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ENGINEERING EVALUATION/COST ANALYSIS FOR THE VACANT LOT SITE NSTC GREAT LAKES IL

10/30/1997

ECOLOGY AND ENVIRONMENT, INC

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ENGINEERING EVALUATION/COST ANALYSIS
FOR THE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

START CONTRACT NO. 68-W6-001
TDD NO. S05-9609-017

October 30, 1997

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 5
Emergency and Enforcement Response Branch
77 West Jackson Boulevard
Chicago, Illinois 60604

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FOR
VACANT LOT SITE
NORTH CHICAGO, LAKE COUNTY, ILLINOIS
TDD: S05-9609-017
PAN: 6P1701RE

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77 West Jackson Boulevard
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List of Acronyms/Abbreviations

A

ARARs	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry

B

BAT	Best Available Technology
bgs	below ground surface

C

CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program (U.S. EPA)
cm/sec	centimeter per second
COC	contaminant of concern
Creek	Pettibone Creek

D

day/μg	day per microgram

E

E & E	Ecology and Environment, Inc.
EE/CA	engineering evaluation/cost analysis
EJ&E	Elgin, Joliet & Eastern Railroad
EMCO	EMCO Chemical Distributing, Inc., facility
E.P. Tox	extraction procedure toxicity
ESOD	erythrocyte superoxide dimutase

F

Fansteel	Fansteel, Inc., facility
FEMA	Federal Emergency Management Agency
ft/min	feet per minute

G

GAC	granular activated carbon
GLNTC	Great Lakes Naval Training Center
GPS	Global Positioning System

H

HI	hazard index
HQ	hazard quotient

I

IAC	Illinois Administrative Code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IESPB	Illinois Endangered Species Protection Board
IEUBK	integrated exposure uptake biokinetic model
IPCB	Illinois Pollution Control Board
IRIS	Integrated Risk Information System

K

K	hydraulic conductivity
K_{oc}	soil adsorption factor
kg-day/mg	kilogram-day per milligram

L

LADI	lifetime average daily intake
LCSWMC	Lake County Storm Water Management Commission
Lockheed	Lockheed Environmental Systems and Technologies Co.

M

MAECORP	MAECORP, Inc., facility
MCL	maximum contaminant level
MCLGs	non-zero maximum contaminant level goals
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter

mL	milliliter
mm	millimeter

N

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCRS	North Chicago Refiners and Smelters Company
NCWD	North Chicago Water Department
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetlands Inventory

O

1,2-DCE	1,2-dichloroethene

P

PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PERC	perchloroethene, tetrachloroethene
PID	photoionization detector
Phytotech	Phytotech, Inc.
PPE	personal protective equipment
ppm	parts per million
PRSC	post-removal site control
psi	pounds per square inch
PTA	packed tower aeration
PVC	polyvinyl chloride

Q

QA/QC	quality assurance/quality control

R

RAGS	Risk Assessment Guidance for Superfund
RAL	removal action level
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	chronic reference dose

S

SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service (of USDA)
SERE	Streamlined Ecological Risk Evaluation
SF	slope factor

SRE	Streamlined Risk Evaluation
START	Superfund Technical Assessment and Response Team (U.S. EPA)
SVE	soil vapor extraction
SVOC	semivolatile organic compound

T

TACAO	Tiered Approach to Corrective Action Objectives
TBC	to be considered
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TDD	Technical Direction Document
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
TSS	Technical Support Section

U

μg/kg	micrograms per kilogram
μg/L	micrograms per liter
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Service

V

VLS	Vulcan Louisville Smelting Company
VOC	volatile organic compound

1. Executive Summary

Ecology and Environment, Inc. (E & E), was tasked by the United States Environmental Protection Agency (U.S. EPA) to perform an Engineering Evaluation and Cost Analysis (EE/CA) to evaluate alternatives for conducting a removal action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), at the Vacant Lot site located in North Chicago, Lake County, Illinois. This work was conducted by the Region 5 Superfund Technical Assessment and Response Team (START) under Contract No. 68-W6-0011 and Technical Direction Document (TDD) S05-9609-017.

The purpose of this EE/CA is to identify removal action goals and evaluate removal action alternatives for on-site soil and sediment contamination, and on-site and/or off-site groundwater contamination at the Vacant Lot site.

The Vacant Lot site (a.k.a. the Vulcan Louisville Smelting Company [VLS]) encompasses 6.4 acres of land in a mixed residential/industrial area in North Chicago. The site poses easy access through its unfenced west boundary. The site is vegetated with grass, weeds, and moss in most areas, although portions of the site are barren. The southern two-thirds of the site has a weathered concrete/gravel layer, under approximately 6 inches of top soil. Several areas of the northwest one-third portion of the site have deposits of slag, ash, and cinders. The site is transected by the Pettibone Creek (Creek), an intermittent water body that lies in a relatively steep-sided ravine, and originates at the northwest boundary of the site. The ravine is lined with large weeds, bushes, and deciduous trees. The Creek flows through the site from north to south, and then flows east into Lake Michigan (1.5 miles from the site). The Creek, at its origin, receives water through the North Chicago stormwater discharge and a ditch. The Creek is also fed by rainwater and outfalls from two nearby industries/facilities, EMCO Chemical Distributing, Inc. (EMCO), and Fansteel, Inc. (Fansteel).

A 1921 plat map depicts the site property, as well as the properties of adjacent Fansteel and the nearby North Chicago Refiners and Smelters (NCRS) company (east of Fansteel), as being owned by VLS. The southern half of the current Fansteel property was occupied by F.E. Ball Coal & Material Co., Agartol Coal Co., and C & NS Electric Sub-station & Car Barns. Two additional coal companies operated immediately south of 22nd Street (the present southern Fansteel location). By 1954, the current Vacant Lot property was sold to an individual who developed the property as a parking lot. The owner reportedly solicited fill materials to be placed at the site. The source, quantity, and nature of materials brought to the site are not well documented. Aerial photographs from 1939 through 1986 indicate staining, excavations, mounded material, and tire tracks in the northeastern area of the site, at the end of an access road. These stain patterns trended into the Creek. In 1981, a possible shallow trench was observed, which was filled by 1986 (U.S. EPA 1997).

A complaint issued by the Illinois Pollution Control Board (IPCB) on March 1, 1972, stated that effluent from Fansteel, containing settleable solids, cyanide, metals, acid, and caustic wastes, were discharged to the Creek. The presence of on-site contamination came to the attention of U.S. EPA due to an underground fire at the site in 1988. After the fire, the Illinois Environmental Protection Agency (IEPA) collected soil samples that indicated high extraction procedure toxicity (E.P. Tox) lead concentration. A source/fill area was identified in the northeastern portion of the site, that may have contributed to the fire. Since 1989, several investigations were conducted under various authorities, including soil, sediment, and groundwater sampling conducted by E & E, MAECORP, Inc. (MAECORP), Geraghty and Miller, Envirodyne Engineers, Inc., and Aires Environmental Services, Limited. Groundwater sample results from these investigations indicated the presence of 1,1-dichloroethene, 1,2-dichloroethene (1,2-DCE), trichloroethene (TCE), and vinyl chloride in on-site monitoring wells. Of these compounds, 1,2-DCE and vinyl chloride exceeded the Superfund removal action level (RAL) for contaminated drinking water (U.S. EPA 1995b). Elevated levels of heavy metals, chlorinated solvents, polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs) were detected in on-site soil samples. Arsenic, beryllium, lead, zinc, TCE, benzo(a)pyrene, and PCBs were the most prevalent contaminants in the soil samples. Elevated levels of heavy metals, chlorinated solvents, PAHs, and PCBs were detected in on-site sediment samples collected from the Creek. Beryllium, lead, benzo(a)pyrene, and PCBs were the most prevalent contaminants in the sediment samples. Several off-site soil samples, collected to the north and northwest of the site, exhibited elevated levels of heavy metals, PAHs, pesticides, and PCBs.

In order to supplement the previous site investigation data, which identified a contamination source/fill area in the northeastern portion of the site, E & E performed additional site characterization activities, including soil, sediment, and groundwater sampling, as part of this EE/CA. An EE/CA sampling plan was developed, and soil samples were collected from the nodes of an 80-foot by 80-foot grid layout. Sediment samples were collected from the on-site segment of the Creek. All monitoring wells on site were sampled. Based on the initial sample results, several deep boring soil samples, using Geoprobe equipment, were collected from the source/fill area, and from other suspected contaminated areas. Geoprobe groundwater samples were collected from the perimeter of the site to identify and evaluate the influence of potential off-site source(s).

A Streamlined Risk Evaluation (SRE), including a screening level human health risk assessment and a Streamlined Ecological Risk Evaluation (SERE), was performed to estimate potential health risks related to human and wildlife exposure to chemicals present at the site. Analytical data developed during previous site investigations, as well as during the EE/CA support sampling, were used in the development of the SRE. The screening level human health risk assessment for the Vacant Lot site was prepared by a U.S. EPA Region 5 risk assessor.

The SRE identified several contaminants of concern (COCs) at the Vacant Lot site. The human health risk assessment identified six PAH compounds (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, and benzo[k]fluoranthene); seven metals (antimony, beryllium, cadmium, copper, iron, manganese, and zinc); and PCBs as COCs in surface soils and sediment at the site. Significant cancer risks were estimated for a future worker at the site (estimated excess cancer risk of 4.2×10^{-4}). The estimated risks are primarily from dermal contact with PAHs in soil (56% of total risk). Benzo(a)pyrene accounted for 62% of the risk from combined soil and sediment exposure. A total hazard index (HI) of 2.7 was calculated for future workers at the site. Significant non-cancer risks (i.e., hazard quotient [HQ] > 1) were estimated for PCBs in surface soils (HQ=1.7), with incidental ingestion of contaminated soil accounting for over 90% of the risk.

The results of the ecological risk evaluation indicate that the site contaminants pose minimal risk to the terrestrial and aquatic ecology of the site; however, a potential exists for off-site migration of sediment and surface runoff to nearby Lake Michigan.

Based upon the site characterization data and the results of the SRE, removal action objectives were developed to provide a basis for the identification and evaluation of alternatives for a non-time-critical removal action. The removal action alternatives were developed in accordance with the

National Oil and Hazardous Substances Contingency Plan (NCP) and U.S. EPA's Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (U.S. EPA 1993). Removal action objectives were developed for those areas of the site which were determined to exceed a risk of 1×10^{-5}, an HI of 1, or for those areas which have a high potential to release contaminants to the environment. The following areas of the site were selected for the development of removal action objectives.

- The entire site soil area, excluding two small areas (Appendix C, Figures C-4 and C-5), is generally contaminated up to a 2-foot depth with elevated concentrations of lead (> 1,400 milligrams per kilogram [mg/kg]);

- The source/fill area is contaminated with tetrachloroethene (perchloroethene [PERC]) to a 4-foot depth (170 mg/kg), and lead contamination to a 9-foot depth (1,700 mg/kg). The source/fill area, based on EE/CA sampling, historical sampling, and groundwater contamination, is defined as the area bounded on the south by grid node I2, on the north by grid node K2, on the west by grid node J3, and the east by a location 20 feet east of grid node J2 (Appendix C, Figure C-5);

- The area around grid node K1 is contaminated with PCBs to a 9-foot depth (68 mg/kg);

- Within the northern one-third of the site area, groundwater contamination of 1,2-DCE and vinyl chloride, as evident in monitoring wells MW-3 and GMMW-2, could potentially be attributed to the source/fill area. The remainder of the northern one-third of the site area has TCE contamination attributed to an off-site plume;

- The eastern perimeter of the site has TCE contamination;

- Although the GMMW-3 monitoring well area contains vinyl chloride, arsenic, and manganese above RALs, a removal scope has not been prepared for this area because off-site conditions on the west side of the site have not been characterized; and

- The entire creekbed, from the surface to the clay layer (3 to 4 feet deep), is contaminated with benzo(a)pyrene (13 mg/kg maximum). In the northern portion of the Creek, benzo(a)pyrene is prevalent to a 6-foot depth.

Identification of applicable or relevant and appropriate requirements (ARARs) and/or requirements to be considered (TBCs) was performed. Although no groundwater receptors have been identified, Federal Maximum Contaminant Levels (MCLs), and the Illinois Class I Groundwater regulations (35 Illinois Administrative Code [IAC] Part 620) are considered ARARs for the site. The

IPCB's Tiered Approach to Corrective Action Objectives (TACAO) (35 IAC Part 742) were identified as potential ARARs for soil and sediment remediation at the site. U.S. EPA Region 3 Risk-Based Concentrations (RBCs) for soil were also evaluated as TBC requirements for soil and sediment at the site. A cleanup goal for lead in soil was calculated by U.S. EPA using a lead model recommended by the U.S. EPA Technical Review Workgroup for Lead. The cleanup goal corresponds to a level of lead that would be protective of a pregnant adult worker. Although significant ecological risks were not identified at the site, the August 1993 "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario" were also considered as TBC requirements at the request of the United States Fish and Wildlife Service (U.S. FWS).

Using the results of the SRE and the evaluation of the ARARs/TBCs, the following removal action objectives are proposed for the Vacant Lot site:

- Prevent direct and indirect contact and ingestion of soil and waste contaminated with chemicals of potential concern by human receptors at concentrations which exceed 1×10^{-5} risk factor;
- Prevent actual or potential contamination of groundwater with volatile organic compounds (VOCs). Even though no groundwater receptors were identified, there is a potential for contaminated groundwater to flow into the Creek and eventually into Lake Michigan;
- Prevent direct and indirect contact with sediments contaminated with chemicals of potential concern by human receptors at concentrations which exceed TACAO guidelines; and
- Stabilize or eliminate hazardous substances in drums that pose a threat of migration or direct contact hazards.

Based on the analysis of the nature and extent of contamination, and on the removal action objectives developed in Section 3, a limited number of removal action alternatives were identified and evaluated for the Vacant Lot site. The soil and sediment removal alternatives developed for the site include the following:

- No Action: included as a requirement of the NCP;
- Natural Attenuation/Institutional Controls: relies on natural degradation processes to address contamination and is coupled with land use and site access restrictions;

- Containment with Natural Attenuation: includes a cap over the contaminated soils with natural attenuation, land use, and site access restrictions;

- Soil Excavation and Direct Disposal: excavation of nonhazardous soils and PCB-contaminated soil, and disposal at a landfill;

- Soil Excavation and On-Site Stabilization: excavation of hazardous soil and on-site stabilization prior to off-site disposal at a landfill;

- Soil Excavation and Off-Site Stabilization and Disposal: excavation of hazardous soil and stabilization/disposal at a permitted off-site faculty;

- In-Situ Stabilization: an in-situ technology to stabilize metals-contaminated soil on site; and

- Soil Vapor Extraction (SVE) followed by Metals Stabilization: an in-situ technology to treat VOC-contaminated soils through volatilization, followed by stabilization of metals-contaminated soil.

The following groundwater removal action alternatives were developed:

- No Action: included as a requirement of the NCP;

- Natural Attenuation and Institutional Controls: relies on natural degradation processes to address contamination and is coupled with groundwater use and site access restrictions;

- Containment-Capping: includes a cap over the contaminated soils, thereby reducing rainwater infiltration, with natural attenuation, and groundwater use and site access restrictions;

- Source Excavation: includes excavation and appropriate disposal of the contaminated soils which are identified as the source of groundwater contamination;

- SVE and Air Sparging: an in-situ technology where air is used to volatilize VOCs present in contaminated groundwater, and collecting volatilized compounds and discharging to atmosphere after reducing their concentrations, if needed, by granular-activated carbon treatment.

- Pump and Treat - Air Stripping (Packed Tower Aeration): a pump and treat technology usually used for pumping out contaminated groundwater and stripping VOCs with the assistance of air.

Soil and sediment removal action alternatives were evaluated against three general criteria of effectiveness, implementability, and cost. The No Action and Natural Attenuation Alternatives are not considered effective due to the mobility of the contaminants involved. Capping and SVE

Alternatives are effective in reducing, but not completely eliminating overall threats due to soil and sediment contamination, while Excavation and Disposal Alternatives are expected to be completely effective because all contamination exceeding the proposed cleanup levels are removed. Excavation and Disposal Alternatives are also considered the most reliable because of the total removal of contaminated materials, including the removal of on-site groundwater contamination source. The In-Situ Stabilization Alternative is effective in providing overall protection of public health and the environment from metals contamination, but is considered ineffective in reducing threats posed by high levels of organic contamination. The order of implementability from easiest to most difficult follows: No Action, Natural Attenuation, Excavation and Disposal, In-Situ Stabilization, and SVE. The estimated costs for the soil and sediment removal action alternatives follows:

Excavation and Disposal of Nonhazardous Soil	$1,326,800
Excavation and Disposal of Nonhazardous Sediment	$100,725
Capping	$1,062,160
In-Situ Stabilization	$3,246,250
SVE and In-Situ Stabilization	$3,338,550
Soil Excavation, Off-Site Stabilization, and Off-Site Disposal	$1,504,980
Sediment Excavation, Off-Site Stabilization and Off-Site Disposal	$45,625
Soil Excavation, On-Site Stabilization, and Off-Site Disposal	$1,360,588
Sediment Excavation, On-Site Stabilization, and Off-Site Disposal	$56,340

Groundwater removal action alternatives were also evaluated against effectiveness, implementability, and cost criteria. The No Action, Natural Attenuation, and Containment-Capping Alternatives are not considered fully effective due to the mobility of the contaminants involved. The Source Excavation Alternative is considered effective in eliminating contamination due to the on-site source/fill, but will not effectively eliminate the threats posed by perimeter contamination with off-site sources. Source Excavation is also considered very reliable as it pertains to the source/fill area groundwater contamination because all source material will be removed. Both SVE (with Air Sparing) and Air Stripping Alternatives are considered effective for reducing the threats posed by perimeter groundwater contamination and are of comparable reliability. The order of implementability from easiest to most difficult follows: No Action, Natural Attenuation, Containment-Capping, and Source Excavation followed by SVE (with Air Sparing) and Air Stripping. The estimated costs for the groundwater removal action alternatives follows:

On-Site Source Excavation and Stabilization	$ 224,400
SVE and Air Sparging of Perimeter Groundwater	$ 335,200
Air Stripping of Perimeter Groundwater	$ 537,900

By removing the source/fill area, vinyl chloride, 1,2- DCE, and other VOC contributions to groundwater may be eliminated. Based upon the results of the EE/CA support sampling, localized groundwater contamination in the source/fill area soils is believed to be due to soil contamination in the top 5 feet of source fill area. After the source/fill area soil removal, the contamination present in groundwater may not pose a substantial threat to warrant a removal action. However, perimeter sampling by Geoprobe equipment along the eastern fence shows TCE and manganese contamination. Based upon the Geoprobe groundwater sampling results and historical site data, it is likely that an off-site source is contributing to groundwater contamination in this area. Any active groundwater extraction/remediation addressing the perimeter groundwater contamination will likely escalate and introduce new contamination, due to potential migration from the off-site plume. Therefore, active pumping and groundwater remediation is not addressed as an alternative in this EE/CA at the present time. Further information concerning the nature and extent of off-site groundwater contamination and source(s) will need to be developed and appropriate alternatives for groundwater remediation evaluated.

The Capping Alternative is not a fully effective removal action since groundwater upgradient of the site can still infiltrate the site and continue to draw on-site contaminants into the groundwater. The In-Situ Stabilization Alternative was briefly considered, but again this technology does not effectively treat VOC contamination. The Soil Vapor Extraction Alternative to remove VOC contamination from the source/fill area will only be partially effective since it does not remediate inorganic contamination. Therefore, further stabilization of metals contamination would be required in combination with the SVE treatment. On the contrary, if the source/fill area is excavated to eliminate threats from metals contamination, no additional action to address VOC contamination is necessary, because the existing concentration of VOCs in the source/fill area are below regulatory disposal criteria. A portion of the contaminated soil can be disposed of without any treatment, while other material (i.e., lead-contaminated soil determined to be hazardous by toxicity characteristic leaching procedure [TCLP] data) needs stabilization. The actual volume of hazardous material will be determined by sampling during the removal action. Given the levels of contamination and the apparently limited connection to soil and groundwater contamination at the site, the remediation of the on-site segment of the Creek should be considered only if upgradient sources are identified and addressed first. This may include diversion of surface flow from contaminated upstream culverts and channels, and oversight by the City of North Chicago to ensure that any stormwater discharge into the

Creek is free of contamination. The Creek sediments should only be addressed if contaminant migration from upstream sources can be eliminated. As the sediments and soils are similar in nature with respect to excavation and disposal, the recommended soil removal action alternative can be applied to the Creek sediments.

The most effective, implementable, and economical removal action alternative to abate threats to human health and the environment at the present time is the Excavation and Disposal Alternative addressing contaminated soil. Within this alternative, Excavation, On-Site Stabilization followed by Off-Site Disposal is estimated to cost less than Excavation and Off-Site Stabilization and Disposal.

A site cleanup alternative involving soil and sediment excavation, on-site stabilization, and off-site disposal is recommended as the removal action which best suits the Vacant Lot site.

An additional EE/CA investigation of the neighboring Fansteel property is recommended to identify and characterize additional source areas that impact groundwater, so that comprehensive groundwater remediation alternatives can be developed.

2. Site Characterization

2.1 Introduction

E & E START has completed an EE/CA for the Vacant Lot site, located in North Chicago, Lake County, Illinois. This EE/CA was conducted under Contract No. 68-W6-0011 and TDD S05-9609-017. Based on the evaluation of existing field sampling data, U.S. EPA has determined that a removal action, in accordance with the criteria set forth in Section 300.415(b)(2) of the NCP, is necessary to reduce the threats posed to public health and/or the environment by contaminated media found on site. An EE/CA is required for all non-time-critical removal actions, pursuant to Section 300.415 (b)(4) of the NCP. An EE/CA identifies, evaluates, and provides a comparative analysis of removal action options for a Superfund hazardous waste site.

The EE/CA has been prepared and organized in accordance with U.S. EPA's *Guidance for Conducting Non-Time-Critical Removal Actions Under CERCLA* (U.S. EPA 1993). The remainder of Section 2 of this EE/CA presents site background information, including descriptions of existing analytical results, additional sampling activities conducted for the EE/CA, and results of analyses from samples collected as part of the EE/CA. The scope and the objectives of the removal action and ARARs are discussed in Section 3. Section 4 identifies and describes the removal action alternatives determined to be applicable to the site. Section 5 provides a detailed analysis of each removal action alternative. Removal action alternatives are compared against one another in Section 6. All references cited in this report are listed in Section 7.

2.2 Site Description and Background

Historical information indicates that the Vacant Lot site has been utilized by nearby industries for waste disposal. The nature and composition of the waste material is unknown. The site occupies an area of approximately 6.4 acres and is located in a mixed residential and industrial area. The presence of contamination came to the attention of U.S. EPA due to an underground fire at the site in

1988. According to an official of the City of North Chicago HAZMAT team, a two- to three-week period of extremely hot dry weather (90-100°F) preceded a rash of grass fires at the Vacant Lot site. In response to a grass fire on June 12, 1988, firemen noticed that the ground was unusually hot and the water they were applying was causing the ground to bubble, as if the water was boiling. These observations were highly unusual for a simple grass fire and the firemen called the local HAZMAT team. During temperature monitoring, one HAZMAT team member burned his foot when it sank into a gray powder in the burn area. The underlying fill was burning at very high temperatures. The ground fire was then allowed to burn itself out because of the unknown nature of the fire and the unknown hazards of applying water (Humphres 1996). Three soil samples were collected at the time of the fire by IEPA, and analyzed for eight heavy metals by the E.P. Tox method, which is specified under the Resource Conservation and Recovery Act (RCRA) for the purposes of evaluating the leachability of select contaminants. One of the samples contained 43.5 milligrams per liter (mg/L) E.P. Tox lead, exceeding the 1988 RCRA regulatory limit of 5 mg/L; therefore, characterizing the soil as a RCRA hazardous waste (IEPA 1988) when it is excavated.

Several investigations have been conducted at the site since the time of the fire. Several soil samples collected from the site indicated the presence of contaminants above U.S. EPA- and IEPA-regulated levels (Appendix D, Table D-1). Contamination was also detected in the on-site sediments of the Creek. Three monitoring wells were installed after the fire incident. Results of the monitoring well samples indicated metal, VOC, and PCB contamination. Soil, sediment, and groundwater samples exhibited metal, VOC, PCB, and PAH contamination.

Between September 1988 and February 1989, MAECORP of Chicago, Illinois, was contracted, soon after the ground fire, by Karaganis and White, Ltd., of Chicago, Illinois, to collect samples at the site in order to characterize the condition of on-site soil and groundwater. Analyses of soil and groundwater samples collected during the course of these investigations revealed heavy metal contamination in both soil and groundwater. VOCs (including chlorinated solvents) and PCBs were also detected in several of the soil samples (MAECORP 1989a,b,c). Overall, barium, cadmium, chromium, lead, and mercury were the most elevated contaminants detected in the soils. Cadmium, chromium, mercury, and lead were the most elevated contaminants detected in the groundwater. During this period, MAECORP was also contracted by Northern Trust Company to evaluate discharge from the outfall located on the west bank of the Creek, which is east of EMCO. Zinc, phenols, and VOCs, including several chlorinated solvents, were detected in the surface water sample collected at the outfall (MAECORP 1988).

Between February and June of 1991, Envirodyne Engineers, Inc., of Chicago, Illinois, conducted a two-phase environmental assessment of several properties along Commonwealth Avenue, including the Vacant Lot site. The purpose of the assessment was to evaluate the condition of the properties for the proposed installation of a public bike path. The Phase I report included a review of the historical use of the properties, as well as the results of comprehensive environmental database searches. A review of the Toxic Release Inventory (TRI) database (compiled by U.S. EPA) indicated that the two adjacent industrial facilities, Fansteel and EMCO, reported handling several chemicals. Several contaminants detected in environmental samples collected at the Vacant Lot site were part of the TRI database. TCE, detected in soils, groundwater, and sediments, was listed on the TRI database for both facilities. EMCO also listed acetone, methyl ethyl ketone (2-butanone), methylene chloride, tetrachloroethylene, phenols, toluene, and 1,1,1-trichloroethane (Envirodyne 1991b). Phase II activities included drilling several soil borings along the proposed bike path. Three of the six soil boring samples were collected on the Vacant Lot site. Generally, lead was the most elevated analyte detected, with 1,250 mg/kg in one sample (Envirodyne 1991a).

In June of 1992, Aires Environmental Services, Limited, of Batavia, Illinois, collected several soil samples along Commonwealth Avenue corresponding to the proposed bike path, including two borings on the Vacant Lot site. The samples were located at the northwest and southwest corners of the site. Several PAHs and chloroform were detected at low levels in the samples (Aires 1992).

IEPA performed a CERCLA integrated site assessment at the Vacant Lot site beginning in September of 1992. The assessment included groundwater, sediment, and soil sampling. For the first time, chlorinated solvents (including 1,1-dichloroethene, 1,2-DCE, TCE, and vinyl chloride) were detected in the monitoring wells. Of these, 1,2-DCE and vinyl chloride exceeded the Superfund RAL for contaminated drinking water (U.S. EPA 1995b). Heavy metal concentrations in the groundwater were still elevated, however; cadmium, chromium, lead, and mercury concentrations were no longer greater than the RALs, as they were in the 1989 MAECORP samples. Additionally, manganese and zinc, which were not included in the MAECORP analysis, were present in the 1993 IEPA samples at levels exceeding their corresponding RALs. A trace amount of PCBs was also detected in one of the monitoring wells. Elevated levels of heavy metals, chlorinated solvents, PAHs, pesticides, and PCBs were detected in on-site soil samples collected during the assessment; specifically, arsenic, beryllium, lead, zinc, TCE, benzo(a)pyrene, and PCBs were the most prevalent contaminants. Elevated levels of heavy metals, chlorinated solvents, PAHs, pesticides, and PCBs were detected in on-site sediment samples collected during the assessment; specifically, beryllium,

lead, benzo(a)pyrene, and PCBs were the most prevalent. Several off-site soil samples, collected to the north and northwest of the site, exhibited elevated levels of heavy metals, PAHs, pesticides, and PCBs (Appendix D, Table D-2). Based on an analysis of potential on-site and off-site sources of contamination, IEPA concluded that residential soil contamination was not attributable to the Vacant Lot site; several elevated parameters were more concentrated in residential soils than in Vacant Lot soils (IEPA 1995).

The IEPA Integrated Site Assessment Report also documented groundwater use from the contaminated aquifer as potable water within a 4-mile radius of the site. The potentially affected population was limited to 115 persons within 1 to 2 miles; 3,160 persons within 2 to 3 miles; and an additional 1,820 persons within 3 to 4 miles from the site. The potential for migration of contaminants via surface water was also described in the report. Several potential receptors for contamination were identified near the mouth of the Creek, where it empties into Lake Michigan. These potential receptors include lacustrine wetlands and surface water intakes for drinking water. In addition, the potential exposure to windblown contaminated soils which may migrate off site, as well as direct contact exposure to contaminated soils and sediments by trespassers, were also described (IEPA 1995).

Geraghty & Miller, Inc., of Chicago, Illinois, performed a groundwater investigation at the Vacant Lot site in November of 1993 on behalf of Northern Illinois Trust Company, who represented the owners of the Vacant Lot site. The study was conducted in order to evaluate the condition of shallow groundwater, groundwater flow direction, and potential off-site impacts to groundwater quality. Three additional monitoring wells were installed and all six wells were sampled. Groundwater was observed at 7 to 14 feet below ground surface (bgs). The groundwater quality was impacted by chlorinated solvents, including 1,1-dichloroethene, 1,2-DCE, TCE, and vinyl chloride. Of the heavy metals previously detected in groundwater, only manganese continued to exceed the RAL. For the first time, arsenic was detected in one well at levels exceeding the corresponding RAL (Appendix D, Table D-3). Despite the observed manganese and arsenic levels, the report concluded that the levels were low enough to have been caused by natural sources, and that the shallow groundwater was not impacted by metals (Geraghty & Miller 1994).

In August and September of 1994, the City of North Chicago collected several sediment samples from the Creek. Six of the samples were analyzed for total phenol, paint filter, flash point, pH, PCBs, pesticides, and TCLP metals. The seventh composite sample was analyzed for landfill disposal parameters (Appendix D, Table D-4). Low levels of pesticides and PCBs were detected in

several samples. TCLP lead was also detected, but at levels below the federal-regulated hazardous characteristics concentration criteria of 5 mg/L. Zinc and chromium TCLP concentrations, and TCE and PCB concentrations, were detected at low levels in the composite sample (Burris 1996).

In September of 1994, E & E conducted a site assessment at the Vacant Lot site under the Technical Assistance Team contract to U.S. EPA. Several soil and sediment samples were collected, including samples from the location of the previous fire incident. Generally, elevated levels of heavy metals (including arsenic, beryllium, and lead), chlorinated solvent TCE, and PCBs were detected at the Vacant Lot site. The site assessment report characterized the following threats to human health and the environment which may warrant a removal action, as specified in the NCP:

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- High levels of hazardous substances or pollutants or contaminants at or near the surface, that may migrate;
- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released, and;
- Threat of fire or explosion (E & E 1995).

2.2.1 Site Location and Physical Setting

The Vacant Lot site (a.k.a. Vulcan Louisville Smelting Company, (CERCLIS ID# 097 271 563) is a 6.4-acre parcel of land located at the northeast corner of Commonwealth Avenue and 22nd Street (Appendix C, Figure C-1) in North Chicago, Lake County, Illinois (latitude 42°19'43"N, longitude 87°51'43" W). The site is bordered on the north by elevated tracks of Elgin, Joliet & Eastern (EJ&E) Railroad, on the east by Fansteel, on the south by 22nd Street (a.k.a. Martin Luther King Jr. Drive) and on the west by Commonwealth Avenue (Appendix C, Figure C-2). The EMCO facility is located on the west side of the site, west of Commonwealth Avenue. The site has a metal fence on the east side and a combination of metal and snow fence on the south side. The site poses easy access through its unfenced west boundary, through gaps in the snow fence, and along the unfenced northeast corner of the site. An access road made of gravel or badly weathered concrete pavement originates at the south end of the site and proceeds north through approximately three-fourths of the site length. General site topography is uniformly flat, with the exceptions being the Creek ravine and the relatively steep rise to the railroad bed along the north edge of the site. The site

is vegetated with grass, weeds, and moss in most areas, although portions of the site are barren. The southern two-thirds of the site has a weathered concrete/gravel layer, under approximately 6 inches of top soil. Several areas of the northwest one-third portion of the site have deposits of slag, ash, and cinders.

The site is transected by the Creek, an intermittent water body that lies in a relatively steep-sided ravine, and originates at the northwest boundary of the site. The ravine is lined with large weeds, bushes, and deciduous trees. The Creek flows to the south on site, and then flows east to finally merge into Lake Michigan (1.5 miles from the site). The Creek, at its origin, receives water through the North Chicago stormwater discharge and a ditch. The Creek is also fed by rain water and outfalls from two nearby industries/facilities (EMCO and Fansteel). As such, the Creek, within the site premises, contains water only during rain, stormwater, or industrial discharge events. The stormwater pipeline terminates under the elevated EJ&E Railroad tracks, giving rise to the Creek. The ditch, which is on the north side of the EJ&E Railroad tracks, is oriented in an east-west direction until it reaches the aboveground stormwater pipeline, where it turns south and passes under the pipeline and flows into the Creek. Water flows for approximately 10 feet in the Creek, and then reenters another water pipeline. This pipeline turns south and then runs underground along Commonwealth Avenue (parallel to the Creek) and empties into the Creek immediately south of the site. This diversion was designed by the City of North Chicago due to the silted bed of the Creek inhibiting the flow of water. An inactive discharge pipe enters the ravine at the northeast portion of the Creek, immediately after the stormwater discharge. This outfall is closed with a metal plate and is approximately 6 feet above the creekbed. This outfall was once active and was used by Fansteel (Gibbel K. 1996). The remains of a discharge pipe entering the ravine from the west, are located at approximately one-third of the site length, from the northern edge of the site. An active outfall originates from the direction of the EMCO facility, and enters the ravine from the west, at approximately one-half the site length. An active Fansteel outfall, through a discharge pipe, enters the ravine from the east at the southern boundary of the site, immediately before the Creek flows into the culvert under 22nd Street. The southern one-half of the creek, beginning immediately north of the EMCO discharge, flows south and exits the site through the culvert under 22nd Street.

