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List of Acronyms

ARARs	applicable or relevant and appropriate requirements
BERA	baseline ecological risk assessment
BGS	below ground surface
Clayton	Clayton Group Services, Inc.
cm/sec	centimeters per second
COPC	contaminant of potential concern
CPECs	contaminants of potential ecological concern
CSM	conceptual site model
CWA	Federal Clean Water Act
DOT	U.S. Department of Transportation NPDES requirements (40 CFR 122),
EcoTox	ecological and toxicological
E & E	Ecology and Environment, Inc.
EEEI	Ecology and Environment Engineering, Inc.
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
EPCs	exposure point concentrations
ERT	Environmental Response Team
ESA	Federal Endangered Species Act
ET	evapotranspiration
FFS	Focused Feasibility Study
FML	flexible membrane liner
FWS	U.S. Fish and Wildlife Service
HDPE	high-density polyethylene
HEAST	Health Effects Assessment Summary Table
HHRA	human health risk assessment
HI	hazard indices

List of Acronyms (Cont.)

IAC	Illinois Administrative Code
IGA	intergovernmental agreement
Illinois EPA	Illinois Environmental Protection Agency
IRIS	Integrated Risk Information System
IROD	Interim Remedial Action Record of Decision
LCC	Lake Calumet Cluster
LFG	landfill gas
MWH	Montgomery Watson Harza
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OU1	Operable Unit 1
OU2	Operable Unit 2
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PRG	preliminary remediation goal
RAIS	Risk Assessment Information System
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RfDs	reference doses
ROs	Remediation Objectives
SFs	slope factors
SIC	Standard Industrial Classification
SLERA	screening-level ecological risk assessment
START	Superfund Technical Assessment and Response Team

List of Acronyms (Cont.)

TACO	Tiered Approach to Corrective Action Objectives
TBCs	to be considered
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act

1 Introduction

This document was prepared for the Illinois Environmental Protection Agency (Illinois EPA) under Professional Services Agreement Number HWA-1309, Amendment No. 17, dated February 18, 2006 between Illinois EPA and Ecology and Environment, Inc. (E & E).

Under this work order, E & E was tasked to develop a Focused Feasibility Study (FFS) Report for the Lake Calumet Cluster (LCC) site located in Chicago, Cook County, Illinois (see Figure 1-1). This FFS was prepared to identify potential remedial options that may be implemented as part of a proposed interim remedial action, which is intended to address buried and exposed waste on the site, as well as site surface water runoff that enters Indian Ridge Marsh.

Ecology and Environment Engineering, Inc. (EEEI), E & E's wholly owned, Illinois-licensed engineering subsidiary, developed this document. Additionally, the Illinois EPA is the lead agency, and the United States Environmental Protection Agency (EPA) is the support agency for this site.

1.1 Purpose and Organization of Report

This FFS Report was developed in accordance with applicable EPA guidance documents, including:

- EPA's *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (EPA/540/P-91-001); and

- EPA's *Presumptive Remedy for CERCLA Municipal Landfill Sites* (EPA 540-F-93-035).

This report is divided into six sections. Section 1 provides background information and summarizes the findings of previous LCC site investigations and reports. Section 2 screens potential remedial technologies, Section 3 develops comprehensive site alternatives, and Section 4 provides a detailed analysis of the alternatives

characterized by marsh-type vegetation and some open water. Activities up to the 1970s consisted primarily of a combination of what are described as "extraction" activities, which evidently refer to excavation and removal of soil materials from the site, and filling activities. The filling activities were first noted in the northwest quadrant of the site, and were described as the dumping of both solid and liquid wastes in this area. Drainage was noted to flow toward the eastern half of the site, which at the time was still a wetlands area.

Extraction and filling continued on the site through the early 1970s, at which time the entire site was disturbed, and fill occupied the full site north to south and over half the site from west to east. Liquids were noted to be draining in all directions, and standing pools of liquids were noted in the pit areas, which had been excavated and as yet unfilled.

Several investigations have been performed at the LCC site since the early 1980s. These investigations, which have identified soil, sediment, and groundwater contamination at the site, are discussed in more detail in Sections 1.3 and 1.4. A brief description of each of the LCC sites is presented below.

1.2.2.1 Alburn Incinerator

The former Alburn Incinerator (Alburn) site is located 0.5 miles east of Lake Calumet, 1 mile west of the Calumet River, and 1.25 miles north of the Little Calumet River. The Alburn Incinerator parcel encompasses approximately 35 acres. The Alburn site operated as a landfill from 1967 through 1977, and historic records suggest that the property received a large amount of slag material that raised the ground height above the existing surface water level. No details are available concerning the types and quantities of wastes buried during this period. In 1977, Alburn initiated hazardous waste incineration and hazardous waste storage and transfer operations. In 1979, the EPA issued a Resource Conservation and Recovery Act (RCRA) permit to Alburn for the operation of the incinerator. Alburn incinerated/stored hazardous wastes and sludge, including paints, thinners, varnishes, chlorinated solvents, styrene, ink, adhesives, waste oils, antifreeze, petroleum, naphtha, coal tar, and waste solvents. Site storage and disposal methods included landfilling, incineration, operation of a surface impoundment, and bulk liquid waste storage.

In 1982, Alburn had their permit revoked due to several RCRA violations. Alburn continued to accept bulk waste until January 1983. On July 5, 1983, two on-site drums exploded from heat expansion and a subsequent chemical reaction. EPA ordered an immediate removal action to remove all visible sources of hazardous materials from the site, including bulk storage tanks, drums, 5-gallon pails, and lagoon sludge. In addition, the top 6 inches of soil, assumed to be the most contaminated, was excavated, and the site received a partial cover. Illinois EPA conducted a follow-up soil sampling investigation in 1988 and 1989.

of drums are also alleged to have been buried. Illinois EPA samples collected in 1985 indicated significant levels of volatiles, semivolatiles, polychlorinated biphenyls (PCBs), and heavy metals. In 1990, Illinois EPA conducted an immediate removal action at the site of 60 drums of hazardous materials and 2,200 cubic yards of acidic soil. The lagoon area was capped with clay. The lagoons have been closed and fenced since October 1993.

1.3 Nature and Extent of Contamination

For this FFS, data obtained from the four most recent investigations has been used to define the nature and extent of soil contamination at the LCC site, which has been defined as Operable Unit 1 (OU1). It should be noted that addressing groundwater contamination as a remedial action is beyond the scope of this FFS and will not be addressed in this report. Groundwater, which for the LLC site is defined as OU2, will be addressed under a separate action. Groundwater monitoring is included as a component of each of the alternatives for OU1.

The four investigative reports used in the development of this section are:

- E & E, March 10, 1999a, *Results of Phase I Sampling Activities for the Lake Calumet Site*;
- E & E, November 30, 1999b, *The Nature and Extent of Contamination at the Lake Calumet Cluster Site*;
- Harza Engineering Company, May 2001, *Comprehensive Site Investigation Report, Lake Calumet Cluster Site: Alburn, U.S. Drum, and Unnamed Parcel Areas*; and
- Clayton Group Services, Inc. September 27, 2002, *Remedial Options Report, Southeast Chicago Cluster Site*.

Since 1998, a total of 123 surface soil samples and 19 subsurface soil samples have been collected and submitted for various analyses. Additionally, a total of 145 test pit excavations have been performed with a minimum of two soil samples collected from each pit.

