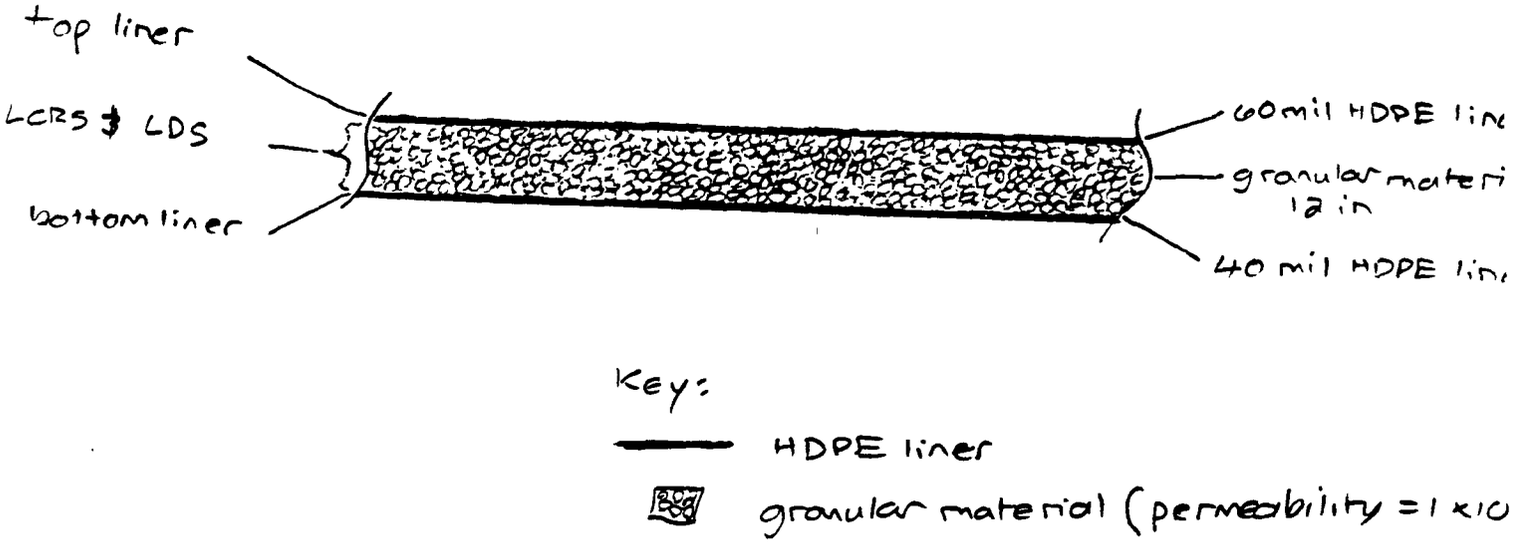
key:

HDPE liner

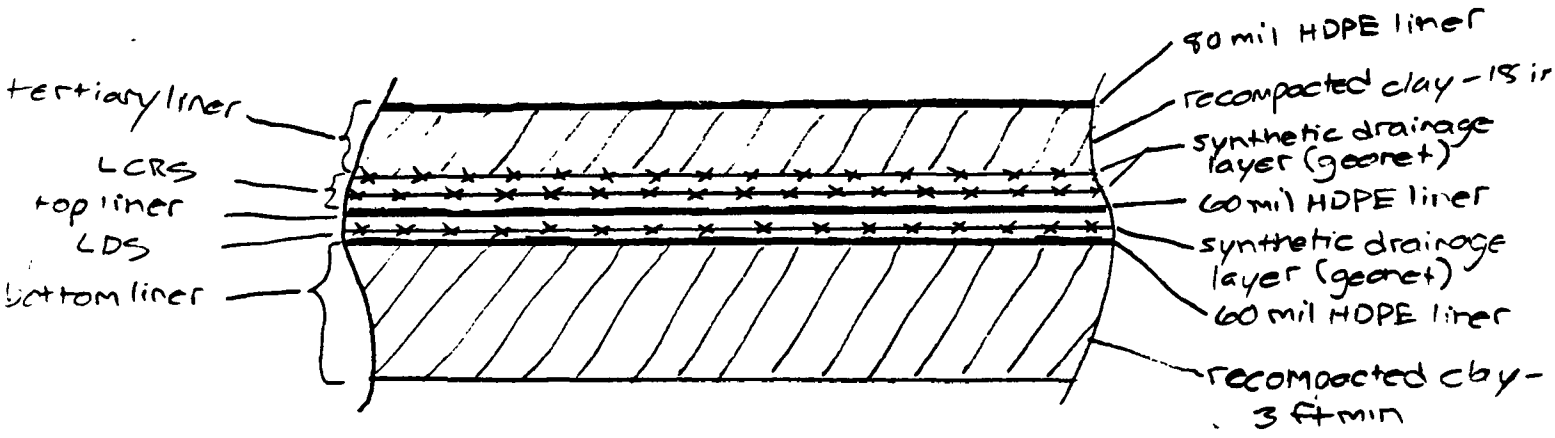
recompacted clay (permeability = 1×10^{-7} cm/s)

granular material (permeability = 1×10^{-1} cm/s)

Envirosafe Services of Idaho
(Evaporation Pond 1 and Collection Ponds 1, 2 and 3)



Chem Waste Management of Northwest, OR
(Surface Impoundments P-A, P-B, and P-C)



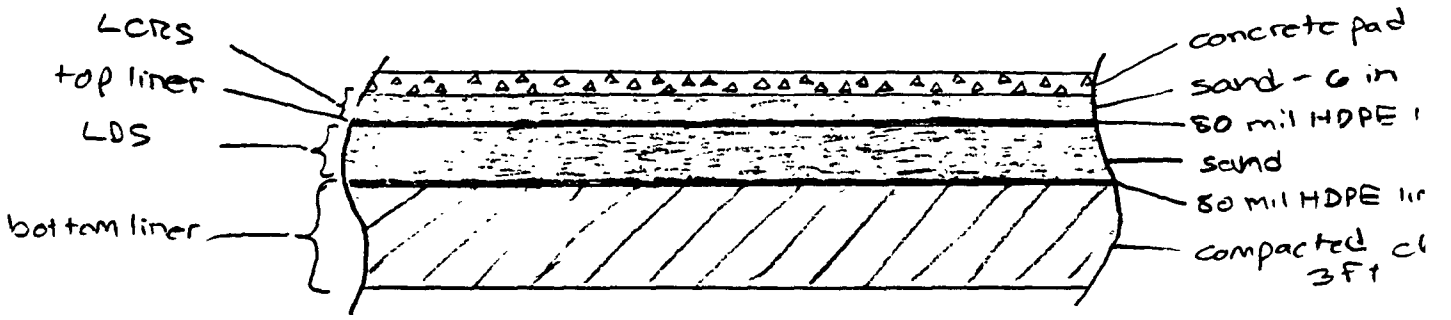
Key:

HDPE liner

geonet

recompacted clay

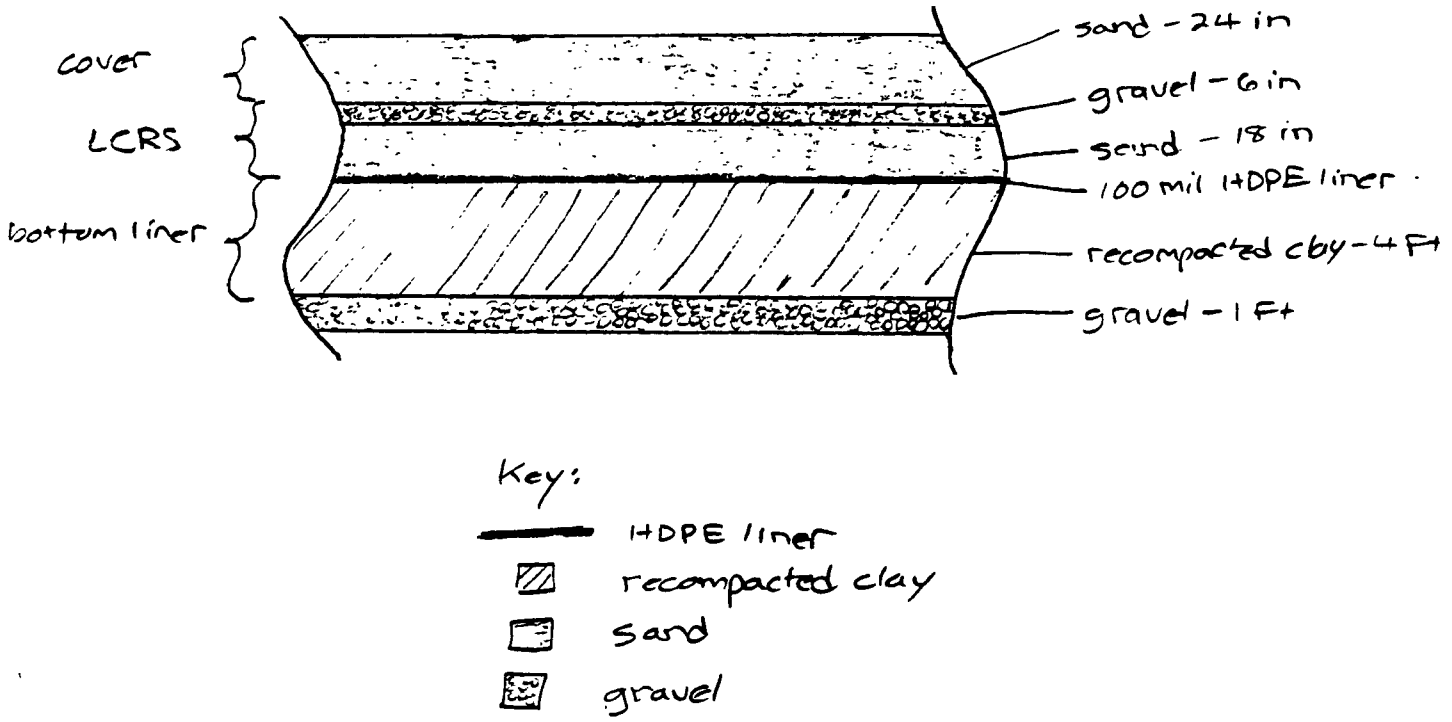
Envirosafe of Ohio
(Waste Pile)