2.2.2 Present and Past Facility Operations

According to U.S. EPA site file information, a 1907 plat map indicates noncommercial ownership of the property. A 1921 plat map depicts the site property, as well as the properties of

adjacent Fansteel and the nearby NCRS company (east of Fansteel), were owned by VLS. The southern half of the current Fansteel property was occupied by F.E. Ball Coal & Material Co., Agartol Coal Co., and C & NS Electric Sub-station & Car Barns. Two more additional coal companies operated immediately south of 22nd Street (the present southern Fansteel location). A tailings pile is located on the northern portions of both the current Vacant Lot and Fansteel properties. In 1936, the property was transferred to the C.N.S. & M. Railroad Company. By 1954, the current Vacant Lot property was sold to an individual who developed the property as a parking lot. The owner reportedly solicited fill materials to be placed at the site. The source, quantity, and nature of materials brought to the site is not well documented. However, reports of foundry sand and tailings deposition at the site is consistent with descriptions of materials observed on site. The Vacant Lot property is currently inactive and is held in trust by the Northern Trust Bank of Lake Forest, Illinois (IEPA 1995). Vacant Lot site aerial photographs were analyzed by Lockheed Environmental Systems and Technologies Co. (Lockheed), a contractor to the U.S. EPA Office of Research and Development. Lockheed reviewed photographs from 1939 through 1994. Results of the analysis revealed that in 1939, disturbed ground was visible east of the Creek. In 1953, 1954, and 1967, this portion of the site was used as a parking lot. From 1939 through 1986, staining, excavations, mounded material, and tire tracks were present in the northeastern area of the site at the end of an access road. These stain patterns trended into the Creek. In 1981, a possible shallow trench was observed, which was filled by 1986 (U.S. EPA 1997). Because a Vacant Lot owner reportedly solicited fill material from surrounding facilities, a brief description of adjacent Fansteel facility operations is included in this section. The Fansteel facility is divided into two main areas; the north and south plants. The north plant (adjacent to Vacant Lot) contained a boiler house and a laboratory, and conducted metal cleaning operations, tungsten cutting and polishing activities, wire drawing, tube drawing, and tungsten powder reduction activities. The north plant was erected in 1942 with assistance from an agency of the U.S. Government. Because the plant was used for purposes other than its original intent, organization of past plant operations is not clear (Fansteel permit application). The south plant (south of Vacant Lot, south of 22nd Street) consisted of facilities which manufactured electrical and electronic components, and precious metals.

On December 22, 1972, a letter regarding the south plant treatment system, addressed to IPCB, discussed alkaline precipitation of acid and caustic cleaning rinses, nickel plating rinses, and rinse water from tumbling and deburring operations. This letter indicated that the treated effluent would be piped, through an existing trench under 22nd Street, to the north plant and discharged into an

existing sanitary line. This letter was in response to an IPCB complaint against Fansteel, charging Fansteel with water pollution and cyanide discharge. The complaint stated that effluent from these two plants, containing settleable solids, cyanide, metals, acid, and caustic wastes, were discharged to the Creek.

2.2.3 Geology/Hydrogeology/Hydraulics

Regional geological information indicates that unconsolidated deposits in the vicinity of the site consist of glacial lake deposits and glacial till. This material consists of thin deposits of silt, clay, and sand accumulated on the floors of glacial lakes. These strata are reportedly underlain by glacial till. Thickness of the glacial lake deposits range from 10 to 25 feet thick. The underlying glacial till is generally 50 to 100 feet thick, but can be as thick as 300 feet in areas of prominent moraines (Geraghty & Miller 1994).

The Niagaran Series Racine Dolomite Formation is the bedrock immediately underlying the glacial material. Based on well records, this Silurian Formation occurs at a depth of approximately 130 to 160 feet bgs, with a thickness ranging from 225 to 350 feet. Maquoketa Group Shale lies beneath the dolomite and forms an aquitard separating the Silurian Dolomite aquifer from underlying Ordovician aquifers (Galena-Platteville Dolomite, Glenwood-St. Peter Sandstone) and Cambrian aquifers (Eminence-Postosi Dolomite, Franconia Formation, and Ironton-Galesville Sandstone) (Geraghty & Miller 1994).

Several soil borings have been conducted on site. Based on boring logs from the site, 1.5 to 5 feet of black sandy fill (fill unit), also described as slag/fly ash, occurs at the surface and is underlain by 2 to 4.5 feet of tan to gray sandy silt (silt unit). These strata are underlain by grayish silty clay (clay unit), which was observed continually downward to the end of the soil borings (10.5 to 20 feet bgs). Laterally, discontinuous silty to gravel sand deposits were encountered just above or within the silt unit, particularly in the northern portion of the site. The clay unit is reported to contain several thin sand and gravel seams which did not appear to be laterally continuous (Geraghty & Miller 1994).

Four main aquifers are used in the region for water sources. These are, in descending order; the unconsolidated sand and gravel deposits, the shallow dolomite aquifer, the Cambrian-Ordovician aquifer, and the Elmhurst-Mt. Simon aquifer. The shallow dolomite aquifer primarily consists of Silurian Dolomite. The Ironton-Galesville and Glenwood-St. Peter Sandstones are the most productive of the Cambrian-Ordovician aquifer. The Elmhurst-Mt. Simon aquifer consists of the Mt.

Simon Sandstone and the basal sandstone of the Eau Claire Formation. The shallow unconsolidated sand and gravel aquifer is hydraulically connected to the Silurian Dolomite, and both are recharged by seepage from precipitation. The Maquoketa Group Shale provides a hydrologic barrier between the shallow Glacialdolomitic aquifer and the Cambrian-Ordovician aquifer, which is separated from the Elmhurst-Mt. Simon aquifer by shaly and silty beds of the Eau Claire Formation (Geraghty & Miller 1994).

The depth to ground water ranged from 7.22 to 13.81 feet bgs. The Creek flows in a southerly direction across the site. The shallow groundwater flow direction ranged from southwest to southeast, and flowed toward the Creek ravine. These variances in flow direction can be attributed to the Creek. The Creek most likely acts as a local discharge area for shallow groundwater. Horizontal hydraulic gradient at the site was observed to range from 0.01 to 0.02 feet per foot (Geraghty & Miller 1994).

Hydraulic conductivity measurements were conducted at the site in December 1996 by a U.S. Geological Survey team. Monitoring wells GMMW2 and GMMW3 were selected since they had sufficient water to allow slug testing. Slug tests were performed using standard equipment, including an in-situ two-channel battery-powered recorder and a PVC slug (4.0 x 0.11-foot diameter). A 10 pounds-per-square inch (psi) in-situ pressure transducer was also used. Data reduction for hydraulic conductivity (K) determination was performed using a Geraghty and Miller, Inc., AQTESOLV software program. The K value was evaluated using the computer model, "Bouwer-Rice Solution for Unconfined Aquifers". Extracted values are 0.012 and 0.021 feet per minute (ft/min) for GMMW2 and GMMW3, respectively. Since accurate porosity values for the sand pack were not available, K values were approximated using porosity values between 0.1 and 0.3. This resulted in an increased K value of 0.20 ft/min for 0.3 porosity and a decreased K value of 0.008 ft/min for 0.1 porosity. The calculated flow rates are in the range of 0.173 and 0.346 feet per day for a K value of 0.012 ft/min, and in the range of 0.302 and 0.605 feet per day for a K value of 0.021 ft/min.

The on-site segment of the Creek receives surface water from a storm sewer, a ditch, industrial outfalls, and rain water. After exiting the site, the Creek flows through a series of culverts and buried pipes, and resurfaces on the Great Lakes Naval Training Center (GLNTC), where it eventually contains water year-round. The Creek discharges into Lake Michigan after passing through GLNTC. It is not known how frequently the Creek flows with water at the Vacant Lot site.

2.2.4 Surrounding Land Use and Populations

Land in the vicinity of the Vacant Lot site is used for both residential and industrial purposes. A chemical distributor lies to the west of the site, west of Commonwealth Avenue; commercial parking lies to the south of the site, south of 22nd Street; two heavy metal refiners/processors lie to the east of the site; and a residential area is located north of the EJ&E Railroad tracks. The population in the vicinity of the site is estimated to be 700 within 0.25 mile; 3,939 within 0.5 mile; 19,028 within 1 mile; 52,059 within 2 miles; 76,955 within 3 miles; and 100,590 within 4 miles of the site (IEPA 1995).

The City of North Chicago has an ordinance that requires all residents to use City-supplied drinking water. Telephone conversations with personnel from the North Chicago Water Department (NCWD) indicate that approximately 18,000 residences are metered and supplied with water from NCWD. Well logs from within a 4-mile radius of the Vacant Lot site, and information from IEPA, indicate no known potable groundwater usage within a 1-mile radius of the site. The nearest well is in Shore Acres, located approximately 1.5 miles southeast of the Vacant Lot site. The well log indicates that a clay layer is present to a 24-foot depth from the surface, followed by a 3-foot fine gravel layer, followed by clay to 151 feet bgs, and finally sand and gravel after the clay layer. Groundwater is obtained from a sand and gravel formation, at a depth of approximately 158 feet bgs. Approximately 15 private wells are located in Shore Acres.

The site groundwater flow direction is south and southeast. The Creek, after exiting the Vacant Lot site, flows southeast for approximately 0.5 mile, and then flows east to Lake Michigan. An unnamed creek flows in a southerly direction and joins the Creek when it turns east. The nearest Shore Acres well is located to the east of the unnamed creek and is approximately 0.5 mile south of the easterly flowing Creek.

The following factors were taken into consideration to evaluate potential contamination of the nearest well:

- The contamination in the Vacant Lot site groundwater is due to sources above the clay formation of the Shore Acres area. The monitoring wells at the Vacant Lot site are installed between 7- and 20-foot depths in the sandy/fill deposits.

- The Shore Acres wells are formed in sand and gravel at a depth of approximately 151 feet, overlain with approximately 124 feet of clay. This clay layer will act as a barrier and would limit any groundwater contamination penetrating the sand and gravel formation.

- Since the groundwater flows in a south and southeast direction at the site,

groundwater from the site would flow into the Creek and, eventually flow into Lake Michigan.

The contaminated groundwater from the Vacant Lot site will most likely follow the above pathways, than proceed south under the Creek and potentially contaminate Shore Acres wells. Potential contamination of the nearest residential well in Shore Acres, due to Vacant Lot groundwater contamination, is very unlikely.

The Arden Shores Estates has one public well situated approximately 1.9 miles south-southwest of the site. This public well draws water from a limestone formation at a depth of 272 feet bgs. Approximately 160 feet of clay lies above the limestone formation. Potential contamination of the nearest residential well in the Arden Shores Estates, due to the Vacant Lot groundwater contamination, is very unlikely. The clay formation and the groundwater flow direction from the site rule out contamination potential.

2.2.5 Sensitive Ecosystems

No sensitive ecosystems are known to be present in the immediate vicinity of the site. The Creek drains into Lake Michigan and may serve as a migration pathway for contaminants. The Creek eventually becomes a year-round waterway (generally within GLNTC), and this aquatic environment may be considered the nearest and most vulnerable sensitive ecosystem to the Vacant Lot site. The relative health of the aquatic environment in the Creek downstream of the site is not known. Samples collected from the Creek sediments at the Vacant Lot site were contaminated with low levels of metals, PAHs, and PCBs. Engineering controls which would restrict migration of contaminated sediments are not known to be implemented at the site.

2.2.6 Meteorology

The climate of Lake County has a wide range of annual and daily temperatures. The average annual temperature is 48.6 °F. Summer is generally warm and humid, with temperatures that can exceed 90°F. The warmest month of the year is July, where the average temperature is 72.5°F. June receives the most precipitation, with 3.88 inches. The winter is cold, with temperatures as low as 0°F. The coldest month is January, where the average temperature is 24.3°F. February is the driest month, averaging 1.48 inches of precipitation. The average rainfall for Lake County is 32.8 inches per year. Average snow accumulation is 38.3 inches annually. O'Hare International Airport receives an annual precipitation averaging 39.82 inches per year. By extrapolating this data, it is

estimated that the average precipitation for Lake County, Illinois, is 39 inches annually.

2.3 Previous Removal Actions

No previous removal actions were undertaken at the Vacant Lot site.

2.4 Source, Nature, and Extent of Contamination

To define the source, nature, and extent of contamination, an EE/CA sampling plan was developed and submitted to U.S. EPA in January 1997. The representative soil sampling recommended for the Vacant Lot site was based on U.S. EPA's *"Removal Program Representative Sampling Guidance, Volume 1 - Soil"*. The sampling plan recommended collecting samples at the nodes of an 80-foot by 80-foot grid for characterizing metal contamination in soil. Using site features and analytical data, the calculated sampling design showed that an elliptical-shaped hot spot, with approximate dimensions of 95 feet long by 45 feet wide, would be detected with a probability of 95% using an 80-foot by 80-foot grid. For characterizing organic contamination, the sampling plan recommended collecting soil samples from approximately 25 nodes of a 113-foot by 113-foot grid. Using site features and analytical data, the calculated sampling design indicated that an elliptical-shaped hot spot, with approximate dimensions of 105 feet long by 53 feet wide, would be detected with a probability of 95% using an 113-foot by 113-foot grid. Based on this sampling plan, two sampling events were conducted. In the first sampling event, soil and sediment samples were collected from 0- to 1-foot and 1- to 2-foot depth intervals to characterize the contaminants, define areas of fill, and to evaluate the nature of sampling for the second sampling event. In the second sampling event, only those areas which are identified as potential source/fill areas, or areas that may require cleanup and/or disposal, were sampled by collecting deep boring samples using Geoprobe equipment. Deep boring soil samples from areas in close proximity to some of the Geoprobe groundwater locations were also collected to correlate the presence of any contamination detected in Geoprobe water samples with the contamination, if any, in the soil samples. Deep boring soil samples from the source/fill area were collected to aid in defining lateral and vertical extent of contamination, while soil borings near Geoprobe groundwater locations were collected to aid in determining any source contributing to groundwater contamination at that location. Monitoring well samples were collected during the first and the second sampling events to characterize and evaluate the nature and fate of the contaminants. Apart from monitoring well sampling, the first sampling event also involved collecting groundwater samples using Geoprobe equipment from the inside

perimeter of the site to identify any on-site migration of contamination from off-site sources. To characterize sediment contamination, the first sampling event involved biased sampling in the on-site segment of the Creek based on the knowledge of present and past outfalls into the Creek. The sampling plan recommended collecting sediment samples from the present and past outfalls, from upgradient locations, and from the bed of the Creek. Sample results at each outfall would be used to evaluate the constituents of the discharge, while the creekbed samples would be used to evaluate the potential migration of contaminants. Although the Creek originates at the site, samples collected from the ditch north of the site and from the point of termination of the storm sewer, were considered upgradient sediment samples, since these two water bodies empty into the Creek. Six on-site and two off-site upgradient sediment samples were collected from 0- to 1-foot and 1- to 2-foot intervals. Two of the on-site locations represented active outfalls and one location represented an inactive outfall. Two off-site sediment samples were collected, one from the ditch in close proximity to the electric substation on the north side of the elevated EJ&E Railroad tracks, and the other at the origin of the Creek and the termination of the stormwater pipeline. In the second sampling event, additional sediment samples were collected at depth to define the depth of contamination prevailing in the northern, middle, and the southern portions of the on-site segment of the Creek.

For EE/CA sampling, the approximately 6.4-acre site was systematically sampled based on an 80-foot by 80-foot grid layout. The U.S. EPA's Technical Support Section (TSS) laid out the grid using a Global Positioning System (GPS) instrument. The location of the Creek and on-site monitoring wells were also recorded with the help of the GPS instrument. The origin of the grid layout is near the southeast corner of the site. The rows of the grid are labeled A through M on the "Y" axis, and the columns of the grid are labeled 0 through 4 on the "X" axis (Appendix C, Figure C-3). The sampling identification was based on the grid node location, followed by a notation for the depth interval of the sample, with "-1" representing a sample collected at a depth interval of 0 to 1 foot and "-2" representing a sample collected at a depth interval of 1 to 2 feet. For example, "A1-1" represents a sample collected at a node where row "A" intersects column "1" at a depth interval of 0 to 1 foot.

2.4.1 Soil Contamination

E & E has based its soil sampling on the 80-foot-square grid. At each grid node, two samples were collected, one from a 0- to 1-foot interval and the second from a 1- to 2-foot interval. Both samples collected from each node were analyzed for total metals, semivolatile organic

compounds (SVOCs), pesticides, and PCBs. In addition to this, the 1- to 2-foot sample, at every alternate grid node, was also analyzed for VOCs (Figure C-3). VOC analysis was not performed on the 0- to 1-foot depth samples for several reasons. The southern two-thirds of the site is underlain by a weathered concrete/gravel layer under approximately 6 to 8 inches of topsoil. Historical data indicated VOC concentrations at several orders of magnitudes lower than risk-based levels for site workers, which were used for evaluation at this depth. If VOC contamination is detected in the 1- to 2-foot depth samples, the soil above it must be removed to access this contamination during the removal action. Once the top 1 foot of soil is removed, it may be analyzed for VOC contamination and disposal parameters.

E & E mobilized to the site and collected samples for the first sampling event on January 7, 8, 21, 22, and 23, 1997. During this period, 45 locations were sampled and 90 samples were collected. Twenty-five samples were analyzed for all parameters, including VOCs. Observations made during sampling activities indicate that the weathered concrete/gravel-compacted layer extends from the southern portion of the site north to the "E" row, and spreads laterally between the access road on the east and the vegetation on the west. Even though similar material was observed at a 6- to 8-inch depth between the access road and the east fence, the gravel layer was not as continuous as on the west side of the access road. A barren area was noted at MW-3, GMMW2 and MW-1. Fill material, including bricks, debris, and metal were observed when collecting samples from the slopes of the ravine of the Creek. The majority of the 1-foot-depth interval samples were collected from a gravel and soil matrix. Cinder/slag piles were observed in the northern part of the site, immediately west and north of monitoring well GMMW2. Gray- to-black colored material resembling cinder/slag material, was also observed in the surface soil, near rows K and M, and between columns 1 and 2.

Results of First Sampling Event

Since historical soil sampling data indicated contamination off site, IEPA's soil background sample results were used to compare on-site concentrations. The site is classified by U.S. EPA as an industrial area. Lead concentration ranged from 1,550 to 24,100 mg/kg. Beryllium concentrations were detected as high as 30.1 mg/kg in one soil sample.

Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and n-nitroso-di-n-propylamine were detected in surface and subsurface soil samples. Benzo(a)pyrene concentrations ranged from 0.8 to 49 mg/kg and dibenzo(a,h)anthracene concentrations ranged from 0.9 to 4.2 mg/kg in soil samples. Benzo(a)anthracene concentrations were

detected as high as 51 mg/kg, benzo(b)fluoranthene concentrations were detected as high as 69 mg/kg, and indeno(1,2,3-cd)pyrene concentrations were detected as high as 14 mg/kg in soil samples. Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1.2,3-cd)pyrene were detected in one soil sample location, even at the 2-foot depth interval sample. Only one soil sample (at grid node K2) contained n-nitroso-di-n-propylamine at an elevated concentration. Aldrin and dieldrin were detected at elevated concentrations in two soil samples. Total PCB concentrations were detected at elevated levels in 13 soil samples. Four of these soil samples exceeded a PCB concentration of 50 mg/kg and qualified for classification as Toxic Substances Control Act (TSCA) waste. The remaining seven samples contained less than 10 mg/kg total PCBs. PCBs, especially Aroclor 1254, (contamination between 1 and 10 mg/kg) and benzo(a)pyrene (contamination between 0.8 and 2.5 mg/kg) were distributed randomly in the southern two-thirds of the site. Elevated concentrations of PCBs, between 100 and 160 mg/kg, were detected in the soil samples collected from the former fire area. PERC was detected at a concentration of 170 mg/kg within the 1- to 2-foot interval I2-2 sample (Appendix D, Tables D-5 and D-6). Based on the analytical results of the samples collected from the former fire area, a source/fill area is identifiable in the northern one-thirds of the site, lying in the area bounded by grid nodes I2, J1, K1, K2, and J3. The presence of a source/fill area is further substantiated by the detection of similar or byproduct contaminants in the monitoring wells located in the source/fill area.

Results of Second Sampling Event

The second sampling event was conducted on April 24 and 25, 1997. The second sampling event was based primarily on the evaluation and interpretation of the first sampling event's analytical results. Emphasis was placed on collecting 4- to 12-foot depth soil samples, using Geoprobe drilling equipment, from the source/fill area, and collecting samples at 2-foot intervals to define the depth of contamination. To define the lateral extent of contamination of the source/fill area, soil samples were collected to 8-foot depths. Soil samples from the second column of rows I, J, and K, were collected from 4-, 6-, 8-, 10-, and 12-foot intervals. Extending 40 feet laterally in all directions from the source/fill area, samples were collected in between grid nodes, at 4-, 6-, and 8-foot intervals from KL2, J23, and J21 locations. A sample identification of KL2 indicates a sample location midway between nodes K2 and L2, while a J23 sample identification represents a sample location midway between nodes J2 and J3. First sampling event results from the K1 node location indicated PCBs as the only organic contaminant of concern. Past history indicated that PCBs were not present below a

2-foot depth, even in the source/fill area. Based on this information, at grid node K1, only 4- and 6-foot interval samples were collected. Soil boring samples, using Geoprobe equipment, were also collected from GEO-6, GEO-7, and GE0-8 groundwater locations. These samples were collected 6 to 12 inches south of their respective groundwater locations, and were collected at 2- and 4-foot depths.

Benzo(a)pyrene, a very frequent contaminant encountered at a 2-foot depth in the first sampling event, was not encountered above 0.8 mg/kg beyond the 2-foot depth. Sample I2-2 did not contain PERC above the detection level at 4-, 6-, 10-, and 12-foot interval samples, but contained 15 mg/kg PERC at the 8-foot interval sample. Sample I2-4 contained TCLP lead at 81.6 mg/L in the 4-foot interval sample, and sample I2-8 contained 8.86 mg/L TCLP lead in the 8-foot interval sample (Appendix D, Table D-7).

All the soil samples were collected using hand augers, shovels, and trowels. VOC samples were placed in sample jars prior to mixing the sample in a bowl. Sample material for remaining parameters were placed in sample jars after mixing the sample in the bowl. Quality assurance/quality control (QA/QC) Level II criteria was used for sampling protocol, with a duplicate sample collected approximately every 10 samples. The first sampling event samples were analyzed at a Contract Laboratory Program (CLP)-approved laboratory arranged through U.S. EPA. The second sampling event samples were analyzed using the same protocols as the first sampling event, but were analyzed at a commercial laboratory subcontracted by E & E, to expedite analyses and reporting time. All sampling equipment was decontaminated using a 4-step procedure; 1) wash with Alconox solution, 2) water rinse, 3) rinse with dilute nitric acid solution and water, and 4) rinse with a hexane solution.

Extent of Contamination

Inorganic and organic contamination is prevalent in on-site soils. Lead contamination is prevalent throughout the site and is encountered at 1-foot and 2-foot interval samples with the exception of two areas. These exceptions are a 40-foot by 250-foot area between row "B" and the southern boundary of the site and a 100-foot by 100-foot area between nodes E3 and E4, and H3 and H4. Beryllium was detected at elevated concentrations in several soil samples, and usually is encountered coupled with lead contamination. In spite of this widespread metal contamination, no definitive on-site source is identifiable. It is probable that the source material, used at the site in grading and preparing the parking lot, may have contained metal contamination. With the exception of the I2 node, lead contamination was not detected beyond the 2-foot depth in any other nodes (Appendix C, Figure C-4). Based on the second sampling event, the leachable lead above 5 mg/L is

estimated to constitute 6.8% of the total lead concentration.

Benzo(a)pyrene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene constitute the most frequently occurring contaminants in on-site soil. PCB contamination, especially Aroclor 1254 (between 1 and 10 mg/kg) and benzo(a)pyrene (between 0.8 and 2.5 mg/kg) was randomly distributed in the southern two-thirds of the site. No sources were identified to attribute the presence of this contamination. The northern one-third of the site, lying in the area bounded by nodes I2, J1, K1, K2, and J3, is identified with organic and inorganic contamination extending to an average 2-foot depth. Pesticides (aldrin, dieldrin, and toxaphene) were detected at elevated concentrations in samples I2-2 and K2-1. Elevated concentrations of PCBs, between 100 and 160 mg/kg, were detected in the soil samples collected from the source/fill area (Appendix C, Figure C-5). This is the only on-site area where pesticides and other contaminants were observed in individual soil samples.

The extent of contamination is within 2- to 3-foot depths in the on-site soils, with the exception of two locations, and to a 4-foot depth in the source/fill area. In addition to this, grid node I2 in the source/fill area contains contamination to a 9-foot depth. Based on the second sampling event results, the source/fill area boundaries are redefined. The redefined source/fill area extends to grid node I2 on the south, to grid node K2 on the north, to grid node J3 on the west, and to 20 feet east of grid node J2 on the east. The source/fill area measures approximately 180 feet by 100 feet by 4 feet and contains approximately 2,067 cubic yards of hazardous material.

2.4.2 Groundwater Contamination

Six monitoring wells and two Geoprobe locations were sampled during the first sampling event and analyzed for metals, VOCs, SVOCs, pesticides, and PCBs (Figure C-3). During the second sampling event, conducted between February 17 and 26, 1997, the second set of monitoring well samples and six additional Geoprobe samples were collected. All eight Geoprobe water samples were collected along the inside perimeter of the site. Four of the six monitoring wells are located in or near the past fire/source/fill area. Monitoring well GMMW2 is located to the northwest of grid node K2. Monitoring well MW-1 is located to the southeast of monitoring well GMMW2, between grid nodes K0 and J0. Monitoring well MW-3 is located to the northwest of node I2 node (south of monitoring well GMMW2). Monitoring well MW-2 is located southeast of grid node I2. Monitoring well GMMW1 is located between grid nodes El and F1, in the southern portion of the site. All these monitoring wells are located on the east side of the Creek. Monitoring well GMMW3 is located on the west side of the Creek, and is northwest of grid node E3. Monitoring wells GMMW2 and MW-3

are located in the source/fill area, while MW-2 is southeast of the source/fill area. Monitoring well MW-1 is located east of the source/fill area, and monitoring well GMMW1 is located close to the eastern fence.

Geoprobe locations were chosen to depict upgradient, perimeter, and downgradient sampling points. Geoprobe location GEO-1, northeast of GMMW1, did not yield enough water to enable sampling. Geoprobe location GEO-2, near EJ&E Railroad tracks and northwest of grid node M1, represents the northern perimeter and upgradient location. Geoprobe location GEO-7, is near the northeast corner of the site (18.3 feet west of the eastern fence and 34.2 feet south of the EJ&E Railroad tracks) and represents an additional upgradient location. Geoprobe location GE0-8, is north of MW-1 (northeast direction from GMMW2) and is situated between grid nodes K0 and L0. Geoprobe locations GEO-2, GEO-7, and GE0-8, all constitute upgradient wells. Geoprobe location GEO-9, is west of node H0 (eastern perimeter) and represents a location midway between monitoring wells MW-1 and GMMW1. Geoprobe location GEO-6 is at the southeast corner, approximately 20 feet north of the south fence and 25 feet west of the eastern fence, and represents a downgradient location. Geoprobe location GEO-5, is located approximately 16 feet southeast of node B2, and represents the midpoint of the southern perimeter. Geoprobe location GEO-4, (60 feet west and 40 feet north of grid node A3) on the west side of the Creek, represents the southern perimeter location, and is south of monitoring well GMMW3. Geoprobe location GEO-3, is on the west side of the Creek, 20 feet north and 15 feet west of grid node H3, and represents an upgradient location. To summarize, GEO-2, -7, and -8 represent the north and northeast upgradient locations; GEO-9 represents the eastern perimeter location; GEO-4, -5, and -6 represent downgradient locations, and GEO-3 represents the western perimeter, as well as an upgradient location for the groundwater on the west side of the Creek. The majority of these Geoprobe locations did not yield enough water for a full parameter sample analyses.

After opening the caps of the monitoring wells, a photoionization detector (PID) was used to screen the air immediately above the outer casing and at the mouth of the inner pipe. The presence of VOCs was detected at monitoring well GMMW2, with a concentration of 0.4 to 0.8 parts per million (ppm) in the breathing zone immediately above the pipe, and above 20 ppm at the mouth of the inner pipe. The water from all the monitoring wells and Geoprobe locations was turbid and brown in color. All monitoring well samples were collected after purging water equivalent to three times their well capacity. Monitoring well MW-3 recharged slowly and was dry after purging water three times its well capacity. During the first sampling event, temperature, pH, conductivity, and

turbidity of the water were measured at the end of each purge volume from these monitoring wells. Samples for VOC analyses were collected in hydrochloric acid-preserved 40-milliliter (mL) bottles. Samples for metal analyses were collected after filtering the initial sample and preserving it with nitric acid. All samples were collected using dedicated polyethylene bailers and nylon rope. Geoprobe water samples were collected after pumping water out of the boring using dedicated Teflon tubing. VOC and metal analyses samples were collected in the same manner as the monitoring well samples. Geoprobe pipes were decontaminated by the 4-step decontamination procedure referenced in Section 2.4.1.

Results of First and Second Sampling Events

Groundwater sample results were evaluated based on the criteria presented in the U.S. EPA document, "*Numerical Removal Action Levels for Contaminated Drinking Water Sites*". Although there were no groundwater receptors, groundwater contamination was evaluated due to potential for off-site migration. The MCL values and the RAL values of this table were used to determine appropriate removal alternatives. Results of the monitoring well samples indicate both inorganic and organic contamination of groundwater (Appendix D, Table D-8). Cadmium, manganese, and lead were detected above their MCL values in monitoring well sample MW-1. However, both lead and manganese concentrations decreased below the MCLs in the second sampling event. Zinc contamination above the MCL value was detected in monitoring well sample MW-1, in the second sampling event only. Manganese was detected above the MCL value in monitoring well sample MW-2, in both the first and second sampling events, with its concentration increasing in the second sampling event. In monitoring well samples MW-3 and GMMW1, no metal contamination was observed above the MCL values. In sample GMMW2, manganese above the MCL value, was detected in both the first and second sampling events; however, the manganese concentration decreased in second sampling event. Arsenic and manganese, with contamination above their respective MCL values, were detected in sample GMMW3. Arsenic contamination decreased, and manganese contamination increased slightly in the second sampling event. Two of the three Geoprobe samples (GEO-2 and GEO-7) that were analyzed for metals contained manganese contamination above the MCL, these are northeastern upgradient sample locations (Appendix C, Figure C-6).

Vinyl chloride, 1,1-dichloroethene, 1,2-DCE, TCE, and PERC were detected above the MCL values. All four contaminants were detected at higher concentrations in monitoring well sample MW-3, than in any other monitoring well samples. Monitoring well samples MW-1, MW-2, and

GMMW1 did not contain any VOC contamination above the MCL values. Monitoring well sample GMMW3 contained a vinyl chloride concentration above the RAL (Appendix C, Figure C-7). Contaminant 1,2-DCE, detected in this sample at 0.044 mg/L during the first sampling event, decreased below the MCL of 0.07 mg/L in the second sampling event. TCE was detected at 5 mg/L in Geoprobe sample GEO-6, at 0.420 mg/L in Geoprobe sample GEO-7, and at 0.180 mg/L in Geoprobe sample GE0-8. PERC was detected at 0.003 mg/L in Geoprobe sample GEO-2 (Appendix D, Table D-9).

Extent of Contamination

Arsenic, cadmium, lead, manganese, and zinc are the metals of concern in the groundwater. Manganese is present in the monitoring wells of the source/fill area, as well as in the Geoprobe groundwater samples of the northeastern perimeter of this site. The presence of a low concentration of manganese in perimeter, as well as on-site monitoring wells, suggests that it may be a naturally occurring element in the vicinity of the site. VOC contamination detected in groundwater includes 1,1-dichloroethane, 1,2-DCE, vinyl chloride, TCE, and PERC. There are several different and distinctive groundwater-contaminated areas on site. The first area of groundwater contamination is located in the northern one-third area of the site, and extends from monitoring well MW-2 to the northern boundary of the site. In this area, manganese, 1,2-DCE, and TCE are the contaminants detected in groundwater. TCE concentrations above RALs and 1,1-dichlorethene concentrations above MCLs were detected only in the north and northeastern perimeter Geoprobe water samples, while 1,2-DCE and vinyl chloride above RALs were detected only in monitoring well MW-3, which was located in the middle of the source/fill area. Both TCE and 1,2-DCE hydrolyze in water to produce vinyl chloride; however, with the absence of substantial amounts of TCE in the source/fill area soil and groundwater, it appears that vinyl chloride, as evident in monitoring well MW-3, is produced via 1,2-DCE. Based on these results, it is postulated that contribution to groundwater contamination in the source/fill area, as evident in monitoring wells GMMW2, MW-2, and MW-3, could potentially be coming from the source/fill material. The presence of a relatively higher concentration of TCE contamination in the east and northeast boundaries of this area, indicate a different source that is potentially contributing to groundwater contamination; this distinction is evident upon review of the groundwater flow direction at the site. The local groundwater flow direction is southwest on the east side of the Creek and southeast on the west side of the Creek, resulting in groundwater flowing from the northeast and northwest part of the site towards the Creek

and the source/fill area. Vinyl chloride is not detected in the upgradient groundwater, but is detected above RALs in monitoring well MW-3 and above MCLs in monitoring well GMMW2. The presence of hydrolysis products in source/fill area groundwater indicates two possibilities; either hydrolysis is occurring in the source/fill area, or it is occurring elsewhere and migrating to the source/fill area. Sample GMMW2, collected from monitoring well GMMW2, located at the northern perimeter of the source/fill area, and sample MW-2 collected from monitoring well MW-2, located immediately outside the southern perimeter of the source/fill area, do not contain any VOC contamination above the RALs, but contain manganese contamination. Sample MW-3, collected from monitoring well MW-3, located in the middle of the source/fill area, did not contain manganese contamination above the RAL. Due to the absence of manganese, it is reasonable to assess that the material/fill around monitoring well MW-3 is not native.

The second area of contamination is based on the results of two Geoprobe water samples collected from the southern and southeastern part of the site. Sample GEO-6, collected from Geoprobe location GEO-6, at the southeastern perimeter of the site, contained the highest TCE concentration encountered on site. TCE concentrations, below detection levels in monitoring well GMMW1 (350 feet north of Geoprobe location GEO-6) and Geoprobe location GEO-5 (80 feet northwest of Geoprobe location GEO-6) indicate a TCE groundwater plume in this area with probable origin elsewhere.

The third area of contamination is based on the prevalent contamination in monitoring well GMMW3, located on the west side of the Creek. Metal and vinyl chloride contamination above their respective RALs are detected in this well, while Geoprobe samples collected to the north and south of this location did not contain contamination above the detection levels. Again, no source is identified here and the groundwater contamination may be due to a migrating groundwater plume with origin elsewhere. Based on the analytical results and historical information, this groundwater contamination could potentially extend beyond the site boundaries on the north and east sides of the site.

The on-site groundwater is contaminated from two different pathways; the potential leaching attributes of the contaminants found in the on-site source/fill area, and the on-site migration of offsite-contaminated groundwater, as evident from the perimeter sampling results. Based on VOC and metal contamination, the on-site groundwater contamination extends from north of monitoring well MW-2 to the northern perimeter, and along the eastern perimeter of the site. The groundwater along the eastern perimeter of the site, extending from the northeast corner to immediately north of monitoring well MW-1, contained contamination probably due to contaminated groundwater migrating onto the

site. This correlation is made based on the presence of certain contaminants (e.g; TCE) in on-site water that are also known to be present in nearby off-site deep bore samples. Also, the concentration of TCE detected in the eastern perimeter water samples are substantially higher than in the monitoring wells of the source/fill area. With the local groundwater flow direction from the northeast to the south and southeast, it is very unlikely that contaminated groundwater would flow towards the eastern perimeter. In monitoring well GMMW2, metal contamination above the RALs is present, but VOC contamination is below the RALs and above the MCLs.