In addition to the soil and test pit investigations, groundwater was also investigated by E & E. A total of 18 groundwater monitoring wells were sampled for VOCs, SVOCs, and metals. Based on the detected contaminant concentrations, iron, manganese, benzene, and benzo(a)pyrene exceeded the human health threshold for drinking water. Groundwater contamination for these contaminants of potential concern (COPCs) extends across most of the site with the two areas of highest contamination being located on the Alburn site in an area between the Paxton I Landfill and Big Marsh. Additionally, within the Paxton I area, a significant tetrachloroethene and trichloroethene plume was identified. While this information shows that groundwater has been adversely affected by previous site use, groundwater will be addressed under a separate action and will not be further discussed in this FFS.

1.3.1 Surface and Subsurface Soil Sampling Results

Between August 1998 and June 1999, and under contract to the EPA, E & E's Superfund Technical Assessment and Response Team (START) collected surface and subsurface soil samples and provided for laboratory analysis of approximately 135 compounds. Based on the detected concentrations in these samples, the following COPCs were identified:

- Metals – Arsenic, barium, chromium, lead, and mercury;
- PCBs and Pesticides – Aroclor 1254, beta-BHC, and Dieldrin;
- Volatile organic compounds (VOCs) – Naphthalene; and
- Polynuclear aromatic hydrocarbons (PAHs) - Benzo(a)pyrene, benzo(a)anthracene, and dibenz(a,h)anthracene.

The area of the former Alburn incinerator was the most consistently contaminated parcel of the LCC site. Two other areas that consistently showed contamination were the southwestern area of the Unnamed Parcel and the area immediately south of the Alburn parcel.

For metals, arsenic was the most frequently detected analyte that exceeded human health risk criteria. Barium, chromium, lead, and mercury were detected at concentrations that most frequently exceeded ecological risk criteria. Tables 1-1, 1-2, and 1-3 provide a summary of the analytical results.

1.3.2 Sediment and Surface Water Sampling Results

In addition to surface and subsurface soil sampling, E & E's START collected sediment and surface water samples from the LCC site and Indian Ridge Marsh for laboratory analysis. Based on the detected contaminant concentrations, the following sediment and surface water COPCs were identified:

Sediment:

- Metals –Arsenic, barium, cadmium, chromium, lead, manganese, mercury, and nickel; and
- PAHs –Anthracene, benzo(a)anthracene, benzo(a)pyrene, and chrysene.

Surface Water:

The most highly contaminated sediment samples collected at the LCC site were collected from the Alburn area. Toxicity characteristic leaching procedure (TCLP) analysis was also performed for metals. No detectable TCLP concentrations were reported for any analyte. Table 1-4 provides a summary of the analytical results for the COPCs.

In all of the collected samples, barium concentrations were detected at concentrations above the threshold screening value of 0.004 milligrams per liter. As with the sediment sample results, the most contaminated surface water samples were collected in the vicinity of the Alburn parcel. Water quality across the LCC site varies from north to south with the northern section having the highest detected contaminant concentrations and the southeastern section having the lowest ethene. Based on the varying depths of buried waste and the fact that the excavations apparently did not reach the bottom of the waste, the vertical extent of contamination (i.e., total depth/thickness of waste) was not be defined in the previous site investigations.

1.3.4 TCLP Soil Results

As part of the multiple investigations performed at the LCC site, limited TCLP testing was performed on a finite number of samples. As part of the E & E investigation, a total of 68 samples underwent TCLP metals analysis. A total of 3 samples detected lead at a concentration above its TCLP limit. No other metals were detected above their regulatory limits.

During the test pit investigations, 1 soil sample was submitted for TCLP SVOC analysis, 2 soil samples were submitted for TCLP pesticide analysis, 3 soil samples were submitted for TCLP metals analysis, and 4 soil samples were submitted TCLP VOC analysis. In one sample, trichloroethene was detected above its regulatory limit. No other compounds were detected above their regulatory limits in any of the samples.

Since records of waste shipments and disposal locations are not available, it can only be assumed that on-site hazardous waste determination can only be made based on analytical results. While there was limited sampling and analysis for TCLP parameters, based on the analytical results, isolated areas of site soil would be classified as a characteristic hazardous waste.

1.4 Human Health Risk Assessment Summary

This section summarizes the *Human Health Risk Assessment (HHRA) Report for the LCC Site: Alburn, U.S. Drum II, and Unnamed Parcel Areas – Final Report,* previously prepared for the City of Chicago Department of Environment ta

1.4.1.1 Soil
Soil data were compared to Illinois TACO background concentrations and Tier 1 Soil Remediation Objectives (ROs) for the receptors listed in Subsection 1.4.2.1 of this report. Chemicals that exceeded both criteria were selected as COPCs.

1.4.1.2 Sediments
Sediment data were compared to Ontario Ministry of the Environment guidelines for protection of aquatic sediment quality (Persaud et al. 1993). Chemicals that exceeded these guideline concentrations were selected as COPCs.

1.4.1.3 Surface Water
Surface water data were compared to ecological and toxicological (EcoTox) thresholds (EPA 1996). Chemicals that exceeded the thresholds were selected as COPCs.

1.4.1.4 Groundwater
Groundwater data were compared to Illinois TACO Class I Groundwater ROs. Chemicals that exceeded these criteria were selected as COPCs.

1.4.1.5 Essential Nutrients
Calcium, potassium, magnesium, iron, and sodium are natural constituents, and were detected in all media. These chemicals are essential human nutrients and EPA has not established maximum allowable daily intakes or reference doses (RfDs) for these chemicals. Therefore, these chemicals were not selected as COPCs.

COPCs selected for soil and sediment for the Alburn, U.S. Drum II, and the Unnamed Parcel of the Lake Calumet Cluster site are listed in Table 1-7 of this FFS report. Approximately 25 to 35 COPCs were identified in each of the areas. A greater number of COPCs were found in soil and groundwater; fewer were found in surface water and sediment. The largest numbers of COPCs were metals or PAHs, but VOCs, SVOCs, pesticides, and PCBs also were represented.

1.4.2 Exposure Assessment
No significant use of the LCC site was occurring when the HHRA was prepared. A possible future use considered by the HHRA was as a solar-powered generating station. Therefore, potential receptors and exposures associated with such a use were used as the basis of the HHRA.

1.4.2.1 Receptors
Five categories of on-site workers were considered:

- A solar panels maintenance worker;
- A mower;
- A landscape maintenance worker;

critical noncarcinogenic effects and target organs of the systemic toxicants are summarized in Table 5-3 of the HHRA report.

1.4.4 Risk Characterization

Risk characterization procedures and calculations are described in the Human Health Risk Assessment report (Appendix A) for carcinogens and noncarcinogens. The human health risks estimated for all three areas are summarized in Table 1-7.

1.4.4.1 Alburn Area

Cancer risk and noncancer hazard estimates for the Alburn area are presented in HHRA Table 6-1. Soil COPCs were estimated to pose an excess lifetime cancer risk (ELCR) ranging from 2 x 10^{-6} for construction and landscape workers to 2 x 10^{-5} for general industrial/commercial workers. The total estimated hazard indices (HIs) for soil were less than 1 for all workers except construction workers for whom the HI was 3. For groundwater, surface water, and sediment, estimated ELCRs were less than 1 x 10^{-6} and the total HI was less than 0.1 for all workers.