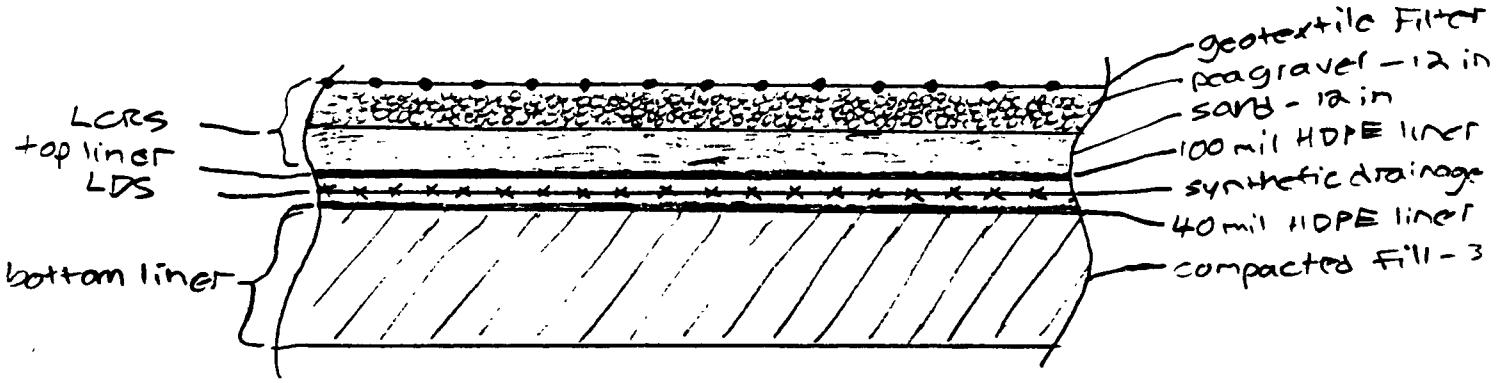
Key:

- HDPE liner
- compacted clay
- sand
- concrete

Burlington Northern Tie Plant, MN
(Waste Pile)



Burlington Northern Tie Plant - Paradise, MT
(Waste Pile)



Key:

- HDPE liner
- synthetic drainage grid (unspecified)
- geotextile
- compacted Fill
- sand
- pea gravel, ¼ in rounded

APPENDIX D.2
SUMMARY OF ADDITIONAL SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
REGION II Dupont Chambers Works, NJ (landfill)			Leachate level over upper liner ≤ 12 in.; cessation of use if detected on lower liner		Indicator parameters until steady state; specific conductance, TOC, TOX, TDS; Appendix IX when available	No bulk or non-containerized hazardous waste containing free liquid; no non-hazardous waste liquids	No liquids per the PFLT for containerized, solidified bulk, or treated wastes	
Chemical Waste Management, Model City, NY (landfill)		Weekly removal of liquid in secondary leachate sumps		ALR = 93 gpad ILR = 600 gpad RLL = 5600 gpad		No noncontainerized liquids or wastes containing free liquids; none on biodegradable	PFLT; compaction test - maximum liquid loss limit of 5%	
GE Waterford North Central Plateau Cell, NY #6 (landfill)			Secondary LCS pumped dry daily (1 ft)	Permit ALR = 114 gpad RAP ALR = 50 gpd		No bulk or non-containerized liquids; free liquid only after PFLT; none on biodegradable	PFLT	None
BFI CECOS, Niagra Falls, NY (SCMF - landfill)			Max level = 1 foot in sumps	No RAP		No bulk or non-containerized liquids or wastes containing free liquids	PFLT	

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
BFI CECOS Niagara Falls, NY Landfill No. 6 (landfill)		Weekly removal of liquid in secondary leachate collection system			Monthly - pH, specific conductance Quarterly - pH, specific conductance, priority pollutant VOCs Annually - pH, specific conductance, priority pollutant organics (VOCs, semivolatiles, pesticides, PCBs) priority pollutant metals		PFLT	None
Union Carbide Corporation, Ponce, PR (landfill)						No bulk liquids or wastes with free liquids (as determined by PFLT); no containerized waste allowed	PFLT Surface impoundment liquids/sludges must be stabilized with cement kiln dust and caliche Tests: (1) PFLT (2) Moisture content - either 12-24% or 16-30% (wet basis) (3) UCS (≥ 20 psi after 8 days)	
REGION III Union Carbide Sisterville plant, WV (surface impoundment)						—	—	—

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
American Cyanamid, WV Incinerator Ash Disposal Impound-ment (surface impoundment)						—	—	—
BSC Johnstown Secure Landfill, PA (landfill)								
REGION IV ChemWaste Management, Emelle, AL (landfill)			30 cm (to top of sump); both a design and performance standard			None	None	None
American Cyanamid, FL, (surface impoundment)						—	—	—
Olin-Charleston, Charleston, TN (surface impoundment)					Analysis in accordance with WAP		PFLT	
CIBA Geigy, AL Hazardous Waste Land - vault #1 (landfill)					Yes (no specifics provided)		PFLT	
CIBA Geigy, AL Hazardous Waste Land - vault #2 (landfill)					Yes		PFLT	

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
AKZO Chem American, AL New Brine Mud Pond (surface impoundment)					Yes		PFLT	
REGION V Adams Center Landfill, IN (landfill)			< 1 foot in primary system (design performance standard)		Yes	Must use cement kiln dust as sorbent	Load-bearing capacity test	Maintain and inspect supply of oil dry, vermiculite, and fly ash
Envirosafe of Ohio (wastepile)				Yes; pump leachate at any detectable level in sump; submit RAP	Yes	Must use pozzolan cement; must use Mebius Test to measure TOC	PFLT	
Envirosafe of Ohio (landfill)				Yes; pump sumps if hazardous constituents are detected; submit RAP	Yes; hazardous constituents	Must use pozzolan cement; use Mebius Test to measure TOC	PFLT	
Peoria Disposal Cell C-1 Landfill, IL (landfill)			1 foot (operational standard)	Yes; pump sumps if leachate detected	Yes	Must use pozzalime; use Mebius Test to measure TOC	PFLT	Yes; supply for spills
Peoria Disposal Cell C-2 Landfill, IL (landfill)			1 foot (operational standard)	Yes; pump sumps	Yes	Must use pozzalime; use Mebius Test to measure TOC	PFLT	Yes; supply for spills
BFI - CECOS, IL (landfill)			1 foot (both design and operational standard)	None; but pump leachate as necessary	Yes; submit results to state and EPA		PFLT and load-bearing test (2 ton/ft^2)	
Burlington Northern Tie Plant, MN (waste pile)				None/leachate is pumped to a POTW from sump)	Yes	None, but must perform biological treatment of creosote-contaminated soils		

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
CID Landfill, IL (Area IV landfill)				None, but must collect and treat leachate from sumps	Yes	Must use cement or pozzolan	PFLT Load-bearing capacity test; Stabilization evaluation test	Yes; inspect supplies weekly
Heritage Environmental Services, IN (landfill)				None, but must remove liquid in cell daily	Yes	PFLT		
Allied-Signal, Inc., IL (surface impoundment)				pH 8.5 fluorides > 5 ppm; lower level in pond and fix leak in rubber liner - install more lysimeters	Yes; pH and fluorides			
REGION VI Texas Ecologists, Inc. (landfills - 5 units)		primary - 74 gpm secondary - 3.6 gpm	1-foot head in LDS (design and operational standard)		Yes; Appendix VIII	Acceptable sorbents - cement kiln dust for wastes scheduled for solidification; also fly ash; restricted biodegradable sorbents not specified, but must not be capable of reacting dangerously, by being decomposed or ignited by the liquid	PFLT	
Dupont Victoria plant, TX southeast (landfill - several cells)		76 gpm per cell	4 inches in LDS (Both design and operational standard)			Restrictions on biodegradable	PFLT	