2.4.3 Sediment Contamination

Since the Creek is originating on site, and contains intermittent water mostly due to stormwater, industrial outfalls, rain, and surface water runoff, no aquatic life was evident in the on-site segment of the Creek. Except during storm events, a low flow of surface water is anticipated, along with minimal sediment migration from the site to downstream locations. During the first sampling event, biased sediment sampling was conducted in the Creek based on the knowledge of present and past outfalls in the Creek. With some exceptions, sediment samples were usually collected from 0- to 1-foot and 1- to 2-foot intervals. Two off-site sediment samples were collected, one from the ditch in close proximity to the electric substation (SED1) and the second from the origin of the Creek, where the North Chicago stormwater discharge terminates under the elevated EJ&E railroad tracks (SED2). Sample SED2 was collected from a 0- to 6-inch interval. Six on-site sediment samples were collected from the Creek; two of these locations represent active outfalls (SED4 and SED5) and one location represents an inactive outfall (SED3). Samples SED3-1 and SED3-2 ("-1" represents a 1-foot interval sample and "-2" represents a 2-foot interval sample) were collected immediately in front of the inactive outfall, located in the slope of the Creek. TCE was detected in these samples (below RALs) but was not detected in upgradient samples SED1 and SED2. Sediment samples SED4-1 and SED4-2 represent the location of the EMCO outfall in the Creek. During the first sampling event, the water from the active EMCO outfall was observed with a sheen. The EMCO outfall is the approximate midpoint of the Creek. PAHs were detected at elevated levels in the EMCO samples. Aroclor 1254 was detected at an elevated level in the 1-foot interval sample. Sediment sample SED5-1 represents the location of Fansteel's active outfall, situated at the southern tip of the Creek. Sediment samples SED3C-1 and SED3C-2 were collected from the Creek at grid node C3, approximately midway between the EMCO and Fansteel outfalls. Sediment sample SED6-1 was collected approximately midway between the EMCO outfall and SED3C sample location; a

deeper 1- to 2-foot sediment sample was not collected due to the presence of debris and stones at this location. Sediment samples SED7-1 and SED7-2 were collected from the Creek, approximately 25 feet south of the inactive Fansteel outfall (Figure C-3).

Results of First Sampling Event

Evaluation of the analytical results indicate the presence of beryllium at elevated concentrations in four sediment samples (range of 1.5 to 2.2 mg/kg). One sample contained 1,550 mg/kg lead (Appendix C, Figure C-8). Benzo(a)anthracene, benzo(b)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene were detected in several sediment samples (Appendix D, Table D-10). Analytical results of sediment sample SED2-1, collected at the origin of the Creek, indicates relatively higher concentrations of benzo(a)anthracene (18 mg/kg), benzo(b)fluoranthene (33 mg/kg), and benzo(a)pyrene (25 mg/kg) than those found in any on-site sediment samples. Sediment samples SED2-1, SED1-1 and SED1-2 are considered upgradient/background samples. Results of sediment samples SED3-1 and SED3-2 indicate benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and benzo(a)pyrene concentrations at elevated levels at the 1- and 2-foot depths (Appendix C, Figure C-9). Since the location of this sample (under the inactive Fansteel outfalls) is at a higher elevation than the creekbed, there is minimal or no potential for the Creek contamination to contaminate this location. The presence of PAHs in samples SED3-1 and SED3-2 indicate potential discharges of contaminants in the past from the now inactive outfall. Results from samples SED4-1 and SED4-2 (EMCO outfall area) indicate benzo(a)pyrene and dibenzo(a,h)anthracene contamination at elevated levels at both the 1-foot and 2-foot interval depths.

Results of Second Sampling Event

For the second sampling event, three sediment sample locations were chosen to characterize the depth of contamination in the Creek. Sediment locations represented the northern (SED7 location), middle (SED4 location), and the southern (C3 grid node) portions of the Creek. Sediment samples SED7-3 and SED7-4 were collected from 2- to 4-foot and 4- to 6-foot depths, respectively. Sediment samples SED4-3 and SED3C-3 were collected from 3.5- to 4-foot depths. With the exception of the northern one-third of the site, clay is present at a 3.5- to 4-foot depths in the Creek, as evidenced during sampling.

Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene were detected at elevated concentrations in all the sediment samples collected

during the second sampling event (Appendix D, Table D-11).

All sediment samples were collected using hand augers, shovels, and trowels. VOC samples were collected prior to mixing the sample in a bowl. Sample material for all other parameters were placed in sample containers after mixing the sample in a bowl. QA/QC Level II criteria was used for sampling protocol, with a duplicate sample collected approximately every 10 samples. The first sampling event samples were analyzed at a CLP-approved laboratory arranged through U.S. EPA. The second sampling event samples were analyzed at a commercial laboratory subcontracted by E & E, using the same sampling protocols as the first sampling event. All sampling equipment was decontaminated using the 4-step procedure referenced in Section 2.4.1.

Extent of Contamination

Sediment extent of contamination is defined based on the presence of beryllium, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene. Analytical results have confirmed benzo(a)pyrene and beryllium contamination in sediment samples collected to a depth of 4 feet (top of clay layer) (Appendix C, Figure C-10).

The U.S. FWS recommended an evaluation of sediment contamination based on the "*Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*"(August 1993) document. Lead is present at or above the "Severe Effect Level" concentration (250 mg/kg), and is detected at a maximum concentration of 1,550 mg/kg in sediment sample SED3C-1. This concentration of lead classifies the sediments to be "highly contaminated and will likely have a significant effect on benthic biological resources". Analytical results indicate lead concentration below 250 mg/kg at the 3- to 4-foot depth. Copper is the other metal present at or above the "Severe Effect Level" concentration (110 mg/kg), and is detected at a maximum concentration of 3,100 mg/kg in sediment sample SED3C-1. This concentration of copper classifies the sediments to be "highly contaminated and will likely have a significant effect on benthic biological resources." Benzo(a)pyrene, indeno(1,2,3-cd)pyrene, anthracene, fluoranthene, pyrene, heptachlor epoxide, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor 1254, and Aroclor 1260 contaminant concentrations are above the "Lowest Effect Level", but are typically 2 to 3 orders of magnitude below the "Severe Effect Level". According to the guidelines, if a single parameter value for a given material is at or above the "Lowest Effect Level" guidelines, that material fails the guideline and it is anticipated that such material may have an adverse effect on some benthic biological resources. However, given the lack of an aquatic ecosystem in the on-site segment of the Creek, sediment contamination is evaluated

according to their potential risk posed to human health and the environment. Sediment contamination in the 3- to 4-foot depth range indicate contaminant concentrations below the "Lowest Effect Levels" or "No Effect Levels".

2.4.4 Nature of Contaminants

2.4.4.1 1,2-DCE

Transportation

The compound 1,2-DCE has a relatively low soil adsorption factor (K_{oc}), a high vapor pressure, is water soluble, and is more dense than water. K_{oc} is defined as the affinity of a chemical to adsorb to soil. The lower the K_{oc}, the less likely the chemical will adsorb to the soil, thus resulting in faster migration. A high vapor pressure indicates a chemical that will readily volatilize. These four properties predict how 1,2-DCE will behave when released into the atmosphere.

When released to moist soil surfaces or surface water, 1,2-DCE will volatilize. Once 1,2-DCE has entered the air, it will remain in the vapor phase until it is washed out by precipitation or degrades. If removed by precipitation, it is likely to re-enter the atmosphere by volatilization. Thus, significant transportation away from the source of 1,2-DCE may occur. If 1,2-DCE does not volatilize, migration through the soil will occur. The compound 1,2-DCE exhibits medium to high mobility, depending on the soil type. Once in the groundwater, 1,2-DCE will sink, preventing contact with the surface.

Degradation

The primary means for degradation of 1,2-DCE vapor is through reactions with photochemically generated oxygenated species (hydroxyl radicals) in the atmosphere. The estimated half-life resulting from this degradation is 12 days for *cis*-1,2-DCE and 5 days for *trans*-1,2-DCE. Actual rates will vary, dependent on temperature, air movement, quantity of hydroxyl radicals, and other factors. Atmospheric ozone, nitrate radicals, and singlet oxygen have little effect on 1,2-DCE.

Degradation in surface waters is not considered due to the rapid transfer to air by volatilization. The half-life of the transfer of 1,2-DCE from a depth of 1 meter in water to air is five to six hours. Actual rates will vary depending on temperature, water movement and depth, associated air movement, and other factors.

The sole mechanism for degradation of 1,2-DCE in soils and groundwater is anaerobic

digestion. Biodegradation is favored under limited conditions, and has a half-life of 13 to 48 weeks, depending on conditions. The biodegradation has multiple pathways and can produce vinyl chloride, TCE, and PERC. Vinyl chloride is a known carcinogen. The *cis* isomer of 1,2-DCE degrades more rapidly than the *trans* isomer.

Potential for Exposure in Humans

The general population may be exposed through the following pathways; inhalation, oral, and dermal. Higher possibilities of exposure occur in communities that rely on groundwater supplies. Inhalation of 1,2-DCE may occur while breathing contaminated air; and through vaporization from contaminated water during cooking and bathing activities. Dermal contact of 1,2-DCE may occur while bathing. Ingestion of 1,2-DCE may occur from drinking contaminated water. Based on these factors, the potential for 1,2-DCE exposure in humans is minimal.

Bioaccumulation

1,2-DCE has a low potential to bioconcentrate in aquatic organisms. The potential for bioaccumulation is unknown.

2.4.4.2 Vinyl Chloride

Transportation

Vinyl chloride has a relatively low K_{oc}, a high vapor pressure, is water soluble, and is less dense than water. As indicated by these four properties, vinyl chloride volatilizes when released to surface waters and dry soil surfaces. If the surface water contains salt, then vinyl chloride may complex with the salts, thereby increasing water solubility and inhibiting volatilization. If vinyl chloride does not volatilize at the soil surface, migration through the soil will occur, thereby contaminating the groundwater.

Degradation

The primary means for degradation of vinyl chloride vapor is by reactions with photochemically generated oxygenated species (hydroxyl radicals) in the atmosphere. The effective half-life of vinyl chloride, placed in dry soil to a depth of 10 centimeters, is predicted to be 12 hours. This half-life includes volatilization and degradation. Smog increases the rate of degradation.

The primary removal process of vinyl chloride from surface waters is evaporation. Vinyl

chloride is assumed to be introduced to the surface and is readily transferred into the air. The predicted half-life of the transport is eight hours for a river and 45 hours for a lake. Actual rates will vary, depending on temperature, water movement and depth, associated air movement, salt content, and other factors. Both aerobic and anaerobic biodegradation of vinyl chloride can occur under limited conditions; both of these degradation mechanisms are slow. Based on these factors, the potential for vinyl chloride exposure is minimal.

Bioaccumulation

Vinyl chloride has a low potential to bioconcentrate in aquatic organisms. Vinyl chloride has a low potential to biomagnify in terrestrial and aquatic food chains because of high volatility, and because it readily volatilizes in higher-trophic level organisms.

2.4.4.3 TCE

Transportation

TCE has a relatively moderate K_{oc}, a high vapor pressure, is moderately soluble in water, and is more dense than water. As indicated by these four properties, TCE rapidly volatilizes when released to surface waters and dry soil surfaces. Once TCE has entered the air, it will remain in the vapor phase until it is washed out by precipitation or degrades. If removed by precipitation, it is likely to re-enter the atmosphere by volatilization. If TCE does not volatilize, migration through the soil will occur. TCE exhibits medium to high mobility, depending on the soil type. Once in the groundwater, TCE will sink, preventing contact with the surface.

Degradation

The primary means for degradation of TCE vapor, is through reactions with photochemically generated oxygenated species (hydroxyl radicals) in the atmosphere. The effective half-life of TCE vapors is estimated to be 6.8 days.

The primary removal process of TCE from surface water is evaporation. Once TCE is introduced to the surface, it is readily transferred into the air. Actual rates will vary, dependent on temperature, water movement and depth, associated air movement, salt content, and other factors. The half-life of TCE from a rapidly moving shallow river (1 meter deep, flowing 1 meter per second, wind velocity of 3 meters per second) is 3.4 hours. TCE is not soluble and is more dense than water; therefore, TCE will sink if not immediately volatilized from the surface.

The sole mechanisms for degradation of TCE in groundwater, sediments, and soils, is aerobic and anaerobic digestion; aerobic and anaerobic digestions are favored under limited conditions. The biodegradation has multiple pathways and can produce vinyl chloride. TCE will tend to leach to groundwater. Based on these factors, TCE and its byproducts pose a direct contact threat.

Bioaccumulation

TCE has a low potential to bioaccumulate in aquatic organisms and some plants. Bioaccumulation in the terrestrial food chain has not been determined.

2.4.4.4 1,1-Dichloroethene

Transportation

The compound 1,1-dichloroethene has a relatively low K_{oc}, a high vapor pressure, is water soluble, and is more dense than water. As indicated by these four properties, 1,1-dichloroethene volatilizes when released to surface waters and dry soil surfaces. Once 1,1-dichloroethene has entered the vapor phase, it has low potential to be removed by precipitation of adsorption to atmospheric particles. If 1,1-dichloroethene does not volatilize, it will migrate through the soil into the groundwater.

Degradation

The primary means for degradation of 1,1-dichloroethene vapor is through reactions with photochemically generated oxygenated species (hydroxyl radicals) in the atmosphere. The estimated half-life resulting from this degradation is two to three days. Actual rates will vary, dependent on temperature, air movement, quantity of hydroxyl radicals, and other factors. Degradation may also occur with other atmospheric oxidants, especially ozone and nitrate radicals; however, these reactions are slow to compete with hydroxyl radicals. Products from these reactions are phosgene, formaldehyde, and chloracetyl chloride. Biodegradation of 1,1-dichloroethene can occur under limited conditions in soil and water. Based on these factors, the potential for 1,1-dichloroethene exposure in humans is minimal.

Bioaccumulation

The compound 1,1-dichloroethene has a low to moderate potential to bioaccumulate in aquatic organisms and some plants. Bioaccumulation in the terrestrial food chain has not been determined.

2.5 Analytical Data

2.5.1 Historical Data

Tables D-1, D-2, D-3, and D-4 provide a concise summary of the majority of existing historical analytical results of samples collected from soil, groundwater, and sediment matrices. Data gaps exist in these tables since samples were not always analyzed for all parameters. Historically, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and benzo(a)pyrene were detected in on-site soil and sediment samples. Historically, groundwater contamination was due to manganese, arsenic, lead, TCE, and vinyl chloride.

2.5.2 EE/CA Data

Analytical results of soil, sediment, and groundwater samples collected by E & E confirms the presence of contaminants that have been historically encountered at the site.

2.5.3 Discussion of Overall Results

2.5.3.1 Soil Results

Heavy metals have been detected at elevated levels in off-site soil locations, including a residential neighborhood to the north. The deposition of particulate matter from industrial emissions and the historical usage of the site may have potentially contributed to both on-site and off-site heavy metal contamination. PAHs and PCBs were also detected in off-site soils. On-site PCB soil concentrations were substantially higher than off-site levels. Off-site PAH and PCB concentrations were detected at elevated levels in several residential soil samples. No sources for PAH contaminants are evident.

2.5.3.2 Sediment Results

Beryllium, lead, benzo(a)anthracene, benzo(b)anthracene, and benzo(a)pyrene are the contaminants detected in sediments of the Creek. Potential off-site sources include discharges from the storm sewer to the north, water discharges from the ditch along the north side of the EJ&E Railroad tracks, discharge from an unknown outfall along the western bank of Creek, discharge from an EMCO outfall along the western bank of the Creek, and discharge from a Fansteel outfall along the eastern bank of the Creek.

2.5.3.3 Groundwater Results

Monitoring well sample results indicate TCE and 1,2-DCE (total isomers) concentrations above the MCLs in monitoring wells MW-3 and GMMW2. The concentration of 1,2-DCE in monitoring well MW-3 is also above the RAL value. Vinyl chloride is also present above the MCL and RAL values in monitoring well MW-3. The contamination in these two monitoring wells can be attributed to the fill area surrounding them. The four Geoprobe water samples collected along the eastern perimeter of the site contained TCE concentrations ranging from 2 micrograms per liter (μg/L) to 5,000 μg/L.

A comparison of TCE concentrations in soil in the vicinity of the Geoprobe locations indicate the following: soil samples M1-1 and M1-2 collected from grid node M1 (100 feet west of sample location GEO-7) and soil samples H1-1 and H1-2 collected from grid node H1 (40 feet west of sample location GEO-9) did not contain TCE concentrations above the instrument detection level. Soil sample L0-2 collected from grid node L0 (60 feet north of sample location GEO-8) contained a TCE concentration of 190 micrograms per kilogram (μg/kg). Soil sample B1-1 collected from grid node B1 (80 feet northwest of sample location GEO-6) contained a TCE concentration of 3 μg/kg. A review of the Fansteel facility's background information reveal soil TCE contamination to 180 mg/kg (180,000 μg/kg), at depths ranging from the surface to 40 feet bgs. Apart from TCE, PERC, lead, and cadmium were also present at these depths (Carlson Environmental 1993). The available historical information on soil borings pertain only to the northern one-third of the Fansteel facility and contained drawings of known TCE plumes. Geoprobe sample location GEO-7, at the northeast boundary of the Vacant Lot site (TCE concentration of 420 μg/L in sample GEO-7) is in close proximity to an identified TCE plume on the Fansteel property, and lies in the potential groundwater migration pathway from the Fansteel facility onto the site. Geoprobe location GEO-8 (TCE concentration of 180 μg/L in sample GEO-8) is southwest of another known TCE plume on the Fansteel facility. The local groundwater flow is southwest towards the Creek. Geoprobe location GEO-6, at the southeast boundary of the site (TCE concentration of 5,000 μg/L in sample GEO-6), has the highest TCE concentration detected in on-site groundwater. The nearest soil sample contained a TCE concentration of 3 μg/kg at a 2-foot depth. During the second sampling event, 2-feet and 4-feet interval soil samples were collected from locations immediately adjacent to GEO-6, GEO-7, and GEO-9 Geoprobe locations. TCE concentrations in all these samples, except the 4-foot depth soil sample at location GEO-9, were below the instrument detection limit. A TCE concentration of 11 μg/kg was detected in the 4-foot depth soil sample at location GEO-9. Due to a lack of any

identifiable on-site source in the vicinity of this location, this elevated TCE concentration may be attributed to migrating TCE-contaminated groundwater from a source off site. The background information did not indicate sampling information in the southern half of the Fansteel facility, directly upgradient from the GEO-6 Geoprobe location.

2.6 Streamlined Risk Evaluation

The SRE is included as a component of the EE/CA in order to assist in determining whether a removal action is required, and to identify the potential current and future exposures that should be prevented. The SRE is intermediate in scope between the limited risk evaluation performed for a removal action and the conventional baseline risk assessment conducted for remedial actions. The SRE is intended to evaluate the existing and potential risks posed by the specific problem that the removal action is intended to address, and can be both qualitative and quantitative in nature.

The ecological portion of the SRE has been prepared by E & E and is organized in general accordance with U.S. EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume II. Environmental Evaluation Manual, EPA/540/1-89/001* (U.S. EPA 1989) and other related guidance. The human health portion of the SRE was conducted by U.S. EPA, and follows the ecological assessment.

2.6.1 Streamlined Ecological Risk Evaluation

This SERE for the Vacant Lot site has been conducted in accordance with the *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, U.S. EPA/540/1-89/001* (U.S. EPA 1989) and *Ecological Risk Assessment Guidance For Superfund: Process For Designing And Conducting Ecological Risk Assessments* (U.S. EPA 1996a) documents.

2.6.1.1 Purpose

The purpose of the SERE for the Vacant Lot site is to evaluate the ecology of the site, identify the chemicals of potential concern associated with the site, evaluate the pathways and the extent to which ecological receptors might be exposed to these chemicals, and assess the environmental effects associated with exposures to the chemicals.

2.6.1.2 Scope

According to U.S. EPA guidance (U.S. EPA 1989), the ecological risk assessment process is

divided into five major components: problem formulation, ecological data acquisition and review, exposure assessment, ecological effects assessment, and risk characterization. Because this is a *streamlined* risk evaluation, not a complete baseline risk assessment, several components of the risk assessment process are treated in a combined fashion, and some process steps that are usually quantitative in nature, are addressed qualitatively.

To satisfy the goals of the SERE, START gathered sampling data and utilized existing reports on the Vacant Lot site. In addition, START reviewed site photographs, wetlands maps, topographic quadrangles, soil maps, and state and federal lists and reviews of species of potential concern. An ecological field reconnaissance was not conducted as part of the SERE. However, some general observations were made by field personnel and those observations have been used as part of this investigation.

The ecological risk assessment is presented in two major sections; the environmental resources identified at the Vacant Lot site are presented in the Environmental Resources Inventory section, Section 2.6.1.3; and the potential risks to the ecological resources are presented in the Ecological Risk section, Section 2.6.1.4.

2.6.1.3 Environmental Resources Inventory

The literature review, photographs, and field observations documented the following environmental resources at the Vacant Lot site:

- Surface water resources (streams, wetlands, floodplain, and surface water drainage);
- Habitats;
- Species of potential concern;
- Geology and hydrogeology;
- Soils;
- Topography;
- Land use; and
- Non-site related conditions of potential environmental concern.

Surface Water Resources

To assess the surface water resources on site and adjacent to the site, START utilized field observations and reviewed the following resources: U.S. FWS National Wetlands Inventory (NWI) Waukegan quadrangle, Illinois (U.S. FWS 1981) and the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, City of North Chicago, Illinois (FEMA 1980). Wetland types have been classified in accordance with the *Classification of Wetlands and Deepwater Habitats*

(Cowardin *et al.* 1979) document and are described under the Wetlands section.

Pettibone Creek

The Creek is an intermittent stream that flows north to south, across the Vacant Lot site. The Creek begins in the northwestern corner of the Vacant Lot site. A stormwater pipeline and a drainage ditch terminate at the northern end of the Vacant Lot site and supply water to the Creek. At the site, the Creek ranges in width from 1 to 10 feet. The length of the Creek on the Vacant Lot site is approximately 1,000 feet.

To the north of the site, a stormwater pipeline flows north to south along Commonwealth Avenue, in an aboveground pipeline. This stormwater pipeline receives drainage water from a portion of the City of North Chicago (IEPA 1995). The stormwater pipeline terminates under the elevated EJ&E Railroad tracks, which form the northern boundary of the Vacant Lot site.

A drainage ditch runs east to west along the northern side of the EJ&E Railroad tracks, under the North Chicago stormwater pipeline, and into the Creek. Water in this ditch comes from runoff from the railroad tracks.

The water from the City of North Chicago stormwater discharge and the ditch along the railroad tracks, flows into the Creek channel on the site for approximately 10 feet before the water re-enters another stormwater pipeline. This pipeline runs underground along Commonwealth Avenue and empties into the Creek, to the south of the site. This stormwater diversion was created by the City of North Chicago, and now prevents water which enters the site from the north, from running across the entire Vacant Lot site during normal flow conditions. When stormwater volume entering the site from the north is heavy; however, water will bypass the stormwater diversion and flow across the entire length of the Vacant Lot site into the Creek.

The Creek within the site boundaries contains water only during rain, stormwater, and industrial discharge events. An active discharge pipe originates from the west and empties into the Creek near the center of the length of the Creek on the site. This discharge is believed to originate from the EMCO facility, to the west of the site. During normal flow periods in the Creek, there is no water within the creek to the north of this discharge. There are two industrial discharges in the north area of the site, but they are inactive. An active discharge from the Fansteel facility to the east, enters the Creek at the southern end of the site, immediately upstream of the location where the Creek flows into a culvert and under 22nd Street. It is not known how frequently the entire length of the Creek flows with stormwater at the Vacant Lot site, but flow is believed to be substantial at times, due to observations of large amounts of debris piled up in areas along the Creek.

To the south of the site, the Creek flows south and southeast through an underground drainage pipeline. The Creek resurfaces from the underground drainage pipeline at the Great Lakes Naval Training Center, and then flows into Lake Michigan, approximately 1.5 miles from the Vacant Lot site. The Creek is reported to contain water year-round in the vicinity of the Great Lakes Naval Training Center. According to IEPA, there are fish and frogs present in the Creek in the vicinity of the Great Lakes Naval Training Center. Fish from Lake Michigan are believed to swim into the Creek in the vicinity of the Great Lakes Naval Training Center to spawn (IEPA 1995).

Wetlands

The NWI map of the Waukegan, Illinois quadrangle, does not indicate the presence of any wetland habitats on site or in the immediate vicinity of the Vacant Lot site. The entire length of the Creek, from the Vacant Lot site to Lake Michigan, is not designated as a wetland habitat on the NWI map (U.S. FWS 1981).

Floodplains

The 100-year floodplain is defined by state and local regulations as those mapped by the FEMA National Flood Insurance Program, Flood Insurance Rate Maps. In general, FEMA maps identify all land within reach of a flood with a 1% probability of occurring in any given year; also referred to as the base flood. Floodplains occur in areas along or adjacent to streams or bodies of water that are capable of storing or conveying floodwater (Kusler and Platt 1988).

The FEMA map for the City of North Chicago, Illinois, indicates the entire Vacant Lot site and surrounding areas are within Zone C. Zone C areas are defined by FEMA as those areas of minimal flooding, and not within the 100-year floodplain (FEMA 1980).

Surface Water Drainage Patterns

Based on field observations and on topographic mapping of the site, START has estimated surface water runoff patterns on the Vacant Lot site. Surface water drainage on the entire Vacant Lot site is towards the Creek. The Creek runs approximately north to south across the Vacant Lot site. Appendix C, Figure C-11 presents the direction of surface water drainage on the site.

Habitats

Terrestrial habitats were identified based on field observations and have been classified according to *A Field Guide To Eastern Forests* (Kricher and Morrison 1988) document. The major habitat types identified on the Vacant Lot site include:

- Early Successional Old Field;
- Disturbed Mixed Deciduous forest;
- Intermittent Stream; and
- Barren Land.

In addition, there are areas of barren land on site that are not considered ecological habitats. Appendix C, Figure C-12 depicts the locations of the habitat types on the site.

The vegetation observed in each habitat is presented in Appendix D, Table D-12. The birds, mammals, and reptiles, and amphibians that may potentially exist on the site are listed in Appendix D, Tables D-13, D-14, and D-15, respectively.

Early Successional Old Field

The Early Successional Old Field community comprises approximately 4.5 acres or 70% of the 6.4-acre site. This community exists on either side of the Disturbed Mixed Deciduous Forest that lines the Creek.

An old field is defined as an abandoned field or disturbed terrestrial habitat that has a well-developed soil base. Old field succession begins soon after a field is abandoned or a disturbed terrestrial habitat is left alone. Many fields are abandoned with bare ground. When bare ground is available, it is quickly colonized by herbaceous plants whose seeds were present in the soil. The plants that originally colonize an area are called pioneer species, and develop quickly in the abundant sunlight available due to the removal of the overstory (Kricher and Morrison 1988).

The growth of the vegetation in this community is likely limited by the high amount of cinder/slag material at the surface of the soil. Vegetation in this on-site community includes the following: Grasses (*Graminae* spp.), Goldenrods (*Solidago* spp.), and various other herbaceous plants.

Disturbed Mixed Deciduous Forest

The Disturbed Mixed Deciduous Forest community comprises approximately 1 acre or 15% of the 6.4-acre site. This plant community exists along either side of the Creek on the site.

This community consists primarily of a mix of different types of trees and shrubs. Observations of the vegetation in this community include the following species: Eastern Cottonwood (*Populus deltoides*), Ashleaf Maple (*Acer negundo*), Red Maple (*Acer rubrum*), Silver Maple (*Acer saccharinum*), Red Oak (*Quercus rubra*), Smooth Sumac (*Rhus glabra*), Northern Catalpa (*Catalpa speciosa*), and a Grape species (*Vitis* spp.).

Intermittent Stream

As discussed in the Pettibone Creek Section, the channel of the Creek runs north to south across the Vacant Lot site.

Barren Land

Barren Land comprises approximately 1 acre or 15% of the 6.4-acre site. Barren Land habitat exists on the north-central portion of the site, in the area with the piled fill material. Barren Land habitat also exists along the western edge of the site, at the location of the gravel parking area. The Barren Land habitat on the site consists of gravel or cinder/slag material not covered with any vegetation.

Species of Potential Concern

To identify species of potential concern in the vicinity of the Vacant Lot site, START reviewed current lists of threatened and endangered plants and animals in the vicinity of the site from U.S. FWS and the Illinois Endangered Species Protection Board (IESPB). The U.S. FWS and IESPB lists of threatened and endangered plants and animals are presented in Appendix E.

U.S. FWS lists the Karner Blue Butterfly (*Lycaeides melissa samuelis*) as the only federally endangered species existing in Lake County, Illinois. U.S. FWS lists the Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) and the Dune Thistle (*Cirsium pitcheri*) as federally threatened species existing in Lake County, Illinois (U.S. FWS 1997). These three species are discussed in further detail below.

START requested that the Illinois Department of Natural Resources (IDNR) conduct an endangered species consultation for the area surrounding the Vacant Lot site. The consultation, performed by Keith M. Shank of IDNR, is presented in Appendix F, and is summarized below:

- There are threatened/endangered species known to be located in the vicinity of the project;
- The proposed project is not likely to adversely affect the threatened/endangered species; and
- The nearest location of endangered species habitat is 1 mile south of the site (IDNR 1997).

Keith Shank of IDNR, stated that the listed records are for state-listed plant species only, and the nearest recorded threatened or endangered plant is approximately 1 mile from the Vacant Lot site (Shank 1997).

Karner Blue Butterfly

U.S. FWS identifies the Karner Blue Butterfly as the only federally endangered species known to exist or potentially exist within Lake County, Illinois. The habitat requirements for the Karner Blue Butterfly include pine barrens and oak savannahs on sandy soils which contain Wild Lupine (*Lupinus perennis*), the only known food plant for the larvae (U.S. FWS 1997). Wild Lupine is a plant of dry sandy woods and banks (Newcomb 1977). It is highly unlikely that Wild Lupine exists on the disturbed Vacant Lot site; therefore, the potential presence of the Karner Blue Butterfly is also highly unlikely at the Vacant Lot site.

Eastern Prairie Fringed Orchid

U.S. FWS identifies the Eastern Prairie Fringed Orchid as a federally threatened species known to be present within Lake County, Illinois. It exists on mesic to wet prairies. The limited existence of prairie remnants is the reason for the threatened status of this plant (U.S. FWS 1997). There are no prairie habitats on site or in the immediate vicinity of the site, making the presence of the Eastern Prairie Fringed Orchid highly unlikely on site, or in the vicinity of the Vacant Lot site.

Dune Thistle

U.S. FWS identifies the Dune Thistle as a federally threatened species known to be present within Lake County, Illinois. It exists along lakeshore dunes and has been introduced into Lake County (U.S. FWS 1997). There are no lakeshore dunes in the immediate vicinity of the site, making the existence of the Dune Thistle highly unlikely on or near the Vacant Lot site.

Based on the habitat requirements of the above-identified species-of-concern and the disturbed nature of the Vacant Lot site, it is highly unlikely that any federal or state species-of-concern occur at the Vacant Lot site.

Geology and Hydrogeology

Regional geological information indicates that there are unconsolidated glacial lake deposits and glacial till in the vicinity of the site. This material consists of thin deposits of silt, clay, and sand (Geraghty & Miller 1994).

The depth to groundwater on site ranges from approximately 7 to 14 feet bgs. Shallow groundwater generally flows towards the south, southwest, and southeast (Geraghty & Miller 1994).

Soils

The soils within Lake County, Illinois, have been mapped by the United States Department of

Agriculture, Soil Conservation Service (SCS) in the *Soil Survey of Lake County, Illinois* document. The entire Vacant Lot site is mapped as made land. Made land soils are those areas of manmade cuts and fills and areas covered almost entirely by roads and buildings. The fill is made up of various materials, including some that are not soil materials (SCS 1971).

Observations of soil on the Vacant Lot site indicate that a cinder/slag material covers most of the site surface, except at the northern end of the site and in the vicinity of the Creek. The cinder/slag material is at the surface and ranges in thickness from 3 inches to 3 feet. In some areas there is pavement below the cinder/slag material because the site was once developed as a parking lot.

Topography

The majority of the site is nearly uniformly flat with a slight slope towards the Creek. The Creek is contained within a ravine with relatively steep slopes on either side, that range between 5 and 10 feet above the creekbed. The Creek slopes downward, towards the south. There is a relatively steep slope leading up to the railroad bed on the northern edge of the Vacant Lot site. The railroad grade is approximately 20 feet high.

Land Use

Land use on and adjacent to the site was identified by observations made by field personnel. Land-use types have been categorized according to *A Land Use and Land Cover Classification System For Use With Remote Sensor Data* (Anderson *et al.* 1976) document. The following land-use types were identified within the vicinity of the site and are presented in Appendix C, Figure C-13:

- Industrial;
- Commercial and Services; and
- Transportation, Communications, and Utilities.

A description of each land-use type and the location of each is presented below.

Industrial

Industrial areas include a wide array of land uses from light manufacturing to heavy manufacturing (Anderson *et al.* 1976). The Vacant Lot site, the Fansteel property to the east of the site, the Fansteel property to the south of the site and 22nd Street, the electrical substation property to the north of the site and the railroad tracks, and the EMCO property to the west of the site and

Commonwealth Avenue, are categorized as this land use.

Commercial and Services

Commercial and Services areas are those used predominantly for the sale of products and services (Anderson *et al.* 1976). The property to the southwest of the site, across the intersection of Commonwealth Avenue and 22nd Street, is a commercial strip development and is categorized as this land use.

Transportation, Communications, and Utilities

This land use category includes highways, railways, and areas associated with these uses (Anderson *et al.* 1976). Commonwealth Avenue, which borders the site to the west; 22nd Street, which borders the site to the south; and the EJ&E Railroad, which borders the site to the north, are categorized as this land use.

Non-Site Related Conditions of Potential Environmental Concern

This section describes conditions in the vicinity of the site that are not related to the site, but may have, or may have recently had, an impact on the ecology or physical characteristics of the Creek. The following non-site related conditions of potential concern were identified within the vicinity of the site and are presented in Appendix C, Figure C-14:

- Active Discharges;
- City of North Chicago Stormwater Drainage; and
- EJ&E Railroad Drainage Ditch

Active Discharges

There are two active discharges to the Creek from adjacent facilities. A pipe actively discharges into the Creek near the center of the length of the Creek on the site, and is believed to originate from the EMCO facility to the west of the Vacant Lot site. At the southern end of the site, an active discharge enters the Creek from the east. This discharge is believed to originate from the Fansteel property. The exact sources and exact chemical compositions of these discharges is unknown.

City of North Chicago Stormwater Drainage

As described in Pettibone Creek Section, a stormwater drainage pipeline from the City of North Chicago terminates at the northwestern corner of the Vacant Lot site and forms the beginning of the Creek. During normal flow times, the water from this pipeline enters the Creek for approximately 10 feet, before re-entering another stormwater pipeline that carries water to the south

of the Vacant Lot site. During high flow times, however, water from this pipeline may flow through the entire length of the Creek channel on the site.

This stormwater pipeline drains an unknown area of the City of North Chicago to the north of the Vacant Lot site. A background sediment sample was collected at the end of this pipeline, upgradient of the site, and elevated levels of a variety of organic and inorganic analytes that may have an impact on sediment quality in Creek were detected.

EJ&E Railroad Drainage Ditch

As described in Pettibone Creek Section, a drainage ditch runs east to west, along the northern side of the EJ&E Railroad, and enters the Creek, along with the City of North Chicago stormwater drainage. Runoff from the railroad tracks and the railroad bed fill material enters this ditch and flows into the Creek on the site. Contaminant influence from this drainage ditch to the Creek sediments is possible.