The estimated ELCRs from soil COPCs fall within the 10^{-4} to 10^{-6} range generally considered acceptable by EPA. The estimated ELCRs for other media were less than 10^{-6} and would be considered minimal and acceptable. The COPCs that contributed significantly to the estimated ELCR included arsenic, benzene, benzo(a)pyrene, PCBs, and vinyl chloride.

The estimated HI of 3 for construction workers exceeds 1, the value below which adverse noncarcinogenic effects would not be expected. An HI above 1 does not necessarily mean that adverse effects would be manifested, but as the value increases above 1 the risk of adverse effects also increases. The elevated noncancer hazard was due primarily to toluene.

1.4.4.2 U.S. Drum II

Cancer risk and noncancer hazard estimates for the U.S. Drum II area are presented in HHRA Table 6-3. Soil COPCs were estimated to pose an ELCR ranging from 5 x 10^{-6} for construction workers to 5 x 10^{-5} for general industrial/commercial workers. The total estimated HIs for soil were less than 1 for all workers, although the HI approached 1 (0.9) for construction workers. For groundwater and surface water estimated ELCRs were less than 1 x 10^{-6}, and the total HI was less than 0.1 for all workers. No COPCs were identified for sediment in this area. The COPCs that contributed significantly to the estimated ELCR included arsenic, benzo(a)pyrene, dibenz(a,h)anthracene, and PCBs.

1.4.4.3 Unnamed Parcel

Cancer risk and noncancer hazard estimates for the Unnamed Parcel are presented in HHRA Table 6-5. Soil COPCs were estimated to pose an ELCR ranging from

assessment endpoints were found to be at risk. A summary of the individual assessment endpoint findings is provided below:

1. Wetland structure and function were predicted to be at risk based on adverse effects on fish, benthos, and nearly all wildlife functional groups from a variety of chemicals in water, sediment, and biota.
2. Fish recruitment and nursery function were predicted to be at risk for two reasons: (1) reduced survival of fathead minnows in toxicity tests with surface water from pond LHL-1 and the southeast ponds, and (2) exceedances of surface water screening criteria for metals (aluminum, chromium, copper, lead, vanadium, and zinc) and PCBs in the southeast ponds.
3. Benthic community viability and function were predicted to be at risk for three reasons: (1) low diversity and abundance of benthos in on-site ponds and nearby wetlands, (2) reduced survival of amphipods in toxicity tests with sediment from pond LHL-1 and the southeast ponds, and (3) exceedances of

Table 1-2 Summary of Surface Soil Analytical Results (2 to 3 Feet Below Ground Surface) for Contaminants of Potential Concern

Table 1-3 Summary of Subsurface Soil Analytical Results (4 to 6 Feet Belov l Surface) for Contaminants of Potential Concern
Focused Feasibility Study, Lake Calumet Cluster Site, Chicago nty, Illinois

Compound	Frequency of Detection	Minimum Detection	Average Detection	Maximum Detection

Table 1-4 Summary of Sediment Sample Analytical Results for Contaminants of Potential Concern Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois

Compound	Frequency of Detection	Minimum Detection	Average Detection	Maximum Detection	RCRA EDQL[a]	Number of Samples Exceeding RCRA EDQL
Metals (milligrams per kilogram)						
Arsenic	26/27	4.900	17.015	104	5.9	24/27
Barium	27/27	42.400	156.822	582	NP	NP
Cadmium	24/27	0.200	2.813	8.9	0.596	21/27

Table 1-5 Summary of Surface Water Sample Analytical Results for Contaminants of Potential Concern Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois

Compound	Frequency of Detection	Minimum Detection	Average Detection	Maximum Detection	OSWER[a] EcoTox	Number of Samples Exceeding OSWER Ecotox	RCRA[b] EDQL	Number of Samples Exceeding RCRA EDQL
Metals (milligrams per kilogram)								
Barium, dissolved	4/4	0.036	0.148	0.285	0.004	4/4	5	0/4
Barium, total	25/25	0.049	0.108	0.358	0.004	25/25	5	0/25
Iron, dissolved	4/4	0.054	0.195	0.523	1	0/4	NP	NP
Iron, total	25/25	0.084	0.909	6.580	1	7/25	NP	NP
Lead, total	7/25	0.003	0.022	0.107	0.002	7/25	0.001	7/25
Manganese, dissolved	4/4	34.7	56.000	75.8	NP	NP	NP	NP
Manganese, total	25/25	35.3	52.004	73.9	NP	NP	NP	NP
Pesticides (milligrams per kilogram)								
4,4'-DDD	2/25	0.00001	0.00002	0.00003	NP	NP	1.1E-6	2/25
Heptachlor	3/25	0.00001	0.0001	0.0003	6.9E-6	3/25	3.9E-7	3/25

linois

	Unnamed Parcel			
	Maximum Detected Concentration	**a**	**b**	**c**
	Not Detected			
	99.9	X		X
	3.0	X		
Chromium (Total)	1,620	X		
Lead	5,710	X		

**Table 1-6 Comparison of Test Pit Soil Analytical Data to TACO Cleanup Objectives
Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois**

Parcel	Alburn Incinerator				U.S. Drum II				Unnamed Parcel			
Compound	Maximum Detected Concentration	a	b	c	Maximum Detected Concentration	a	b	c	Maximum Detected Concentration	a	b	c
bis(2-Chloroethyl) Ether	0.68	X		X	ND				ND			

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Table 1-7 Summary of Human Health Risk Estimates

Environmental Medium	On-Site Worker	Construction Worker	Industrial/ Commercial Worker	Mower	Landscape Worker	Risk Drivers
Alburn Area						
Total Excess Lifetime Cancer Risks						
Soil	**5E-6**	**2E-6**	**2E-5**	**1E-5**	**2E-6**	Arsenic, benzene, benzo(a)pyrene, total PCBs, vinyl chloride
Groundwater	8E-7	3E-8	8E-7	NA	NA	
Surface Water	3E-9	1E-10	3E-9	NA	NA	
Sediment	2E-7	9E-9	2E-7	NA	NA	
Total Noncancer Hazard Index						
Soil	2E-2	**3E+0**	2E-1	4E-2	8E-1	

2 Identification and Screening of Technologies

2.1 Introduction

This section presents the first phase of the FFS process for the Lake Calumet Cluster site. The first step in developing remedial alternatives is to establish remedial action objectives (RAOs). Thus, for each medium of interest at the site, RAOs that will protect both human health and the environment are established. These objectives are typically based on COPCs and contaminants of potential ecological concern (CPECs), applicable or relevant and appropriate requirements (ARARs), and the findings of the human health and ecological risk evaluations. General response actions describing measures that will satisfy the remedial action objectives are then developed. This includes estimating the areas or volumes to which the response actions may be applied. Finally, remedial technologies applicable to each action are identified and discussed with respect to their effectiveness and implementability. The applicable technologies are then assembled into medium-specific remedial alternatives in Section 3.

2.2 Remedial Action Objectives

2.2.1 Development of Remedial Action Objectives

Based on the Human Health Risk Evaluation, Ecological Risk Evaluation, and potentially complete exposure pathways, the following list of RAOs was developed for protection of human health and the environment:

1. Prevent direct and dermal contact with, and ingestion of, contaminated soil/landfill contents;
2. Prevent inhalation of dust;
3. Minimize or eliminate contaminant leaching to groundwater aquifers;
4. Prevent ingestion, adsorption, and bioconcentration of on-site surface water and sediment;
5. Provide groundwater monitoring of the contaminant plume;
6. Prevent explosions from accumulations of LFG; and
7. Prevent inhalation of COPCs present in the LFG in excess of benchmark concentrations.