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
Stauffer Chemical Company, LA (surface impoundments - 2 units)						—	—	—
Gulf Coast Waste Disposal, TX; hazardous waste disposal Cell H (landfill)			1-foot head in LDS (operational standard)		Appendix VIII	Wastes with visible liquids are not accepted; returned to generator	PFLT	
Olin Corporation Lake Charles, LA (settlement agreement landfill)		623 gpad = secondary collection system capacity	primary LCRS = 3.15 inches					
ChemWaste Management Lake Charles, LA (landfill cells 6 & 7, - 2 units)				Leachate levels monitored monthly; leachate will be collected and disposed of offsite				Contain spill with appropriate stabilization agent and place in drum
Pine Bluff Arsenal, AR (hazardous waste management facility landfill)			1-foot head (both design and operational standard)	Leachate recovery weekly and after storms		Wastes must have a total solids content of at least 30% (SW -846)		
Pine Bluff Arsenal, AR (hazardous waste landfills #1 & #2 - 2 units)			12-inch maximum in LDS (design and operational standard)	Leachate recovery weekly and after storms			PFLT Liquids Release Test	
Pine Bluff Arsenal (surface impoundment)						—	—	—

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
Agrico Chemical Company, OK (surface impoundment)				Close inflow values; remove liquid from sump				
REGION VII Chemical Waste Management, KS (landfill)				LCRS ALR = 5 gpad ILR = 156 gpad RLL = 1,560 gpad LDS ALR = 5 gpad ILR = 156 gpad RLL = 1,560 gpad				
REGION VIII USPCI Grassy Mountain, UT (surface impoundment)	3.4 hours (assuming head of 1 foot and slope (min.) of 0.0114)			No trigger levels, but within 72 hours of "presence of liquid notification" must notify executive secretary, submit RAP within 10 days		—	—	—
USPCI Grassy Mountain, UT (landfill)	Upper - 15 gpad Lower - 10 gpad		1-foot head on top liner (operational standard)	No trigger levels, but within 72 hours of "presence of liquid notification" must notify executive secretary, submit RAP within 10 days	Fingerprint analysis	Must use fly ash and/or other stabilization agent		
Envirocare of Utah (landfill)	1 gpad		1-foot head on top liner (operational standard)	None, but within 72 hours of "presence of liquid notification" must notify executive secretary, submit RAP within 10 days	Fingerprint analysis		PFLT (or presence by visual inspection)	

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
Burlington Northern Tie Plant, MT (wastepile)				None, but pump leachate into 55-gallon drums for off-site treatment; notify state if leak is detected		—	—	—
REGION IX IT Imperial Valley, CA (landfills LC-1, LC-2 and LC-3 - 3 units)			1-foot head in LDS (both design and operational standard)					
Chemical Waste Management, CA - Kettleman (landfills - 7 units)			1- foot head in LDS (design performance standard)	LDCRS ALR = 29 gpad ILR = 890 gpad RLL = 8900 gpad		TOC = 1% (max)	PFLT	
Chemical Waste Management, CA - Kettleman (surface impoundments - 15 units)			1-foot head in LDS (design performance standard)	LDCRS ALR = 29 gpad ILR = 890 gpad RLL = 8900 gpad		TOC = 1% (max)	PFLT	
IT Petroleum Waste, Inc., CA (landfill)				ALR = 5 gpad Pump out liquid daily - notify EPA, state within 7 days	TOC TDS pH color	No free liquids		
IT Petroleum Waste, Inc., CA (landfill - 10 units)				ALR = 5 gpad Pump out liquid within 7 days, notify EPA, state	TOC TDS pH color			
PG&E - Morrow Bay, CA; metal cleaning wastes (surface impoundments - 3 units)						—	—	—

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
PG&E - Morrow Bay, CA; Oil-Water Separator (surface impoundment)						—	—	—
PG&E - Moss Landing, CA; Metal Cleaning Wastes Units 1 & 2 (surface impoundment - 2 units)						—	—	—
PG&E - Moss Landing, CA; Metal Cleaning Waste Units (surface impoundments - 3 units)					Yes	—	—	—
PG&E - Moss Landing, CA; Oil Sludge Pond (surface impoundment)						—	—	—
U.S. Ecology, Inc., NV (landfill)						No liquids permitted in landfill		
REGION X Envirosafe Services of Idaho; Trench 14 (landfill)	Detection of leak in 118.6 minutes (time for saturation of drainage layer)			ALR = 20 gpad (avg) 50 gpad (max) ILR = 300 gpad RLL = 1500 gpad	Yes; parameters based on knowledge of waste disposed of; not required if leachate is managed as hazardous waste	Acceptable sorbents include clays, lime-bearing pozzolanic materials, and cement	PFLT Load-bearing strength test - using packed penetrometer to illustrate change over time (i.e., a chemical reaction); 1 ton/ft^2 over 24-hr period	

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
Envirosafe Services of Idaho; Trench 5 (landfill)	Detection of leak in 25 minutes (time for saturation of drainage layer)			ALR = 20 gpad (avg) 50 gpad (max) ILR = 300 gpad RLL = 1500 gpad	Yes; parameters based on knowledge of waste disposed of; not required if leachate is managed as hazardous waste	Acceptable sorbents include clays, lime-bearing pozzolanic materials, and cement	PFLT Load-bearing strength test - using packed penetrometer to illustrate a change over time (i.e., a chemical reaction); 1 ton/ft^2 over 24-hr period	
Envirosafe Services of Idaho; Evaporation Ponds 2 & 3 (surface impoundments - 2 units)	Detection of leak in 20 hours (time for saturation of drainage layer)			ALR = 20 gpad (avg) 50 gpad (max) ILR = 300 gpad RLL = 1500 gpad	Yes; parameters based on knowledge of waste disposed of; not required if leachate is managed as hazardous waste	—	—	—
Envirosafe Services of Idaho; Evaporation Pond 1 and Collection Ponds 1, 2, 3 (surface impoundments - 4 units)	Detection of leak in 50 days (time for saturation of drainage layer)			ALR = 20 gpad (avg) 50 gpad (max) ILR = 300 gpad RLL = 1500 gpad	Yes; parameters based on knowledge of waste disposed of; not required if leachate is managed as hazardous waste	—	—	—
Chem Waste Management of Northwest, OR; P-A, P-B, and P-C (surface impoundments - 3 units)	Detection of leak in 14 hours (based on travel time through geonet to furthest sump)			ALR = 20 gpad (avg) 50 gpad (max) ILR = 600 gpad RLL = 4000 gpad	Yes; parameters based on knowledge of waste disposed of; not required if leachate is managed as hazardous waste	—	—	—

SUMMARY OF SURVEY RESULTS FOR LEAK DETECTION SYSTEMS AND LIQUIDS IN LANDFILLS

Facility Name	Leak Detection, Collection, and Removal					Liquids in Landfills		
	Minimum Leak Detection Capability	Minimum Removal Capacity	Maximum Leachate Levels in LDS	Action Trigger Levels	Analysis of Leachate	Restrictions on Free Liquids; Biodegradable Absorbents	Testing Requirements for Absorbent-Treated Liquid Wastes	Requirements for Absorbents Used to Clean Up Spills
Chem Waste Management of Northwest, OR; (L-13, and L-12) (landfills - 2 units)	Capable of detecting leak in 7.4 hours (travel time through geonet to furthest sump)			ALR = 20 gpad (avg) ILR = 300 gpad (max) ILR = 300 gpad RLL = 1500 gpad	Yes; parameters based on knowledge of waste disposed of; not required if waste is managed as a hazardous waste		PFLT Stabilization Evaluation test	