Conclusions

Based on the inventory of environmental resources, the following conclusions have been made regarding the Vacant Lot site and the Creek. The conclusions will be used in the assessment of ecological risk associated with the site:

- Stormwater flow through the site in the Creek represents a valid pathway for sediments to be carried off site, possibly to Lake Michigan, 1.5 miles to the southeast;
- There are no terrestrial or aquatic habitats of concern on the site;
- There are not likely to be any state or federal species of concern on or in the immediate vicinity of the site;
- Surficial stormwater flow across site soils may potentially cause the migration of site surface soil particles into the Creek and eventually into Lake Michigan;
- The majority of site surface soils are composed of a cinder/slag material that may represent a source of contamination;
- Land use in the vicinity of the site is dominated by industry and is likely to remain industrial in the future;
- Due to the small size of the site (6.4 acres) and the largely industrial land use of the surrounding area, there are not expected to be any significant ecological habitats or species of concern on the site in the future; and
- Off-site active industrial discharges and stormwater drainages into the Creek

represent potential sources of contamination and impact to the Creek and the site.

2.6.1.4 Ecological Risk

Identification of Contaminants of Potential Ecological Concern

In this section, sampling results have been compared to media-specific screening criteria to determine the extent of potential ecological concern associated with contaminants at the Vacant Lot site. Ecological characteristics of the Vacant Lot site and the Creek, described in Section 2.6.1.3, have been used in combination with screening criteria; contaminant source, fate, and transport; and contaminant ecological effects, to determine overall ecological risks associated with the Vacant Lot site. The Creek sediments have been screened for the presence of contaminants of potential ecological concern because, based on current knowledge, the Creek sediments have the potential to migrate downstream of the site and impact Lake Michigan, 1.5 miles from the site. There are no aquatic habitats or receptors of concern on the Vacant Lot site, but Lake Michigan contains a wide array of aquatic receptors, so sediment contamination and its impacts must be considered. Sediment contaminant screening is discussed in further detail below.

Vacant Lot site surface soils have not been quantitatively screened for the presence of contaminants of potential ecological concern for the following reasons; the terrestrial habitats on and adjacent to the site are of low ecological quality, the land use is currently industrial and is expected to remain industrial, the site is not an attractant to significant ecological receptors and is not expected to be in the future, and the site is very small in size. Site surface soil contamination has been addressed qualitatively in this report with regard to the potential for site surface soil contamination to migrate into the Creek and into Lake Michigan.

Groundwater samples were not screened for contaminants of potential ecological concern because direct contact with subsurface groundwater is not likely to occur for ecological receptors. In addition, there was very little surface water in the Creek during sampling; therefore, surface water samples could not be collected in the Creek by START. Therefore, surface water contamination could not be evaluated in this risk evaluation. The purpose of this screening assessment is to evaluate the available data, identify data gaps, and screen contaminants of potential ecological concern. Screening is accomplished by using toxicological benchmarks to determine whether contaminants warrant further assessment. If a chemical concentration exceeds a lower benchmark value, then the chemical needs to be evaluated further to determine the ecological hazards posed by the chemical. If

a chemical also exceeds an upper screening benchmark, then a more definitive indication and likelihood of effects exists. If a chemical concentration falls below the lower benchmark value, then the chemical can be safely eliminated from further study (Jones *et al.* 1996).

The sediment screening benchmarks used in this report to identify contaminants of potential ecological concern are conservative benchmark values that represent maximum concentrations observed to have no adverse ecological effects or minimum concentrations observed to have low adverse ecological effects on study organisms. When available, values that represent no adverse ecological effects were used. These screening benchmark values are based on studies unrelated to the Vacant Lot site.

Sediment Contaminant Screening

START collected six on-site surface sediment samples from the Creek, and two upgradient surface sediment samples from the stormwater and drainage ditch discharges to the Creek from the north of the site. Biased sediment samples were collected by START based on the presence of active and inactive outfalls. The Creek sediment sampling results were screened against ecotoxicity values for sediments. The ecotoxicity values used for screening purposes were taken from the following documents and in the following order of preference: *Eco Update: Ecotox Thresholds* (U.S. EPA 1996b); *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (Persuad et al. 1993); and Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1996 Revision* (Jones *et al.* 1996). As outlined in the U.S. EPA Region 5 document, *Biological Technical Assistance Group, Ecological Risk Assessment Bulletin #1, Development and Use of Ecotox Thresholds (U.S. EPA 1996c)*, values obtained from *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* were given priority over National Oceanic and Atmospheric Administration values from ECO Update:Ecotox Thresholds.

Appendix D, Table D-16, lists the analytes and compounds detected in the Creek sediments, frequency of detection, percent detected, the range of sample quantitation limits, the range of detected concentrations, background concentrations, the number of samples exceeding background, the sediment screening benchmark values, and the number of samples exceeding the benchmark values. Inorganic analytes detected in sediments at levels greater than three times background and greater than the ecological benchmarks were considered to be contaminants of potential concern (U.S. EPA 1990). Appendix D, Table D-17, presents sediment screening benchmarks used for the Vacant Lot site

SERE. The background concentrations were the mean of the two upstream sediment samples. Organic analytes detected at levels greater than the ecological benchmarks were considered to be contaminants of potential concern.

The following inorganic sediment contaminants in the Creek were found to exceed ecological sediment screening benchmarks and three times the background level and; therefore, are considered to be contaminants of potential ecological concern: antimony, copper, lead, manganese, mercury, and silver. The following organic sediment contaminants in the Creek were found to exceed ecological sediment screening benchmarks and; therefore, are considered to be contaminants of potential ecological concern: acetone; 1,2-dichloroethene; acenaphthene; acenaphthylene; anthracene; benzo(a)anthracene; benzo(k)fluoranthene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; 2-methylnaphthalene; naphthalene; phenanthrene; pyrene; alpha-chlordane; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; endosulfan I; endosulfan II; heptachlor; heptachlor epoxide; methoxychlor; Aroclor 1254; and Aroclor 1260. In addition, the following contaminants have no screening benchmark values available, but have been included as contaminants of potential ecological concern because the levels of these contaminants appear to be elevated: barium; benzo(b)fluoranthene; benzo(g,h,i)perylene; carbazole; endrin aldehyde; and endrin ketone.

2.6.1.5 Ecological Significance of Contamination

Contaminant Source, Fate, and Transport

This section identifies potential sources and pathways of contaminants, identified in Section 2.6.1.4, under Identification of Contaminants of Potential Ecological Concerns.

Sediment

Antimony

Antimony is a naturally occurring element in the earth's crust (Agency for Toxic Substances and Disease Registry [ATSDR] 1992b). It is likely to be a pollutant in industrial environments, with sources that include metal smelting and refining, coal-fired power plants, and refuse incineration (Kabata-Pendias and Pendias 1992; ATSDR 1992b).

Antimony is usually associated with particulate matter in waterways and typically settles down unto the sediments. The speciation and physiochemical state of antimony are important to its behavior in the environment. Little is known about the adsorption of antimony to sediment and soil, but antimony is believed to be fairly mobile under diverse environmental conditions. It is known that

adsorption to sediment is primarily correlated with the sediment content of iron, manganese, and aluminum. Antimony co-precipitates with hydroxylated oxides of these elements (ATSDR 1992b).

Antimony is considered to be a fairly volatile metal. It can be reduced and methylated by microorganisms in anaerobic sediment, thus releasing volatile methylated antimony compounds into water (ATSDR 1992b).

Barium

Barium, like other metals, is a naturally occurring element in the environment. It is found in small but widely distributed amounts in the earth's crust, especially in igneous rocks, sandstone, shale, and coal. Anthropogenic sources are primarily associated with industrial processes (ATSDR 1992c).

Barium is a highly reactive metal that occurs naturally only in a combined state. It is stable in the +2 valence state and is found primarily in the form of inorganic complexes (ATSDR 1992c).

Barium adsorbs readily to sediment particles. In aquatic media, it is likely to precipitate out of solution as an insoluble salt. Sedimentation removes a large portion of the barium found in surface waters. Conditions such as pH, oxidation-reduction potential, and the presence of sulfate, carbonate, and metal oxides affect the partitioning of barium and its compounds in the environment. Barium is not very mobile because it readily binds to sediments (ATSDR 1992c).

Copper

Copper is a naturally occurring element. Major anthropogenic sources of copper include municipal and industrial influents, especially from the refining, smelting, and metal plating industries. Copper also can be found in many aquatic herbicides and algicides (Hutchinson 1979; Harrison and Bishop 1984).

Due to its reactive nature, copper forms complexes with organic and inorganic constituents commonly present in aquatic systems. Copper readily sorbs to the surfaces of sediments and suspended solids (U.S. EPA 1985).

Lead

Lead is a naturally occurring element in sediment and is derived from parent rocks. There has been widespread lead pollution throughout the world. Most sediments and soils, however, are anthropogenically enriched with lead, especially in the top horizon. The natural lead content of sediments is strongly related to the composition of the bedrock. Lead is reported to be the least mobile among the heavy metals (Kabata-Pendias and Pendias 1992).

A high soil pH may precipitate lead as hydroxide, phosphate, or carbonate, as well as

promote the formation of lead-organic complexes, which are stable. The solubility of lead may increase with increasing acidity (Kabata-Pendias and Pendias 1992).

Lead is characteristically found near the sediment surface because lead concentrations are primarily related to the surficial accumulation of organic matter. Therefore, organic matter should be considered the primary sink of lead in polluted sediments (Kabata-Pendias and Pendias 1992).

Lead enters sediment and soil in various and complex compounds, so reactions may differ widely among areas. Opinion differs as to whether lead as a pollutant is mobile or stable (Kabata-Pendias and Pendias 1992). Lead is the most stable metal in forest soil, and the time necessary for the total concentration of lead to decrease 10% by leaching, was calculated to be 200 years for polluted soil. The amount of time for lead in soil to decrease by 50% ranged from 740 to 5,900 years, depending on the type of soil, the water management, and the amount of organic matter present (Kitagishi and Yamane 1981). Contamination of soils with lead is mainly irreversible and a cumulative process (Kabata-Pendias and Pendias 1992). These same factors will also hold true for sediments.

Manganese

Manganese is a naturally occurring element that is important to life. Background soil levels range from 40 to 90 ppm. Releases to water occur by discharge from industrial facilities or as leachate from landfills and soil. Land disposal of manganese-containing wastes are the principal source of anthropogenic releases to sediment soil (ATSDR 1992d).

The adsorption of manganese to soils and sediments is extremely variable. The solubility and behavior of manganese in surficial deposits is highly dependent on pH and redox potential. The tendency of soluble manganese compounds to adsorb to soils and sediments depends mainly on the cation exchange capacity and the amount of organic matter in the soil. Manganese is often transported in rivers as suspended sediments. At low concentrations, manganese may be "fixed" by clays and will not be released into solution readily. At higher concentrations, manganese can be desorbed by ion exchange mechanisms with other ions in solution (ATSDR 1992d).

All manganese compounds are very important soil constituents because manganese is essential in plant nutrition; plants uptake the soluble form of manganese (ATSDR 1992d).

Mercury

Mercury occurs naturally in small amounts as a mineral and is distributed throughout the environment. Natural mercury comes from the weathering of mercury-bearing minerals in igneous rocks (ATSDR 1994). Mercury has three valence states and is found in the environment in various

inorganic and organic complexes and in metallic form (Kabata-Pendias and Pendias 1992).

Anthropogenic releases of mercury to surface waters include effluents from industrial processes, mining operations and ore processing, metallurgy and electroplating, chemical manufacturing, ink manufacturing, paper mills, leather tanning, pharmaceutical production, and textile manufacturing. Unnatural sources of mercury in soils include direct application of inorganic and organic fertilizers, lime, fungicides containing mercury, sewage sludge, yard compost, industrial and domestic solid waste products, municipal incinerator ash, and industrial air emissions (ATSDR 1994).

The transport and partitioning of mercury in surface waters and soils is influenced by the particular form of the compound. Volatile forms (metallic mercury and dimethyl mercury) are expected to evaporate to the atmosphere. Solid forms of mercury partition to particulates in soil or the water column and are transported to the sediments in the water column (ATSDR 1994).

The dominant process for controlling the distribution of nonvolatile forms of mercury to soil and sediment particulates is sorption, with little resuspension from sediments back into the water column. The sorption process is related to the organic matter content of the soil and sediment (ATSDR 1994). Mercury is strongly sorbed, even in sandy soils (Kabata-Pendias and Pendias 1992). Mercury is strongly sorbed to humic materials and sesquioxides in soil at a pH higher than 4 and to the surface layer of peat. Mercury volatilizes from surface soils with a pH less than 3. Inorganic mercury sorbed to particulate matter is not readily desorbed. Sediments are important repositories for inorganic mercury. Leaching is a relatively insignificant transport process in soils. Surface runoff is an important mechanism for moving mercury from soil to water, particularly for soils with a high humic content (ATSDR 1994).

The most common organic form of mercury (methylmercury) is soluble and mobile (ATSDR 1994). Soil contamination with inorganic mercury is not usually considered to be a serious problem, but there is the possibility that it will be converted to methylmercury by bacteria and fungi under aerobic and anaerobic conditions (Kabata-Pendias and Pendias 1992).

Pesticides

Pesticides include the following contaminants of potential ecological concern in sediments: alpha-chlordane; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; endosulfan I; endosulfan II; endrin aldehyde; endrin ketone; heptachlor; heptachlor epoxide; and methoxychlor.

Pesticides are synthetic compounds that are designed to control species of insects, plants, and rodents. Most pesticide compounds are designed to be resistant to degradation to enhance their persistence and effectiveness in the environment. Pesticides are usually applied in bulk quantity and

dispersed over large areas, which results in atmospheric transport to natural systems and runoff to surface water bodies (LaGrega *et al.* 1994).

There are two categories of pesticide compounds: chlorinated pesticides and organophosphorus pesticides. All of the pesticides of potential ecological concern in the Vacant Lot sediments are chlorinated pesticides. Chlorinated pesticides have been used widely as insecticides, fungicides, and herbicides (LaGrega *et al.* 1994). These pesticides have high organic carbon partitioning coefficients (K_{oc} values), low vapor pressures, and low water solubilities; therefore, these pesticides should remain adsorbed to sediments.

PCBs

PCBs include the following contaminants of potential ecological concern: Aroclor 1254 and Aroclor 1260. PCBs were commercially produced in the United States from 1929 to 1977, but are no longer produced, except under exemption. PCBs have been used in the following capacities: capacitors and transformers, heat transfer and hydraulic fluids, plasticizers, surface coatings, inks, adhesives, flame retardants, pesticide extenders, paints, and carbonless duplicating paper. The major source of ambient PCB exposure today is believed to be environmental cycling of PCBs that were previously introduced into the environment (ATSDR 1995).

PCB adsorb strongly to soil and sediment and usually persist in the environment. The environmental fate and transport and the toxic properties of PCBs are determined by the properties of the 209 congeners of PCBs. Adsorption generally increase carbon and clay content of the soil and sediment increases. Leaching of PCBs from soil is generally slow and is increasingly slower for the more highly chlorinated compounds. Leaching from soil will be greatest from soils with low organic carbon and from soils with a high presence of organic solvents. Stormwater runoff can transport PCBs from soil to surface water (ATSDR 1995).

The highly chlorinated Aroclors (1248, 1254, and 1260) resist both chemical and biological degradation in the environment. Volatilization and biodegradation account for major routes of removal of less chlorinated Aroclors from water and soil. Volatilization is the major removal process in water, but adsorption to sediment significantly decreases the volatilization rate. The chemical composition of original Aroclor mixtures will change over time since individual congeners degrade and partition at different rates (ATSDR 1995).

Adsorption of PCBs in sediment increases as organic matter, clay, and microparticle content increases. Concentrations in sediment and suspended matter are higher than in the assoclumn from sediments does occur. PCBs in sediments can act as an environmental reservoir from which PCBs

may be released slowly over time into other media. The environmental redistribution from sediments is most significant from the top layers of sedimentary deposit, and the rate of redistribution is greater in summer than in winter because of the rapid volatilization from water. Distribution of PCBs in Lake Michigan have been reported to be 2.3% in water, 0.084% in fish, 97.5% in sediment, and 0% in air (ATSDR 1995).

PAHs

PAHs include the following contaminants of potential ecological concern in sediments: acenaphthene; acenaphthylene; anthracene; benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; benzo(g,h,i)perylene; benzo(a)pyrene; chrysene; dobbins(a,h)anthracene; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; 2-methylnaphthalene; naphthalene; phenanthrene; and pyrene. Carbazole, although not a PAH, is considered to have similar fate and transport mechanisms in the environment as PAHs, and is included in this discussion.

Approximately 200,000 metric tons of PAHs are released annually into aquatic environments. The major sources of PAHs include petroleum spillage and deposition of particulates from fossil fuel combustion (LaGrega *et al.* 1994).

PAHs are persistent in the environment. The hydrophobic nature of PAHs leads to rapid association with particulate matter and partitioning to either sediments or tissue (LaGrega *et al.* 1994). PAHs may undergo chemical oxidation and biodegradation (Seuss 1976). PAHs are usually associated with particulates and generally only 33% of total PAH concentrations are present in dissolved form (Grant and Lee 1981). PAHs in the water column will degrade rapidly through photo-oxidation (U.S. EPA 1980). They degrade more rapidly at higher concentrations, elevated temperatures, elevated oxygen levels, and in areas of high solar radiation (McGinniss and Snoeyink 1974; Seuss 1976; Bauer and Capone 1985). PAHs may be biotransformed and biodegraded by benthic organisms, but may persist indefinitely in oxygen-poor or anoxic environments. They typically remain close to sites of deposition in aquatic environments. The more hydrophobic PAHs have a higher affinity for binding to dissolved humic materials, and generally have rapid biotransformation rates (McCarthy and Jimenez 1985); (McCarthy *et al.* 1985). PAHs generally have high K_{oc} values, low vapor pressures, and low water solubilities.

Silver

Silver is a rare element that occurs primarily as sulfides. It is naturally released to air and water through the weathering of rocks and the erosion of soils. The major anthropogenic source to surface waters is effluent from photographic processing. The major anthropogenic sources to soils

are releases from the photographic industry and disposal of sewage sludge and refuse. Other sources to soil and water include: atmospheric deposition; textile plant wastewater effluents; petroleum refinery effluents; landfilling of household refuse, sewage sludge, and industrial wastes; and leaching of metal tailings (ATSDR 1990).

Under oxidizing conditions, the silver compounds present in the environment will be bromides, chlorides, and iodides. Under reducing conditions, free silver and silver sulfide will predominate. In freshwater, silver may form complex ions with chlorides, ammonium, and sulfates; form soluble organic compounds; become adsorbed onto humic complexes and suspended particulates; and become incorporated into, or adsorbed onto, aquatic biota. Sorption is the dominant process leading to the partitioning of silver in sediments. Concentrations in lake sediments have been reported to be 1,000 times that of the overlying waters (ATSDR 1990).

The mobility of silver is affected by drainage, pH, redox potential, and the presence of organic matter. Silver tends to form complexes with inorganic chemicals and humic substances (ATSDR 1990). It is almost totally immobile when the soil pH is greater than 4 (Kabata-Pendias and Pendias 1992). Silver tends to be removed from well-drained soils (ATSDR 1990).

Volatile Organic Compounds

This section describes the source, fate, and transport of the following VOCs: acetone and 1,2-DCE. In general, VOCs are not persistent in the environment. VOCs generally have low K_{oc} values, high vapor pressures, and high water solubilities.

The major source of acetone is from the manufacture of solvents. Other sources include manufacturing of smokeless powder; paints, varnishes, and lacquers; organic chemical manufacturing; pharmaceuticals manufacturing; sealants and adhesives manufacturing; and agricultural, food, and animal wastes. Acetone is a chemical that the adjacent EMCO facility is known to have used and possibly still uses (Envirodyne 1991a). Adsorption of acetone to soils and sediments is usually not significant because acetone has a low organic carbon partition coefficient. Volatilization and biodegradation of acetone are important fate-determining processes in streams. Acetone in sediments is likely to enter the water column where it may volatilize, biodegrade, or become available to ecological receptors (ATSDR 1992a).

The compound 1,2-DCE is a man-made compound that volatilizes readily and does not adsorb well to soil and sediment particles. It exhibits medium to high mobility, depending on the soil or sediment type. The sole mechanism for degradation in soils is anaerobic digestion. Biodegradation of 1,2-DCE has multiple pathways and can produce vinyl chloride, TCE, and 1,1,2,2-PERC.

Surface Soil

With the exception of some pesticide compounds, the maximum detected concentrations of chemicals in Vacant Lot surface soils exceed the maximum detected concentrations in the Creek sediments on the Vacant Lot site. For the most part, the contaminants of concern in sediments were also found to be highly elevated in site surface soils. Therefore, Vacant Lot surface soils appear to represent a potential source for most of the sediment contaminants of concern, with the possible exception of some pesticide compounds.

Ecological Effects Assessment

The purpose of this section is to identify potential ecological effects from contaminants of potential concern to ecological receptors at the Vacant Lot site. Table D-16 identifies several screening benchmark values for the contaminants of potential concern in sediments for comparison of potential degree of effects for site contaminant levels.

Antimony

Antimony does not appear to significantly bioconcentrate in fish and aquatic organisms. Bioconcentration factors have been reported to range from 0.15 to 390. Antimony does not biomagnify from lower to higher trophic levels in the ecosystem (ATSDR 1992b).

Barium

Barium is absorbed by organisms following ingestion and inhalation. Some plants can absorb barium from soil. There is information that it bioconcentrates in aquatic organisms. Barium has been shown to biomagnify in terrestrial and aquatic food chains (ATSDR 1992c).

Copper

The principal toxic species of copper is the cupric ion (Cu^{+2}). The sensitivity of aquatic organisms to copper is great for species that have a high surface to volume ratio, high respiratory flows, and an extensive, highly permeable gill surface. In water, copper toxicity increases with reductions in alkalinity, dissolved oxygen, chelating agents, humic acids, pH, and suspended solids (LaGrega *et al.* 1994).

Maximum fish tissue copper concentrations are found in the liver, followed by the gills, kidneys, and muscles. Copper has been shown to accumulate in the liver at 10 times the amount that accumulates in muscle tissue in aquatic organisms. Copper residing in the liver may disrupt normal metabolic activity and may produce deleterious effects on reproduction and development. In chronic studies on freshwater fish species, early life stages were shown to be the most sensitive to elevated

levels of copper, with sublethal effects that influenced the success and survival of larvae and juveniles. Inhibition of spawning, decreases in egg hatchability, and reductions in growth have been observed over a wide range of copper concentrations (LaGrega *et al.* 1994).

Lead

Bioaccumulation of lead has been demonstrated for a variety of organisms, with bioconcentration factors ranging from 42 to 1,700. Lead bonds with amino acids contained in proteins and polypeptides. This characteristic increases bioaccumulation and inhibits excretion. High levels of lead exposure can have neurobehavioral effects (U.S. EPA 1986).

Lead concentrations in aquatic biota are usually found to be highest in algae and benthic organisms, and are lowest in upper-level trophic predators (Eisler 1988b). Bioconcentration factors ranged from 499 to 1,700 for four freshwater invertebrate species exposed to lead. Scuds (*Gammarus pseudolimnaeus*) have been reported to be highly sensitive to lead. Rainbow Trout, Northern Pike, and Walleye have shown spinal deformities when exposed to lead in early life cycle tests. Numerous animal studies have shown the following: significant differences occur between species in response to lead insult; effects of lead are more pronounced with organic lead than with inorganic lead compounds; younger developmental stages are more sensitive; and the effects are exacerbated by elevated temperatures, and by diets deficient in minerals, fats, and proteins (Eisler 1988b).

Manganese

Manganese may be significantly bioconcentrated at lower trophic levels in aquatic ecosystems. The following bioconcentration factors have been reported: 2,500 to 6,300 for phytoplankton; 10,000 to 20,000 for freshwater plants; 10,000 to 40,000 for invertebrates; and 100 to 600 for fish. Lower organisms have higher bioconcentration factors than higher organisms, thus making biomagnification of manganese in the food chain insignificant (ATSDR 1992d).

Mercury

The most common form of organic mercury (methylmercury) quickly enters the aquatic food chain and accumulates to a greater extent in biological tissue than does inorganic mercury. Methylmercury has aquatic biomagnification factors of 10,000 to 100,000. Methylmercury constitutes over 99% of the total mercury detected in fish muscle tissue, while there is no detection of inorganic or dimethyl mercury (ATSDR 1994).

Plant roots readily take up mercury, but there is conflicting evidence as to whether it is translocated within plants (Kabata-Pendias and Pendias 1992; ATSDR 1994). Plant toxicity symptoms include the stunting of seedling growth and root development, and the inhibition of photosynthesis

(Kabata-Pendias and Pendias 1992).

Pesticides

Pesticides are designed to render adverse effects on target species without impacting non-target species. However, information on many pesticides indicates that they have deleterious effects on non-target organisms as well (LaGrega *et al.* 1994).

Most pesticides act by interfering with nervous system function. There are many diverse non-lethal effects of pesticide exposure. The effects are related to metabolic and behavioral responses, such as alterations in enzyme production, growth, reproduction, activity, production of tumors, and teratogenic effects. Chlorinated pesticides tend to accumulate in the fatty tissues of most mammals and the toxicities of the compounds varies widely. For example, DDT has a fairly low toxicity, while chlordane has a moderate toxicity to mammals. The bioconcentration factors of pesticides are high (LaGrega *et al.* 1994).

PCBs

PCBs partition significantly from water to aquatic organisms. Bioconcentration factors for PCBs in aquatic animals have been reported to range from 26,000 to 660,000. The following ranges of bioaccumulation factors have been reported: 5,250 to 64,570 for mussels (*Mytilus galloprovincialis*); 5,000 to 977,240 in red mullet (*Mullus barbatus* and *Mullus surmuletus*); and 5,890 to 575,440 in crabs (*Macropipus tuberculatus*). Bioaccumulation values increase with increasing chlorine substitution and decreasing water solubility. Since sediment concentrations are higher than in water, bioaccumulation in bottom-feeding species is expected to be high. It has been documented that PCBs biomagnify in shellfish that feed on phytoplankton and zooplankton (ATSDR 1995).

The elimination of PCBs from aquatic organisms is both species- and congener-specific. There is a higher bioaccumulation of PCBs in fatty tissues than in muscle, because PCBs will tend to remain stored in lipids (ATSDR 1995).

Terrestrial vegetation can accumulate PCBs. Vegetation can uptake PCBs from the surrounding soil and it has been reported that translocation to aerial parts of the plant can occur. Plants can also obtain PCBs from deposition of atmospheric particulates on aerial plant surfaces and from uptake of airborne vapors by aerial plant parts (ATSDR 1995).

PAHs

PAHs are readily accumulated by most aquatic species at low concentrations in the

environment, although uptake is highly species-specific. PAHs are rapidly metabolized by most organisms (Eisler 1987). Uptake of PAHs is much higher in mollusca, algae, and other species incapable of metabolizing PAHs. The lower molecular weight unsubstituted PAH compounds with two or three aromatic rings (naphthalenes, fluorenes, phenanthrenes, and anthracenes) can be highly acutely toxic to some organisms (Eisler 1987). The bioconcentration factors of PAHs generally increase with an increase in molecular weight of the compounds. Very high molecular weight PAHs have low acute toxicities because of their low solubilities in water.

Bluegills had an 89% loss of benzo(a)pyrene after four hours post exposure; Midge larvae biotransformed 72% after eight hours post exposure; and Daphnids biotransformed 21% after 18 hours post exposure. *Daphnia pulex* took between 0.4 and 0.5-hour to biotransform 50% of accumulated PAHs.

Sediments heavily contaminated with PAHs by industrial sources have been directly linked to elevated PAH body burdens and elevated frequencies of liver neoplasia in fishes (Eisler 1987). PAH exposure has been observed to have adverse biological effects on the survival, growth, metabolism, and tumor formation of several species of organisms. In areas of elevated PAH levels in sediments, elevated PAH levels in whole insect larvae, Crayfish muscle, Lamprey flesh (family *Petromyzontidae*), Brown Trout (*Salmo trutta*), and White Suckers (*Catastomus commersoni*) were found (Black *et al.* 1981) . In areas of elevated PAHs, benthic organisms were found to obtain a great deal of their PAHs through their ability to mobilize PAHs from the sediment/pore matrix, thus enabling them to become a source to predator fish (Eadie *et al.* 1983). There may be a link between PAHs and cancer in fish populations, especially bottom-dwellers in areas of high PAH concentrations in sediments. Brown Bullheads from the Black River in Ohio were found to have liver tumors that corresponded to PAH contamination in sediments (Baumann and Harshbarger 1985; Black *et al.* 1985). Tumor frequencies in Great Lakes fish were found to be highest in areas containing high levels of PAHs and included tumors of the thyroid, gonads, skin, and liver (Baumann 1984).

Silver

Aquatic bioaccumulation factors for silver are low and have been reported as: less than 1 to 6 for Bluegills (*Lepomis macrochirus*); 2 to 10 for Largemouth Bass (*Micropterus salmoides*); 9 to 26 for Water Fleas (*Daphnia magna*); 6.6 to 9.8 for Mussels; and 4 to 6.2 for fish. Aquatic bioconcentration factors have been reported as: 96 to 150 in Algae (*Scenedesmus* spp.); 12.2 to 26 for Water Fleas (*Daphnia magna*); 5.9 to 8.5 for Mussels (*Ligumia* spp. and *Margaritifera* spp.); and 1.8 to 28 for Fathead Minnows (*Pimephales promelas*). There is little potential for silver

biomagnification. Silver is toxic to microorganisms and inhibits bacterial enzymes. Therefore, biotransformation is not expected to be a significant process (ATSDR 1990).

Volatile Organic Compounds

Acetone is considered to be one of the least toxic solvents used in industry, but exposure to high concentrations can produce central nervous system depression and narcosis. It is readily absorbed by all routes of administration and its high solubility in water ensures widespread distribution in tissues (Clayton and Clayton 1982). Bioaccumulation and bioconcentration of acetone are not significant (ATSDR 1992a).

The compound 1,2-DCE has a low potential to bioconcentrate in aquatic organisms. The potential for 1,2-DCE to bioaccumulate is unknown (Verschueren 1983).

Risk Characterization

The purpose of this section is to assess the levels of ecological risks associated with contaminants of potential ecological concern.

Based on the discussion of the contaminants of potential ecological concern in the previous section, the following contaminants may pose a significant risk to aquatic life downstream of the site: barium, copper, lead, manganese, mercury, pesticides, PCBs, and PAHs. These contaminants are persistent in the environment and have been shown to have significant ecological impacts in aquatic ecosystems. Therefore, these contaminants are believed to have the greatest potential to migrate from the Vacant Lot site to Lake Michigan, where they may possibly have significant adverse ecological effects on aquatic receptors. Antimony and silver have low ecological effect potential in aquatic ecosystems. VOCs of potential concern (acetone and 1,2-DCE) are not persistent in the environment and are not likely to remain at elevated levels in sediment that may reach Lake Michigan. Acetone and 1,2-DCE also have low ecological effect potential.

Uncertainty Assessment

Sediment and surface soil sampling data collected by START provides an adequate assessment of site contamination that may affect ecological receptors at the site. Sediment sampling, however, did not include an assessment of the site contamination which may migrate downstream of the site, possibly to Lake Michigan. The potential exists for Vacant Lot site contaminants to impact off-site areas and off-site receptors, but it is unknown whether that is occurring and to what extent it is occurring.

The sediment screening performed as part of this report assumes that sediment contaminants are migrating off site to Lake Michigan, and at the maximum concentrations detected on site. In this regard, the sediment screening may be overestimating the ecological risks posed by Vacant Lot site contaminants to aquatic receptors.

Conclusions

Based on the inventory of environmental resources and the information presented on contaminants of potential ecological concern, the following conclusions have been made regarding overall ecological risk associated with the Vacant Lot site:

- There is little risk posed by site contamination to the ecology of the site because the site is located in an urban, industrialized area, and provides poor quality wildlife habitat;
- Based on current knowledge, there is potential for the Creek sediment contamination to migrate off site and potentially impact the ecology of Lake Michigan; and
- Site surface soil contamination represents a potential source of contaminants to migrate to the Creek and possibly to Lake Michigan.

2.6.2 Screening Level Human Health Risk Assessment

The Screening Level Human Health Risk Assessment for the Vacant Lot site has been prepared by a U.S. EPA Human Health Risk Assessor (U.S. EPA, 1997), and is presented below. Utilizing the information from U.S. EPA, START developed Tables D-18 and D-19 in Appendix D to support the text. Section 2.6.2.6 contains conclusions developed by START, based on the U.S. EPA human health risk assessment.

2.6.2.1 Purpose

This document presents preliminary findings regarding potential human health risk at the Vacant Lot site, and is based upon the analytical results of the EE/CA. The purpose of this assessment is to identify human health risks at the site through the identification of contaminants of human health concern, as well as exposure pathways. In addition, this assessment will identify any data gaps, and the resulting assumptions required to assess risk.

2.6.2.2 Background

The Vacant Lot site is a former parking lot located in the City of North Chicago, Lake County, Illinois, which reportedly received industrial fill of unknown quantity and type. In addition, several storm sewers and industrial outfalls from neighboring facilities reportedly discharged into the Creek that flows north to south across the site. The nearest residents are located within 0.5 mile to the north.

2.6.2.3 Data Gaps

Soil sampling performed at 0- to 1-foot depths and 1- to 2-foot depths. The 0- to 1-foot samples were used for calculating risk, since individuals are most likely to be exposed to surface contamination. This surface exposure is most likely to occur at the top 1- to 3-inches. The 0- to 1-foot samples may over- or underestimate this exposure.

2.6.2.4 Exposure Pathways

In order to evaluate potential human health risk(s) that could be occurring at the site, various exposure pathways were considered. This assessment considers contamination data for soil and sediment. COCs were identified by scanning the level of contamination of various compounds in the soil and sediment to determine whether contamination by any of the compounds was high enough to suggest possible human health risk.

A screen of soil contamination indicated several COCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene (all six PAHs), PCBs, beryllium, manganese, antimony, copper, iron, zinc, cadmium, and lead (U.S. EPA 1997). A screen of sediment contamination also indicated several COCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, (all four PAHs), and beryllium. Exposure to groundwater was considered to be an incomplete pathway due to reports that no one is drinking the groundwater. This risk assessment uses the maximum detected level of contaminants in soil and sediment, and assumes that an individual is being exposed to this level of contamination. If the individual is exposed equally to all levels of contamination found on site, his risk would be less than that calculated here.

Exposure to contaminated soil can occur via incidental ingestion and dermal absorption. Dermal exposure was considered to be of special concern due to the fact that PAHs are known to cause skin cancer when applied directly to the skin.

The primary exposure pathway is assumed to be a worker. A commercial exposure scenario was considered, not to indicate current risk, but to describe possible risks if future use of the site includes office buildings and/or a park. This scenario differs from the residential exposure scenario in that it assumes primarily adult exposure. This assessment assumes that a worker would spend 250 days per year on site for 25 years. In addition, it is assumed that the worker's hands would be exposed to soil at that time. These exposure assumptions are likely to be conservative considering the nature of the site. Another possible exposure pathway for soil is dust inhalation. This pathway is not considered in the current assessment primarily due to vegetation in the area and the fact that the site is not expected to be frequently trafficked. If, for some reason, dust becomes an issue at the site, it would be advisable to assess this pathway.

Incidental ingestion of sediment was not determined to be a major route of exposure, due to the relatively low level of direct sediment ingestion which is likely to occur. Thus risk from contaminated sediment was calculated using a dermal exposure equation. The assessment assumes that an adult would have his hands covered with sedimsumptions are likely protective.