Selected RAOs are consistent with those presented in *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (EPA/540/P-91/001). Groundwater remedies and development of groundwater RAOs are not included as part of this FFS.

2.2.2 ARARs and Other Policies a

The requirements set forth under 35 IAC 817.410 are same as those set forth under 35 IAC 811.314 with the following exceptions:

- The low-permeability layer, if constructed of earthen material, shall be a minimum of 2 feet thick.

- The protective layer shall have a minimum thickness of 1.5 feet.

Given that slag may be imported from local steel mills to be used as part of a gas collection system, the requirements of 35 IAC 817 are considered to be relevant.

35 IAC 724

This standard is for owners and operators of hazardous waste treatment, storage, and disposal facilities. Its purpose to establish minimum standards that define the acceptable management of hazardous waste.

Section 724.410 (Closure and Post-Closure Care) defines the minimum requirements for landfill covers, which are:

- Provide long-term minimization of migration of liquids through the closed landfill;

- Function with minimum maintenance;

- Promote drainage and minimize erosion or abrasion of the cover;

- Accommodate settling and subsidence so that the cover's integrity is maintained; and

- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

At the LCC site, there is no manmade or installed liner system. Waste material was placed at and/or beneath the water table, with the aquifer soil consisting primarily of fine silty sand. Located approximately beneath the aquifer is a clay lens, which acts as an aquitard. The characteristics of this clay layer across the site are poorly defined. Given that waste material is in direct contact with groundwater and the clay layer is not clearly defined, a standard hydraulic permeability cannot readily be established for this regulation.

While 35 IAC 724 was established to address hazardous waste treatment, storage, and disposal facilities, the EPA issued a technical guidance document, *Final*

extraction system. Treatment, discharge and the associated permits for emitting combusted landfill gas to the atmosphere would be covered under 35 IAC 811.312 (Landfill Gas Processing and Disposal System). Given that the flare system at Paxton will be used, and no additional equipment outside of the collection header piping and valves would be installed at the LCC site, an air permit for the LCC site would not be required. However, 35 IAC 811.312 is still considered to be relevant because a permit modification may have to be obtained to add the LCC site landfill gas to the influent gas generated at Paxton II.

Additionally, 35 IAC 811.312 further references that the discharge permit from a flare system must include the six criteria air pollutants and the hazardous air pollutants subject to regulation under the Clean Air Act (42 U.S. C. 7401 et seq.). Finally, the air discharge permit must also meet the requirements of 35 IAC 200 through 245.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) addresses the manufacture, handling, and disposal of specific toxic substances, including PCBs. Because PCBs have been detected at significant concentrations at the LCC site, TSCA requirements apply to actions addressing PCB-containing materials.

The ARARs and TBCs identified in Tables 2-1, 2-2, and 2-3 enter into the evaluation of remedial alternatives, discussed in Section 4 of this report. The list of ARARs and TBCs will be refined as a preferred alternative is selected, and final ARARs will be presented in the Interim Remedial Action Record of Decision (IROD).

2.2.3 Cleanup Goals

The final step required for the development of RAOs is to establish cleanup goals based on chemical-specific ARARs, TBCs, and COPCs and CPECs. The aim of remedial action objectives is to meet ARARs and eliminate exposure to contaminants of concern such that human health and the environment are adequately protected. This can be achieved by eliminating exposure pathways (which is discussed in the upcoming Section 2.3, Identification of General Response Actions) or reducing contaminant concentrations to levels that are accepted to be adequately protective of human health and the environment.

This FFS follows the presumptive remedy for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) municipal landfill sites and focuses on capping to eliminate exposure pathways. Therefore, establishing

2.3.5 Surface Area and Volume Estimation of Contaminated Media

Land Disposal Areas and Volumes

The surface area of the site was obtained using the boundaries established in a 1999 aerial photograph obtained from Patrick Engineering Inc. Based on this aerial photograph and adding to the north boundary to tie into the Paxton I landfill cap, it is estimated that the site encompasses an area of approximately 90 acres. Total fill volumes were obtained from estimates in Clayton Group Services, Inc.'s (Clayton's) *Remedial Options Report for the Southeast Chicago Cluster Site,* Volume 1 of 2. Reported fill areas are estimated to be up to 30 feet in depth; based on this value and using a site area of 76 acres, Clayton estimated a total fill volume in excess of 4.75 million cubic yards (Clayton 2002).

Gas Production Rates

Methane gas production in landfills can be associated with the anaerobic decomposition of organic materials in the landfill and depends on the moisture content of the waste. (The highest generation rates occur between 60% and 80% saturation.) Since significant concentrations of organic vapors were documented during the test pit excavations, for the purposes of this FFS it has been assumed that methane is being generated and that a gas collection system will be required. It should also be noted that a methane survey may be performed at the site as part of the engineering design effort.

2.4 Identification of Applicable Remedial Technologies

Applicable remedial technologies are identified below for each general response action. The section has been refined by retaining only those remedial technologies appropriate for the LCC site, taking into account the following:

- Site conditions and characteristics that may affect implementability of the technology;
- Physical and chemical characteristics of contaminants that determine the effectiveness of various technologies; and
- Performance and operating reliability of the technology.

2.4.1 Soil and Waste

Existing site information was reviewed to determine future probable property use. As indicated by the site history and analytical results from site investigations, the site consists of multiple disposal areas generally extending to a depth of 30 feet. The agglomeration of disposal areas makes up what could be considered a non-permitted landfill. The most likely future use of the property is as open space. This evaluation assumes that the site would not be accessible to people with the exception of periodic on-site operations and maintenance (O&M) work.

The first step in the development of remedial alternatives was to screen available, viable remedial technologies that could be applied to the site. The list of potential remedial technologies was quickly narrowed because VOCs, SVOCs, and metals were all present above acceptable risk levels at the site. Most technologies currently available are not able to address both organics and inorganic contamination. Additionally, the various organics present in at the site are generally remediated by different methods (i.e., anaerobic degradation for tetrachloroethene (PCE) and aerobic degradation for benzene). The immense volume of waste present at the site (in excess of 4.75 million cubic yards assuming a total depth of 30 feet [Clayton 2002]) makes any option focused on removal or treatment of the total volume economically infeasible. Technologies that were considered but eliminated during the initial screening include:

1. Bioremediation;
2. Chemical destruction/detoxification (oxidation/reduction, dehalogenation, neutralization);
3. Thermal treatment (incineration, in situ vitrification, pyrolysis);
4. Chemical/physical extraction (soil vapor extraction, soil flushing, soil washing);
5. Thermal desorption (low temperature thermal desorption, steam stripping);
6. Immobilization (stabilization/solidification, fixation); and
7. Soil aeration.