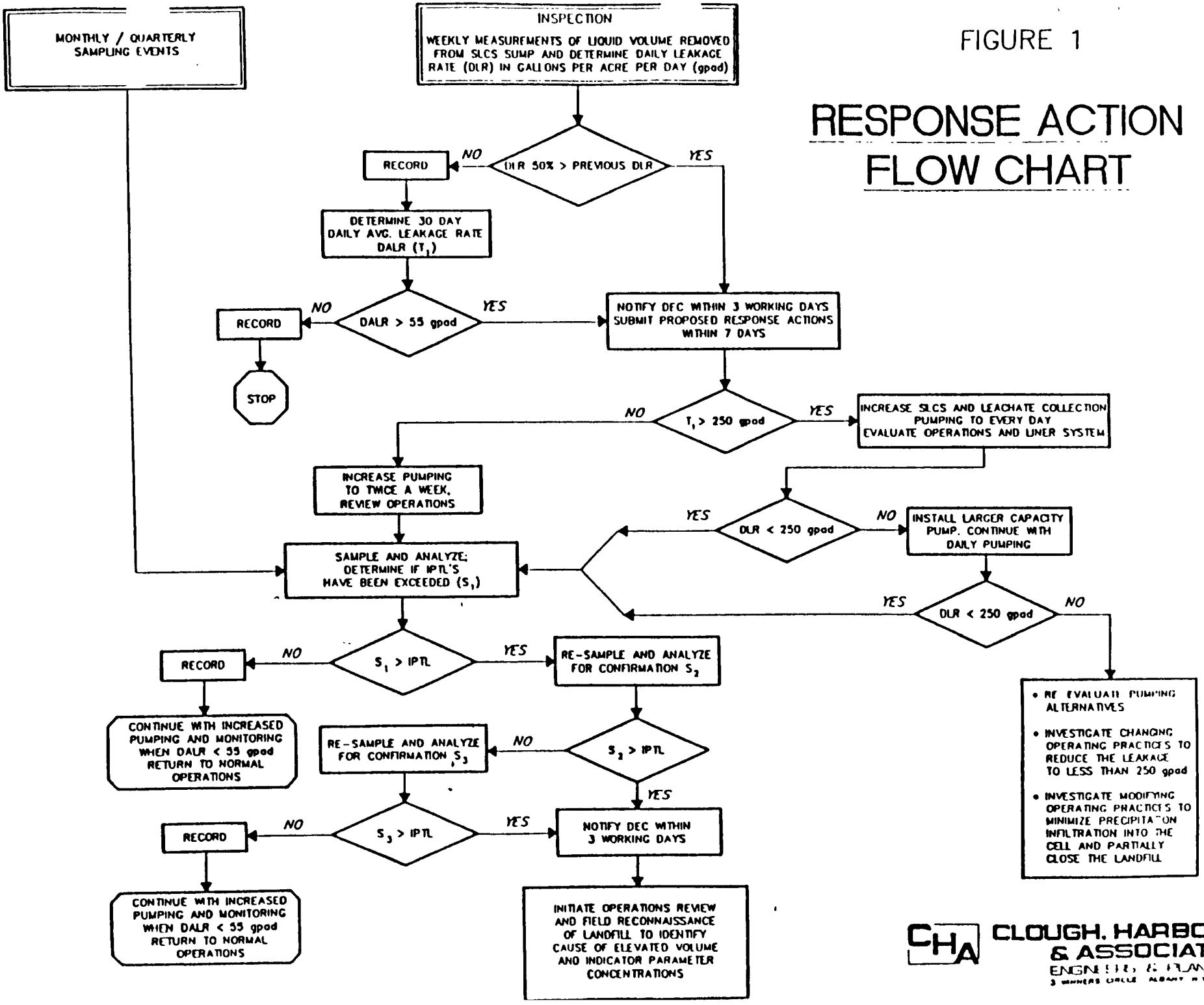
APPENDIX D.3
EXAMPLES OF RESPONSE ACTION PLANS
FOR CERTAIN FACILITIES

General Electric - Waterford
Chem Waste Management - Model City
Chem Waste Management of Kansas
Chem Waste Management - Kettleman
IT Corp. - Petroleum Waste
Chem Waste Management of Northwest (impoundments)
Chem Waste Management of Northwest (landfill cells)
Envirosafe Services of Idaho

General Electric - Waterford

FIGURE 1

RESPONSE ACTION FLOW CHART



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GE Waterford (5)

Chem Waste Management - Model City

6.0 RESPONSE ACTIONS

6.1 General

The response actions required to respond to various flow rates in the SLCS sumps of each cell of SLF 12 are provided in this section. As discussed in Sections 3.0-5.0 and summarized in Table 6-1, three trigger level flow rates; the ALR, the ILR, and the RLL have been selected. The cell-specific ALRs shown in Table 3-1 are based strictly on the calculations presented in Appendix C. A common unit-specific RLL of 5,600 gpad was selected for all cells based on the cell with the lowest calculated SLCS sump yield (Table 4-1). A common unit-specific ILR of 600 gpad was also selected based on approximately 10 percent of the selected unit-specific RLL. All trigger flow rates shown in Table 6-1 are provided on a cell-specific basis in Tables 3-1, 4-1 and 5-1 in gallons per day, which will ease operational procedures and directly indicate the category of leakage, and appropriate response actions.

The following procedure is required for monitoring of the SLCS:

- Each SLCS sump will be monitored at least once every 7 days for the presence of liquids. Pumpable amounts of liquids contained in the sump will be removed, quantified, and recorded. If the sump is monitored or if liquids are removed more frequently, the inflow will be determined for each pumping event. The inflow value will be determined by adding the liquid volumes removed with the time interval between pumping events divided by the number of days between pumping events. The pumped amount of liquid will be divided by the days since the previous pumping event to establish a daily average inflow.

However, the inflow value compared against trigger levels outlined in this RAP will be the weekly average value.

- The responses for each trigger level are listed sequentially in the subsequent text and should be followed in the order presented. For any sequence, if the averaged flow rate in the SLCS drops below the ALR, no further actions are required.

6.2 Flow Rates at or Below the ALR of 93 GPAD

1. Routine monitoring should continue. No further action is required.

6.3 Flow Rates Between the ALR of 93 GPAD and the ILR of 600 GPAD

1. Verbally notify the EPA and the New York Department of Environmental Conservation (DEC) within 3 working days if the average flow to an SLCS for two consecutive weeks exceeds the ALR, if not clearly attributable to an operational disturbance (e.g., equipment or power failures).

2. Increase monitoring and pumping frequency from the SLCS sumps of the cell involved, if pumpable quantities are present, to every day until flow decreases below the ALR. Also, verify that the automatic removal of liquid from the PLCS sumps is functioning as designed.

3. If the average flow is between the ALR and the ILR for seven consecutive additional daily pumping events, provide written notification within 14 days to EPA and DEC and implement the following steps:

a. Remove all standing water, if any, from the surface of the landfill.

b. Examine any exposed portions of the cell liner.

c. Repair any observed damage.

d. Document location, type, and extent of liner damage, if any.

4. If a leak cannot be found and the elevated flow rate continues after any required repair of the exposed liner(s), review existing analytical data and investigate alternative sources of liquid. Prepare a written report describing actions taken to date and proposed future responses and submit to the EPA and DEC within 60 days.

6.4 Flow Rates Between the ILR of 600 GPAD and the RLL of 5,600 GPAD

1. Verbally notify the EPA and DEC within 3 working days if the average flow to an SLCS sump for one pumping event exceeds the ILR, if not clearly attributable to an operational disturbance.

2. Increase monitoring and pumping frequency from the SLCS sumps of the cell involved, if pumpable quantities are present, to every day until flow decreases below the ALR. Also, verify that the automatic removal of liquid from the PLCS sumps is functioning as designed.

3. If the flow is between the ILR and the RLL for three additional daily consecutive pumping events, provide written notification to EPA and DEC within 14 days and implement the following steps:

a. Remove all standing water, if any, from the surface of the landfill.

b. Examine any exposed portions of the cell liner.

c. Repair any observed damage.

d. Document location, type, and extent of liner damage, if any.

4. If flow continues to exceed the ILR for an additional two daily pumping events after the above actions have been taken, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid. Review available analytical and pumping data for the cell to identify any trends.

5. If the leak cannot be located, and/or the flow continues to exceed the ALR after any exposed liners have been repaired as necessary, investigate alterative sources of liquid. Prepare a written report describing actions taken to date and proposed future responses and submit to EPA and DEC within 60 days for approval.

6.5 Flow Rates Greater than the RLL

1. Verbally notify the EPA and DEC within 3 working days if the average flow to an SLCS sump for one pumping event exceeds the RLL, if not clearly attributable to an operational disturbance.

2. Increase pumping and monitoring frequency from the SLCS sumps to every day, if pumpable quantities are present, until flow decreases below the ALR. Also, verify that the automatic removal of liquid from the PLCS sumps is

functioning as designed.

3. If the average flow exceeds the RLL for two consecutive daily pumping events, provide written notification to EPA and DEC within 14 days and implement the following steps:

   a. Test a sample of the liquid obtained from the SLCS for constituents listed in Table 6-2.

   b. Remove all surface standing water adjacent to and inside SLF 12.

   c. Examine any exposed portions of the cell liner.

   d. Repair any observed damage.

   e. Document location, type, and extent of liner damage, if any.

   f. Verify that the waste surface is sloping away from the landfill side slopes. If necessary, regrade waste or place soil to achieve a minimum 1 percent slope away from the landfill side.

4. If flow continues to exceed the RLL for an additional two daily pumping events after the above actions have been taken, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid. Document location, type, and extent of liner damage, if any, in a written report to EPA and DEC. Review available analytical and pumping event data for the cell to identify any trends.

5. If flow continues to exceed the RLL for three additional days, a total of 7 days after first exceedance of RLL,

temporarily stop placing waste into the affected cell until repairs to the lining system or other appropriate actions are completed, and flows to the SLCS sump have decreased to below the ALR. Prepare a written report describing actions taken to date and proposed future responses and submit to EPA and DEC within 60 days for approval.

Chem Waste Management of Kansas

7.0 RESPONSE ACTIONS FOR THE LDCRS

7.1 General

The actions required to respond to various flow rates in the LDCRS are provided in this section. For all flow rates, the following procedures are required for monitoring the LDCRS:

- During the post-closure period, the LDCRS sump will be monitored at least weekly for the presence of fluids. During this time, pumpable amounts of liquids contained in the sump will be removed, as required, to ensure that fluid levels will be maintained within twelve (12) inches above the rim of the sump. The liquid quantity removed during each pumping event will be documented. Inflow will be determined by dividing the liquid volume removed by the number of days elapsed since the previous pumping event.