Data

The maximum detected concentration of a given contaminant was used. This maximum concentration, detected at a 0- to 1-foot depth, was used in the assessment to give an upper-bound estimate of the risk from the Vacant Lot site. The maximum concentrations at 0- to 1-foot depths are presented in the following table:

MAXIMUM CONCENTRATION AT 0- TO 1-FOOT DEPTHS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997
units = mg/kg

Matrix	Sample Identification	Parameter	Maximum Concentration
Soil	J2-1	Benzo(a)anthracene	51
Soil	J2-1	Benzo(a)pyrene	37
Soil	J2-1	Benzo(b)fluoranthene	69
Soil	J2-1	Dibenzo(a,h)anthracene	4
Soil	J2-1	Indeno(1,2,3-cd)pyrene	14
Soil	J2-1	Benzo(k)fluoranthene	65
Soil	K2-1	Polychlorinated biphenyl	68
Soil	D3-1	Beryllium	30
Soil	J3-1	Manganese	52,000
Soil	H-1	Antimony	113
Soil	K1-1	Copper	26,000
Soil	E1-1	Iron	102,000
Soil	K1-1	Zinc	35,000
Soil	K1-1	Cadmium	50
Sediment	SED2-1	Benzo(a)pyrene	25
Sediment	SED2-1	Benzo(a)anthracene	18
Sediment	SED2-1	Benzo(b)fluoranthene	33
Sediment	SED2-1	Indeno(1,2,3-cd)pyrene	9.7
Sediment	SED2-1	Beryllium	2.2

Dermal Exposure Equation - Soil and Sediment

The following equation is used for estimating exposure intake to contaminants due to dermal contact with chemicals (U.S. EPA 1989):

$$\text{Exposure} = \frac{CS \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

where: CS = concentration in soil or sediment
SA = surface area
AF = soil to skin adherence factor
ABS = absorption
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

The soil and sediment dermal exposure is presented in the following table:

SOIL AND SEDIMENT DERMAL EXPOSURE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

Variable	Units	Value Used	Comment
CS	mg/kg	Site specific, see Maximum Concentration Table	Data is taken from EE/CA.
SA	cm^2	840	Hands (adult) Standard default exposure factors (U.S. EPA Risk Assessment Guidance for Superfund (RAGS) Supplemental Guidance) (U.S. EPA 1991b)
AF	mg/cm^2	0.2 (soil) 1.0 (sediment)	U.S. EPA Risk Assessment Guidance for Superfund (RAGS) (U.S. EPA 1989)
ABS	none (fraction)	1.0 (PAHs) 0.01 (PCBs) 0.001 (metals)	Study assumption
EF	event/year	250 (soil) 25 (sediment)	Study assumption
ED	years	25	Study assumption
CF	none	0.000001	
BW	kg	70	Exposure Factors Handbook, 1989, EPA/600/8-89/043
AT	days	25,550 (cancer) 9,125 (noncancer)	(70 x 365) (25 x 365)

Ingestion Exposure Equation

The following equation is used for estimating exposure intake to contaminants due to incidental ingestion of chemicals (U.S. EPA 1989):

$$\text{Exposure} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where: CS = concentration in soil
IR = ingestion rate
CF = conversion factor
FI = fraction ingested
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

The estimated exposure intake to contaminants due to incidental ingestion of chemicals is presented in the following table:

EXPOSURE INTAKE DUE TO INCIDENTAL INGESTION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

Variable	Units	Value Used	Comment
CS	mg/kg (soil)	Site specific, see Maximum Concentration Table	Data is taken from EE/CA.
IR	mg/day	50	Standard default exposure factors, RAGS Supplemental Guidance (U.S. EPA 1991b)
CF	none	0.000001(soil)	
FI	none	1.0	Study assumption
EF	days/year	250	Standard default, RAGS Supplemental Guidance (U.S. EPA 1991b)
ED	years	25	Standard default RAGS Supplemental Guidance (U.S. EPA 1991b)
BW	kg	70	Standard default, RAGS Supplemental Guidance (U.S. EPA 1991b)
AT	days	25,550 (cancer) 9,125 (noncancer)	(70 x 365) (25 x 365)

2.6.2.5 Toxicity

The COCs consist of multiple contaminants: PAHs, PCBs, beryllium, manganese, antimony, copper, iron, zinc, and cadmium (the latter seven are metals). Toxicity information is taken from the 1997 Integrated Risk Information System (IRIS), unless otherwise indicated. PAHs, PCBs, and beryllium are believed to be carcinogenic. PCBs and metals are believed to contribute to health effects, other than cancer.

Carcinogens are chemicals which cause or induce cancer. Carcinogenic effects are assumed to demonstrate a nonthreshold response mechanism. This hypothesized mechanism for carcinogenesis is referred to as nonthreshold because it assumes that there is no level of exposure to such a chemical that does not pose finite probability, however small, of generating a carcinogenic response. The dose response relationship for carcinogens is expressed as a carcinogenic potency factor or slope factor that converts estimated intakes directly to incremental lifetime risk. Slope factors for oral carcinogens (ingested) are expressed in units of the inverse of milligrams of chemical per kilogram of body weight per day.

Chemicals causing noncarcinogenic effects (i.e., systemic toxins) are assumed to exhibit a level of exposure above zero that can be tolerated by an organism without causing an observed health effect. It is believed that organisms have adaptive mechanisms that must be overcome before a toxic endpoint (effect) is manifested. Noncarcinogenic health effects include a variety of toxic effects on body systems ranging from renal toxicity (toxicity to the kidney) to central nervous system disorders. The toxicity value describing the dose-response relationship for noncarcinogenic effects is the RfD. U.S. EPA defines RfD as follows:

"In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily chemical exposure by the human population (including sensitive subpopulations) that is likely to be without appreciable risk of deleterious effects during a lifetime. The RfD is generally expressed in units of milligrams per kilogram of body weight per day (mg/kg-day)" (U.S. EPA 1989).

The noncarcinogenic risks are presented as hazard indices with any number over 1 as posing a potential human health risk.

The November 1, 1994, IRIS entry for benzo(a)pyrene classifies it as a probable human carcinogen. This classification is based upon the fact that while human data specifically linking benzo(a)pyrene to carcinogenic effects are lacking, there are multiple animal studies demonstrating it to be carcinogenic following administration by numerous routes. The animal data cited in the IRIS entry include dietary, gavage, inhalation, intratracheal instillation, dermal and subcutaneous studies.

In addition, IRIS states: "Repeated benzo(a)pyrene administration has been associated with increased incidences of total tumors and of tumors at the site of exposure." IRIS states that: "benzo(a)pyrene is commonly used as a positive control in many dermal application bioassays and has been shown to cause skin tumors in mice, rats, rabbits, and guinea pigs. Benzo(a)pyrene is both an initiator and a complete carcinogen in mouse skin. Increased incidences of distant site tumors have also been reported in animals as a consequence of dermal benzo(a)pyrene exposure." Benzo(a)pyrene has an oral cancer slope factor of 7.3 kilogram-day per milligram (kg-day/mg). Benzo(a)pyrene has a dermal cancer slope factor of 0.27 day per microgram (day/μg).

Cancer slope factors for the other PAHs were taken from the "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. The guidance provides a series of relative potency values for the risk evaluation of PAHs. In deriving the potency of each PAH relative to benzo(a)pyrene, it was assumed that the PAHs and benzo(a)pyrene have similar dose-response curves, but that it takes a proportionally larger concentration of non-benzo(a)pyrene material to induce an equivalent tumor response. Although PAHs have been documented to cause immunological effects, there is no toxicity value (RfD) for noncancer endpoints (Table D-18).

PCBs are classified as a probable human carcinogen and has a cancer slope factor of 2.0 kg-day/mg (upper bound slope factor applicable of soil ingestion and dermal exposure). PCBs have been shown to induce liver tumors in male and female rats. Mechanistic studies are beginning to identify several congeners that have dioxin-like activity and may promote tumors by different modes of action. Human carcinogenicity data is considered inadequate, although a study of Italian workers at a capacitor manufacturing plant showed a statistically significant increase in death from cancer compared to national and local rates. PCBs can be composed of numerous Aroclors. The Vacant Lot site has a preponderance of Aroclor 1254, which has an RfD of 0.00002 mg/kg-day (medium confidence). The RfD is based upon studies in monkeys that showed decreased antibody response to sheep red blood cells and distorted growth of finger- and toenails. Adult female Rhesus monkeys were exposed orally to Aroclor 1254 for five years and clinical evaluations were performed weekly during that period. Reproductive toxicity was not examined (Table D-19).

Beryllium is classified as a probable human carcinogen with a slope factor of 4.3 kg-day/mg, based upon its ability to induce osteosarcomas in rabbits via intravenous or intramedullary injection. Human epidemiology studies are considered to be inadequate. There have been reported increases in cancer that appear to be correlated with occupational exposure to beryllium, but a variety of confounding factors have not been taken into account. Beryllium has a RfD of 0.005 mg/kg-day (low confidence), based upon the No Effect Level following a lifetime of treatment of male and female

rats. Mice have also been exposed to beryllium, and the studies revealed slight changes in weight between the experimental and control groups. These effects were not considered to be adverse.

Manganese is not classifiable as to human carcinogenicity. Manganese has an RfD of 0.14 mg/kg-day (medium confidence), based upon effects of the central nervous system in humans. Manganese is an ubiquitous element that is essential for normal physiologic functioning in all animal species. Several disease states in humans have been associated with both deficiencies and excess intakes of manganese. Individual requirements for, as well as adverse reactions to, manganese may be highly variable.

Antimony has an RfD of 0.0004 mg/kg-day (low confidence), based upon effects on longevity, blood glucose, and cholesterol in rats. Both male and female rats were treated with antimony and the experimental group survived an average of 106 (males) and 107 (females) fewer days than did the control group. Nonfasting blood glucose levels were deceased in treated males, and cholesterol levels were altered in both sexes. A similar study in mice also revealed shortened lifespans in the experimental group when compared to controls.

Copper is not classifiable as to human carcinogenicity. Copper has an RfD of 0.04 mg/kg-day (U.S. EPA-NCEA regional support provisional value) as reported in the U.S. EPA Region III Risk-Based Concentration Table (U.S. EPA 1995a).

Zinc is not classifiable as to human carcinogenicity. Zinc has an RfD of 0.3 mg/kg-day (medium confidence), based upon a 47% decrease in erythrocyte superoxide dismutase (ESOD) concentration in adult females after 10 weeks of zinc exposure. This critical study indicated that zinc supplementation can alter copper and iron balance. The effects on copper and iron biochemistry are considered of concern since long-term iron or copper deficiency could result in significant adverse effects. A change in ESOD activity is considered to be a better indicator of altered copper status than the measure of metal concentration in tissue or plasma.

Cadmium is classified as a probable human carcinogen, however, there are no positive studies of ingested cadmium suitable for use in calculating an oral slope factor. Cadmium has an RfD of 0.0005 mg/kg-day, based upon significant proteinuria in humans. Cadmium is unusual in relation to most, if not all, of the substances for which an oral RfD has been determined, in that a vast quantity of both human and animal toxicity data are available. The RfD is based upon the highest level of cadmium in the human renal cortex not associated with proteinuria. A toxicokinetic model has been used to determine the highest level of exposure associated with the lack of the critical effect.

2.6.2.6 Conclusion

A worker on the Vacant Lot site would have a 4 x 10^{-4} increased risk of contracting cancer from his exposure on the site. Dermal exposure to COC in soil accounted for 56% of the estimated cancer risks, with incidental ingestion of soil accounting for 28%, and dermal contact with sediment 16%. Benzo(a)pyrene accounted for 62% of the total risk from soil and sediment exposure at the site (Table D-16). The hazard index for a worker on the Vacant Lot site is 2.7. Since the COC have different mechanisms of toxicity, the individual HQs were reviewed. Analysis of the individual HQ shows that PCBs contribute 64% of the total non-cancer risk and are the only COC with a HQ greater than 1 (HQ = 1.7). In fact, the sum of the HQ for all the other chemicals does not exceed 1 (Table D-17). Both of these values represent upper-bound estimates of risk from exposure to the Vacant Lot site. A detailed explanation of risk from exposure to lead has been evaluated separately (Appendix G).

3. Identification of Removal Action Objectives

3.1 Determination of Removal Scope

Historical analytical data and EE/CA analytical data indicate soil, sediment, and groundwater contamination at the Vacant Lot site. The removal action objectives are developed based on the following factors:

- **Prevention or abatement of actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.** Lead, beryllium, benzo(a)pyrene, benzo(a,h)anthracene, PCBs, and TCE contamination, prevalent in the top 2 feet of soil, pose actual or potential exposure via the ingestion pathway. Homeless people were reportedly seen inhabiting the site; therefore, a potential contamination threat exists. The potential exposure threat to nearby human populations is through direct contact. The Creek water flow is intermittent, and does not provide enough water for fish to survive at the site. However, during storm events, there is a potential for sediments to migrate into Lake Michigan, and subsequently pose potential contamination of the food chain (fish, etc.).

- **Prevention or abatement of actual or potential contamination of drinking water supplies or sensitive ecosystems.** Groundwater is contaminated with arsenic, cadmium, lead, manganese, 1,2-DCE, TCE, PERC, and vinyl chloride. Although there are no known groundwater receptors in the site vicinity, the groundwater may cause actual or potential contamination via migration into the Creek which feeds into Lake Michigan (1.5 miles from site).

- **Stabilization or elimination of hazardous substances in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.** Seven drums, labeled TCE, were found on site. These drums have residual material and pose a migration threat and a direct contact threat.

- **Treatment or elimination of high levels of hazardous substances, pollutants, or contaminants in soils or sediments largely at or near the surface that may migrate.** EE/CA sampling results indicate elevated to moderate levels of contaminant concentrations in surficial soils. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene, PCBs, and beryllium contamination was confirmed in on-site soils. These soils pose a migration threat due to surface runoff into the Creek.

- **Elimination of threat of fire or explosion.** Fire had occurred in the source/fill area on site. The source of this fire was determined to originate from below the ground surface, and poses a potential for recurrence.

- **Mitigation or abatement of other situations or factors that may pose threats to public health, welfare, or the environment.** Surface water runoff can cause actual or potential migration of soil contamination, which will result in a threat to public health.

3.1.1 Identification Of and Compliance with Applicable or Relevant and Appropriate Requirements

Section 300.415(i) of the NCP states that fund-financed removal actions under CERCLA Section 104 shall, to the extent practicable considering the exigencies of the situation, attain ARARs under federal or state environmental laws. Other advisories, criteria, or guidance may be considered for a particular site, and are referred to as TBC requirements.

Under CERCLA, a requirement may be either "applicable" or "relevant and appropriate" to a specific removal action, but not both. The definition of the components of ARARs are listed below:

- **Applicable Requirements:** Defined as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site.
- **Relevant and Appropriate Requirements:** Defined as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site, that their use is well suited to the particular site.

Several potential ARARs have been identified for groundwater removal/remediation action. For evaluating maximum contaminant levels, the applicable Illinois ARAR is listed under Title 35 of the IAC:

§311(a)1	Identifies MCLs for drinking water.
§620.410	Identifies groundwater quality standards.

§742.410 and Table A	Define voluntary remediation program standards for contaminated groundwater.
§611.311(b)	Identifies the best available technology (BAT) for achieving compliance with VOC MCLs.

The applicable Illinois ARAR listed under Title 35 of the IAC for the design and operation of the air stripping unit are as follows:

§201	Clean Air Act Ambient Air Quality Standards under 40 CFR §50 are implemented under this code.
§232	National Emissions Standards for Hazardous Air Pollutants under 40 CFR §61 are implemented under this code.
§724 Subparts AA and BB	Substantive RCRA standards for air stripper operations.
§201.141	Prohibits air pollution.
§201.42	Construction permit for new emission source.
§210.43	Operating permit required for new emission sources.
§201.241(h)	Contents of compliance program.

Several potential ARARs have been identified for the removal/remediation action. The applicable Illinois ARAR listed under Title 35 of the IAC for the remediation of soil and groundwater contamination is as follows:

§2175.535(e)	Resource Conservation and Recovery Act, Subtitle C, hazardous waste (RCRA Subtitle C): Section 22.4(a) of the Illinois Environmental Protection Act [415 ILCS 5/22.4(A)].
§721	Standards for hazardous waste identification.
§722	Establishes standards for hazardous waste generators.
§723	Establishes standards for hazardous waste transporters.
§728	Establishes standards for soil excavation and treatment residuals.
§728.Table T	Treatment standards for hazardous wastes.
§728.101	Identifies hazardous wastes that are restricted from land disposal.

§728.140	Applicability of treatment standards.
§808	Establishes standards for soils that are not hazardous waste under RCRA.
§742.275	Determination of compliance with remediation objectives.
§240.930	Produced water discharge permit requirements.
§309.103	National Pollutant Discharge Elimination System (NPDES) permit application.
§742.410	Determination of area background for groundwater.
§732 Table A	Groundwater and soil remediation objectives.
§742.505(B)	Lists Tier 1 soil remediation objectives for inhalation exposure route based upon industrial/commercial property.
§742.505 and Table A	Lists voluntary remediation program standards for contaminated soils.

Several potential ARARs have been identified for this removal/remediation action. The applicable Federal ARARs for treatment and disposal of soil and sediment contaminated with hazardous materials are as follows:

40 CFR §261	Establishes standards for hazardous waste identification.
40 CFR §262	Establishes standards for hazardous waste generators.
40 CFR §263	Establishes standards for hazardous waste transporters.
40 CFR §268	Establishes standards for soil excavation and treatment residuals.
40 CFR §268.7	Resource Conservation and Recovery Act.

For evaluating maximum groundwater contaminant levels, the applicable Federal ARARs are as follows:

40 CFR §141.61	MCLs for organic chemicals in groundwater.
40 CFR §141.62	MCLs for inorganic chemicals in groundwater.

The applicable Federal ARARs for the design and operation of the air stripping unit are as follows:

40 CFR §122.26	Stormwater discharges.
42 CFR §112	Clean Air Act.

40 CFR §50	Clean Air Act Ambient Air Quality Standards
40 CFR §264	Subparts AA and BB Substantive RCRA standards for air stripper operations.

The Lake County Storm Water Management Commission (LCSWMC) has prepared a Creek restoration plan that calls for laying a fabric liner at the bottom of the Creek, followed by an aggregate layer and use of seed and mulch on the banks of the Creek. After dredging the Creek, U.S. EPA will evaluate this option against other options, and will implement the selected option. The LCSWMC plan and the Ontario guidelines are considered as TBCs for sediment cleanup.

3.1.2 Determination of Removal Scope for Soil

Based on the SRE for the site, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, PCBs, and beryllium were identified as contaminants posing risk-based threats. A comparison of these risk-based concentrations with the TACAO values reveal that TACAO values were slightly more stringent than risk-based concentrations. Therefore, TACAO values for these contaminants are considered as RALs (Appendix D, Table D-20).

The entire site soil area, excluding two small areas, is generally contaminated to a 2-foot depth, with elevated concentrations of lead, and low concentrations of beryllium, aldrin, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dieldrin, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-nitroso-di-n-propylamine, and PCBs. The soil contamination must be abated. In addition to these contaminants, the source/fill area also contains PERC contamination to a 4-foot depth, while the grid node I2 location, within the source/fill area, contains lead contamination to a 9-foot depth. Apart from this general area of contamination, particular areas of contamination include grid node K1 with PCB contamination to a 2-foot depth, and a source/fill area with contamination to a 4-foot depth. The source/fill area, based on EE/CA sampling, historical sampling, and groundwater contamination, is defined as the area bounded on the south by grid node I2, on the north by grid node K2, on the west by grid node J3, and the east by a location 20 feet east of grid node J2. Grid node I2 also contains PERC contamination to a 2-foot depth (170 mg/kg) and lead contamination to an 8-foot depth. All these areas have benzo(a)pyrene contamination, and therefore must be addressed with abatement actions.

3.1.3 Determination of Removal Scope for Sediments

Beryllium, benzo(a)anthracene, benzo(b)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and lead contamination is prevalent above the removal action criteria in the Creek sediments to 3- to 4-foot depths. The entire creekbed, to a 3- to 4-foot depth, may need to be addressed with abatement activities. The northern portion of the Creek, between the EJ&E Railroad tracks and the inactive Fansteel outfall, with contamination varying to 7-foot depths, needs to be addressed for sediment contamination.

3.1.4 Determination of Removal Scope for Groundwater

Manganese is the most widespread contaminant, while arsenic, cadmium, lead, and zinc contaminants were also detected in some wells. Manganese, present in both on-site and perimeter upgradient samples, indicates that manganese is a potential natural background contaminant. Organic contamination includes 1,1-dichloroethene, 1,2-DCE, and vinyl chloride. The area of groundwater that needs abatement action involves the northern one-third area of the site, the eastern boundary of the site, and the monitoring well GMMW3 area. The groundwater contamination area in the northern one-third of the site has two different attributable sources. The contamination in monitoring wells GMMW2 and MW-3 could potentially be attributed to the source/fill area; the removal scope for the source/fill area will abate the groundwater contamination. The remainder of the northern one-third site groundwater contamination area and the eastern perimeter groundwater contamination, could potentially be attributed to an off-site TCE plume; the removal scope for abating this contamination will address the TCE source. However, since the source is off site, no matter which abatement action is undertaken on site to address TCE contamination, the groundwater beneath the entire site could potentially become recontaminated. As a result, groundwater cleanup (beyond what is accomplished through the on-site soil excavation and disposal) will be deferred to identify off-site sources and determine the best way to address their impact on groundwater. The groundwater contamination in the area of monitoring well GMMW3 contains arsenic and manganese contaminants above RALs, and vinyl chloride and 1,2-DCE contaminants below the RALs. Considering the presence of metals as background or natural contaminants, the removal scope is not addressed for this area. However, due to the presence of vinyl chloride and 1,2-DCE since 1993, it is reasonable to assume that there is a contributing source elsewhere which needs to be identified.

3.2 Determination of Removal Schedule

By abating threats posed due to contamination, the specific removal action objective of

prevention or abatement of contaminants; treatment or elimination of high levels of hazardous substances, pollutants, or contaminants; and mitigation of the environment, will be met. The goals of the removal action are:

- Evaluate various alternatives to abate exposure threats due to soil, sediment, and groundwater contamination;
- Evaluate potential threat to recontaminate soil, sediment, and groundwater due to contamination from off-site sources; and
- Evaluate treatment alternatives to reduce and abate threats due to contaminated groundwater.

The general schedule for this removal action is anticipated as follows:

- Mobilization, excavation, and sampling: 4 weeks
- Direct disposal: 4 weeks;
- On-site stabilization/off-site disposal: 4 weeks; and
- Grading: 2 weeks.

3.3 Planned Removal Activities

Removal activities planned for the Vacant Lot site include:

- Remove contaminated soil, backfill, and grade with clean soil.
- Remove contaminated source/fill area.
- Evaluate treatment alternatives to treat any residual groundwater contamination remaining after removing the source/fill area, and determine the extent of contamination for the potential TCE plume which exists at the perimeter of the site.

4. Identification and Analysis of Removal Action Objectives

The following removal alternatives were considered for soil and sediment contamination abatement:

1) No Action
2) Natural Attenuation and Institutional Controls
3) Containment - Capping
4) Phytoremediation
5) In-Situ Stabilization
6) Soil Vapor Extraction (SVE) and In-Situ Stabilization
7) Excavation and Disposal, which includes:
   Direct Disposal
   Stabilization and Disposal

The following alternatives were considered for groundwater remediation:

1) No Action
2) Natural Attenuation and Institutional Controls
3) Containment - Capping
4) Source Excavation
5) SVE and Air Sparging
6) Pump and Treat - Air Stripping

Identification and Analysis of Soil and Sediment Removal Action Alternatives

1) No Action

Under the No Action Alternative, the Vacant Lot site would be left in its present condition, contaminant migration to the groundwater would continue, and the direct contaminant exposure associated with on-site soil contamination will still exist. The No Action Alternative has been included as a requirement of the NCP to provide a basis of comparison for the remaining alternatives. No institutional controls or monitoring are included with this alternative.

2) Natural Attenuation and Institutional Controls

Natural attenuation results in a decrease in organic contaminant concentrations through a biological degradation process. Historical VOC contamination in soils and sediments at the site have maintained their concentrations without any significant change, as documented in the EE/CA sampling. The presence of vinyl chloride indicates that 1,2-DCE is potentially undergoing a biodegradation process. Vinyl chloride is a known carcinogen and is more harmful than 1,2-DCE. Additionally, heavy metals cannot be naturally attenuated.

Institutional controls in the form of access and deed restrictions, installation of a chain-link fence around the perimeter of the site, and posting of warning and no trespassing signs would be implemented as part of this removal alternative. Restrictions would be placed on the site property to limit any future use of the property to one that is compatible with site conditions.

Due to the nature of contaminants (i.e., metals) present in soil and sediment, and the difficulty of ensuring the integrity of the fencing over time, the Natural Attenuation and Institutional Controls Alternative is not a viable removal alternative and will no longer be addressed by this EE/CA.

3) Containment - Capping

This alternative includes capping, in addition to implementing institutional controls. The cap will provide a protective barrier that will prevent soil contaminant exposure to human and ecological receptors. If properly maintained, the cap will reduce stormwater infiltration, thereby reducing vertical migration of contaminants through the soils.

The entire site is considered under this alternative. The objective of capping is to limit infiltration of water to the waste, so as to minimize creation of leachate that would contaminate

groundwater. Capping is not considered for the Creek remediation since this would disrupt or stop the flow of water. Subparts G, K, and N of the RCRA subtitle C regulations form the basic requirements for capping/covering. Capping will provide a protective barrier that will prevent soil contaminant exposure to human and ecological receptors.

The capping would consist of 2 feet of compacted clay, placed in 6-inch lifts, and have a maximum hydraulic conductivity of 1×10^{-7} centimeters per second (cm/sec); a 12-inch drainage layer with a minimum hydraulic conductivity of 1×10^{-2} cm/sec; plus 24 inches of topsoil capable of supporting a vegetative cover. Additionally, the cap will have a minimum 3% slope to prevent ponding from rainfall events.

The final cover consists of the following items from bottom to top:

- **Low-hydraulic conductivity geomembrane/soil layer.** A 24-inch layer of compacted natural or amended soil with a hydraulic conductivity of 1×10^{-7} cm/sec is placed in intimate contact with a minimum 0.5 microns (20 mil)-geomembrane liner. The low-hydraulic conductivity soil components placed over the waste should be at least 24 inches deep, and have an upper surface with a 3% maximum slope and be below the maximum frost line. This layer is placed so it is below the depth of the maximum frost penetration.

- **Drainage layer.** The drainage layer should be a minimum 12-inch soil layer, which has a minimum hydraulic conductivity of 1×10^{-2} cm/sec, or a layer of geosynthetic material having the same characteristics. The drainage layer is designed to minimize the time the infiltrated water is in contact with the bottom, low-hydraulic conductivity layer, in order to lessen the potential for the water to reach the waste. Water that filters through the top layer is intercepted and rapidly moved to an exit drain, such as by gravity flow to a toe drain. Between the bottom of the topsoil layer and the drainage sand layer, a granular or geosynthetic filter layer is included to prevent the drainage layer from clogging by top-layer fines. Granular material is sand (24 inches), with a hydraulic conductivity of 1×10^{-2} cm/sec or greater.

- **Top vegetation/soil layer.** The top layer will include vegetation (or an armored top surface) and a minimum of 24 inches of soil, graded at a slope of between 3 and 4%. Vegetation over soil (part of which is topsoil) is part of the top layer, which will allow runoff from major storms, while inhibiting erosion. The root system shouldn't extend into the drainage layer. A top layer with a minimum 3% surface slope, at least 24 inches deep, should include at least 6 inches of top soil. The landfill closure standards require postclosure care and maintenance of the unit for at least 30 years after closure. Postclosure care includes maintenance of the final cover; operation of a leachate collection and removal system, if necessary; and maintenance of the groundwater monitoring system [40 Code of Federal Regulations [CFR] 264.117, 264.228(b)].

Prior to installation of the cap, all existing trees, shrubs, and other ground vegetation would be removed using standard construction equipment. Vegetation would be cut, chipped, and spread over the area during grading. Loaders and compaction equipment would then be used to place and compact the clay to design specifications. Clay would be trucked in locally from an off-site borrow source. Engineering design documents will specify the necessary quality control checks to ensure the appropriate properties and cleanliness of the clay material. Once the clay layer had been installed, a 6-inch topsoil layer would be placed over the clay layer to act as a vegetative medium. Clean topsoil would be trucked to the site, stockpiled, then spread using loaders and bulldozers to the design grade. The topsoil would then be seeded with a grass chosen for low maintenance and long-term erosion, as well as provide protection until the grass seed could germinate.

During construction activities, air monitoring would be conducted to ensure that workers and nearby residents are not exposed to site contamination above allowable levels. Action levels would be established in the design documents to initiate engineering controls, such as dust suppression, or to stop work at individual work areas.

Since contaminated soil would remain on site, this alternative would also include institutional controls in the form of deed restrictions to further limit the potential for human exposure to contaminants. Any future site development would require a reevaluation of the protectiveness of the cap, and a determination of the detrimental effects that the new development would have on the cap. Post-removal site control (PRSC) procedures associated with this alternative include regular inspection of the cap and maintenance of the vegetative cover. Fencing along the south and west boundaries of the site may also have to be maintained. The PRSC activities required for this alternative would also include groundwater monitoring. Sampling and analysis of groundwater from all on-site monitoring wells for site contaminants would be performed on a yearly basis to ensure that site soil contaminants have not migrated into the shallow aquifer.

4) Phytoremediation

Phytoremediation is an innovative technology where metal/radionuclide-accumulating plants are cultivated on contaminated soil. Phytoextraction is a form of phytoremediation that integrates a specially selected metal-accumulating crop with innovative soil amendments, allowing plants to achieve higher biomass and metal accumulation rates from soils. At these higher levels of lead accumulation, contaminant disposal volume is reduced by up to 95%. Thereafter, the mature plant is harvested. The harvested plants are then burned and ashes are disposed as hazardous material.

Depending upon the concentration of metal contamination, typically two to four growing seasons are required to remediate contaminated soil. Phytoremediation offers an attractive and economical alternative to currently practiced soil removal and burial methods. Phytoextraction costs between $600,000 to $900,000 per 10 acres per year.

The site lead contamination data and site characteristics were provided to Phytotech, Inc. (Phytotech), to evaluate the potential of effectively using phytoextraction techniques at the Vacant Lot site. Phytotech's evaluation reveals that the presence of higher lead levels at both 1-foot and 2-foot depths, may not be suitable for this technology. Usually, phytoextraction is effective to a 1-foot depth. Phytoremediation is not a viable removal alternative for the Vacant Lot site and will not be evaluated further by this EE/CA.

5) In-Situ Stabilization

The In-Situ Stabilization Alternative involves introduction of a stabilization agent (cement) and a chemical reagent into contaminated soil present on site (in-situ), and mixing them with a machine-mounted auger or steel blades. This technology is usually applicable to abate metal contamination in soil and sediments. In-situ stabilization is ideal for contamination present at deeper depths and over an extended area. After in-situ stabilization, the material is left in place. There is a waste volume increase of between 15 to 30% due to stabilization. Routine monitoring of the in-situ stabilized material is necessary by collecting soil samples initially and groundwater samples periodically.

In-situ stabilization of the contaminated soil, except the source/fill soil, PCB-contaminated soils, and the Creek sediments, is evaluated under this alternative.

A treatability study would need to be performed prior to implementation of the in-situ stabilization alternative, in order to evaluate the optimum ratio of the stabilization agent and chemical agent, and its effectiveness in rendering inorganic contamination below action levels. Due to the nature of the auger equipment, this alternative will potentially treat soil beyond the contamination depths presently prevailing at the site. In-situ stabilization used alone, is not a complete removal alternative. This alternative, when combined with remediation alternatives for the source/fill soil, PCB-contaminated soils, and Creek sediments, will constitute a complete removal.

6) Soil Vapor Extraction (SVE) and In-Situ Stabilization

Under this alternative, a vapor extraction system with a vapor barrier would be employed to remediate the contamination. Semiannual monitoring would be used to track site conditions during

SVE operations, and the vapor barrier would be used to enhance the capture of subsurface vapors and to restrict access to the area during remediation procedures.

During SVE, soil vapors would be collected from the subsurface by applying a vacuum at a series of extraction points. However, modeling and monitoring of the off-gas would be required, and treatment of the operation may be necessary to ensure that the emissions meet local, state, and federal regulations. The vacuum would draw vapors from the contaminated soils and would decrease the pressure and contaminant particles, thereby releasing additional VOCs. Vapor removal could be maximized using pulsed venting, in which a blower would be turned off and on to allow the soil vapor to re-equilibrate, or be venting different combinations of wells to change the flow field.

To prevent preferential pathways from being established, which would cause a decrease in the overall effectiveness of the bioventing wells, a geomembrane cap would be installed. The cap also would reduce soil contaminant exposure to human and ecological receptors, prevent inhalation of dust particles during the bioventing process, and be protective of injection well piping. A minimum 40-mil geomembrane would be installed over a 1-foot layer of gravel and covered by 6 inches of sand to provide ultraviolet protection and to minimize wind lift on the geomembrane cap. A geomembrane cap has an approximate life of 30 to 50 years, and parts of the cap can be removed with minimal difficulty for future sampling. The flexibility of this technology is considerably less susceptible to cracking from influences, such as settlement and frost heave.

Horizontal wells will be placed in trenches approximately 10 feet bgs. Several vertical wells will be placed, covering an area 80 feet in diameter. By installing a geomembrane cap over the vapor extraction system, the capture zone of the wells will be dramatically increased.

Vapor extraction is a proven technology for remediating vadose-zone soils contaminated by VOCs. The use of shallow horizontal wells, in conjunction with the vapor barrier, will ensure that air flow throughout the remediation area will be sufficient to cause volatilization, allowing subsequent removal of VOC contaminants.

Prior to full-scale implementation, a pilot test would have to be performed to obtain the necessary data (i.e., air permeability, obtainable flow rates, radius of influence) to determine the number and location of extraction wells, equipment requirements, expected mass removal rates, and the duration of the operation.

Selected design criteria includes the use of two 200-foot horizontal pipes for transportation of air, and eight recovery wells, up to 8-foot depths, to recover VOCs. Other major components of the SVE system include below-grade polyvinyl chloride (PVC) piping, valves, sampling ports, pressure

gauges, and blowers. The blowers will be housed in a temporary building. SVE is only applicable to the source/fill area. SVE would be performed on an area measuring approximately 250 feet by 150 feet, and would be followed by in-situ stabilization to remediate metal contamination in the source/fill area. Approximately 2,700 cubic yards of soil would be remediated using this alternative.

SVE and In-Situ Stabilization is not a complete removal alternative for the Vacant Lot site. This alternative for the source/fill area, in combination with the In-Situ Stabilization Alternative for remediating metal contamination, and alternatives for remediating PCB-contaminated soil and Creek sediment contamination, will accomplish a complete removal at the site.

7) Excavation and Disposal

When evaluating the Excavation and Disposal Alternative, the contaminated soil and sediment is classified as hazardous and nonhazardous, based on U.S. EPA regulatory criteria for disposal at a landfill. The nonhazardous soil and sediment materials will be excavated and directly disposed off site. The hazardous material can either be stabilized on site and disposed off site at an approved landfill facility, or stabilized and disposed off site at an approved landfill facility.