Although not technically a landfill, the LCC site has the same characteristics as a non-permitted abandoned landfill. The permeable cover allows substantial infiltration of water through the waste, contaminated shallow groundwater is present possibly due to this infiltration, regional shallow groundwater flow is present, and contaminant types (i.e., organics, metals, pesticides, etc.) are not specific to a particular area due to widespread dumping of various wastes. Because of the uncertainty about specific site contents and their location, it is impossible to fully characterize, excavate, and/or treat independent source areas. Characterization of landfill contents is not necessary for selecting a remedial option, but existing data are used to determine whether the containment presumption is appropriate. Based on the

northwest corner of the Paxton II site to Lake Calumet. The option to discharge surface waters to Indian Ridge Marsh will also be explored during the design phase of the project.

2.4.5 Groundwater

Groundwater remediation is not part of OU1; however, groundwater monitoring will be a component of the operations and maintenance for any selected remedy.

2.4.6 Construction Quality Assurance Program

The CQA program ensures the structural stability and integrity of all components, proper construction of all components, and conformity of all materials used with design or other material specifications. A construction quality assurance (CQA) program is required in accordance with 35 IAC 724.119.

Table 2-1 Chemical-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation

Table 2-2 Location-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Location-Specific ARARs and TBCs					
Illinois Environmental Protection Act, Pollution Control Board	Secondary Contact Waters	Title 35 IAC, Section 303.441	Designates Lake Calumet and Calumet River as secondary contact and indigenous aquatic life waters	Potentially Relevant	For this category of surface waters, different water quality standards apply; pertinent for any wastewater discharges in the course of the remedial action
Illinois Endangered Species Protection Act, Illinois Department of Natural Resources	Endangered Species	Title 17 IAC, Part 1075	Requires consultation with DNR by other state/local agencies prior to acts that may affect T & E species	Potentially Applicable	Relevant if T&E species in vicinity of site
Illinois Interagency Wetlands Policy Act	Wetlands Protection	Title 17 IAC, Part 1090	Requires DNR review of any state-funded action that may impact wetlands	Potentially Relevant	
Illinois Department of Natural Resources	Floodplain Construction	Title 17 IAC, Part 3706	Restricts construction activities in floodplain	Not Applicable	

Table 2-3 Action-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation

Table 2-3 Action-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Illinois Environmental Protection Act, Pollution Control Board (Cont.)	Illinois Superfund Program	35 IAC 750	Establishes procedures for assessing and remediating Illinois State Superfund sites	Applicable	See text
	Solid Waste and Special Waste Hauling	Subtitle G, Chapter I, Subchapter i	Regulates classification, transport, and disposal of solid and special waste	Potentially Applicable	Relevant to transport and disposal of non-hazardous remediation-derived waste; landfill requirements may be relevant and appropriate for capped area (refer to federal requirements)
	Noise	Subtitle H	Sound emission standards and limitations	Potentially Applicable	For construction equipment during remedial action; because of surrounding land use, may not be relevant
	Hazardous Waste Cover Systems	35 IAC 724, Subpart N	Standards for hazardous waste landfill cover systems	Potentially Applicable	
	Closure and Post-Closure Care	35 IAC 724.410	Closure and post-closure requirements for hazardous waste landfills	Potentially Applicable	
	Leachate Collection	35 IAC 724.401(c)(2)	Liner requirements and collection and removal standards	Not Applicable to OU1	Not relevant to this phase of the project
	Run-on and Run-off Management and Collection Systems	35 IAC			

Table 2-3 Action-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation	Brief Description	

Table 2-3 Action-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Clean Water Act	National Pollutant Discharge Elimination System (NPDES)	40 CFR 122 and 125	Issues permits for discharge into navigable waters. Establishes criteria and standards for imposing treatment requirements on permits.	Potentially Applicable	Relevant for any wastewater discharges in the course of the remedial action
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb).	Potentially Applicable	Potentially relevant for landfill gas flare emissions
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants. Identifies 25 additional contaminants as having serious health effects but does not provide emission standards for these contaminants.	Potentially Applicable	Potentially relevant for landfill gas flare emissions
Toxic Substances Control Act	Rules for Controlling PCBs	40 CFR 761	Provides guidance on storage and disposal of PCB-contaminated materials	Potentially Applicable	Relevant for transport of any PCB-containing materials, if any such materials generated in the course of the remedial action is removed from the site
Resource Conservation and Recovery Act	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste.	Potentially Applicable	

Table 2-3 Action-Specific ARARs and TBCs, Lake Calumet Cluster Site

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
EPA Publication (Cont.)	Standardized Procedures for Planting Vegetation on Competed Sanitary Landfills	EPA/600/2-83/055	Describes planting proce		

3 Development of Remedial Alternatives

Currently, the LCC site is covered with soil, slag, cinders, and various other construction debris with depths generally ranging from 0 to 3 feet. Test pit excavations found fill thicknesses ranging from 0 to greater than 30 feet BGS. Based on the results of the soil investigation, contamination was detected in surface soils, and there are several locations were little to no soil cover exists and contact with waste material is possible. Additionally, the bulk of waste located on site is beneath the water table, allowing contaminants to leach directly into the groundwater.

Under an intergovernmental agreement (IGA) with the Illinois EPA, the Illinois Department of Transportation (IDOT) has been exporting excess native soils from their Dan Ryan Expressway Reconstruction Project to the LCC site. This soil varies from sand to clay with the majority of the material being silty-clay to clay. The material imported to the LCC site is tested by IDOT prior to shipment to the site to ensure that the standards of the IGA are met. The IGA requires all soils to meet the TACO Tier 1 Soil Remediation Objectives for Residential Properties (35 IAC 742, Appendix B, Table A). The IAG also requires the soils to not contain any contaminants that are not listed on the Target Compound List found in 35 IAC 740, Appendix A, to contain only native soils, to be visually inspected, and not to have been used as fill material.

In addition to the Tier 1 requirements, the IGA establishes acceptable levels for PAHs, which are based on background concentrations for the City of Chicago, Metro, and Non-Metro areas.

Whenever IDOT imported soils are referenced within this document, it should be assumed that these soils meet the IGA standard. There are approximately 300,000 cubic yards of material currently on site, and it is estimated that the total volume of imported soils may reach as much as 1 million cubic yards. Once the soil reaches the site, it is sorted into piles based on a visual inspection.

Given the amount of the soil that will be required as part of the action alternatives, it has been assumed, wherever possible, that the IDOT material will be incorpo-

Site Preparation

Site preparation would be performed before any disturbance of the existing surface is initiated. The purpose of site preparation is to remove on-site structures and vegetation that would affect the cover construction, and to control and collect runoff during construction. Three small structures will be demolished and disposed of off site following assessments for asbestos-containing materials and lead. Site runoff can potentially be contaminated by contact with the waste and sediment from exposed soils. Temporary collection ponds would be built, and silt fencing or straw bales located along downstream perimeters will prevent sediment-laden water from flowing off site. Following implementation of these measures, clearing, grubbing, and removal of the existing vegetation on site is necessary to facilitate further operations. Woody and brushy material can be chipped for volume reduction, and may be reusable as mulch elsewhere. The vegetation removal would be done in phases preceding earthwork operations to minimize erosion impacts.

The TCLP results obtained from previous investigations indicate that there are four sampling locations that contained wastes characteristically hazardous for either metals or VOCs (Clayton 2002). The Illinois EPA will need to evaluate whether any of these wastes would be regulated as hazardous waste under this alternative, and require removal and off-site disposal.