Three trigger level flow rates have been established for monitoring the LDCRS. These are the Action Leakage Rate (ALR), the Rapid and Large Leak (RLL) and an intermediate value between the ALR and the RLL, referred to herein as the Intermediate Leakage Rate (ILR). The responses that shall be implemented if a trigger level flow rate occurs are listed sequentially and should be followed in the order presented. For any sequence, if the flow rate in the LDCRS drops below the ALR, no further actions beyond routine monitoring are required. The flow rates for the ALR, the ILR, and the RLL are listed on Table 5 as a function of the area of the cell.

7.2 Flow Rates at or Below the ALR (5 gpad)

Routine monitoring should continue. No action is required.

7.3 Flow Rates Between the ALR (5 gpad) and the ILR (156 gpad)

1. Verbally notify the EPA and KDHE within one working day if flow to the LDCRS sump exceeds the ALR.

2. Provide written notification to EPA and KDHE within 7 days of the time that the ALR is exceeded, and implement the following steps.

3. Increase monitoring and pumping frequency from both LCRS and LDCRS sumps to every other day, if pumpable quantities are present, until flow decreases below the ALR.

4. Investigate alternative sources of liquid.

5. Prepare a written report describing actions taken to date and proposed future responses and submit to the EPA and KDHE within 60 days for approval.

7.4 Flow Rates Between the ILR (156 gpad) and the RLL (1560 gpad)

1. Verbally notify EPA and KDHE within one working day if flow to the LDCRS sump exceeds the ILR.

2. Provide written notification to EPA and KDHE within 7 days of the time that the ILR is exceeded and implement the following steps.

3. Sample for parameters listed in Table 6.

4. Increase monitoring and pumping frequency from both the LCRS and LDCRS sumps, if pumpable quantities are present, to every day until flow decreases below the ALR.

5. Remove all standing water, if any, from around the landfill perimeter.

6. If flow continues to exceed the ILR for an additional pumping event, provide third party inspection by a registered professional engineer and investigate alternative sources of liquid.

7. Prepare a written report describing actions taken to date and proposed future responses and submit to the EPA and KDHE within 60 days for approval.

7.5 Flow Rates Greater than the RLL (1,560 gpad)

1. Verbally notify the EPA and the KDHE within one working day if flow to the LDCRS sump exceeds the RLL.

2. Provide written notification to EPA and KDHE within 7 days of the time that the RLL is exceeded and implement the following steps.

3. Sample for parameters listed in Table 6.

4. Increase pumping and monitoring frequency from both the LCRS and LDCRS sumps to every day, if pumpable quantities are present, until flow decreases below the ALR. For flows between the ALR and RLL, Sections 7.3 and 7.4 apply, as appropriate.

5. Remove all standing water, if any, from around the landfill perimeter.

6. If flow continues to exceed the RLL for an additional pumping event, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid.

7. Prepare a written report describing actions taken to date and proposed future responses and submit to EPA and KDHE within 60 days for approval.

8.0 RESPONSE ACTIONS FOR THE LDS

8.1 General

The actions required to respond to various flow rates in the LDS are provided in this section. In any event, the flow rates measured in the LDCRS take precedence over flow rates measured in the LDS with respect to federal and state regulatory compliance. For all flow rates, the following procedures are required for monitoring the LDS:

- During the post-closure period, the LDS will be monitored at least weekly for the presence of fluids. During this time, any liquid that will drain from the sump will be removed and the quantity will be documented. Outflow will be determined by dividing the liquid volume removed by the number of days elapsed since the previous monitoring event.

Three trigger level flow rates have been established for monitoring the LDS. These are the Action Leakage Rate (ALR), the Rapid and Large Leak (RLL) and an intermediate value between the ALR and the RLL, referred to herein as the Intermediate Leakage Rate (ILR). The responses that shall be implemented if a trigger level flow rate occurs are listed sequentially and should be followed in the order presented. For any sequence, if the flow rate in the LDS drops below the ALR, no further actions beyond routine monitoring are required. The flow rates for the ALR, the ILR, and the RLL are listed on Table 5 as a function of the area of the cell.

8.2 Flow Rates at or Below the ALR (5 gpad)

Routine monitoring should continue. No action is required.

8.3 Flow Rates Between the ALR and the ILR

1. If the flow rate from the LDS exceeds the ALR, then monitor the LDCRS. If the flow rate in the LDCRS is less than its respective ALR, then increase monitoring and removal of accumulated liquids from the LDS. If the flow rate in the LDCRS exceeds its respective ALR, then implement the following steps.

2. Verbally notify the EPA and KDHE within one working day.

3. Provide written notification to EPA and KDHE within 7 days of the time that the ALR is exceeded.

4. Increase monitoring and pumping frequency from the LCRS, LDCRS, and the LDS sumps to every other day, if pumpable quantities are present, until flow decreases below the ALR.

5. Investigate alternative sources of liquid.

6. Prepare a written report describing actions taken to date and proposed future responses and submit to the EPA and KDHE within 60 days for approval.

8.4 Flow Rates Between the ILR (156 gpad) and the RLL (1560 gpad)

1. If the flow rate from the LDS exceeds the ILR, then monitor the LDCRS. If the flow rate in the LDCRS is less than its respective ILR, then monitor the LDS according to procedures listed under Section 8.3, as appropriate. If the flow rate in the LDCRS exceeds its respective ILR, then implement the following steps.

2. Verbally notify EPA and KDHE within one working day.

3. Provide written notification to EPA and KDHE within 7 days of the time that the ILR is exceeded.

4. Increase monitoring and pumping frequency from the LCRS, LDCRS and the LDS sumps, if pumpable quantities are present, to every day until flow decreases below the ALR.

5. Sample for parameters listed in Table 6.

6. Remove all standing water, if any, from around the landfill perimeter.

7. If flow continues to exceed the ILR for an additional monitoring event, provide third party inspection by a registered professional engineer and investigate alternative sources of liquid.

8. Prepare a written report describing actions taken to date and proposed future responses and submit to the EPA and KDHE within 60 days for approval.

8.5 Flow Rates Greater than the RLL (1,560 gpad)

1. If the flow rate from the LDS exceeds the RLL, then monitor the LDCRS. If the flow rate in the LDCRS is less than its respective RLL, then monitor the LDS according the procedures listed under Sections 8.4, 8.3 or 8.2 as appropriate. If the flow rate in the LDCRS exceeds its respective RLL, then implement the following steps.

2. Verbally notify the EPA and the KDHE within one working day.

3. Provide written notification to EPA and KDHE within 7 days of the time that the RLL is exceeded.

4. Sample for parameters listed in Table 6.

5. Increase pumping and monitoring frequency from the LCRS, LDCRS, and the LDS sumps to every day, if significant quantities are present, until flow decreases below the ALR. For flows between the ALR and RLL, Sections 8.3 and 8.4 apply, as appropriate.

6. Remove all standing water, if any, from around the landfill perimeter.

7. If flow continues to exceed the RLL for an additional monitoring event, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid.

8. Prepare a written report describing actions taken to date and proposed future responses and submit to EPA and KDHE within 60 days for approval.

GOLDER ASSOCIATES INC.

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3086-RPT.JUL/903-3086/GRD

TABLE 1

CONSTRUCTION WATER QUANTITIES

SOURCE	FLOW QUANTITY (gpad)
Geonet/Geotextiles	<1
Gravel Drain	10

TABLE 2

FLOW RATES RESULTING FROM
CONSOLIDATION/COMPRESSION OF LINING
SYSTEM COMPONENTS

SOURCE	FLOW QUANTITY (gpad)
Gravel Drain	<1
Geosynthetics	<1
Primary Clay Liner	38
Secondary Clay Liner	>38

TABLE 3

LIQUID QUANTITIES THAT MAY ENTER THE LDCRS OR THE LDS FROM SOURCES OUTSIDE THE GEOMEMBRANE

SOURCE	FLOW QUANTITY (gpad)
Consolidation of Underlying Clay Layer	<1
Inflow from Groundwater	0
Inflow from Precipitation (LDS only)	<1

TABLE 4

LDCRS DESIGN CAPACITY (RLL)

LIMITING FLOW RATE (GALLONS/DAY)	AREA (ACRES)	RLL (gpad)
4,368	2.8	1,560

NOTE: Limiting flow rate is from capacity calculations presented in Appendix IV.

TABLE 5

TRIGGER LEVEL FLOW RATES FOR THE LDCRS AND THE LDS

	LDCRS (gpad)	LDS (gpad)
ALR	5	5
ILR	156	156
RLL	1,560	1,560

Chem Waste Management - Kettleman

6.0 RESPONSE ACTIONS

6.1 GENERAL

The actions required to respond to various flow rates in the LDCRS are provided in this section. These flow rates, as presented in Table 6-1, are a function of the impoundment area.

For all flow rates, the following procedure is required for monitoring the LDCRS. Each LDCRS sump will be inspected at least once every 7 days for the presence of fluids. Pumpable amounts[1] of liquids contained in the sumps will be removed and the liquid quantity measured.