Lead- and beryllium-contaminated soil needs to be excavated to a 2-foot depth at a minimum. For removal alternative estimates, a 3-foot depth of entire site soil removal, except for two areas described in Section 2.4.1 under Extent of Contamination, and 3- to 4-foot depths of sediment removal are considered. This accounts for approximately 24,200 cubic yards of material. It is estimated that approximately 15,400 cubic yards of this excavated material does not need any stabilization to remove the toxicity characteristic requirements for lead prior to disposal. The remaining 8,800 cubic yards of soil (30% of excavated material) needs to be stabilized prior to disposal at a landfill. Approximately 185 cubic yards of PCB-contaminated soil will need to be disposed of at a TSCA-approved landfill. The following excavation-related work is applicable to both of the above-mentioned disposal options under the Excavation and Disposal Alternative section.

Soil exceeding the cleanup criteria would be excavated. Upon completion of excavation activities, the side walls and base of the excavation will be sampled and analyzed to determine compliance with the cleanup criteria. The cleanup criteria requires excavating soil exhibiting at least 1,400 mg/kg lead, or greater than 5 mg/L TCLP lead, 1 mg/kg beryllium, 8 mg/kg benzo(a)anthracene, 0.8 mg/kg benzo(a)pyrene, 8 mg/kg benzo(b)flouranthene, 0.8 mg/kg dibenz(a,h)anthracene, 8 mg/kg indeno(1,2,3-cd)pyrene, 78 mg/kg benzo(k)fluoranthene, and 25 mg/kg PCBs. The sampling and analysis plan utilized during the remedial action will be developed

during the engineering design phase and should be based upon U.S. EPA's "*Removal Program Representative Sampling Guidance, Volume 1 - Soil*". A composite soil sample, after 2 feet of excavation, will be collected within each grid's exposed surface area of excavation. The soil sample will then be submitted for analysis to determine its compliance with the cleanup objectives. In the event that analysis indicates contamination, an additional foot of soil will be excavated and soil samples will be collected as previously described. Upon receipt of analytical data that verifies compliance with the cleanup criteria, the open excavations will be backfilled with clean earthen material similar in nature to site soils and obtained from a local borrow source. Engineering design documents will specify the necessary quality control checks to ensure the type and cleanliness of backfill material.

Based on the EE/CA analytical results for total metals and TCLP analysis of site soils and sediments, it has been determined that the majority of soil and sediment to be excavated can likely be classified as being nonhazardous, which meets with the current land ban restrictions. It is recommended during the engineering design, that samples be collected and tested for waste disposal parameters prior to selecting a disposal facility.

During excavation activities, air monitoring would be conducted to ensure that workers and nearby residents are not exposed to site contaminants above allowable levels. Action levels would be established in the design documents to initiate engineering controls, such as dust suppression, or to stop work at individual work areas.

The entire site area will be excavated using a front-end loader and track loader, and the excavated soil will be staged on site after segregating into nonhazardous and hazardous soil. For the initial segregation, soil classified as hazardous waste can be identified via sampling results of the EE/CA. Composite samples from the staged nonhazardous and hazardous stock piles will be collected and sent to a laboratory or disposal facility to evaluate its characteristics prior to disposal. The Excavation and Disposal Alternative used alone, would fulfill a complete removal alternative for the Vacant Lot site.

Direct Disposal

The Direct Disposal Alternative is for the removal of nonhazardous material and hazardous material. The nonhazardous soils and sediment on site are above the site-specific remedial action levels, but are below the nonhazardous definition of federal disposal criteria regulations and Illinois land disposal restrictions. This option calls for disposal of soils and sediments at a landfill without any stabilization. The driving force for disposal of contaminated soil is regulations under the CFR,

specifically 40 CFR, Section 261.2 to 261.4, and under 35 IAC part 728 defining the hazardous nature of soil. Based on the criteria for TCLP lead, TCLP beryllium, and PAHs disposal levels, 70% of the soil to be abated could be sent to a disposal facility as nonhazardous material and directly landfilled. This includes metals, PAHs, and small concentrations of pesticides (aldrin, dieldrin, and toxaphene) that are present in soils. Approximately 185 cubic yards of PCB-contaminated material detected in the source/fill area would be disposed of at a TSCA-approved landfill.

Benzo(a)pyrene, dibenzo(a,h)anthracene, beryllium, and total lead are the COCs for this alternative. Under the Direct Disposal Alternative, the entire southern two-thirds of the site soil, to a 2-foot depth; and the entire Creek bed, to 3- to 4-foot depths or to the onset of clay (910 cubic yards), needs to be remediated. This soil volume constitutes a bulk of site material, and is estimated to account for approximately 15,400 cubic yards.

Since this alternative will remove all on-site contamination at levels of concern, there are no institutional controls or operation and maintenance requirements associated with this alternative.

For removal alternative cost estimates, soil removal to a 3-foot depth and sediment removal to a 4-foot depth is considered. This accounts for approximately 23,300 cubic yards of material. Approximately 16,000 cubic yards of this excavated material does not need any stabilization prior to disposal. It is assumed that U.S. EPA will select the disposal facility, taking into account economic considerations and U.S. EPA compliance of the disposal facility.

Stabilization and Disposal

This alternative would include the excavating of all on-site surface soil, subsurface soil, and sediment that contain levels of contamination exceeding the cleanup objectives. The excavated material would then be solidified to immobilize metals contamination. The majority of the soil in the northern one-third of the site, lying north of row K, is identified with both organic and inorganic contamination extending to an average 2-foot depth, and needs stabilization of metals contamination. The source/fill area, measuring approximately 180 feet by 100 feet by 4 feet (2,700 cubic yards), also needs stabilization of metals contamination. This soil is considered hazardous waste, based on EE/CA analytical results, and would require stabilization for rendering TCLP lead characteristics below the regulatory criteria of 5 mg/L prior to landfilling. The VOC concentrations in the source/fill area are low enough, as far as disposal criteria is concerned, to dispose of it at a landfill without any treatment for VOC reduction. The total amount of hazardous soils to be stabilized and disposed of is estimated at 9,550 cubic yards.

There are two options evaluated under this alternative. The first option is off-site stabilization

and disposal, and the second option is on-site stabilization and off-site disposal.

Off-Site Stabilization and Disposal

E & E was provided cost estimates from disposal facilities to stabilize hazardous soils and dispose of the stabilized material in a landfill. After excavation and staging, the material will be sampled systematically and then transported in trucks to the selected landfill. All applicable regulatory requirements will be met.

On-Site Stabilization and Off-Site Disposal

The excavated hazardous soil can be rendered nonhazardous, with respect to lead and beryllium contaminants, by stabilizing with approximately 15% Portland cement. This ratio of Portland cement to soil (15:85) is by weight, and estimates are based on previous projects that had similar metal concentrations and soil characteristics.

Under this alternative, solidification equipment and the necessary reagents would be transported to the site. Prior to the implementation of this alternative, a bench-scale pilot test would have to be conducted. The test would be conducted using contaminated site soil and sediments and various solidifying agents (i.e., lime, Portland cement, fly ash) separately and in conjunction with each to determine the best mix and appropriate proportions needed for the on-site solidification process.

Stabilization treatment systems attempt to accomplish improved handling and physical characteristics of the contaminants, reduction of surface area where transfer or loss of contaminants can occur, or reduction in the solubility of hazardous constituents in the wastes. Stabilization methods used for chemical soil and sediment consolidation can immobilize contaminants.

Most of the stabilization techniques involve a thorough mixing of the solidifying agent and the excavated material. Stabilization produces a monolithic block with great structural integrity. The contaminants do not necessarily interact chemically with the stabilization reagents, but are mechanically locked within the stabilized matrix. Stabilization methods usually involve the addition of materials that limit the solubility or mobility of the excavated waste constituents, even though the physical handling characteristics of the waste may not be improved.

During mixing of the solidifying agent with the contaminated wastes, volatilization and release of VOCs may occur. Stabilization is most effective on metals since metals easily bond with the solidifying agents. U.S. EPA considers solidification to be an appropriate treatment for large volumes of waste material containing toxic heavy metals. Unlike metals, organics do not readily react

with the solidifying agents and simply become entrapped in the matrix. In addition, the long-term effectiveness of the solidified mass cannot be ensured.

Soil stabilization is accomplished either by batch stabilization or by continuous stabilization.

Batch Stabilization

Between 150 to 200 cubic yards of contaminated soil is stockpiled and subjected to stabilization under the batch process. A predetermined weight of Portland cement is then added to the stockpile and mixed uniformly with a track-mounted front-end loader. Small amounts of water are used to enable homogenous mixing and to minimize nuisance dust. Every batch of stabilized soil is left to cure for approximately 48 hours or more before analyzing for TCLP metals.

After successful stabilization of contaminated soil, the stabilized material will be hauled in dump trucks/roll-off boxes to an approved disposal facility for landfilling.

Continuous Stabilization

Equipment for concrete stabilization includes a conveyor to transport soil from the source to a mixer, a silo to store Portland cement and distribute it to the mixer, a water line to add water to the contents of the mixer, and a second conveyor to remove the mixed material from the mixer. A front-end loader will then haul the mixed material to a staging area, where it will be cured for 48 hours (depending upon treatability study) before analyzing for TCLP metals.

The stabilization process is expected to last approximately 30 days. The mobilization, soil setup, final disposal, and demobilization activities will last approximately five days.

During solidification activities, air monitoring would be conducted to ensure that workers and nearby residents are not exposed to site contaminants above allowable levels. Action levels would be established in the design documents to initiate engineering controls such as dust suppression, or to stop work at individual work areas.

Since this alternative will remove all on-site contamination, there are no institutional controls or operation and maintenance requirements associated with this alternative.

It is assumed that U.S. EPA will select the disposal facility, taking into account economic considerations and U.S. EPA compliance of the disposal facility.

Identification and Analysis of Groundwater Removal Action Alternatives

1) No Action

Under the No Action Alternative, the Vacant Lot site would be left in its present condition.

On-site and off-site contamination will continue to migrate to the groundwater. Present groundwater contamination will remain and continue to migrate away from site. The No Action Alternative has been included as a requirement of the NCP to provide a basis of comparison for the remaining alternatives. No institutional controls or monitoring are included with this alternative.

2) Natural Attenuation and Institutional Controls

Natural Attenuation results in a decrease in contaminant concentrations through a degradation process. Monitoring of the natural attenuation process requires collection and analysis of groundwater samples. VOC contamination detected in the source/fill area indicates biodegradation, leading to more potent contaminants. Groundwater contained 1,2-DCE, TCE, and vinyl chloride. The presence of vinyl chloride indicates that 1,2-DCE is potentially undergoing a biodegradation process. Vinyl chloride is a known carcinogen and is more harmful than 1,2-DCE.

Institutional controls in the form of access and deed restrictions, installation of a chain-link fence around the perimeter of the site, and posting of warning and no trespassing signs would be implemented as part of this alternative. Restrictions would be placed on the site property to limit any future use of the property to one that is compatible with site conditions.

Metals present in soil and sediment do not biodegrade naturally. VOCs present in site soils and sediments biodegrade, but convert into more potent forms. Due to the nature of these contaminants present in the soil and sediment, the Natural Attenuation and Institutional Controls Alternative is not a viable remediation alternative for groundwater.

3) Containment - Capping

This alternative includes capping, in addition to institutional controls. If properly maintained, the cap will reduce rainwater infiltration, thereby reducing the potential for vertical migration of contaminants through the soils and into the groundwater.

The objective of capping is to limit infiltration of water to the waste, so as to minimize creation of leachate that would contaminate groundwater. If properly maintained, the Capping Alternative will reduce water infiltration, thereby reducing vertical migration of contaminants through the soils.

4) Source Excavation

One simple, yet effective way to handle on-site groundwater contamination without posing a

potential threat of drawing off-site contamination within the site's boundaries, is to excavate the known source/fill area and dispose of it appropriately. Any residual contamination left in on-site groundwater would pose very minimal human health or ecological threats. With on-site VOC contamination due to the source/fill area addressed, other contributing source(s) to on-site groundwater contamination could potentially be from off-site source(s). After removing the first 2 feet of soil from the site, groundwater contamination should be re-evaluated, especially for the concentration of manganese and other metals. Manganese, which is present both in the perimeter and on-site groundwater, may be coming from migrating groundwater, or may be a naturally occurring native contaminant.

During the second sampling event, fill material was observed in I2, J2, and K2 sample locations of the source/fill area. Monitoring well MW-3, which is at the southern boundary of the source/fill area, never contained manganese above MCL and RAL values, but contained VOC contamination. Monitoring well GMMW2, located at the northern area of the source/fill area, and monitoring well MW-2, located immediately outside the southern boundary of the source/fill area (southeast of monitoring well MW-3) contained manganese contamination. It is probable that the fill material around monitoring well MW-3 is inhibiting contaminants, other than from its source, from entering monitoring well MW-3 due to the nature of the fill material. It is estimated that 2,700 cubic yards of soil from the source/fill area would need to be excavated, stabilized, and disposed.

5) Soil Vapor Extraction (SVE) and Air Sparging

This alternative addresses perimeter groundwater remediation. Even though perimeter groundwater remediation is presented in this report, several off-site actions are essential prior to any on-site removal action. SVE involves the use of forced air through the contaminated soil to strip VOCs. Air sparging involves injection of pressurized air into contaminated groundwater, resulting in the volatilization of VOCs and enhanced biodegradation of contaminants susceptible to aerobic microbial degradation. The stripped VOCs are then directed to the surface through recovery wells. Depending upon VOC concentrations in the stripped effluent, further treatment with GAC may be necessary.

The air sparging system resembles an enhanced SVE system in configuration, however, there are two major differences. First, with air sparging, the air would be injected at least 4 feet below the groundwater table, unlike the enhanced SVE system in which the air is injected above the groundwater table. Secondly, each injection well of the air sparging system would be co-located with

an extraction well to capture the vadose zone air stream that carries volatile contaminants. In addition to treating groundwater contaminants, air sparging also treats contaminated soils found in the vadose zone.

The SVE and air sparging system would consist of extraction and injection wells, piping, compressor, vacuum blower, air/water separator, heat exchanger, housing and heating system, and monitoring devices. For cost estimates, the design criteria is based on an assumption that two areas, measuring approximately 250 feet by 175 feet by 20 feet, each require the use of three 200-foot horizontal pipes to send in air, and 12 recovery wells, to 20-foot depths, to recover VOCs. Air sparging design criteria requires the use of 10 wells to send in air. After a pilot scale study, injection wells and recovery wells will need to be installed in the actual source/fill area plume off-site. Monitoring wells will need to be installed in and around the area of contamination. These recovery wells can be connected to SVE recovery wells. The air from the recovery wells is passed through GAC to reduce VOC concentrations below applicable regulatory limits, if necessary.

A pilot scale study is recommended prior to any on-site treatment. Design parameters, such as the radius of influence of the air sparging system at different injection flows and pressures, and the pressure and vacuum requirements for effective treatment and capture of volatilized materials, should be determined through pilot-scale testing. Information such as duration of treatment and verification of remediation criteria should also be obtained based on pilot-scale tests. However, a preliminary cost estimate and comparison of alternatives is presented, even though this is applicable only at the off-site location. Due to a lack of information of off-site source(s), a preliminary estimate is made to evaluate the technology requirements. There is a potential for remediation at northern and southern boundaries of the off-site facility.

6) Pump and Treat - Air Stripping (Packed Tower Aeration)

This alternative also addresses perimeter groundwater remediation. Air stripping is a process by which contaminated water is passed downward through a tower by gravity. The tower contains a packing material. Air is forced through the tower and through the contaminated water by blowers or pumps. The packing material increases the time the air is in contact with the water. The air strips the VOCs out of the water and into the off-gas stream, resulting in the removal of contaminants. A granular activated carbon may be used to filter these off gasses, thereby reducing VOC contamination. The design criteria for packed tower aeration requires the installation of two wells, an air stripper unit, storage tanks, and a GAC unit.

Air stripping also has the potential to remediate small amounts of manganese. Manganese reacts with oxygen to form manganese dioxide, which then settles down. However, if manganese concentration increases, the VOC-remediated water still must be treated for manganese concentration reduction. One method of treatment would require storing the VOC-remediated water in tanks and then treating them with a flocculent and a coagulant to settle the manganese metal. The supernatant water will be separated and discharged to the Creek or a disposal facility based on U.S. EPA's guidelines. However, depending on a treatability study, manganese metal remediation may not need to be addressed separately if aeration during air stripping can remove manganese in the form of manganese dioxide.

5. Detailed Analysis of Alternatives

For soil removal alternatives, Capping, In-Situ Stabilization, SVE and In-Situ Stabilization, and Excavation and Disposal (Direct Disposal, Stabilization and Disposal) were evaluated. For groundwater contamination, Capping, SVE and Air Sparging, and Pump and Treatment Air Stripping Alternatives were evaluated. The alternatives were evaluated using U.S. EPA's three broad criteria of effectiveness, implementability, and cost.

5.1 Effectiveness

Excavation and subsequent appropriate disposal (Excavation and Disposal Alternative), either stabilizing the contaminants on-site or at a disposal facility, will meet the scope of the removal action objective to effectively abate threats due to the presence of soil and sediment contamination. All other soil and sediment removal alternatives are not effective in fully abating threats. The proposed groundwater remediation alternatives for the Vacant Lot site will have partial effectiveness since perimeter contamination will continue to migrate onto the site.

5.1.1 Overall Protection of Public Health and the Environment

Capping

Capping removes threats associated with direct exposure to surficial contaminated soil. This alternative will not completely eliminate groundwater posed risks, since the underlaying soils can still be contaminated due to migration of contaminated water.

In-Situ Stabilization

In-situ stabilization is effective when only metal contamination is prevalent in soil, and the contamination layer is at least 3 to 5 feet in depth. VOCs are not stabilized by in-situ stabilization. Due to the presence of VOC contamination, in-situ stabilization will not prevent exposure to all the contaminants found on site; therefore, protection of public health and the environment is not obtained.

SVE and In-Situ Stabilization

The SVE alternative will provide protection from VOC contamination. However, the SVE will not reduce the risk associated with lead, beryllium, and other metals-contaminated soil. In-situ stabilization alone, as previously discussed, will provide protection from metals contaminated with soil. Therefore SVE, followed by in-situ stabilization, will provide overall protection from the source/fill area contamination.

Excavation and Disposal

The removal of 3 feet of soil contaminated with metals and VOCs will mitigate threats and give overall protection of the public health and the environment posed by surficial soils. Apart from this, the removal of the source/fill area will eliminate threats posed to on-site groundwater from the source/fill material. Off-site migration of contaminated sediments will be eliminated by dredging sediments to a 3- to 4-foot depth, or to the onset of clay material. The Excavation and Disposal Alternative will provide protection of the public health and the environment.

SVE and Air Sparging

This alternative for perimeter groundwater remediation will not provide overall protection of public health and the environment since effective remediation requires addressing treatment of the off-site source area.

Air Stripping (Packed Tower Aeration)

Air stripping will provide partial protection of human health and the environment since there is a potential for drawing an off-site TCE contamination plume onto the site once groundwater extraction begins. Air stripping will remove VOCs and potential low levels of manganese from groundwater. However, extraction of groundwater will provide limited protection since the soil is in a potential groundwater pathway of a migrating off-site plume. Air stripping is not suitable for remediation on-site groundwater, and therefore, will not effectively render overall protection of public health and the environment.

5.1.2 Compliance with ARARS and other Criteria, Advisories, and Guidance

The evaluation of VOCs and setting remediation objectives based on these contaminants, are in compliance with Title 35 of the IAC, paragraph 742.505(b). The use of BAT (granular activated

carbon and packed tower aeration) for remediation of groundwater contamination is in compliance with Title 35 of the IAC, paragraph 611.311(b). Air emission control units will be used with air stripping and air Sparging units and will be in compliance with 42 CFR§112. Illinois and Federal ARARS applicable to the Vacant Lot site are presented and evaluated in Appendix D, Tables D-21 and D-22, respectively.

5.1.3 Long-Term Effectiveness and Permanence

The Air Stripping and Excavation and Disposal Alternatives do not require any long-term maintenance work, while Capping, In-Situ Stabilization and SVE Alternatives require long-term maintenance and monitoring. The Capping Alternative requires periodic work to maintain the integrity of the cap and requires the periodic collection of leachate samples. The SVE and In-Situ Stabilization Alternatives require long-term sampling of soil and leachate material. The soil Excavation and Disposal Alternative offers long-term effectiveness and is a permanent alternative for remediation of current soil contamination. Long-term effectiveness of sediment remediation is very uncertain because there appear to be many off-site sources contributing/causing the contamination, and some of those sources appear to be ongoing and beyond the scope of this EE/CA.

Once the contaminated soil is removed, the residual contaminated groundwater may not have any VOC contamination. However, the presence of manganese and other metals in on-site groundwater cannot be adequately addressed by this approach. Any long-term effectiveness and permanence of an alternative to mitigate on-site metal contamination will succeed only when off-site sources are eliminated.

Magnitude of Risk

The magnitude of risk posed by on-site contaminated soils to groundwater increases as more and more contaminants enter groundwater. Removal of contaminated soil and sediment will eliminate or minimize the magnitude of risk. The magnitude of risk for off-site migration decreases as the contaminated on-site groundwater is treated.

Adequacy

The Excavation and Disposal Alternative provides utmost adequacy of all the soil and sediment remediation alternatives considered for the Vacant Lot site. This alternative is adequate in eliminating all known on-site soil contamination sources. The In-Situ Stabilization Alternative alone,

and the Capping Alternative are inadequate since they do not eliminate all soil contribution sources.

Reliability of Controls

The Excavating and Disposal Alternative is the most reliable of the controls available for the Vacant Lot site, as it does not leave any residual contaminated soil on site. Capping will leave contaminated soil on site, which poses a potential threat to groundwater contamination in the long run, due to upgradient groundwater.

SVE, air sparging, and air stripping for reducing VOCs and subsequent metal reduction (flocculation and coagulation technique), is a very reliable control to reduce or eliminate VOC and metal contamination in groundwater. However, the reliability of this control is unpredictable if metals and other VOC contamination are being contributed from off-site sources.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Excavation and Disposal

Excavation and stabilization of contaminated soil at the Vacant Lot site is applicable for metal-contaminated and PAH-contaminated soil. Metal stabilization is achieved by mixing a binding agent (Portland cement) to contaminated soil, rendering nonleachable characteristics to metal contaminants. Toxicity characteristics are reduced below levels that are regulated by U.S. EPA. The contaminants are immobilized by Portland cement to the degree that they tend to leach only if the pH is changed considerably. The volume of metal contamination does not change by this stabilization, its leachable characteristics are reduced. Metal contamination in its entirety will still be present in the stabilized material. Metal stabilization is a widely used alternative and will satisfy the U.S. EPA's preference for treatment.

Capping

Capping will not reduce the toxicity or the volume of contaminated soil or sediments found on site. It will minimize the mobility of contaminants in groundwater.

In-Situ Stabilization

In-situ stabilization of the entire site soils, except the source/fill area, will reduce the mobility and toxicity of inorganics, but will increase the final volume of the treated material.

SVE and In-Situ Stabilization

SVE is applicable for removing VOC contamination in soil. Approximately 2,675 cubic yards of VOC- and metal-contaminated soil will need to be addressed by SVE. At the end of a successful SVE, the toxicity and mobility due to VOCs will be removed, and the soil concentration of VOC contamination will be reduced by greater than 98%. This SVE alternative is irreversible. SVE will be followed by in-situ stabilization to remediate metal contamination, which will reduce the mobility and toxicity, but not the volume of site contamination associated with metals.

SVE and Air Sparging

The degree of reduction expected in toxicity, mobility, and volume is unpredictable due to off-site contamination influence during treatment. While the actual treatment is irreversible, metal and VOC contamination in groundwater will likely be present since off-site sources still exist.

Air Stripping

Air stripping will reduce the toxicity, mobility, and volume of VOC contamination in the groundwater. The degree of reduction expected in toxicity, mobility, and volume is unpredictable due to off-site contamination migration influence during groundwater extraction. While the actual treatment is irreversible, residual VOC and metal contamination in groundwater will continue to be present until the off-site source removal action is implemented. This alternative will satisfy the U.S. EPA's preference for treatment only if contamination from off-site sources is eliminated.

5.1.5 Short-Term Effectiveness

Capping

The Capping Alternative requires substantial heavy equipment and can produce nuisance dust. However, these effects can be minimized with good engineering controls, proper air monitoring, and ensuring the workers conducting this alternative are protected with proper personal protective equipment (PPE). No adverse environmental impacts are anticipated during the implementation of this alternative. The Capping Alternative timeframe for completion is approximately 20 days.

In-Situ Stabilization

The In-Situ Stabilization Alternative requires substantial heavy equipment, can produce noise, nuisance dust, and a release of VOCs. Any effects on the surrounding community can be minimized

with good engineering controls and proper air monitoring. Any effects on on-site workers can be minimized by ensuring that workers conducting this alternative are protected with proper PPE. No adverse environmental impacts are anticipated during the implementation of this alternative. The In-Situ Stabilization Alternative timeframe for completion is approximately 90 days.

SVE and In-Situ Stabilization

The SVE and In-Situ Stabilization Alternative requires substantial heavy equipment, can produce noise, nuisance dust, and a release of VOCs. Any effects on the surrounding community can be minimized with good engineering controls and proper air monitoring. Any effects on on-site workers can be minimized by ensuring that workers conducting this alternative are protected with proper PPE. No adverse environmental impacts are anticipated during the implementation. The SVE and In-Situ Stabilization Alternative timeframe for completion is approximately 125 days.

Excavation and Off-Site Disposal

The excavation and off-site disposal of hazardous and nonhazardous material requires substantial heavy equipment, can produce noise, nuisance dust, and a release of VOCs. Any effects on the surrounding community can be minimized with good engineering control and proper air monitoring. Any effects on on-site workers can be minimized by ensuring that workers conducting this alternative are protected with proper PPE. No adverse environmental impacts are anticipated during the implementation of this alternative. Increased traffic activity will be visible in the community. Minimal to moderate impact is anticipated, as some plants/trees may need to be removed from work areas. To remove the sediments, the industrial outfalls and the city stormwater outlet into the Creek must be rerouted. This requires installing additional pipelines to the south of 22nd Street. Once the contaminated soil is removed, no further soil remediation action is anticipated. A reasonable timeframe for this alternative is approximately 30 days.

Excavation, On-Site Stabilization and Off-Site Disposal

This alternative requires considerable heavy equipment, can produce noise, nuisance dust, and a release of VOCs. However, these effects can be minimized with good engineering controls, proper air monitoring, and ensuring the workers conducting this alternative are protected with proper PPE. Any effects on on-site workers can be minimized by ensuring that workers conducting these alternatives are protected with proper PPE. Increased traffic activity will be visible in the

community. A reasonable timeframe for this alternative is approximately 50 days.

After excavation, the on-site soil will be replaced by clean soil. The remediation of contaminated sediments may occur after identifying all off-site sources. When implementing sediment remediation, the Creek can be restored by backfilling with clean sediments. LCSWMC has developed a restoration plan, the design of which requires installing a fabric liner at the bottom of the Creek and overlay it with a layer of aggregate. Based on further coordination between U.S. EPA and LCSWMC, the proposed plan may be implemented. The community surrounding the site will no longer be posed with potential off-site contamination migration threats, and all threats posed to human health and the environment will have been abated.

Source Excavation

The Source Excavation Alternative requires considerable heavy equipment, can produce noise, nuisance dust, and a release of VOCs. This release can be monitored using air monitoring equipment, and necessary actions can be taken to prevent undue release to the environment. Due to the site's location in an industrial environment, this alternative's activities pose minimal threats to residences located north of the site. No adverse environmental impacts are anticipated during the implementation of this alternative. A reasonable timeframe for completing this alternative is approximately 10 days.

SVE and Air Sparging

This alternative requires installation of vapor extraction wells, groundwater monitoring wells, and inspection wells. During the construction phase, noise pollution may need to be addressed. Strict controls on air emission units will help curb nuisance emissions. Once the treatment alternative is implemented, there will be minimal environmental impacts. The effectiveness of this alternative can be readily measured at the extraction wells, monitoring wells, and the inspection wells for the SVE; and at the air emission units for the air sparging. A reasonable timeframe for completing this alternative is approximately 40 days.

Air Stripping

This alternative requires construction of two air stripper units, one air emission control unit, and recovery wells. During the construction phase, noise pollution may need to be addressed. Strict controls on air emission units will help curb nuisance emissions. Once the treatment alternative is

implemented, there will be minimal environmental impacts. The effectiveness of this alternative can be monitored by sampling inlet and outlet streams of the air emission units. A reasonable timeframe for completing this alternative is approximately 45 days.

5.2 Implementability

Capping; In-Situ Stabilization; SVE and In-Situ Stabilization; Excavation followed by On-Site or Off-Site Stabilization and Off-Site Disposal; SVE and Air Sparging; and Air Stripping Alternatives are evaluated for their technical feasibility, administrative feasibility, availability of services and materials, and State and community acceptance.

5.2.1 Technical Feasibility

Implementation of any of the selected alternatives involves operation of heavy machinery. The degree of difficulty in operating these machines is minimal. The following is a brief technical feasibility evaluation of each alternative.

Capping

Capping the site involves low to moderate labor difficulty and is easy to install. Routine maintenance of the cap involves little or no degree of difficulty.

In-Situ Stabilization

The In-Situ Stabilization Alternative is labor intensive. Portland cement can be easily procured for on-site stabilization. The degree of difficulty in implementing this alternative is moderate.

SVE and In-Situ Stabilization

The SVE and In-Situ Stabilization Alternative is labor intensive. Portland cement can be easily procured for on-site stabilization. The degree of difficulty in implementing this alternative is moderate.

Excavation and Off-Site Disposal

Excavation and Off-Site Disposal is a very common alternative and easy to implement. The degree of difficulty in implementing this alternative is low.

Excavation, On-Site Stabilization and Off-Site Disposal

Portland cement can be easily procured for on-site stabilization. Excavation and stabilization is a very common and widely used technology for stabilization of metals-contaminated soil. Stabilization involves the addition of the correct proportion of additive, and the degree of difficulty in implementing this alternative is moderate.

Source Excavation

Source Excavation is a very common alternative and easy to implement. The degree of difficulty in implementing this alternative is low.

SVE and Air Sparging

The SVE and Air Sparging Alternative is widely used in groundwater remediation and the units are readily available on the market. Construction of the SVE and air sparging units are complex and labor intensive. The degree of difficulty involved in the maintenance and operation of the units is moderate.

Air Stripping

The air stripping units and air emission control units are readily available on the market. Air stripping units construction is complex and labor intensive. The degree of difficulty involved in the maintenance and operation of the units is relatively moderate.

5.2.2 Administrative Feasibility

Administrative feasibility requires the following to be addressed before excavation:

- Conduct and evaluate treatability study for on-site stabilization of contaminated soil/sediment.
- Select a contractor to supply services and materials, if the On-Site Stabilization Alternative is chosen.
- Select a disposal facility for direct disposal of nonhazardous soil/sediment.
- Select disposal facility for a) stabilization at the disposal facility and subsequent landfill, b) disposal of on-site stabilized soil and sediments.
- Select a contractor to perform a design study for groundwater

treatment.

- Select a contractor to conduct groundwater treatment.
- Select all air emission substantive requirements, treated water discharge substantive requirements, and dewatered filter cake material disposal substantive requirements and facility.
- Select contractor to supply backfill material.
- Obtain all permits, waivers, and other pertinent documents from the federal, state, and local governments before on-site work commences.
- Develop proper operation and maintenance procedures of treatment units.

5.2.3 Availability of Services and Materials

All equipment, personnel, services, and materials, and other resources needed to complete excavation, off-site disposal, on-site stabilization and off-site disposal, capping, and installation of water treatment units are expected to be procured prior to and in time to maintain all schedules involved with said process.

U.S. EPA will coordinate with selected contractor(s) and applicable agencies to ensure compliance with all pertinent federal, state, and local requirements, and requirements of this report.

5.2.4 State and Community Acceptance

State and community acceptance of the options will be evaluated after the public comment period. U.S. EPA shall consider and address state and community acceptance of an alternative when making a recommendation, and in the final selection of the alternative in the Action Memorandum.

5.3 Costs

The Capping, Excavation, In-Situ Stabilization, SVE and In-Situ Stabilization, SVE and Air Sparging, and Air Stripping Alternatives' costs are evaluated. Two excavation alternatives are applicable for remediation soil and sediment contamination. The first alternative, Excavating and Direct Disposal, would take place at an approved landfill. Excavated soil and sediments have contaminants above RALs, but below the regulatory disposal criteria to be classified as hazardous material. Based on this disposal criteria, the contaminated soil can be classified as nonhazardous for disposal and directly landfilled, or otherwise used as landfill cover. The second alternative,

Stabilization and Off-Site Disposal, is applicable to contaminated soil and sediments that are above RALs and are also above the regulatory disposal criteria to be classified as hazardous material. The majority of hazardous soil and sediment contamination on site is due to leachable characteristics of lead. This material must be stabilized prior to disposal to render it nonhazardous (i.e., rendering lead leachable characteristics to below 5 mg/L). PCB-contaminated soil is also present and needs to be disposed of at a TSCA-approved facility. The VOC-contaminated soil in the source/fill area will be disposed of after stabilizing the metal contamination. The following assumptions are applicable to the costs of each alternative:

- The Capping Alternative requires capping the entire site, except the Creek. This requires capping the areas which are not contaminated, in order to maintain continuity of the layer.

- The In-Situ Stabilization Alternative is applicable to the entire site area, except the source/fill area and the Creek. In-situ stabilization would be performed in the areas which are not contaminated, since hazardous and nonhazardous soil cannot be separated without excavation.

- The SVE and In-Situ Stabilization Alternative is only applicable to the source/fill area. Design criteria requires performing SVE on a 250-foot by 150-foot area, followed by in-situ stabilization.

- The Excavation Alternative requires removal of 2 feet of soil from the entire site (except areas mentioned under Section 2.4.1), the deeper contamination at the source/fill area, and the PCB waste area. For cost estimate purposes, a 3-foot instead of a 2-foot excavation is considered, amounting to approximately 24,200 cubic yards of contaminated soil.

- The source/fill area around grid nodes I2, J2, and K2 has contamination to a 4-foot depth (2,675 cubic yards), while around I2, soil is contaminated to a 9-foot depth (75 cubic yards).

- Approximately a 100-foot by 25-foot area, around grid nodes K1 and K2, needs to be excavated to a 2-foot depth, and would be disposed of as PCB waste (approximately 200 cubic yards).

- All the soil from the source/fill area and approximately 30% of the remainder of the excavated soil and sediments of the site is expected to be classified as hazardous material, amounting to a total of 10,250 cubic yards of soil, and 275 cubic yards of sediment, and would be stabilized before landfilling.

- Nonhazardous soil material for direct landfilling is estimated to be

15,400 cubic yards.

- Sediment from the creekbed is to be excavated to 3- to 4-foot depths, or to the onset of clay, and up to 7-foot depths in the northern part of the Creek. A majority of the excavated sediments are expected to be classified as nonhazardous based on disposal criteria, and will be directly landfilled. Approximately 910 cubic yards of sediments need to be excavated.

- All excavated areas will be backfilled with clean soil to 2 feet, followed by 1 foot of top soil. The creekbed will be backfilled with clay and sediment quality material that can support biological life, or will be restored per the LCSWMS plan.

- After the soil and source/fill area remediation, there may not be any on-site source contributing to the groundwater contamination. Metal contamination in groundwater is presumed to be naturally occurring and native to the site area. Groundwater still needs to be monitored after this removal, due to the potential for off-site plume migration onto the site.

- The SVE and Air Sparging, and Air Stripping Alternatives are applicable to the presumed treatment of the TCE plume at the source area off site.

- A 15% increase in volume was used for materials that are stabilized.