Access restrictions will also be enacted, in the form of deed restrictions and fencing (groundwater restrictions already exist within the limits of Cook County,

at the site, there would be a lower potential for percolation through the cover system. Therefore, ET cover systems tend to highlight the following properties:

1. Fine-grained soils, such as silts and clayey silts, that have a relatively high water storage capacity;
2. Native vegetation to increase evapotranspiration; and
3. Locally available soils to streamline construction and provide cost savings.

Two general types of ET cover systems are monolithic barriers and capillary barriers. Monolithic covers use a single vegetated soil layer to retain water until it is transpired through vegetation or evaporated through the soil surface. A capillary barrier system consists of a finer-grained soil layer overlying a coarser-grained material layer, usually sand or gravel.

ET cover systems are increasingly being considered for use at municipal solid waste and hazardous waste landfills when equivalent performance to conventional final cover systems can be demonstrated. ET covers are generally less costly to construct and have the potential to provide equal or superior performance compared to conventional cover systems, especially in arid or semi-arid environments. The limitations of ET systems include the following:

1. Generally considered applicable only in arid or semi-arid climates;
2. Storage capacity must be relied on for large precipitation events occurring during dormant periods;
3. Production of landfill gases may limit plant growth;
4. Landfill gases are not normally captured and vented with ET cover systems;
5. Limited performance data are available; and
6. Models do not effectively predict performance of ET cover systems.

Site Preparation

Site preparation would be the same as detailed in Alternative 2.

Soil Cover and Vegetation

Following completion of site preparation, a grading layer would be constructed on the site using the IDOT material to attain the final site contour, demarcation fabric would be installed across the entire site, and a 4-foot-thick ET soil cap would be constructed. Perimeter waste may need to be excavated and consolidated on site to move it away from the site edges. As necessary, additional fill will be imported and placed to develop an acceptable degree of slope for proper drainage. The ET soil cap would consist of an uncompacted, medium-permeability soil, such a loam or sandy loam. Given the soil properties needed to facilitate proper root growth and permeability, the IDOT material could not be used. Therefore,

required and an inflation rate of 5%, the net present worth of this alternative is estimated to be $18,900,000. Table 3-3 summarizes the cost estimate for Alternative 4. Detailed cost estimate tables for each alternative are included in Appendix C.

3.5 Alternative 5: Capping of Existing Wastes with a Low-Permeability 35 IAC Part 811 Clay Cap

Description of Remedial Alternative

Alternative 5 involves c

will be considered uncontaminated, since it will not contact waste materials or contaminated media.

To collect and regulate the discharge rate of stormwater from the site, a detention pond would be constructed. Runoff would flow overland as sheet flow toward the detention pond, with shallow swales along the site perimeters aiding in collecting and transporting the flow to the pond. The pond area would be built above the soil cover and have an FML (60-mil HDPE) with riprap protection at the waterline to protect the liner from ultraviolet exposure and to protect soil above the FML. A weir structure to regulate overflow and a discharge channel would also be included.

From the discharge, water would flow through the discharge channel to the Paxton I Landfill stormwater collection system. Water could be easily routed from the overflow weir to Indian Ridge Marsh, which presently receives LCC site runoff. A new culvert would be jacked or directionally bored under the Norfolk Southern railroad tracks for this purpose if the existing culverts prove unsuitable for use. Native short-rooted prairie grasses would be used for vegetation of the site based on their low maintenance requirements and compatibility with the end use for the site.

Effectiveness and Cost

The three principal "functional" elements of this alternative are the compacted low-permeability clay cap, gas collection layer, and the stormwater management system. The clay cap will substantially reduce precipitation infiltration into the waste (because of the improved slope for more rapid, positive drainage). The volume and rate of flow of contaminated groundwater will decrease. Disadvantages of the stormwater management system are related to the relatively shallow depth to remaining waste on site, reduced flexibility for future site use, and the relatively large volumes of fill soils required from off-site sources to shape and contour the site for proper drainage.

The cost to construct Alternative 5 is estimated to be $15,900,000, and yearly O&M will cost approximately $83,000. Assuming 30 years of O&M will be required and an inflation rate of 5%, the net present worth of this alternative is estimated to be $17,200,000. Table 3-4 summarizes the cost estimates for the remedial alternatives. Detailed cost estimate tables for each alternative are included in Appendix C.

Table 3-1 Preliminary Construction Cost Estimate, Alternative 2 - Capping of Existing Wastes with a Permeable Soil Cover
Focused Feasibility Study, Lake Calumet Cluster Site,
Chicago, Cook County, Illinois

Item	Description	Quantity	Unit		Cost
C1a	Field Overhead and Oversight	0.5	LS	$	737,100
C1b	Submittals and Testing	0.75	LS	$	75,000
C1c.1	Pre-Construction Surveying	1	LS	$	22,000
C1c.2	Construction Surveying	0.5	LS	$	254,800
C1c.3	Post-Construction Surveying	1	LS	$	22,000
C2a	Clearing and Grubbing	ing3(ost032an)44n(106)-13.2(0)]TJ36.4308 0 Tw[$)6.5( )6			

Table 3-3 Preliminary Construction Cost Estimate, Alternative 4 - Capping of Existing Wastes with a Low-Permeability 35 IAC 724 Clay Clap
Focused Feasibility Study, Lake Calumet Cluster Site
Chicago, Cook County, Illinois

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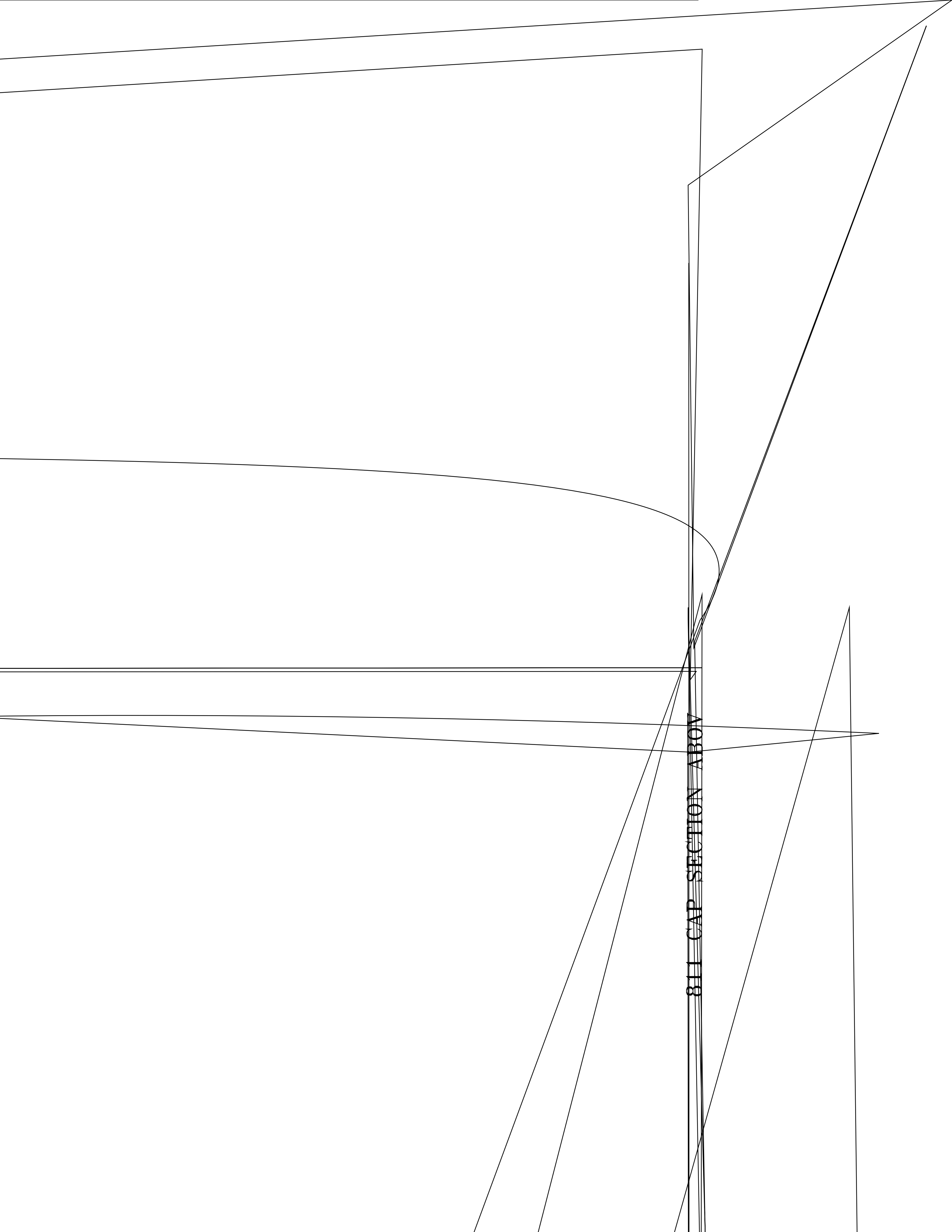
811 CAP SECTION ABOV