The responses for each trigger level are listed sequentially and should be followed in the order presented. For any sequence, if the flow rate in the LDCRS drops below the ALR, no further actions are required. Daily inflow flow rates are determined by dividing the volume pumped from the LDCRS sump by the number of days between pumping events.

6.2 FLOW RATES AT OR BELOW 29 GPAD (THE ALR)

Routine monitoring should continue. No action is required.

6.3 FLOW RATES BETWEEN AND 29 GPAD AND 890 GPAD[2]

1. Verbally notify the EPA, RWQCB, and DHS within one working day if flow to the LDCRS sump exceeds the 29 gpad.

---

1. An amount that can be removed by pumping using a Grundfos Model SP 4-8 or larger pump.

2. 890 GPAD is equal to 10 percent of the RLL (8900 gpd).

Table 6-1

CELL SPECIFIC ALRs AND RLLs

Area (acres)	ALR (gallons per acre per day)	ALR (gallons per day)	ALR (gallons per week)	RLL (gallons per day)
1.9	29	58	406	8900

2. If flow is between 29 gpad and 890 gpad for two consecutive pumping events, provide written notification to EPA, RWQCB, and DHS.

3. Increase pumping frequency to every other day, if pumpable quantities are present, until flow decreases below the ALR.

4. Examine the exposed side slope liner.

5. Repair any observed damage.

6. Document location, type, and extent of liner damage, if any.

7. If a leak cannot be found and the flow continues after the exposed side slope liner has been repaired, if necessary, investigate alternative sources of liquid. Prepare a written report describing actions taken to date and proposed future responses, and submit to the EPA, RWQCB, and DHS within 60 days for approval.

6.4 FLOW RATES BETWEEN 890 GPAD AND 8900 GPD (the RLL)

1. Verbally notify the RWQCB, EPA, and DHS within one working day if flow to the LDCRS sumps exceeds the ALR.

2. If the flow is between 800 and 8900 gpd for two consecutive pumping events, provide written notification to EPA, RWQCB, and DHS and implement the following steps.

3. Increase the LDCRS sump pumping frequency to every day, if pumpable quantities are present, until flow decreases below the 29 gpad.

4. Examine the exposed side slope liner.

5. Repair any observed damage.

6. Document location, type, and extent of liner damage, if any.

7. If flow continues to exceed 29 gpad for an additional 1-week monitoring period, provide third party inspection by a registered professional engineer and investigate alternative sources of liquid.

8. If the leak cannot be located and/or the flow continues to exceed 29 gpad after the primary liner has been repaired, if necessary, investigate alternative sources of liquid. Prepare a written report describing actions taken to date and proposed future responses, and submit to the EPA, RWQCB, and DHS within 60 days for approval.

6.5 FLOW RATES GREATER THAN 8900 GPAD (THE RLL)

1. Verbally notify the EPA, RWQCB, and DHS within one working day if flow to the LDCRS sumps exceeds the ALR.

2. If the flow exceeds the RLL for two consecutive pumping events provide written notification to the EPA, RWQCB, and DHS and implement the following steps.

3. Test the liquid removed from the LDCRS sumps for constituents listed in WDR Tables 1 through 5. These tables are included in Appendix A.

4. Increase the LDCRS sump pumping frequency to every day, if pumpable quantities are present, until flow decreases below 29 gpd.

5. Examine the exposed side slope liner.

6. Repair any observed damage.

7. Document location, type, and extent of liner damage, if any.

8. If flow continues to exceed 29 gpad for an additional pumping event, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid.

9. Temporarily stop placing liquid into the impoundment until repairs to the lining system or other appropriate actions are completed, and flows to the LDCRS sumps have decreased to below 29 gpad.

10. Document location, type, and extent of liner damage, if any, in a written report to the EPA, RWQCB, and DHS.

11. If the leak cannot be located and/or the flow continues to exceed 29 gpad after the primary liner has been repaired, if necessary, prepare a written report describing actions taken to date and proposed future responses, and submit to the EPA, RWQCB, and DHS within 60 days for approval.

IT Corp. - Petroleum Waste

Run-on and Runoff Control Systems Inspection and Maintenance

Facility personnel will perform the following maintenance activities for both run-on and runoff systems weekly and after storms of 0.5 inches or more in 24 hours:

- Repairing any areas where local erosion has occurred.
- Maintaining vegetation by reseeding eroded/repaired areas.
- Removing sediment or debris from drainage channels and properly disposing of removed solids.

Maintenance of Wind Dispersal Controls

If the inspection of wind dispersal control measures indicate that dust generation in the active working area of the landfill is a problem, then facility personnel will be responsible for applying appropriate dust control measures, such as those mentioned in Section 3.2.4.3.

Interim Soil Cover Maintenance

Any damaged areas of the interim cover will be repaired with clean soil.

Final Cover Maintenance

During the post-closure care periods, a survey of the final covers will be made annually to determine if settlement or subsidence occurred. In addition, maintenance of the final covers will be performed as described in Section 2.14.5.

3.2.4.8 Response to Leachate Accumulation

The following actions will be taken in response to the discovery of fluid at greater than five gallons/acre of lined area/day in the secondary LCRS collection sump:

- A sample of the fluid will be obtained from the standpipe in the sump. The sample will be preserved for subsequent analysis of TOC, TDS and verification of pH. Color and pH of the leachate will be determined in the field.

- Fluid will be pumped out daily (if applicable) and the volume recorded.

- The facility manager and/or his designated technical staff will evaluate the analytical data and rate of fluid generation and determine if the fluid results from a liner failure or some other cause. If it is determined that the fluid is leachate, then alternative remedial measures will be developed and IT Environmental Affairs will discuss the recommended remedial measure with regulatory agencies.

- Any leachate collected by the primary and secondary LCRS sump will be transferred to the Stabilization/-Treatment Unit by tank trucks.

Within seven days of discovery of fluid at greater than five gallon/acre of lined area/day in the secondary LCRS, facility management will notify the EPA Regional Administrator, the RWQCB, the DHS and appropriate local government agencies. All analytical data will be retained until closure of the landfill.

3.2.4.9 Response to Run-on/Runoff Control Damage

The procedure for restoration and repair of run-on and runoff structures will be as follows:

- During inspection, all berms, drainage swales and ditches needing repair will be determined.

- Remedial measures will be developed.

- Repairs will be executed under facility management supervision and inspected.

3.2.4.10 Response to Liner Damage

In the event that the liner is damaged, it will be reported immediately to the facility manager. Notification of the damaged liner will be made as soon as possible to the IT Environmental Affairs office, who will in turn notify

appropriate persons. A synthetic liner contractor will be contacted to repair the liner. Until the liner repair is completed, a temporary polyethylene cover will be placed over the damaged area to prevent dust and moisture from entering, and all waste placement activity will be moved a minimum of 50 feet away from the damaged area.

3.2.4.11 Response to Interim or Final Cover Damage

If any significant settling (changes in slope so that drainage structures do not function properly or mass movement results vary in slope instability), erosion, or loss of vegetative cover of the final cover is discovered during inspections, the facility manager will be responsible for development of necessary remedial measures. These measures may include the following:

- Regrading slopes to maintain drainage, and replacing cover material.
- Replacing the topsoil, fertilizing and seeding the affected area. Replanting if drought or disease destroys the vegetative cover.
- Establishing erosion controls pending establishment of vegetative cover.

Remedial measures to maintain the integrity of the cover system(s) will be done by operations personnel as directed by site management. All remedial measures will be inspected by the site engineer.

3.2.4.12 Record Keeping and Reporting

The record keeping and reporting procedures applicable to the operation of the landfill are discussed in Section 3.5.

Chem Waste Management of Northwest (impoundments)

Facility: CWMU
Units: P-A, P-B, & P-C

Response Actions to Leakage
(Permit Attachment 22, Exhibit 21B)

7.0 RESPONSES

The actions required to respond to various flow rates to the LDCRS sumps are provided in this section.

For all flows, the following procedure is required for the LDCRS. Each LDCRS sump will be inspected once every 7 days for the presence of leachate. Pumpable quantities[2] of fluids contained in the LDCRS sump will be removed and the quantity of fluids determined. If present, additional inflow to the LDCRS sump will be measured and pumpable quantities removed.

The actions for each response level are listed sequentially and should be followed in the order presented. If a leak is located and/or flow to the LDCRS sump drops below the ALR, no further action is required.

7.1 FLOW RATE LESS THAN THE ALR (20 gpad)

Under normal operating conditions, flows into the LDCRS are expected to be less than 20 gpad, the amount defined previously as the ALR. No action is required for flows less than the ALR.

7.2 FLOW RATES BETWEEN THE ALR (20 gpad) AND 600 gpad

1. Verbally notify the EPA and DEQ within 1 working day of the sump inspection if flow to the LDCRS sump exceeds 20 gpad.

2. If the flow is between 20 to 600 gpad for two consecutive 1-week monitoring periods provide written notification to EPA and DEQ and implement the following steps.

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2. Quantities which can be removed by pumping using a Grundfos Model SP 4-8 or equivalent submersible pump.