- A 30% fluff factor was used for backfilling.

5.3.1 Direct Capital Costs

Capping
Direct costs for this alternative include labor, equipment, materials, and PPE:

Labor	$ 4,000
Materials (including clay, sand, soil, landscaping, and geoliner)	946,760
Site preparation (clearing debris, grading, removal of vegetation)	4,000
Installation of fence	32,400
Total direct costs	$987,160

SVE and In-Situ Stabilization
Approximately 2,750 cubic yards of the source/fill area soil would be used for this alternative:

Mobilization and demobilization	$12,000
Excavation for vertical wells and trench (@$31/linear foot)	14,400
Piping, etc.	11,700
Flow meter	8,000
Vacuum	6,000

Geoliner		8,000
GAC unit		2,200
Miscellaneous		5,000
	Total direct costs	$67,300

In-Situ Stabilization

Mobilization, reagent and stabilization cost (17,400 cubic yards nonhazardous and 10,250 hazardous @$111/cubic yards)		$3,069,150
Sampling (approximately 300 cubic yards/day at 92 days)		67,100
	Total direct costs	$3,136,250

Nonhazardous Material - Soil Excavation and Direct Disposal
Approximately 15,400 cubic yards of nonhazardous soil will be excavated to a 3-foot depth and disposed of at a landfill. The excavated area will be backkfilled. Direct costs for this alternative include labor, equipment, excavation, analysis of samples, transportation to a disposal facility, disposal, backfilling, and PPE:

Excavation and all other work		$ 133,343
Transportation (approximately 15,400 cubic yards @$21.25/ton)		327,250
Disposal (approximately 15,400 cubic yards @$40.00/ton)		616,000
Backfilling (approximately 20,020 cubic yards @$8.75/ton)		175,175
	Total direct costs	$1,251,768

Nonhazardous Material -Sediment Excavation and Direct Disposal
Approximately 640 cubic yards of nonhazardous sediment will be excavated from the entire creekbed to a 3- to 4-foot depth and to a 7-foot depth, from sample location SED7 to the northern tip of the Creek, and disposed of at a landfill. The excavated area will be backkfilled or restored per the LCSWMC plan. Direct costs for this alternative include labor, equipment, excavation, analysis of samples, transportation to a disposal facility, disposal, restoration, and PPE:

Excavation and all other work		$32,000
Transportation (approximately 640 cubic yards @$21.25/ton)		13,600
Disposal (approximately 640 cubic yards @$40.00/ton)		25,600
Restoration (aggregate, filter fabric, seeding, and top soil)		17,525
	Total direct costs	$88,725

Hazardous Material Disposal - Soil Excavation, Off-Site Stabilization and Disposal
Direct costs for this alternative include expenses for labor, equipment, excavation, transportation to disposal facility, disposal, analysis of samples, backfilling, and PPE:

Excavation and all other work		$ 37,366
Transportation (approximately 10,250 cubic yards @$ 15.00/ton)		153,750
Disposal (approximately 10,250 cubic yards @$ 100/ton)		1,025,000
Disposal of PCB-contaminated material (200 tons @$500/ton)		100,000
Backfilling (approximately 13,585 cubic yards @$8.75/ton)		118,870
Demurrage		5,000
	Total direct costs	$1,439,986

Hazardous Material Disposal - Sediment Excavation, Off-Site Stabilization and Disposal
Direct costs for this alternative include expenses for labor, equipment, excavation, transportation to disposal facility, disposal, analysis of samples, and PPE:

Excavation and all other work	$ 8,000
Transportation (approximately 275 cubic yards @$ 15.00/ton)	4,125
Disposal (approximately 275 cubic yards @$ 100/ton)	27,500
Demurrage	2,000
Total direct costs	$41,625

Soil Excavation, On-Site Stabilization and Off-Site Disposal
This option involves on-site stabilization of hazardous material using cement, and then disposing of the stabilized material at an approved landfill. Approximately 10,250 cubic yards of hazardous material is expected to be stabilized for rendering TCLP lead characteristics below 5 mg/L (regulatory limit). An estimated 50-day work period is used. The anticipated costs are as follows:

Equipment (pugmill, excavator, front-end loader)	$ 22,000
Labor	123,300
Work supplies (trailers, PPE, sampling equipment)	172,052
Excavation (approx. 10,250 cubic yards, excludes transportation and backfilling)	37,366
Transportation (approximately 12,000 cubic yards @ $21.25/ton)	255,000
Disposal of PCB-contaminated material (200 tons @ $500/ton)	100,000
Disposal (approximately 11,800 cubic yards @ $40.00/ton)	472,000
Backfilling (approximately 12,060 cubic yards @8.75/ton)	105,525
Total direct costs	$1,287,243

Sediment Excavation, On-Site Stabilization and Off-Site Disposal
This option involves on-site stabilization of hazardous sediments using cement, and then disposing of the stabilized material at an approved landfill. Approximately 275 cubic yards of hazardous material is expected to be stabilized for rendering TCLP lead characteristics below 5 mg/L (regulatory limit). An estimated 50-day work period is used. The anticipated costs are as follows:

Equipment (pugmill, excavator, front-end loader)	$ 2,000
Labor	8,000
Work supplies (trailers, PPE, sampling equipment)	3,500
Excavation (approximately 10,250 cubic yards, excludes transportation and	3,440
Transportation (approximately 360 cubic yards @ $21.25/ton)	8,000
Disposal (approximately 360 cubic yards @ $40.00/ton)	14,400
Demurage	2,000
Total direct costs	$41,340

Groundwater Remediation - Source Excavation and Stabilization
This option involves on-site stabilization of hazardous material using cement, and then disposing of the stabilized material at an approved landfill. Approximately 2,750 cubic yards of hazardous material is expected to be stabilized for rendering TCLP lead characteristics below 5 mg/L (regulatory limit). An estimated 6-day work period is used. The anticipated costs are as follows:

Equipment (pugmill, excavator, front-end loader)	$ 22,000

Labor	24,600
Work supplies (trailers, PPE, sampling equipment)	51,800
Transportation (approximately 1,300 cubic yards @ $21.25/ton)	27,625
Disposal (approximately 1,300 cubic yards @ $40.00/ton)	52,000
Backfilling (approximately 1,300 cubic yards @ $8.75/ton)	11,375
Total direct costs	$189,400

Soil Vapor Extraction and Air Sparging

Two areas of approximately 250 feet by 175 feet are assumed to be contaminated with VOCs for evaluating costs:

SVE	
Mobilization and demobilization	$ 16,000
Excavation of trenches, wells (@ $31/linear foot)	26,050
Piping, etc.	19,400
Flow meter	12,000
Vacuum pumps (2)	14,000
Blowers (2)	12,000
Geoliners (2)	20,000
GAC unit	2,200
Air Sparging	
Mobilization and demobilization	10,000
Drilling wells (@ $50.75/linear foot x 25 x 10)	12,700
Piping, etc.	5,500
Flow meter	2,000
Air rotary	11,525
Blower	6,700
Miscellaneous (decontamination, fencing for SVE and air sparging, etc.)	5,000
Total direct costs	$175,075

Air Stripping/GAC Treatment

Direct costs include construction of two wells; construction of a 50,000-gallon storage tank to store groundwater before treatment; installation of two air strippers, including a building; construction of a 50,000-gallon storage tank to store treated water before sampling and discharging; pumps; pump power and electrical work.

Two 30-foot wells	$ 3,600
Two 50,000-gallon storage tanks	40,000
Six pumps	12,000
Pump hoses and electrical hookup	14,000
Air stripper units	214,500
GAC unit	56,700
Auto Sampler for the GAC emissions	50,000
Total direct costs	$390,800

5.3.2 Indirect Capital Costs

Capping

Contractor services, including oversight and planning		$70,000
Permits, etc.		5,000
	Total indirect costs	$75,000

In-Situ Stabilization

Contractor services, including oversight and planning		$100,000
Permits, etc.		10,000
	Total indirect costs	$110,000

SVE and In-Situ Stabilization

Contractor services, including oversight and planning		$125,000
Permits, etc.		10,000
	Total indirect costs	$135,000

Nonhazardous Material - Soil Excavation and Direct Disposal
Contractor costs for on-site work, designing final backfill slope (gradient), disposal permits, etc., for the alternative are:

Contractor services		$70,000
Permits, etc.		5,000
	Total indirect costs	$75,000

Nonhazardous Material - Sediment Excavation and Direct Disposal
Contractor costs for on-site work, designing restoration plan, disposal permits, etc., for the alternative are:

Contractor services		$10,000
Permits, etc.		2,000
	Total indirect costs	$12,000

Hazardous Material - Off-Site Stabilization and Disposal of Soil
Contractor costs for planning, on-site work, disposal permits, etc., for the alternative are:

Contractor services		$60,000
Permits, etc.		5,000
	Total indirect costs	$65,000

Hazardous Material - Off-Site Stabilization and Disposal of Sediment
Contractor costs for planning, on-site work, disposal permits, etc., for the alternative are:

Contractor services		$2,000
Permits, etc.		2,000
	Total indirect costs	$4,000

On-Site Stabilization and Off-Site Disposal of Soil

Contractor services		$55,000
Permits, etc.		5,000
	Total indirect costs	$60,000

On-Site Stabilization and Off-Site Disposal of Sediment

Contractor services		$10,000
Permits, etc.		5,000
	Total indirect costs	$15,000

Source Excavation

Contractor services		$30,000
Permits, etc.		5,000
	Total indirect costs	$35,000

SVE and Air Sparging

Contractor services		$75,000
Permits, etc.		10,000
	Total indirect costs	$85,000

Air Stripping/GAC Treatment
Indirect costs for this alternative are associated with engineering and design of air stripper units, storage tanks, drilling contractor services, and obtaining permits:

Drilling contractors services		$10,000
Engineering contractor services		65,100
	Total indirect cost	$75,100

5.3.3 Long-term Operation and Maintenance Costs

Capping
Long-term operation and maintenance costs for this alternative are based on a 10-year period at 10% interest rate:

Item	Annual Cost	Present Worth
Groundwater and soil monitoring	$5,000	$30,725

Maintenance of cap		1,000	6,145
	Total indirect costs	$6,000	$36,870

In-Situ Stabilization
Requires long-term maintenance. Long-term operation and maintenance costs for this alternative are based on a 10-year period at 10% interest rate:

Item		Annual Cost	Present Worth
Groundwater and soil monitoring		$5,000	$30,725
	Total indirect costs	$5,000	$30,725

SVE and In-Situ Stabilization
Requires long-term maintenance. Long-term operation and maintenance costs for this alternative are based on a 10-year period at 10% interest rate:

Item		Annual Cost	Present Worth
Groundwater and soil monitoring		$5,000	$30,725
	Total indirect costs	$5,000	$30,725

Nonhazardous Material - Soil and Sediment Excavation and Direct Disposal
No long-term operation and maintenance costs for these alternatives are anticipated.

Hazardous Material Disposal - Soil and Sediment Excavation and Off-Site Disposal
No long-term operation and maintenance costs for these alternatives are anticipated.

On-Site Stabilization and Off-Site Disposal of Soil and Sediment
No long-term operation and maintenance costs for these alternatives are anticipated.

Source Excavation
No long-term operation and maintenance costs are expected for this alternative.

SVE and Air Sparging
Long-term operation and maintenance costs for this alternative are based on a 10-year period at 10% interest rate:

Item		Annual Cost	Present Worth
Air flow meters		$24,000	$147,470
Maintenance of pumps		3,000	18,435
Electricity		3,000	18,435
Labor		5,000	30,725
	Total indirect costs	$35,000	$215,065

Air Stripping/ GAC Treatment
The following are the long-term operation and maintenance costs for this alternative based on a 10-year period at 10% interest:

Item	Annual Cost	Present Worth
Well pumping power	$ 5,600	$ 34,410
Maintenance of pumps	3,000	18,435

Air stripper-amortized	31,300	192,325
Air stripper tower pumping power	5,600	34,410
Electric blower for air stripper	5,100	31,338
Fin water pump power	1,730	10,630
Maintenance material	322	1,979
Air stripper operation and maintenance	5,110	31,338
Off-gas blower and heater power	8,800	54,072
Maintenance material	440	2,704
Operation and maintenance labor of GAC	6,900	42,398
Off-site GAC regeneration	45,300	278,349
GAC make up	13,000	79,890
Sampling and analysis of VOCs:		
First year @ 100 samples/year	20,000	18,185
Years 2 to 10 @ 26 samples/year	11,700	67,381
Total indirect costs	$163,902	$897,844

6. Comparative Analysis of Removal Action Alternatives

The most effective and suitable removal action alternative to abate threats to human health and the environment is the Excavation and Disposal Alternative for contaminated soil. A portion of the contaminated material can be disposed of without any treatment, while other material will require stabilization. Economic considerations will dictate whether on-site stabilization before off-site disposal, or off-site stabilization and off-site disposal at a landfill, is chosen. An added advantage of the Excavation and Disposal Alternative is that it most likely will eliminate a primary source of vinyl chloride and other VOC contamination which migrates into the groundwater.

SVE to remove VOC contamination from the source/fill area will only be partially effective since it does not remediate inorganic contamination. Therefore, even after SVE, the source/fill area will need to be excavated, stabilized, and disposed of, or undergo in-situ stabilization in order to remediate metal contamination. However, the concentration of VOCs in the source/fill area is below regulatory disposal criteria, and as such, requires no stabilization for off-site disposal. Therefore, if the Excavation and Disposal Alternative is chosen, substantial savings are envisioned, since no VOC stabilization is required.

The Capping Alternative is not a viable removal action since groundwater upgradient of the site can still migrate to the site and maintain contaminant levels. A comparative analysis of removal action alternatives, along with projected costs are presented in Appendix D, Tables D-23 and D-24.

The In-Situ Stabilization Alternative was briefly considered, but again this technology does not effectively treat VOC contamination. Lead and other metal contamination is prevalent in the top 2 feet of soil; in-situ is not a suitable technology for surficial contamination of 2 feet or less.

The on-site segment of the Creek remediation should be considered only if upgradient sources are addressed first. This may include stopping the contaminated ditch water inlet into the Creek, and the City of North Chicago must oversee that the stormwater discharge into the Creek is free of contamination.

On-site groundwater contamination is very difficult to characterize and address because different contaminants exist at different locations on and off the site. The only common contaminant present in the majority of all of the monitoring wells and the Geoprobe water samples is manganese. By removing the source/fill area, vinyl chloride, 1,2- DCE, and other VOC contamination migration to the groundwater from on-site sources will be eliminated. However, perimeter sampling by Geoprobe equipment along the eastern fence indicates TCE and manganese contamination may be originating from an off-site source. The southeast Geoprobe water sample contained the highest detected concentration in the on-site groundwater. Summarizing the prevailing groundwater contamination also requires the following assumptions:

- Manganese detected in upgradient, as well as downgradient locations in groundwater, could be a naturally occurring contaminant or may also be a background contaminant.
- TCE concentrations along the eastern and southeastern perimeter of the site indicates a potential TCE plume migrating onto the site, following the downgradient groundwater flow path.
- Localized groundwater contamination in the source/fill area soils is due to soil contamination in the source/fill area.

Any groundwater remediation will escalate contamination rather than reducing it at parts of the site, as well as introduce new contamination, due to a potential migration of the off-site plume.

However, air stripping is considered as one of the effective treatment technologies to remediate VOC-contaminated water. This technology is to be considered only when TCE concentrations in on-site groundwater are present in considerable amounts, or if groundwater remediation is to occur at the perimeter of the site.

Since pumping the groundwater creates a demand, the demand may potentially draw a known TCE plume northeast of the site, on a path towards the source/fill area. Also, the Pump and Treat Air Stripping Alternative has two considerable drawbacks. Pump and treat methods are only beneficial if no off-site sources are contributing to the on-site contamination. Due to the presence of a known TCE plume northeast of the site and the potential groundwater pathway leading towards the source/fill area, any attempt to pump and treat on site will induce a demand, and can potentially draw the contaminated off-site plume onto the site. Therefore it is appropriate to look into off-site source areas before formulating and finalizing a groundwater response action.

Air stripping removes the VOCs, but will not remove manganese and other metal (inorganic) contamination. After removing the VOC contamination, the treated groundwater will need to be addressed for metal contamination, and may need to be disposed of at a treatment facility.

In terms of cost effectiveness, the hazardous soil Excavation and On-Site Stabilization and Off-Site Disposal Alternative ($1,360,588) is comparatively less expensive than the hazardous soil Excavation and Off-Site Stabilization and Disposal Alternative ($1,504,980). The SVE and In-Situ Stabilization Alternative for soil remediation ($3,338,550) is expensive when compared to all other soil remediation alternatives.

All effective soil remediation alternatives also include remediation of the source/fill area, which is also a contributing groundwater contamination source for monitoring wells MW-3 and GMMW-2. This means that the On-Site Source Excavation and Stabilization Alternative for groundwater remediation ($224,400) is applicable only when no other source/fill area remediation is undertaken in any of the soil remediation alternatives.

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Appendix A

Sampling Plan

ENGINEERING EVALUATION/COST ANALYSIS SUPPORT SAMPLING PLAN
FOR
THE VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
TDD: S05-9609-017
PAN: 6P1701REXX

December 9, 1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Emergency and Enforcement Response Branch
77 West Jackson Boulevard
Chicago, Illinois 600604

Raghu Nagam, START Project Manager	**Date**
John O'Grady, U.S. EPA Remedial Project Manager	**Date**
Tom Kouris, START Program Manager	**Date**

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1.0 Site Background

The Vacant Lot (VL) site is a former parking lot located in the City of North Chicago, Lake County, Illinois (Figure 1-1). Historical information indicates that VL site might have been used for receiving industrial fill of unknown quantity and type. An intermittent creek called Pettibone Creek originates at the northwest boundary of the VL site and flows south across the site. Several storm sewers and industrial outfalls from neighboring facilities reportedly discharge into Pettibone Creek (Figure 1-2). Investigation of an underground fire in one of the reported fill areas of the VL site had first indicated potential contamination at the site. The soils, fill, and sediments at the VL site are contaminated with a variety of heavy metals and organic chemicals including chlorinated solvents, polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). The groundwater at the VL site is also contaminated with heavy metals and chlorinated solvents. The nearest residents are located within ½ mile to the north. The VL site is approximately 6 acres in size and is not currently in use.

A sampling event is being proposed as part of an Engineering Evaluation/Cost Analysis (EE/CA) to evaluate removal alternatives addressing threats posed to human health and/or the environment by contaminated media found on-site. This sampling event will also help estimate the volume of contaminated soils and sediments and delineate groundwater contamination plume. Table 1-1 summarizes the known contaminants of concern. Although other compounds and analytes have been detected in on-site groundwater, soils, and sediments, only those currently exceeding action/cleanup levels as specified in the Risk-Based Concentration Table (Reference 1) and Numeric Removal Action Levels For Contaminated Drinking Water Sites (Reference 2) are listed in Table 1-1. Tables 1-2, 1-3, 1-4, and 1-5 list the analytical results of historical sampling conducted on-site and off-site.

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Table 1-1

SUMMARY OF KNOWN CONTAMINANTS OF CONCERNS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Concentration Range
Inorganics	
Arsenic	ND - 485 mg/kg in soils
Beryllium	0.78 - 58.1 mg/kg in soils 0.36 - 5.1 mg/kg in sediments
Cadmium	ND - 0.0164 mg/L in groundwater
Chromium	ND - 0.212 mg/L in groundwater
Lead	ND - 2.01 mg/L in groundwater ND - 12,600 mg/kg in soils ND - 1,410 mg/kg in sediments
Manganese	0.019 - 1.05 mg/L in groundwater
Mercury	ND - 0.0222 mg/L in groundwater
Zinc	ND - 7.17 mg/L in groundwater 1.13 - 54,900 mg/kg in soils
Volatile Organic Compounds	
1,1-dichloroethene	ND - 0.059 mg/L in groundwater
1,2-dichloroethene	ND - 13.0 mg/L in groundwater
Trichloroethene	ND - 0.11 mg/L in groundwater ND - 45 mg/kg in soils
Vinyl chloride	ND - 2.8 mg/L in groundwater
Semivolatile Organic Compounds	
Benzo(a)pyrene	ND - 2.4 mg/kg in soils ND - 8.2 mg/kg in sediments
Benzo(a)anthracene	ND - 7.5 mg/kg in sediments
Benzo(b)fluoranthene	ND - 7.1 mg/kg in sediments
Polychlorinated Biphenyls	
PCBs	ND - 0.001 mg/L in groundwater ND - 36.3 mg/kg in soils ND - 14.9 mg/kg in sediments

Key: ND = Not detected (less than analytical method detection level).
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

Table 1-2

SUMMARY OF ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E&E S-1 9/94	E&E S-4 9/94	E&E S-5 9/94
Inorganics																		
Arsenic	23	610	ND	ND	ND	ND	ND	3.0	1.33	1.20	*23.2*	*485*	22.8	*29.8*	16.4	19.0	*29.0*	*32.0*
Barium	5,500	1.4E5	53.1	525	42.1	20.1	26.9	ND	ND	ND	364	120	294	210	227	70.0	395	337
Beryllium	0.15	1.3	NA	NA	NA	NA	NA	NA	NA	NA	*54.9*	*2.10*	*58.1*	*57.7*	*15.90*	*3.50*	*0.78*	*21.5*
Cadmium	39	100	0.68	9.46	0.68	ND	ND	0.26	2.99	0.89	35.0	8.80	18.5	19.1	21.7	3.0	18.6	29.9
Chromium	390	10,000	7.72	12.8	10.8	5.35	8.6	16	24.8	14.9	228	32.3	133	136	107	28.0	337	176
Copper	3,100	82,000	NA	NA	NA	NA	NA	NA	NA	NA	38.8	0.910	27.0	28.5	14.3	2,500	*10,900*	*24,700*
Lead	400	None	221	*3,881*	295	20.7	ND	79.3	*1,250*	227	*12,600*	*558*	*8,300*	*8,810*	*8,680*	*1,000*	*6,020*	*6,210*
Manganese	390	10,000	NA	NA	NA	NA	NA	NA	NA	NA	*2,540*	*539*	*3,190*	*3,440*	*1,200*	*710*	*814*	*1,770*
Mercury	23	610	0.417	0.35	0.089	0.189	0.023	0.03	0.07	0.04	1.13	0.66	0.33	0.29	3.23	1.7	3.33	0.51
Selenium	390	10,000	ND	ND	ND	ND	ND	ND	ND	ND	4.06	ND	5.57	5.50	6.41	ND	ND	ND
Silver	390	10,000	5.08	2.43	16.3	1.75	4.50	10.4	2.52	1.13	9.90	3.30	8.40	8.90	49.2	3.8	7.4	21.7
Zinc	23,000	6.1E5	NA	NA	NA	NA	NA	NA	NA	NA	99.0	1.97	82.5	89.3	37.2	8,400	22,100	*54,900*
Volatile Organic Compounds																		
Acetone	7,800	2.0E5	NA	NA	NA	NA	NA	NA	NA	NA	0.019	ND	ND	0.004	0.007	NA	NA	NA

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Table 1-2

SUMMARY OF ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E&E S-1 9/94	E&E S-4 9/94	E&E S-5 9/94
2-Butanone	47,000	1.0E6	NA	NA	NA	NA	NA	NA	NA	NA	0.018	ND	ND	ND	ND	NA	NA	NA
1,1-Dichloroethene	1.1	9.5	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene	780	20,000	ND	ND	ND	ND	ND	NA	NA	NA	0.029	ND	ND	ND	0.056	5.1	NA	NA
Methylene chloride	85	760	ND	ND	ND	0.031	ND	NA	NA	NA	NA	NA	NA	NA	NA	2.40	NA	NA
1,1,1-Trichloroethane	7,000	1.8E5	ND	ND	ND	ND	0.0051	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA	NA
Trichloroethene	58	510	ND	ND	ND	ND	0.091	NA	NA	NA	0.44	ND	ND	ND	0.13	45	NA	NA
Tetrachloroethene	12	110	ND	ND	ND	ND	ND	NA	NA	NA	0.003	ND	ND	ND	0.024	0.93	NA	NA
Toluene	16,000	4.1E5	ND	0.0429	ND	ND	ND	0.014	0.030	0.024	0.007	ND	ND	ND	ND	ND	NA	NA
Vinyl chloride	0.34	3.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA
Semivolatile Organic Compounds																		
Benzo(a)anthracene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	0.19	*2.30*	ND	0.26	*1.00*	NA	NA	NA
Benzo(b)fluoranthene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	0.44	*3.40*	0.49	*1.10*	*0.98*	NA	NA	NA
Benzo(a)pyrene	0.088	0.78	ND	ND	ND	ND	ND	NA	NA	NA	ND	*2.40*	*0.23*	*0.57*	*0.52*	NA	NA	NA
Fluoranthene	NS	NS	ND	ND	ND	ND	ND	NA	NA	NA	0.270	4.00	0.19	0.34	1.10	NA	NA	NA
deno(1,2,3-cd)pyrene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	NA	NA

Table 1-2

SUMMARY OF ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E&E S-1 9/94	E&E S-4 9/94	E&E S-5 9/94
Phenanthrene	NS	NS	ND	ND	ND	ND	ND	NA	NA	NA	0.25	3.80	0.18	0.23	0.70	NA	NA	NA
Pyrene	2,300	61,000	ND	ND	ND	ND	ND	NA	NA	NA	0.29	3.70	0.26	0.36	1.60	NA	NA	NA
Pesticides																		
Aldrin	0.038	0.34	NA	NA	NA	NA	NA	NA	NA	NA	*0.066*	*0.067*	0.024	0.028	*0.049*	NA	NA	NA
Chlordane	0.49	4.4	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	NA	NA	NA
4,4'-DDE	1.9	17	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	1.80	NA	NA	NA
4,4'-DDT	1.9	17	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.18	0.0089	0.012	1.40	NA	NA	NA
Dieldrin	0.04	0.36	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.016	0.0037	0.0049	ND	NA	NA	NA
Endrin	23	610	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.170	ND	ND	ND	NA	NA	NA
Heptachlor epoxide	0.07	0.63	NA	NA	NA	NA	NA	NA	NA	NA	0.027	ND	ND	ND	ND	NA	NA	NA
Polychlorinated Biphenyls																		
Total PCBs	0.083	0.74	ND	ND	ND	*0.238*	*2.25*	*36.3*	*12.8*	*13.9*	*2.57*	*7.50*	*1.26*	*1.28*	*5.80*	*17.4*	ND	NA

Key:
E = power of 10.
RBC = Risk based concentration via exposure by soil ingestion (U.S. EPA 1995b).
R = Residential exposure scenario.
I = industrial exposure scenario.
MAEC = MAECORP, Inc.
Enviro = Envirodyne Engineers, Inc.

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IEPA = Illinois Environmental Protection Agency.
E & E = Ecology and Environment, Inc.
ND = Not detected.
NA = Not analyzed.
mg/kg = Milligram per kilogram.
italic = Exceeds RBC for residential scenario.
bold italics = Exceeds RBC for industrial scenario

Analytical Source(s) (MAECORP 1989a,b,c), (Envirodyne 1991), (IEPA 1995), and (Ecology and Environment 1995)

Table 1-3

SUMMARY OF PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
Inorganics																
Arsenic	23	610	3.39	3.37	4.87	5.54	22.0	ND*	ND*	ND*	ND*	ND*	ND*	ND*	25	NA
Barium	5,500	1.4E5	31.0	81.2	36.8	80.7	58.5	ND*	ND*	ND*	ND*	ND*	ND*	ND*	141	NA
Beryllium	0.15	1.3	0.51	5.10	ND	1.40	0.36	NA	NA	NA	NA	NA	NA	NA	2.22	NA
Cadmium	39	100	ND	3.30	ND	ND	ND	ND*	ND*	ND*	ND*	ND*	ND*	ND*	2.76	NA
Chromium	390	10,000	12.2	29.0	7.80	17.8	21.0	ND*	ND*	ND*	ND*	ND*	ND*	1.40*	22	NA
Copper	3,100	82,000	0.017	3.12	0.075	0.75	0.157	NA	NA	NA	NA	NA	NA	NA	1,300	NA
Lead	400	**	13.9	1,410	65.7	779	256	0.62*	0.14*	0.50*	0.673*	0.31*	0.13*	ND*	659	NA
Manganese	390	10,000	806	476	136	319	274	NA	NA	NA	NA	NA	NA	NA	348	NA
Mercury	23	610	0.16	0.47	0.09	0.09	0.30	ND*	ND*	ND*	ND*	ND*	ND*	ND*	0.16	NA
Selenium	390	10,000	NA	NA	NA	NA	NA	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND	NA
Silver	390	10,000	ND	0.80	ND	1.90	ND	ND*	ND*	ND*	ND*	ND*	ND*	ND*	3.1	NA

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Table 1-3

SUMMARY OF PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
Zinc	23,000	6.1E5	0.071	9.48	0.30	3.27	0.69	NA	NA	NA	NA	NA	NA	12*	4,270	NA
Volatile Organic Compounds																
Acetone	7,800	2.0E5	0.007	0.021	1.20	ND	0.015	NA	NA	NA	NA	NA	NA	NA	NA	ND
2-Butanone	47,000	1.0E6	ND	0.004	0.007	ND	0.004	NA	NA	NA	NA	NA	NA	ND	NA	ND
1,1-Dichloroethene	1.1	9.5	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	ND	NA	0.189
1,2-Dichloroethene	780	20,000	ND	0.091	1.30	3.80	0.22	NA	NA	NA	NA	NA	NA	ND	NA	ND
Methylene chloride	85	760	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND
1,1,1-Trichloroethane	7,000	1.8E5	ND	ND	0.23	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.015
Trichloroethene	58	510	ND	0.080	0.082	0.55	ND	NA	NA	NA	NA	NA	NA	0.051	NA	ND
Tetrachloroethene	12	110	ND	ND	0.011	ND	ND	NA	NA	NA	NA	NA	NA	ND	NA	ND
Toluene	16,000	4.1E5	ND	ND	0.010	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND
Vinyl chloride	0.34	3.0	ND	ND	0.058	2.20	0.14	NA	NA	NA	NA	NA	NA	ND	NA	ND
Semivolatile Organic Compounds																
Benzo(a)anthracene	0.88	7.8	0.35	2.80	ND	2.70	7.50	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1-3

SUMMARY OF PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
Benzo(b)fluoranthene	0.88	7.8	0.78	ND	ND	3.10	7.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.088	0.78	0.41	2.00	ND	2.90	8.20	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene			0.52	3.90	3.40	7.40	14.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ideno(1,2,3-cd) pyrene	0.88	7.8	0.21	ND	ND	ND	2.90	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene			0.23	ND	2.10	5.50	9.50	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	2,300	61,000	0.47	4.20	3.50	5.40	13.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides																
Aldrin	0.038	0.34	0.0018	0.010	0.011	0.027	0.009	ND	ND	ND	ND	ND	ND	NA	NA	NA
Chlordane	0.49	4.4	0.0022	0.012	0.0031	0.016	0.030	ND	ND	ND	ND	ND	ND	NA	NA	NA
4,4'-DDE	1.9	17	0.048	ND	ND	ND	ND	ND	ND	0.036	0.0027	ND	ND	NA	NA	NA
4,4'-DDT	1.9	17	0.056	0.0043	0.042	0.021	0.200	ND	ND	0.036	0.0787	ND	ND	NA	NA	NA
Dieldrin	0.04	0.36	0.0013	0.006	0.0023	0.028	0.0095	ND	ND	ND	ND	ND	ND	NA	NA	NA
Endrin	23	610	0.0033	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA

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Table 1-3

SUMMARY OF PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
Heptachlor epoxide	0.07	0.63	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA	NA	NA
Polychlorinated Biphenyls																
Total PCBs	0.083	0.74	0.084	1.13	3.80	7.30	3.10	ND	14.9	ND	ND	ND	ND	1.7	0.87	NA

Key: RBC = Risk based concentration via exposure by soil ingestion (U.S. EPA 1995b).
R = Residential exposure scenario.
I = Industrial exposure scenario.
IEPA = Illinois Environmental Protection Agency.
N. Chi = City of North Chicago.
E & E = Ecology and Environment, Inc.
ND = Not detected.
NA = Not analyzed.
* = TCLP.