Detailed Analysis of Alternatives

The detailed analysis of alternatives is intended to provide the relevant information required to select a remedy. The evaluation of alternatives was conducted using EPA's nine primary evaluation criteria, which are listed in Section 300.430 in Paragraph (e) (9) (iii) of the NCP. These criteria are:

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Short-term impacts and effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Implementability;
- Cost;
- State acceptance; and
- Public acceptance.

It should be noted that the final two criteria (State and Community Acceptance) are used to modify the selection of an alternative. These criteria will be assessed after the public comment period that follows issuance of the Proposed Plan (the precursor to the IROD). Therefore, these two criteria will not be used in the evaluation presented in this report.

The remaining seven evaluation criteria will be used as the basis of the detailed analysis, which will provide in-depth information that can be used in selecting an interim remedial action alternative for implementation. Descriptions of each of the evaluation criteria are provided below:

Overall Protection of Human Health and the Environment

versus Alternative 2) is performed to show how the alternatives rate when compared to each other and to the evaluation criteria, and a summary of the evaluation is presented in Table 4-2.

4.1 Individual Comparative Analysis

4.1.1 Alternative 1: No Action

Under this alternative, no remedial action would be undertaken at the LCC site. The site would remain in its current condition with the existing soil cover thickness of 0 to 3 feet.

Alternative 1 provides no protection of human health or the environment, and ARARs would not be met. Since no construction activities would be performed, this alternative provides no adverse impacts in the short term.

With regard to long-term effectiveness and permanence, Alternative 1 provides none, in that no remedial action would be implemented. Additionally, there is no reduction of toxicity, mobility, or volume. Potentially contaminated surface water runoff would continue to migrate into Indian Ridge Marsh, and infiltrate into the buried waste causing the contaminants to continue to leach into the groundwater.

The No Action alternative is readily implementable in that nothing is required to be constructed, maintained, or monitored. There are no costs associated with this alternative.

4.1.2 Alternative 2: Capping of Existing Wastes with a Permeable Soil Cover

Under this alternative, construction of a permeable soil cover, grading for stormwater collection over the entire site, and vegetation of the entire site with native plants and prairie grasses would be undertaken.

Alternative 2 provides limited protection of human health and the environment. The permeable soil cover would reduce the risk associated with direct human exposure to the buried waste material. However, surface water infiltration into the waste would still occur, resulting in further contaminant migration into the groundwater. Additionally, animals would still be able to burrow though the cover and enter into the waste.

This alternative would not meet most of the ARARs. Under 35 IAC 742.1105, a low-permeability cover is required for soils having contaminant concentrations that exceed the soil component of groundwater ingestion exposure route. Based on the analytical results from the previous site investigations, the contaminant concentrations detected at the LCC site exceed this threshold. The completed soil cover and topsoil vegetative layer would not eliminate exposure routes to ecological receptors (i.e., burrowing animals) using the site as a food/habitat source. It is assumed that all location-specific ARARs (location near endangered species, wetlands, and secondary contact and indigenous aquatic life waters) would be waived since removal of waste materials is cost prohibitive. Action-specific ARARs for Illinois Pollution Control Board cover requirements (35 IAC 724, 811, and 817) would not be met by a permeable cap.

There are considerable short-term impacts associated with this alternative, which include road closures/restrictions, street cleaning activities, and control of fugitive dust and debris. This alternative does provide some long-term effectiveness and permanence in that human exposure to the buried waste would be reduced. However, animals may still be able to burrow into the waste.

Under this alternative, there would not be a significant reduction of toxicity, mobility, or volume; however, the soil cover would afford some protection from direct contact exposure to waste. The permeability of the cover would allow continued infiltration of precipitation, which would not reduce the migration of contaminants from the site. A disadvantage to the design is that prairie grass vegetation creates an "attractive nuisance" for birds and mammals; furthermore, burrowing animals can easily breach the cover. Implementing the alternative is simple and the design allows for future repairs to the cover to be easily made. Local tradesmen would be available to repair most conditions that may affect cover effectiveness.

4.1.3 Alternative 3: Capping of Existing Wastes with an Evapotranspiration (ET) Cap

Alternative 3 involves construction of an ET cap over the existing waste, which entails construction of a permeable soil cover, grading for stormwater collection, and vegetation with a mixture of warm- and cool-season native grasses, shrubs, and trees over the entire site to prevent infiltration and promote evapotranspiration.

4.1.3.1 Evaluation

Alternative 3 provides protection of human health and seasonal protection to the environment. The ET cap would prevent direct human exposure to the buried waste and would limit the amount of surface water infiltrating into the waste material. However, during periods of dormant plant growth, surface water would migrate into the waste and leach contaminants into the groundwater.

Under 35 IAC 742.1105, a low-permeability cover is required for soils having contaminant concentrations that exceed the soil component of groundwater ingestion exposure route. Based on the analytical results from the previous site investigations, the detected contaminant concentrations at the LCC site exceed this threshold. Additionally, 35 IAC 742.1105 requires a minimum of 10 feet of cover material to provide protection associated with the inhalation exposure

During construction, short-term impacts from grading and material placement of the various cover layers would ensue; longer construction time is another short-term impact. These short-term impacts may include road closures/restrictions, street cleaning activities, and control of fugitive dust and debris. Long-term effectiveness and permanence are the highest under this alternative. This alternative also includes the installation of an LFG collection system, which also increases this alternative's short-term impacts.

Under this alternative, there would not be a significant reduction of toxicity or volume. The 35 IAC Part 724 cap would afford protection from direct contact exposure to wastes and would be effective at decreasing the mobility of subsurface contaminants. The low permeability of the cover would greatly reduce infiltration of precipitation, which would assist in reducing migration of contaminants from the site.