3. Begin pumping from the intermediate leachate collection and removal system (ILCRS) sump.

4. Increase pumping frequency from the LDCRS to every other day until flow decreases below 20 gpad.

5. Examine the exposed side slope liner and repair any observed damage.

6. Document location, type, and extent of liner damage, if any.

7. If a leak cannot be found and flow continues to exceed the ALR for an additional 1-week period, prepare a written report describing actions taken to date and proposed future responses, and submit to the EPA and DEQ within 60 days.

7.3 FLOW RATES BETWEEN 600 gpad AND THE RAPID AND LARGE LEAK (LDCRS SUMP CAPACITY, 4,000 gpd[3])

1. Verbally notify the EPA and DEQ within 1 working day of the sump inspection if flow to the LDCRS sump exceeds 20 gpad.

2. If the flow is between 600 gpad and 4,000 gpd for two consecutive monitoring periods, provide written notification to EPA and DEQ and implement the following steps.

3. Increase pumping frequency from the LDCRS and ILCRS sump to every day until flow decreases below the ALR.

5. Examine the exposed side slope liner.

6. Repair any observed damage.

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3. The upper bound 4,000 gpd represents the design capability of the secondary leachate collection system to remove leakage and is independent of the cell size. This represents a leak defined by EPA as a rapid and large leak (RLL).

7. Document location, type, and extent of liner damage, if any.

8. If flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party assessment by a registered professional engineer.

9. If a leak cannot be located or the flow continues to exceed the ALR for 1 week after the primary liner has been repaired, prepare a written report describing actions taken to date and proposed future responses. Submit this report to EPA and DEQ within 60 days for approval.

7.4 FLOW RATES GREATER THAN 4,000 gpd

1. Verbally notify the EPA and DEQ within 1 working day of the sump inspection, if flow to the LDCRS sump exceeds 20 gpad.

2. If the flow exceeds 4,000 gpd for two consecutive monitoring periods, provide written notification to EPA and DEQ and implement the following steps.

3. Increase pumping frequency to every day from LDCRS and ILCRS sumps until flow decreases below the ALR.

4. As soon as possible reduce the liquid level within the impoundment in increments until flow drops below the ALR. Reduction in the impoundment liquid level should not exceed 1 foot per week in order to enable sequential investigation of the side slope line. As the impoundment liquid level is lowered, measure LDCRS flow rates until flow decreases below the ALR. Complete steps 5 through 7.

5. Examine the exposed side slope liner.

6. Repair any observed damage.

7. Document location, type, and extent of liner damage, if any.

8. If flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party assessment by a registered professional engineer.

9. Repair any observed damage.

10. If flow continues to exceed the RLL, take the pond out of service within 1 year and repair the damaged liner or close the impoundment.

11. If continued operation is planned, document location, type, and extent of liner damage in a written report to EPA and DEQ.

Chem Waste Management of Northwest (landfill cells)

Response Action to Leaks
(Permit Attachment 22, Exhibit 21A)

Facility: CWMNW
Units. L-12 & L-13
ID ORD-089-452-353

6.0 RESPONSES

The actions required to respond to various flow rates to each of the secondary leachate collection sumps are provided in this section. These flow rates, discussed below, are a function of the cell areas. For example, the flow rate in Cell 2 would have to be approximately two times the flow rate in Cell 1 to cause an equivalent response. Specific quantities for each cell are presented in Table 1.

Table 1

CELL-SPECIFIC ALRs AND
MAXIMUM SECONDARY SUMP CAPACITY

Area	Area (acres)	ALR (gallons per day)	ALR (gallons per week)	Maximum Sump Capacity
1	1.93	38	266	1,500
2	3.75	75	525	1,500

For all flows, the following procedure is required for the secondary leachate system.

Each secondary leachate collection sump will be inspected at least once every 7 days for the presence of leachate. Pumpable quantities[4] of leachate contained in the sump will be removed and the quantity of leachate determined. If present, additional inflow to the sump will be measured and pumpable quantities removed.

The responses for each trigger level are listed sequentially and should be followed in the order presented. If a leak is located and flow to

4. Quantities which can be removed by pumping using a Grundfos Model SP 4-8 or equivalent submersible pump.

the secondary collection sump drops below the ALR no further action is required.

6.1 FLOW RATE LESS THAN THE ALR (20 gpad)

Under normal operating conditions, flows into each secondary leachate collection system are expected to be less than 20 gpad, the amount defined previously as the ALR. Of the total 20 gpad, approximately 5 gpad is estimated to be the result of construction water.

Increased flows related to rainfall events indicate damage to the primary lining system located on the landfill side slopes. Since the waste and intermediate cover will slope away from the landfill side slope, and thus direct runoff and any seepage toward the center of the landfill, the only significant flows are expected to occur as a result of damage located above the elevation of the waste surface. This assumption can be verified by observing inflow rates following precipitation. If flow increases in direct response to rainfall or snow melt, the leak probably is located in the primary lining system above the top surface of the waste. If there is a lag time of 2 to 3 days or longer, the leak probably is located in the side slope primary lining system below the top surface of the waste.

The actions required to respond to flows between 5 and 20 gpad are:

1. Determine if the flow rate varies with precipitation.

2. If the flow rate varies with precipitation, examine the exposed side slope liner and repair any damage.

3. Document location, types, and extent of liner damage.

4. No other action is required.

6.2 FLOW RATES BETWEEN THE ALR (20 gpad) AND 300 gpad

Flows between 20 and 300 gpad indicate possible damage to the liner system. The required actions are listed below.

1. Verbally notify the EPA and DEQ within 1 working day if flow to the secondary leachate collection sump exceeds 20 gpad.

2. If the flow is between 20 to 300 gpad for two consecutive 1-week monitoring periods provide written notification to EPA and DEQ and implement the following steps.

3. Increase pumping frequency to every other day from both primary and secondary sumps until flow decreases below 20 gpad.

4. Examine the exposed side slope liner and repair any observed damage.

5. Document location, type, and extent of liner damage.

6. If a leak cannot be found and the flow continues after the exposed side slope liner has been repaired, investigate alternative sources of liquid. Prepare a written report describing actions taken to date and proposed future responses, and submit to the EPA and DEQ within 60 days for approval.

6.3 FLOW RATES BETWEEN 300 gpad AND THE RAPID AND LARGE LEAK (SECONDARY SUMP CAPACITY, 1,500 gpd[5])

1. Verbally notify the EPA and DEQ within 1 working day if flow to the secondary leachate collection sump exceeds 20 gpad.

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5. The upper bound 1,500 gpd represents the capability of the secondary leachate collection system to remove leakage and is independent of the cell size. This represents a leak defined by EPA as rapid and large.

2. If the flow is between 300 gpad and 1,500 gpd for two consecutive monitoring periods provide written notification to EPA and DEQ and implement the following steps.

3. Stop waste placement within 15 feet of the side slope liner until a leak has been located, other appropriate actions have been taken, or flow to the secondary leachate collection system sump has decreased below the ALR.

4. Increase pumping frequency to every day from both the primary and secondary sumps until flow decreases below the ALR.

5. Remove all standing water from within the landfill including from within temporary retention basins.

6. Examine the exposed side slope liner.

7. Repair any observed damage.

8. Document location, type, and extent of liner damage, if any.

9. If flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party inspection by a registered professional engineer and investigate alternative sources of liquid.

10. If a leak cannot be located or the flow continues to exceed the ALR after both the 100-mil and primary liners have been repaired, prepare a written report describing actions taken to date and proposed future responses and submit to EPA and DEQ within 60 days for approval.

6.4 FLOW RATES GREATER THAN 1,500 gpd

1. Verbally notify the EPA and DEQ within 1 working day if flow to the secondary leachate collection sump exceeds 20 gpad.

2. If the flow exceeds 1,500 gpd for two consecutive monitoring periods provide written notification to EPA and DEQ and implement the following steps.

3. Stop waste placement within 15 feet of the side slope liner until a leak has been located, other appropriate actions have been taken, or flow to the secondary leachate collection system sump has decreased below the ALR.

4. Increase pumping frequency to every day from both the primary and secondary sumps until flow decreases low the ALR.

5. Remove all standing water from within the landfill including from within temporary retention basins.

6. Examine the exposed side slope liner.

7. Repair any observed damage.

8. Document location, type, and extent of liner damage, if any.

9. If flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party inspection by a registered professional engineer, and investigate alternative sources of liquid.

10. Examine the primary liner 5 feet on either side of the damage to the protective liner from the elevation of the damage to the top elevation of waste.

11. Repair any observed damage.

12. Temporarily stop placing waste into the affected cell until repairs to the lining system or other appropriate actions are completed, and flows to the secondary sump have decreased to below 20 gpad.

13. Verify that the waste surface is sloping away from the landfill side slopes. If necessary, regrade waste or place soil to achieve a minimum 1 percent slope away from the side slope.

14. Document location, type, and extent of liner damage in a written report to EPA and DEQ.

15. If a leak cannot be located or the flow continues to exceed the ALR after both the 100-mil and primary liners have been repaired, prepare a written report describing actions taken to date and proposed future responses and submit to EPA and DEQ within 60 days for approval.