This alternative is readily implementable. It can be designed to meet the requirements of all the ARARs, and no special waivers from the State of Illinois would be required. Although a gas extraction system is proposed, an existing flare system with the capacity to treat the expected volume of collected gas is in place. By having a flare system in place, air permits would have to modified, not obtained, reducing the amount of paper work and filings. The vegetative layer is standard for a cover system and would not require activities beyond what is normally expected. Since the flare is currently in operation, the addition of the new collection system should not prove to be problematic.

4.1.5 Alternative 5: Capping of Existing Wastes with a Low-Permeability 35 IAC Part 811 Clay Cap

4.1.5.1 Description

Alternative 5 involves construction of a low-permeability clay cap meeting the requirements of Title 35 IAC Part 811 including gas collection, grading for stormwater containment and collection, construction of a stormwater retention pond with overflow to the Paxton I Landfill stormwater collection system, and vegetation of the entire site with native plants and prairie grasses. This alternative differs from Alternative 4 in that a drainage layer would not be incorporated into

would readily infiltrate through the cap providing approximately the same level of reduction in mobility as Alternative 2.

While Alternatives 4 and 5 are similar,

Alternative 1 (No Action), there are no costs. Table 4-3 provides a summary of costs for each alternative.

Table 4-1 Individual Analysis of Alternatives
Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois

Remedial Alternative	Evaluation Criteria: Protection of Human Health and the Environment	Compliance with ARARs	Short-Term Impacts and Effectiveness	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume	Implementability	Cost* Construction, 30-Year O&M, Total
Alternative 1: No Action	No additional protection provided.	Does not comply.	No short-term impacts.	Does not provide any effectiveness or permanence.	No reduction achieved.	Readily implementable.	$0 $0 $0
Alternative 2: Permeable Soil Cover	Provides protection of human health and limited environmental protection.	Can be designed to meet most ARARs. Does not comply with 35 IAC 724.1105, 724, 811, or 817.	Short-term impacts include increased truck traffic, noise, and dust generation.	Provides limited effectiveness and permanence.	No reduction in toxicity or volume, limited reduction in mobility.	Readily implementable. IDOT soils can be used for majority of cover. Waiver for cover must be obtained.	$10,900,000 $ 1,000,000 $11,900,000
Alternative 3: Evapotranspiration Cap	Provides protection of human health and limited environmental protection.	Can be designed to meet most ARARs. Does not comply with 35 IAC 724.1005, 724, 811, and 817.	Short-term impacts include increased truck traffic, noise, and dust generation.	Provides limited effectiveness and permanence. Vegetation requires extensive care.	No reduction in toxicity and volume, slight reduction in mobility.	Readily implementable. However, IDOT soils cannot be used. Waiver for cap must be obtained.	[illegible]

Table 4-1 Individual Analysis of Alternatives
Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois

Remedial Alternative	Evaluation Criteria						
	Protection of Human Health and the Environment	Compliance with ARARs	Short-Term Impacts and Effectiveness	Long-Term Effectiveness and Perma-nence	Reduction in Toxicity, Mobility, and Volume	Implementability	Cost* Construc-tion, 30-Year O&M, Total
Alternative 5: 35 IAC 811 Cap	Provides protection for human health and the environment.	Can be designed to meet most ARARs. Does not comply with 35 IAC 724.	Short-term impacts include increased truck traffic, noise, and dust generation.	Provides long-term effectiveness; however, flare system must be operated and maintained to protect cap.	No reduction in toxicity and volume, but does reduce contaminant mobility.	Readily implement-able. IDOT soils can be used for majority of work. Waiver from 35 IAC 724 ARAR must be obtained.	$15,900,000 $ 1,280,000 $17,180,000

Table 4-2 Comparative Analysis of Alternatives
Focused Feasibility Study, Lake Calumet Cluster Site, Chicago, Cook County, Illinois

	Evaluation Criteria				
Remedial Alternative	Protection of Human Health and the Environment	Compliance with ARARs	Short-Term Impacts and Effectiveness	Long-Term Effectiveness and Perma-nence	

Conclusions

- **Alternative 2 – Capping of Existing Wastes with a Permeable Soil Cover:**

in that the waste materials would be covered, but infiltration would not minimize or prevent continued migration of contaminants from the site. Alternatives 4 and 5 are the most protective, covering the site with a low-permeability cap and reducing the potential for continued migration of contaminants.

In regard to the ARARs, only Alternative 4 could be implemented to meet all of the ARARs. Alternative 5 could meet the majority of ARARs; however, the requirements of 35 IAC 724 would not be met. Alternatives 2 and 3 do not meet the majority of the ARARs associated with capping/cover, and the No Action Alternative does not meet any of them.

Alternative 3 has the most adverse short-term impacts because the imported IDOT soil cannot be used for the majority of its cover installation, and the required additional soil material would have to be trucked to the site. Given that there is approximately the same amount of earthwork involved, Alternatives 4 and 5 have similar degrees of short-term effectiveness. Alternative 2 requires less earthwork, so it has less of an adverse effect in the short term than Alternatives 4 and 5. The No Action alternative has the least amount of adverse effects in the short-term since no remedial action is performed.

Alternative 1 provides no long-term permanence. Given that surface water will continue to migrate through the cap, leaching contaminants into the groundwater, Alternative 2 does not offer long-term permanence. During seasonal plant growth periods, Alternative 3 would reduce the amount of surface water infiltration. However, during periods of dormant vegetative activities, surface water infiltration into the waste material will occur. While more effective than Alternative 2, Alternative 3 does not provide long-term permanence. Both Alternatives 4 and 5 provide for long-term permanence. However, both alternatives require a flare system to be operated to address the collected LFG.

Using the presumptive remedy of capping, there will not be a reduction in toxicity or volume of contamination. However, there can be a reduction in mobility using this presumptive remedy. Alternative 5, which utilizes a clay cap and a drainage layer to prevent surface water from infiltrating into the waste, provides the greatest reduction in contaminant mobility. Alternative 5, which is similar to Alternative 4 but does not have a drainage layer, does not provide as much of a reduction in mobility as Alternative 4. A and 5 are more implementable than Alternative 3, which will require the importation of the majority of soil for its cover system. Of the three alternatives using IDOT soils, Alternative 2 is the most implementable since its cover is relatively simple. However, it is doubtful that a waiver for the ARARs associated with capping could be obtained for this alternative. Given that it has more specific layers associated with its construction, Alternative 4 will be slightly more difficult to implement than Alternative 5.

Since the majority of its material will have to be purchased and transported to the site, Alternative 3 is the most expensive alternative to implement. With its multiple layers and LFG collection system, Alternative 4 is the next most expensive alternative, with Alternative 5 being slightly less. Alternative 2 is the least expensive of the interim remedial action alternatives because of its relatively simple design. Finally, there is no cost associated with the No Action alternative.

Under an agreement with the Illinois EPA, IDOT has been and continues to bring excess soil from its Dan Ryan expansion project to the LCC site. Wherever possible, the alternatives developed for this FFS have used the IDOT material as part of the soils needed for the construction of the various layers associated with its cover system.

United States Environmental Protection Agency, (EPA), 1996, *Ecological and Toxicological (EcoTox) Thresholds*, EPA/540/F-95/038.PB95-963324, Office of Solid Waste and Emergency Response.

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__________, 1989, *Final Covers on Hazardous Waste Landfills and Surface Impoundments*.