Envirosafe Services of Idaho

The magnitude of leakage estimated for the ALR for each disposal unit is 21 gal/day/acre (gpad). This value is comprised of the following:

Source	Estimate Flow Rate (GPAD)
Leakage Through the Primary Liner and Construction Water	20
Measurement Error (Detection Sensitivity)	1
	ALR = 21

6.0 Responses

Actions required for response to established flow rates in each of the LDCRS are provided within this section. Anticipated flow rates within the LDCRS are a function of the disposal unit surface area. The specific ALR values for each of the disposal units are presented in Table 6.1. The responses for each trigger level are listed sequentially and will be followed in the order listed. If a leak is located and flow to the LDCRS sump drops below the ALR, no further action is required.

For all LDCRS, the following steps are required:

- Inspect each LDCRS sump of active units weekly for the presence of liquids. Analyze (average) the monitoring data on a gallons per day basis.

- Inspect the LDCRS sumps of closed units monthly during the facility operating life for the presence of liquids. Analyze (average) the monitoring data on a quarterly basis.

- Remove pumpable quantities of liquid collected within the LDCRS sump. The pumpable level varies based on unit construction and the installed sump pump, but will normally be a liquid level exceeding 12 inches.

- Measure the quantity of liquid removed from the LDCRS sump.

- Compare "averaged" leakage rate to the ALR in Table 6.1.

6.1 Flow Rates Less Than the ALR

Flow rates less than ALR are predicted for normal daily operating conditions. For landfill trenches, if flow rates increase during a rainfall event it may indicate that defects are present in the side slopes of the primary liner. If the flow rate increase lags the rainfall event in the landfill trench by a few days, this situation may indicate that defects are present in the base (floor) of the primary liner. The above assumptions may be confirmed by observing inflow rates during occurance of the rainfall event. A defective surface impoundment will experience an instantaneous response to rainfall events. Increased flows in the LDCRS's may indicate defects to the side slopes of the primary lining system above the initial (prerainfall) water surface.

Actions in response to "averaged" leakage rates between 0 and the ALR in surface impoundments are as follows:

- Determine if the flow rate varies with precipitation. If the flow rate varies with precipitation, observe the flow to determine if a lag time exists.

- If a lag time exists, the most probable leakage source is below the water surface.

- If the flow rate increase is instantaneous, the leakage source is at the liner anchor trench or at the elevation of the water surface.

- Isolate the leakage source by examining the exposed liner surfaces and repair any damage. For leakage that potentially originates below the water surface, continue to monitor the sump to ensure ALR is not exceeded.

- Document the location, types, and extent of liner damage (if any).

- No further action is required.

Actions in response to "averaged" leakage rates between 0 and ALR in landfill trenches are as follows:

- Determine if the flow rate varies with precipitation. If the flow rate varies with precipitation, observe the flow to determine if a lag time exists.

- If a lag time exists, the most probable leakage source is on the liner base (floor).

- If the flow rate increase is instantaneous, the leakage source is at the liner anchor trench or at the elevation of the waste face.

- Isolate the leakage source by examining the exposed liner surfaces and repairing any damage. For leakage that potentially originates between the liner base (floor) and the waste face, continue to monitor the sump to ensure ALR is not exceeded.

- Document the location, types, and extent of liner damage (if any).

- No further action is required.

6.2 Flow Rates Between the ALR and 300 GPAD.

Flow rates between the ALR and 300 gpad in the LDCRS connote possible damage to the primary liner. The required actions for both surface impoundments and landfill trenches are as follows:

- If the "averaged" leakage rate exceeds the ALR, notify the Regional Administrator in writing within 7 calendar days of this determination.

- Review and assess operating practices.

- Increase the pumping rate or frequency for both primary and LDCRS sumps until the flow decreases below the ALR.

- Examine the exposed side slope liner and repair any observed damage.

- Document the location, type, and extent of liner damage.

- Report in writing to the Regional Administrator on the effectiveness of the response action, as soon as practical after the response has been in place for 60 days.

- If a leak cannot be found and the flow continues after the exposed side slope liner has been repaired, investigate alternative sources of liquid. Prepare a written report describing the actions taken to date and the proposed future responses, and submit to the Regional Administrator within 60 days for approval.

6.3 Flow Rates Between 300 GPAD and the Rapid and Extremely Large Leak Rate (RELLR)

Flow rates in surface impoundments LDCRS between 300 gpad and the rapid and extremely large leak require response actions as follows:

- If the "averaged" leakage rate exceeds the 300 gpad, but is less than RELLR, notify the Regional Administrator in writing within 7 calendar days of this determination.

- Review and assess operating practices.

- Inspect LDCRS sump every business day and increase the pumping rate or frequency.

- Cease placing liquid waste in the impoundment until the leakage source has been located, other appropriate actions have been taken, or flow to the LDCRS sump has decreased below the ALR.

- Gradually transfer liquids from within the surface impoundments until the leakage rate drops below the ALR. This will provide an indication of the approximate elevation of the leak. Accept liquid wastes and operate impoundment at this reduced maximum level.

- Examine the exposed portions of the liner.

- Repair any observed damage.

- Document the location, type, and extent of liner damage (if any).

- If the flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party inspection by a registered engineer.

- Analyze liquid for unanticipated waste constituents.

- Report in writing to the Regional Administrator on the effectiveness of the response action, as soon as practical after the response has been in place for 60 days.

- If a leak cannot be located or the flow continues to exceed the ALR after the primary liner has been repaired, prepare a written report describing the actions taken to date and the proposed future responses, and submit to the Regional Administrator within 60 days for approval.

Flow rates in the landfill trenches between 300 gpad and the rapid and extremely large leak rate require response actions as follows:

- If the "averaged" leakage rate exceeds 300 gpad, but is less than the RELLR, notify the Regional Administrator in writing within 7 calendar days of this determination.

- Review and assess operating practices.

- Inspect LDCRS sump every business day and increase pumping rate or frequency for both primary and LDCRS sumps until flow decreases below the ALR.

- Cease placing wastes within 10 feet of the side slope liner until the leakage has been located, other appropriate actions have been taken, or the flow to the LDCRS sump has decreased below the ALR.

- Remove all standing water from within the landfill, including water from within temporary runoff collection areas.

- Examine the exposed portions of the liner.

- Repair any observed damage.

- Document the location, type, and extent of liner damage (if any).

- If the flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party inspection by a registered engineer.

- Report in writing to the Regional Administrator on the effectiveness of the response action as soon as practical after the response has been in place for 60 days.

- If a leak cannot be located or the flow continues to exceed the ALR after the primary liner has been repaired, prepare a written report describing the actions taken to date and the proposed future responses and submit to the Regional Administrator within 60 days for approval.

6.4 Flow Rates Greater Than Rapid and Extremely Large Volumes of Leakage (1,500 gpd)

Flow rates greater than 1,500 gpd require that corrective actions be taken for landfill trenches as follows:

- If the "averaged" leakage rate exceeds the RELLR, notify the Regional Administrator in writing within 7 calendar days of this determination.

- Review and assess operating practices.

- Inspect LDCRS sump every business day and increase the pumping rate or frequency for both the primary and LDCRS sump until flow decreases below the ALR.

- Stop waste placement within 10 feet of the side slope liner until the leakage has been located, other appropriate actions have been taken, or flow to the LDCRS sump has decreased below the ALR.

- Remove all standing water from within the landfill, including water from within temporary runoff collection areas.

- Examine the exposed side slope liner.

- Repair any observed damage.

- Document the location, type, and extent of liner damage (if any).

- If the flow continues to exceed the ALR for an additional 1-week monitoring period, provide third party inspection by a registered professional engineer.

- Examine the primary liner 5 feet on either side of the damage from the elevation of the damage to the top elevation of waste.

- Repair any observed damage.

- Temporarily stop placing waste into the affected disposal unit (or subcell) until repairs to the lining system or other appropriate actions are completed, and flows to the LDCRS sump have decreased to below the ALR.

- Verify that the waste surface is sloping away from the landfill sideslopes toward the temporary runoff collection areas. If necessary, regrade and compact waste or place cover soil to achieve a minimum 2 percent slope to promote runoff and minimize infiltration.

- Report in writing to the Regional Administrator on the effectiveness of the response action as soon as practical after the response has been in place for 60 days.

- If a leak cannot be located or the flow continues to exceed the ALR after the primary liner has been repaired, prepare a written report describing the actions taken to date and the proposed future responses, and submit to the Regional Administrator within 60 days for approval.

Flow rates greater than 1,500 gpd require that corrective actions be taken for surface impoundments as follows:

- If the "averaged" leakage rate exceeds the RELLR, notify the Regional Administrator in writing within 7 calendar days of this determination.

- Inspect LDCRS sump every business day and increase the pumping rate or frequency.

- Dewater surface impoundment until flow to the LDCRS sump is less than the ALR. Operate impoundment at this reduced maximum level.

- Isolate the leakage source by examining the exposed liner surfaces.

- Repair any observed damage.

- Document the location, type, and extent of liner damage (if any).

- Report in writing to the Regional Administrator on the effectiveness of the response action as soon as practical after the response has been in place for 60 days.

- If a leak cannot be located, prepare a written report describing the actions taken to date and the proposed future responses and submit to the Regional Administrator within 60 days for approval.