Analytical Source(s): (IEPA 1995), (Burris 1996), (Ecology and Environment 1995)

Table 1-4

SUMMARY OF GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Designation Date of Colleciton												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
ıorganics															
rsenic	0.050	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*0.1*	*0.092*
ırium	2.0	2.0	0.558	0.451	0.125	0.107	0.0617	0.0617	0.0632	0.089	0.069	0.032	0.12	0.15	0.15
:ryllium	0.004	0.001	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ıdmium	0.005	0.005	*0.006*	0.004	ND	*0.0164*	ND	ND	ND	0.0019	ND	ND	ND	ND	ND
romium	0.100	0.200	*0.212*	*0.157*	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
pper	Treat.	1.3	NA	NA	NA	0.188	ND	ND	ND	0.028	ND	ND	ND	ND	ND
ıd	Treat.	0.030*	**1.56**	**2.01**	0.019	0.0061	ND	ND	0.0016	ND	ND	ND	ND	ND	ND
nganese	NS	0.200	NA	NA	NA	0.0338	**0.591**	**0.902**	**1.05**	0.048	0.019	0.065	**0.25**	**0.43**	**0.44**
rcury	0.002	0.010	*0.0043*	*0.0222*	0.0001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
:nium	0.050	0.200	0.016	0.02	0.015	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
er	NS	0.100	0.018	0.015	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
:	NS	3.0	NA	NA	NA	7.17	ND	ND	ND	0.26	ND	0.021	0.046	ND	ND

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Table 1-4

SUMMARY OF GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Designation Date of Colleciton												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Volatile Organic Compounds															
Acetone	NS	3.5	NA	NA	NA	0.01	0.005	ND	ND	ND	ND	ND	ND	ND	ND
-Butanone	NS	21.0	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
,1-Dichloroethene	0.007	0.070	ND	ND	ND	*0.01*	*0.059*	ND	ND	ND	*0.047*	ND	ND	ND	ND
,2-Dichloroethene	0.07	0.40	ND	ND	ND	0.01	*0.410*	ND	ND	ND	*13.0*	ND	0.023	0.017	0.017
fethylene chloride	0.005	0.50	ND	ND	ND	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
1,1-Trichloroethane	0.200	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
richloroethene	0.005	0.30	ND	ND	ND	*0.01*	*0.097*	ND	ND	ND	*0.11*	ND	ND	ND	ND
etrachloroethene	0.005	0.070	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
oluene	1.0	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
nyl chloride	0.002	0.002	ND	ND	ND	*0.01*	*2.80*	ND	ND	ND	*1.00*	ND	ND	*0.013*	*0.014*
mivolatile Organic Compounds															
nzo(a)anthracene	0.0001	0.0001	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
nzo(b)fluoranthene	0.0002	0.0002	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA

Table 1-4

SUMMARY OF GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Designation Date of Colleciton												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
lenzo(a)pyrene	0.0002	0.0002	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
'luoranthene	NS	NS	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
deno(1,2,3-cd) yrene	0.0004	0.0004	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
'henanthrene	NS	NS	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
yrene	NS	1.1	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
'esticides															
ldrin	NS	0.0002	NA	NA	NA	4E-6	4E-6	6E-6	ND	NA	NA	NA	NA	NA	NA
'hlordane	0.002	0.002	NA	NA	NA	3E-6	3E-5	4E-6	ND	NA	NA	NA	NA	NA	NA
,4'-DDE	NS	NS	NA	NA	NA	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
4'-DDT	NS	NS	NA	NA	NA	8E-6	ND	8E-6	8E-6	NA	NA	NA	NA	NA	NA
ieldrin	NS	0.0002	NA	NA	NA	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
ndrin	0.002	0.003	NA	NA	NA	0.0001	8E-6	ND	ND	NA	NA	NA	NA	NA	NA

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Table 1-4

SUMMARY OF GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Designation Date of Colleciton												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Heptachlor epoxide	0.0002	0.0004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls															
Total PCBs	0.0005	0.0005	ND	ND	ND	*0.001*	ND	1.9E-4	ND	NA	NA	NA	NA	NA	NA

y: MCL = Maximum contaminant level (National Primary Drinking Water Standard) (U.S. EPA 1995a).
RAL = Superfund removal action level for contaminated drinking water sites (U.S. EPA 1995a)
MAECORP = MAECORP, Inc.
IEPA = Illinois Environmental Protection Agency.
GMI = Geraghty & Miller, Inc.
ND = Not detected.
NA = Not analyzed.

lytical Source(s): (MAECORP 1989a,b,c), (IEPA 1995), (Geraghty & Miller 1994)

Table 1-5

SUMMARY OF OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E&E S-6 9/94
	R	I										
Inorganics												
Arsenic	23	610	0.07	1.27	4.00	7.73	9.68	8.06	5.01	9.47	9.47	*180*
Barium	5,500	1.4E5	ND	ND	ND	77.2	176	106	112	129	88.9	55.2
Beryllium	0.15	1.3	NA	NA	NA	*1.00*	*2.00*	*1.40*	*1.00*	*1.30*	*0.97*	*0.63*
Cadmium	39	100	3.26	1.90	2.71	0.82	17.6	8.8	ND	8.8	ND	3.79
Chromium	390	10,000	9.25	12.3	17.2	22.8	80.9	30.9	16.3	24.2	21.4	16.3
Copper	3,100	82,000	NA	NA	NA	0.033	3.02	1.96	1.38	1.16	0.38	ND
Lead	400	**	294	125	*715*	46.8	*1760*	*1110*	*542*	*910*	198	*495*
Manganese	390	10,000	NA	NA	NA	*756*	*393*	*603*	*247*	*738*	314	*774*
Mercury	23	610	0.03	0.20	0.02	0.07	1.77	0.61	0.41	0.36	0.11	0.20
Selenium	390	10,000	ND	ND	ND	0.26	2.79	ND	ND	ND	ND	ND
Silver	390	10,000	2.75	2.17	2.81	0.82	3.30	1.70	ND	0.70	ND	ND
Zinc	23,000	6.1E5	NA	NA	NA	0.124	8.47	4.83	5.81	10.7	1.84	ND
Volatile Organic Compounds												
Acetone	7,800	2.0E5	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA

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Table 1-5

SUMMARY OF OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E&E S-6 9/94
	R	I										
2-Butanone	47,000	1.0E6	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
1,1-Dichloroethene	1.1	9.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene	780	20,000	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
1,1,1-Trichloroethane	7,000	1.8E5	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Trichloroethene	58	510	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Tetrachloroethene	12	110	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Toluene	16,000	4.1E5	0.010	0.014	0.015	0.014	ND	ND	ND	ND	ND	NA
Vinyl chloride	0.34	3.0	NA	NA	NA	NA	NA	ND	ND	ND	ND	NA
Semivolatile Organic Compounds												
Benzo(a)anthracene	0.88	7.8	NA	NA	NA	0.18	*7.70*	0.54	0.84	*1.10*	0.11	NA
Benzo(b) fluoranthene	0.88	7.8	NA	NA	NA	0.34	*8.60*	0.59	*1.10*	*1.20*	0.27	NA
Benzo(a)pyrene	0.088	0.78	NA	NA	NA	*0.44*	*7.90*	*0.55*	*0.74*	*1.00*	ND	NA
Fluoranthene			NA	NA	NA	0.49	16.0	1.00	1.80	2.00	0.20	NA
Ideno(1,2,3-cd)pyrene	0.88	7.8	NA	NA	NA	0.44	*4.00*	ND	0.42	0.57	ND	NA
Phenanthrene			NA	NA	NA	0.25	13.0	0.53	1.20	1.40	0.094	NA
Pyrene	2,300	61,000	NA	NA	NA	0.42	13.0	0.96	1.50	1.70	0.17	NA

Table 1-5

SUMMARY OF OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk Based Concentration		Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E&E S-6 9/94
	R	I										
Pesticides												
Aldrin	0.038	0.34	NA	NA	NA	0.001	0.017	0.0067	0.0048	ND	0.0032	NA
Chlordane	0.49	4.4	NA	NA	NA	0.0023	0.023	0.016	0.007	0.028	0.007	NA
4,4'-DDE	1.9	17	NA	NA	NA	0.0048	0.22	0.070	0.094	0.071	0.0048	NA
4,4'-DDT	1.9	17	NA	NA	NA	0.064	0.580	0.082	0.077	0.097	0.015	NA
Endrin	23	610	NA	NA	NA	0.0068	ND	0.025	ND	0.028	ND	NA
Heptachlor epoxide	0.07	0.63	NA	NA	NA	***0.82***	ND	0.0075	0.0035	0.0033	ND	NA
Polychlorinated Biphenyls												
Total PCBs	0.083	0.74	0.028	0.016	0.064	***0.355***	***3.88***	***1.37***	***1.05***	***0.360***	***0.18***	***0.064***

Key:
RBC = Risk based concentration via exposure by soil ingestion (U.S. EPA 1995b).
R = Residential exposure scenario.
I = Industrial exposure scenario.
Enviro = Envirodyne Engineers, Inc.
IEPA = Illinois Environmental Protection Agency
E & E = Ecology and Environment, Inc.
ND = Not detected.
NA = Not analyzed.
italics = Exceeds RBC for residential scenario
bold italics = Exceeds RBC for industrial scenario

Analytical Source(s): (Envirodyne 1991), (IEPA 1995), and (Ecology and Environment 1995)

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2.0 DATA GAP DESCRIPTION

Soil Contamination

Heavy metals, PAHs, and PCBs were detected in on-site soils at levels exceeding Risk-based concentrations (RBCs) for industrial soils. The highest concentrations of heavy metals occurred in samples collected from the northern portion of the site where foundry sand, tailings, and slag are reported to have been dumped. The extent of on-site heavy metal contamination is not currently delineated. PAHs and PCBs were detected in several areas on the VL site. However, these locations were scattered and did not correspond with any known potential on-site source of contamination. No sources for PAH contaminants are evident.

Soil Contamination Data Gaps

Existing soil sampling locations at the VL site are generally limited to biased samples collected in areas of obvious discoloration (indicating foundry sand, slag, and tailings), burn site, and along the western edge of the site where a bike path was proposed (Figure 2-1, Historical Soil Sample Data Map). The VL site soil has not been sampled in a systematic pattern nor has the extent of contamination of known areas of pollution been determined. For the purposes of the EE/CA, all contaminated soil areas requiring disposal need to be identified and characterized. Contaminated soil volume and depth estimates are necessary for adequate evaluation of removal alternatives.

Sediment Contamination

Heavy metals, PAHs, and PCBs were detected in Pettibone Creek sediment samples at levels exceeding RBCs for industrial soil. Potential on-site sources include contaminated soils and industrial fill deposited in the northern portion of the site. Potential off-site sources include discharge from two

(b) (3) (A)

[redacted]

storm sewers to the north and west, an unknown outfall along the western bank of Pettibone Creek, an outfall (from the EMCO facility) also along the western bank of the creek, and an outfall from Fansteel, Inc., along the eastern bank of the creek. Some of the storm water entering the northwest corner of the creek originates along the northern slope of the EJ & E railroad grade, adjacent to a transformer substation.

Sediment Contamination Data Gaps

Historical sampling events have established that the sediments are contaminated with heavy metals, PCBs, and PAHs (Figure 2-2, Historical Sediment Sample Data Map). Some of the sample locations were not analyzed for all contaminants of concern. Also, not all of the potential sources of sediment contamination were sampled. Sediments at each outfall need to be sampled to determine any contaminant sources from these outfalls.

Groundwater Contamination

Heavy metals and chlorinated solvents have been detected in on-site monitoring wells. The contaminant plume(s) have not been delineated. Foundry sand, slag, and tailings deposited on site as fill may be the source for heavy metal contamination in the groundwater. No potential on-site sources of chlorinated solvent contamination have been identified at the VL site. Nearby industrial facilities handle heavy metals and off-site contribution to groundwater contamination is possible. During a Resource Conservation and Recovery Act (RCRA) closure of two hazardous waste oil storage tanks at the adjacent Fansteel, Inc. facility, chlorinated solvents were detected in subsurface soils to a depth of 20 feet below ground surface (bgs).

Groundwater Contamination Data Gaps

Existing groundwater sampling data is limited to three sampling events; February 1989, May 1993, and November 1993. Only three wells were present during the 1989 sampling event and only heavy metals (cadmium, chromium, lead, and mercury) were detected at levels of concern. During the 1993 sampling events, heavy metals and chlorinated solvents were detected. However, most of the heavy metals detected during the 1989 sampling event were no longer present at levels of concern.

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Instead, several additional metals (including manganese, zinc, and arsenic) at levels of concern were found in 1993 (Figure 2-3, Historical Groundwater Sample Data Map). Analysis for manganese and zinc was not conducted on the 1989 samples. These results are highly variable and additional sampling is warranted to gain a clear picture of present conditions. Furthermore, the groundwater contamination is not completely delineated. It is unknown whether groundwater contamination is being contributed by other up-gradient sources and whether existing groundwater contamination is migrating off-site at down-gradient locations. Full characterization of the extent of groundwater contamination is necessary to delineate the contamination plume and the plume's migration pathway.

A two-round sampling event is also proposed for sampling all existing monitoring wells to effectively compare contaminants of concern. It is also proposed to collect several additional groundwater samples with the aid of Geoprobe sampler. These Geoprobe locations are chosen to aid in the investigation of any other potential groundwater contamination source(s), to determine the contaminant plume, and also in determining the plume boundaries.

2.1 Waste Characterization

Historical information indicates that the VL site has been utilized by nearby industries for waste disposal. The nature and composition of this fill material is unknown. Historical information also indicates that the VL site was used to store tailing materials from operations at the Vulcan Louisville Smelting company (currently North Chicago Refiners and Smelters), located east of and adjacent to Fansteel. Additionally, there are indications that a company named Chicago Hardware Foundry may have disposed of slag material at the VL site. Based on all the above mentioned potential sources of contamination and the review of previous analytical data, the site contamination can be characterized into a) metal contaminated waste, b) semivolatile organic contaminated waste, c) pesticide contaminated waste, d) polychlorinated biphenyl contaminated waste, and e) combination waste containing two or more of the above waste categories.

The soil, sediment, and groundwater samples to be collected during EE/CA site activities will be analyzed for all the above parameters. However, not all samples of each matrix will be analyzed for every parameter. After reviewing the analytical results, contamination will be classified into the above mentioned groups based on their RBCs and their disposal criteria.

(b) (3) (A)

[redacted]

2.2 Hydrogeologic Investigation

Hydrogeologic investigation for the VL site includes performing a slug test on the on-site monitoring well waters to determine groundwater recharge rate. To determine horizontal distribution of contaminants, monitoring well samples will be collected and their contaminant concentrations will be evaluated with respect to groundwater flow direction and the contaminant mobility. Regional and local groundwater flow directions will be determined from historical data.

2.3 Soils and Sediments Investigation

Soil Sampling

Based on the RBC levels, arsenic, beryllium, copper, lead, manganese and zinc are the metals of concern at the VL site. Benzo (a) anthracene, benzo (b) anthracene, benzo (a) pyrene, and PCBs are the volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) encountered in on-site soil samples.

On-site characterization of soil contamination needs to be evaluated based on the presence of any more fill areas apart from the known burn area and contamination of soil in non-fill areas. Boring samples collected from the burn area by E & E and Illinois Environmental Protection Agency (IEPA) indicate metals and organics contamination. In 1993, E & E collected a sample (S-5) at a depth of approximately 6 to 7 feet which showed high levels of metal contamination. However, this sample was not analyzed for all the contaminants of concern. Similarly, data gaps exist for other sample locations. A sampling design based on systematic grid sampling is recommended to fully characterize on-site soils.

Sediment Sampling

Even though there are only four historic sampling locations within the site boundaries of the creek, the analytical results indicate that contamination exists throughout the creek's pathway on site.

The data available indicates contamination, but does not provide the depth that the sediments are contaminated. In order to evaluate the depth of the contamination, sediment samples need to be taken at definite intervals, from depths of 0-12 inches, 1-2 foot, and 2 -3 foot. Depth samples from 0-12 inches and 1-2 foot are proposed in the initial round of sampling. Based on the analytical results of these depth samples, further depth samples may be collected.

2.3.1 Proposed Extent of Contamination Sampling Plan

The VL site needs to be systematically sampled on a predetermined grid system. The results of this sampling should be able to provide information on the depth of contamination and the nature of contaminants. Since the site background information indicates that the site area may have been used to dispose of industrial wastes, the sampling event should provide insight to these areas. Boring samples collected at grid nodes of the grid sampling points will be analyzed for metal and known contaminants of concern.

It is proposed that a two-step sampling process be conducted. In the first step, samples will be collected at the surface (0-12 inches) and from 1-2 foot depths at all the grid nodes, and analyzed for metals and other contaminants of concern. After evaluating the results, some sample nodes may be eliminated based on removal/risk criteria, while other sample nodes may need further sampling. The Second step of sampling involves sampling from 3 feet depth to 6 feet depth in one foot intervals. Since the groundwater table is approximately 7 feet deep in some places, further depth samples will be evaluated carefully. The burn area needs to be sampled up to 9 foot depth since metal contamination was detected at the 9 foot sample (S-1) collected by E & E (this sample was not analyzed for organics).

Sediment samples are proposed to be collected from locations which correspond to all the storm sewer discharges and industrial outfalls in the Pettibone creek. It is proposed that a two-step sampling process be conducted. In the first step, sediment samples will be collected from 0-1 foot depths and 1-2 foot depths and analyzed for metals and other contaminants of concern. After evaluating the results, a second round of sampling may be proposed if deeper contamination is suspected.

2.4 Surface Water Investigation

Since Pettibone Creek originates from the northern end of the site with waters being received from storm sever discharges and industry outfalls, it is proposed that surface water investigation be conducted at a later stage when surface water discharges are thoroughly examined. For this investigation, all storm water discharge permits of the surrounding industries need to be examined to determine the nature of analysis. Also, at the time of previous E & E site inspections, the creek was almost dry, no outfalls were active, and not much water was seen through storm water discharges.

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2.5 Air Investigation

After the first sampling event, data of soils and sediments will be reviewed to identify prevalent contaminants that pose potential threats. Toxicological profiles of these contaminants will then be reviewed to ascertain their potential airborne characteristics, considering the local wind patterns. This information will be included in the EE/CA report.

3.0 QA/QC SAMPLING PLAN

The sampling plan and data validation procedures for the VL EE/CA is based on "Quality Assurance/Quality Control Guidance for Removal Activities" (QA/QC) document of Office of Solid Waste and Emergency Response (OSWER), U.S. EPA (OSWER Directive 9360.4-01). The representative sampling recommended for the VL site is based on the U.S. EPA's *Removal Program Representative Sampling Guidance, Volume 1 - Soil,* U.S. EPA, November 1991, Washington, DC (Reference 3).

3.1 Data Quality Objectives

Quality assurance (QA) level I will be used for screening samples. QA level II will be used for definitive identification of compounds and analytes, as well as non-definitive quantitation of detected compounds.

3.1.1 Data Use Objectives

Although substantial analytical data exists for the VL site, the results of previous sample analyses reflect sampling efforts made in order to establish a threat to human health and/or the environment. The remedial units have been identified, but are to be completely investigated to determine the extent of contamination and the volume of contamination.

Surface and subsurface soils will be sampled in order to determine the approximate extent of contamination of soils. Samples will be collected from Pettibone Creek sediments and will be used to describe the extent of contamination as well as potential attribution of contaminants to several potential sources located along the creek. The results of these analyses will be used to recommend potential soil boring locations to be conducted during a later sampling phase. The results of this first round of sampling will also characterize the on-site waste, and assign waste disposal groups. Based on proposed disposal and/or treatment methods, additional data needs for evaluation of disposal

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and/or treatment methods will be addressed during a later sampling phase.

Since some of the contaminants of concern in the groundwater have not been detected in all prior sampling events, the existing on-site monitoring wells will be resampled in order to determine which contaminants of concern are still present. Additionally, piezometric measurements at the monitoring wells will be taken in order to confirm the groundwater flow direction and hydraulic gradient. A slug test will also be conducted in order to estimate the hydraulic conductivity of the aquifer, thereby providing information on the potential mobility of groundwater contaminants. A Geoprobe, a hydraulic coring device, will be used to collect discreet groundwater samples from locations along the site perimeter and throughout the site area in order to evaluate off-site contribution to groundwater contamination. The results from this round of groundwater sampling and geophysical testing will indicate where the water table will be encountered as well as what contaminants are expected to be present.

3.1.2 Quality Assurance Objectives

All analyses requested for the first round of sampling will be analyzed in accordance with the Solid Waste (SW)-846 methodology at Quality Assurance Level 2 (QA2) or equivalent protocol. These types of quality protocols are specified in the U.S. EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01, April 1990. QA II data quality level with the exception of field screening for VOCs (including chlorinated solvents) will be used for soils. QA2 is a "verification" data quality objective providing definitive identification of contaminants. QA2 data quality objectives are recommended for determining the extent of contamination.

On-site soils will be screened with a field instrument designed to measure organic vapors. Soils with substantial detections above background will be selected for QA2 laboratory analysis for VOCs. Field screening is considered to follow the Quality Assurance Level 1 (QA1) data quality objective and does not provide definitive contaminant identification. QA1 data is almost always semi-quantitative. In order to validate QA1 data, 10% of the field screened samples must be analyzed at the QA2 data quality level.

3.2 Sampling Design

3.2.1 Soils

The VL site needs to be systematically sampled on a predetermined grid system. Both

surface and subsurface samples are necessary. The results of this sampling will provide information on the depth of contamination and the volume of contaminated soil. Since the site background information indicates that the VL site may have been used to dispose industrial wastes, the sampling event will provide identification of unknown deposition locations as well as extent of contamination data on existing areas of fill.

In order to avoid analyzing unnecessary samples, a multi-phase sampling process is proposed. In the first phase, samples will be collected at the surface and at 1 foot bgs at all grid nodes. Heavy metal analysis will be conducted at every grid node. Analysis for PCBs, pesticides, and PAHs will occur at every other grid node because these contaminants are less prevalent than the heavy metals. An organic vapor analyzer will be used to screen soil samples for VOC contamination at every grid node. Samples for VOC analysis will be collected based on detections above background on the screening instrumentation.

Deeper soil borings will be conducted during a later sampling event at select grid locations where contaminants of concern were significantly detected in this round of soil sampling. This process will limit the number of soil borings necessary for site characterization, saving both time and money. Furthermore, chemical analysis requested for subsequent sampling events will be limited to only those analytes which were elevated in samples collected during the initial sampling phase.

The representative sampling approach recommended for the VL site is a systematic grid which is appropriate for extent of contamination applications based on recommendations made in the U.S. EPA's *Removal Program Representative Sampling Guidance, Volume I - Soil*, U.S. EPA, November 1991, Washington, DC (Reference 3). For the VL site, historical dumping events of solid industrial waste would likely have occurred over wide areas of the site, allowing the use of a wider grid system (Figure 3-1, Proposed Soil Sample Location Map). The grid system may be altered by the U.S. EPA if a different level of statistical certainty is required.

3.2.2 Sediments

A multi-stage sampling approach is recommended for sampling the sediments. A biased sampling approach will be utilized to characterize the sediment condition and relative impact of each potential source with sampling locations at or immediately downstream of each potential source (Figure 3-2, Proposed Sediment Sample Location Map). Each sampling location will include a surface sample of 0-1 foot bgs and a subsurface sample of 1-2 feet bgs. Contamination depth data will be useful for volume estimation. Presence of high levels of contaminants (order of magnitudes

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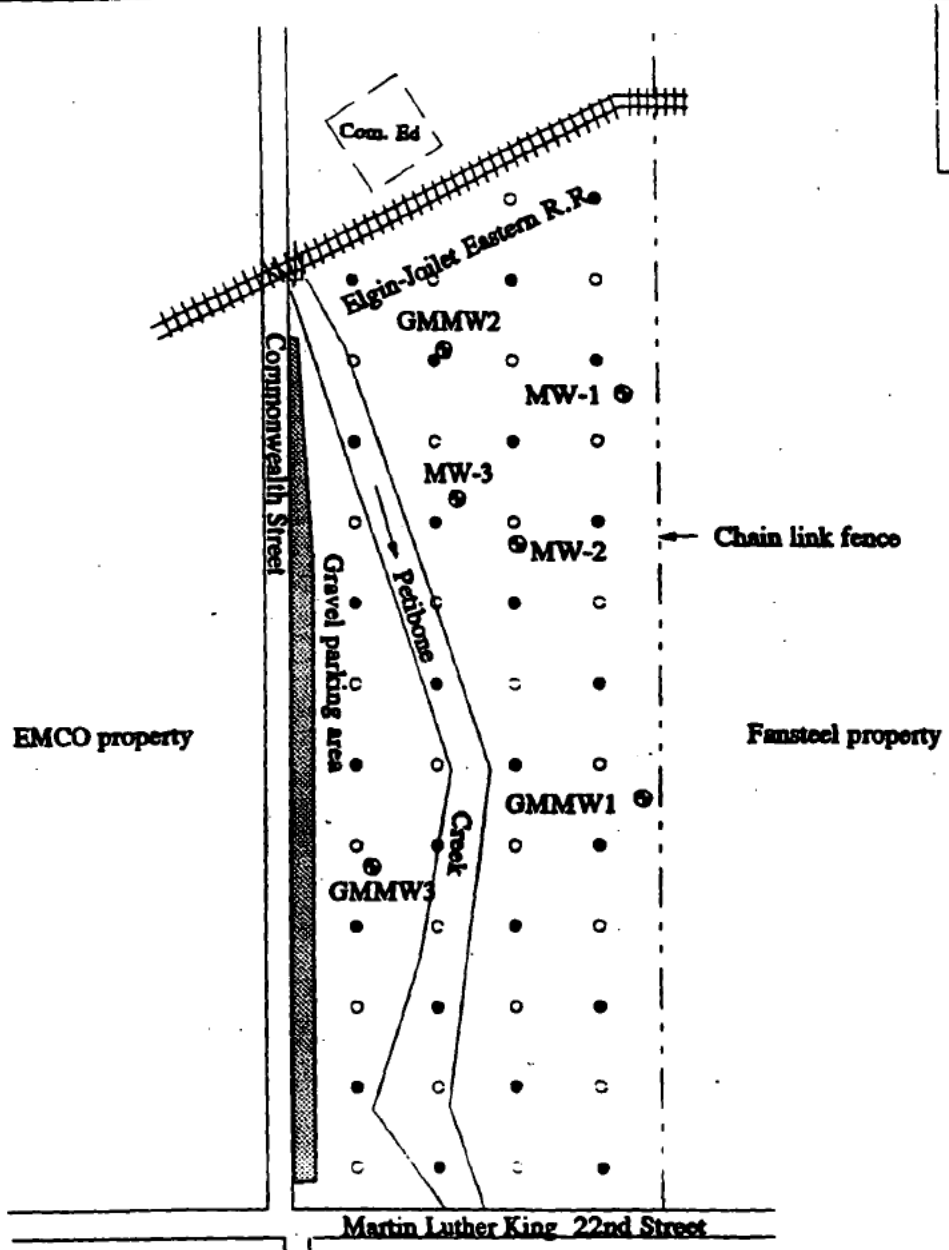
higher than RBCs) of concern at 2-foot depth will be evaluated to recommend a soil boring at that location during a subsequent sampling stage.

3.2.3 Groundwater

A multi-stage sampling event is also proposed for evaluation of groundwater contamination. The first stage will involve resampling all existing monitoring wells and the collection of piezometric data (Figure 3-3, Proposed Groundwater Sample Location Map). These results will determine which contaminants are currently present, and will verify earlier estimations of hydraulic gradient and hence, groundwater flow direction. The first stage of groundwater sampling will also be directed towards characterization of groundwater contamination on-site and along the site boundaries for the purpose of evaluating off-site contributing sources as well as off-site migration of on-site groundwater contamination. This sampling event will be conducted utilizing the Geoprobe which has the ability to obtain groundwater samples. Collection is relatively quick and cost effective because no permanent well construction is necessary. For this reason however, these sampling events cannot be easily duplicated. The results of this Geoprobe sampling will aid in avoiding unnecessary parameter analyses during subsequent rounds of sampling.

If the groundwater sampling indicates contamination across site boundaries, subsequent groundwater investigations at off-site locations will be necessary for adequate characterization. Additional geophysics will be conducted by U.S. EPA personnel in conjunction with the sampling events proposed in this EE/CA for the purpose of estimating hydraulic conductivity in the contaminated aquifer. Specifically, a slug test is planned which involves using a solid object (slug) placed in the well to raise or lower the water level. The rate at which the water level returns to equilibrium after being disturbed by the slug is measured and used to estimate the hydraulic conductivity. The data obtained will be useful in determining the relative mobility of groundwater



Note: Petibone Creek not to scale.

Legend

- ⊕ Monitoring well/number
- c Metals and VOCs only
- • All soil parameters

0 100 200

Scale in feet

Base map source:
Geraghty & Miller, Inc.
Project No. CI0325.001
1/24/94

ecology and environment, inc.
Superfund Technical Assessment And Response Team
Region V
33 North Dearborn Street, Chicago, Illinois 60602

TITLE	Proposed Soil Sampling	FIGURE #	3-1
SITE	Vacant Lot	SCALE	180':1"
CITY	North Chicago STATE Illinois	TDD #	S05-9609-017
SOURCE	Ecology & Environment, Inc.	DATE	1996
		REVISED	1996

(b) (3) (A)

[redacted]

(b) (3) (A)

[redacted]

1 INORGANIC TARGET ANALYTE LIST (TAL)

Analyte	Detection Limit (μg/L -- water (1))
Aluminum	200
Antimony	60
Arsenic*	10
Barium*	200
Beryllium	5
Cadmium*	5
Calcium	5000
Chromium*	10
Cobalt	50
Copper	25
Iron	100
Lead*	3
Magnesium	5000
Manganese	15
Mercury*	0.2
Nickel	40
Potassium	5000
Selenium*	5
Silver*	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

(1) Sediment detection limit 100x water (μg/Kg -- soil/sediment).

Based on the Contract Laboratory Program Statement of Work, ILMO2.1 (9/91).

* RCRA metals

Appendix B

Sampling QA/QC Plan

8.10 DATA VALIDATION

This section is not applicable to this SOP.

8.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

Note: The time required for a slug test to be completed is a function of the volume of the slug, the hydraulic conductivity of the formation and the type of well completion. The slug volume should be large enough that a sufficient number of water level measurements can be made before the water level returns to equilibrium conditions. The length of the test may range from less than a minute to several hours. If the well is to be used as a monitoring well, precautions against contaminating it should be taken. If water is added to the monitoring well, it should be from an uncontaminated source and transported in a clean container. Bailers or measuring devices should be decontaminated prior to the test. If tests are performed on more than one monitoring well, care must be taken to avoid cross-contamination of the wells.

Slug tests should be conducted on relatively undisturbed wells. If a test is conducted on a well that has recently been pumped for water sampling purposes, the measured water level must be within 0.1 foot of the static water level prior to sampling. At least 1 week should elapse between the drilling of a well and the performance of a slug test.

8.7.2 Post Operation

When using an electronic data-logger, use the following procedure:

1. Stop logging sequence.
2. Print data.
3. Send data to computer by telephone.
4. Save memory and disconnect battery at the end of the day's activities.
5. Review field forms for completeness.

8.8 CALCULATIONS

The simplest interpretation of piezometer recovery is that of Hvorslev (1951). The analysis assumes a homogenous, isotropic medium in which soil and water are incompressible. Hvorslev's expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

for $L/R > 8$

where:

K = hydraulic conductivity [feet/second]
r = casing radius [feet]
L = length of open screen (or open borehole) [feet]
R = filter pack (borehole) radius [feet]
T_o = Basic Time Lag [seconds]; value of t on semilogarithmic plot of $(H-h)/(H-H_o)$ vs. t, when $(H-h)/(H-H_o) = 0.37$

where:

H = initial water level prior to removal of slug
H_o = water level at $t = 0$
h = recorded water level at $t > 0$

(Hvorslev, 1951; Freeze and Cherry, 1979)

The Bower and Rice method is also commonly used for K calculations. However, it is much more time consuming than the Hvorslev method. Refer to Freeze and Cherry or Fetter for a discussion of these methods.

8.9 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

- All data must be documented on standard chain of custody forms, field data sheets, or within personal/site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

The following specific quality assurance activity will apply:

- Each well should be tested at least twice in order to compare results.

be used to record observations. The slug test data form should include the following information:

- site ID -- identification number assigned to the site
- location ID -- identification of location being tested
- date -- the date when the test data were collected in this order: year, month, day (e.g., 900131 for January 31, 1990)
- slug volume (ft^3) -- manufacturer's specification for the known volume or displacement of the slug device
- logger -- identifies the company or person responsible for performing the field measurements
- test method -- the slug device either is injected or lowered into the well, or is withdrawn or pulled-out from the monitor well. Check the method that is applicable to the test situation being run.
- comments -- appropriate observations or information for which no other blanks are provided.
- elapsed time (minutes) -- cumulative time readings from beginning of test to end of test, in minutes
- depth to water (feet) -- depth to water recorded in tenths of feet

The following general procedures may be used to collect and report slug test data. These procedures may be modified to reflect site-specific conditions:

1. Decontaminate the transducer and cable.

2. Make initial water level measurements on monitoring wells in an upgradient-to-downgradient sequence, if possible, to minimize the potential for cross-contamination.

3. Before beginning the slug test, record information into the electronic data-logger. The type of information may vary depending on the model used. When using different models, consult the operator's manual for the proper data entry sequence to be used.

4. Test wells from least contaminated to most contaminated, if possible.

5. Determine the static water level in the well by measuring the depth to water periodically for several minutes and taking the average of the readings, (see SOP #2151, Water Level Measurement).

6. Cover sharp edges of the well casing with duct tape to protect the transducer cables.

7. Install the transducer and cable in the well to a depth below the target drawdown estimated for the test but at least 2 feet from the bottom of the well. Be sure the depth of submergence is within the design range stamped on the transducer. Temporarily tape the transducer cable to the well to keep the transducer at a constant depth.

8. Connect the transducer cable to the electronic data-logger.

9. Enter the initial water level and transducer design range into the recording device according to the manufacturer's instructions. The transducer design range will be stamped on the side of the transducer. Record the initial water level on the recording device.

10. "Instantaneously" introduce or remove a known volume or slug of water to the well. Another method is to introduce a solid cylinder of known volume to displace and raise the water level, allow the water level to restabilize and remove the cylinder. It is important to remove or add the volumes as quickly as possible because the analysis assumes an "instantaneous" change in volume is created in the well.

11. Consider the moment of volume addition or removal as time zero. Measure and record the depth to water and the time at each reading. Depths should be measured to the nearest 0.01 foot. The number of depth-time measurements necessary to complete the test is variable. It is critical to make as many measurements as possible in the early part of the test. The number and intervals between measurements will be determined from previous aquifer tests or evaluations.

12. Continue measuring and recording depth-time measurements until the water level returns to equilibrium conditions or a sufficient number of readings have been made to clearly show a trend on a semilogarithmic plot of time versus depth.

13. Retrieve slug (if applicable).

8.0 SLUG TEST: SOP #2158

8.1 SCOPE AND APPLICATION

This procedure can determine the horizontal hydraulic conductivity of distinct geologic horizons under in situ conditions. The hydraulic conductivity (K) is an important parameter for modeling the flow of groundwater in an aquifer.

8.2 METHOD SUMMARY

A slug test involves the instantaneous injection of a slug (a solid cylinder of known volume) or withdrawal of a volume of water. A slug displaces a known volume of water from a well and measures the artificial fluctuation of the groundwater level.

There are several advantages to using slug tests to estimate hydraulic conductivities. First, estimates can be made in situ, thereby avoiding errors incurred in laboratory testing of disturbed soil samples. Second, compared with pump tests, slug tests can be performed quickly and at relatively low cost, because pumping and observation wells are not required. And last, the hydraulic conductivity of small discrete portions of an aquifer can be estimated (e.g., sand layers in a clay).

8.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this Standard Operating Procedure (SOP).

8.4 INTERFERENCES AND POTENTIAL PROBLEMS

- Only the hydraulic conductivity of the area immediately surrounding the well is estimated, which may not be representative of the average hydraulic conductivity of the area.
- The storage coefficient, S, usually cannot be determined by this method.

8.5 EQUIPMENT/APPARATUS

The following equipment is needed to perform slug tests. All equipment which comes in contact with the well should be decontaminated and tested prior to commencing field activities.

- tape measure (subdivided into tenths of feet)
- water pressure transducer
- electric water level indicator
- weighted tapes
- steel tape (subdivided into tenths of feet)
- electronic data-logger (if transducer method is used)
- stainless steel slug of a known volume
- watch or stopwatch with second hand
- semilogarithmic graph paper (if required)
- waterproof ink pen and logbook
- thermometer
- appropriate references and calculator
- electrical tape
- 21X micrologger
- Compaq portable computer or equivalent with Grapher installed on the hard disk

8.6 REAGENTS

No chemical reagents are used in this procedure; however, decontamination solvents may be necessary. When decontaminating the slug or equipment, refer to ERT SOP #2006, Sampling Equipment Decontamination, and the site-specific work plan.

8.7 PROCEDURES

8.7.1 Field Procedures

When the slug test is performed using an electronic data-logger and pressure transducer, all data will be stored internally or on computer diskettes or tape. The information will be transferred directly to the main computer and analyzed. Keep a computer printout of the data in the files as documentation.

If the slug test data is collected and recorded manually, the slug test data form (Appendix C) will

water level measurement was from the top of the steel casing, top of the PVC riser pipe, from the ground surface, or from some other position on the well head.

9. The groundwater level data form in Appendix C should be completed as follows:

   - site name
   - logger name: person taking field notes
   - date: the date when the water levels are being measured
   - location: monitor well number and physical location
   - time: the military time at which the water level measurement was recorded
   - depth to water: the water level measurement in feet, or in tenths or hundreds of feet, depending on the equipment used
   - comments: any information the field personnel feels to be applicable
   - measuring point: marked measuring point on PVC riser pipe, protective steel casing or concrete pad surrounding well casing from which all water level measurements for individual wells should be measured. This provides consistency in future water level measurements.

10. Measure total depth of well (at least twice to confirm measurement) and record in site notebook or on log form.

11. Remove all downhole equipment, replace well casing cap and lock steel caps.

12. Rinse all downhole equipment and store for transport to next well.

13. Note any physical changes such as erosion or cracks in protective concrete pad or variation in total depth of well in field notebook and on field data sheets.

14. Decontaminate all equipment as outlined in Step 3 above.

5.8 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation:

$$Ew = E - D$$

where:

Ew = Elevation of water above mean sea level
E = Elevation above sea level at point of measurement
D = Depth to water

5.9 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

- All data must be documented on standard chain of custody forms, field data sheets or within personal/site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.
- Each well should be tested at least twice in order to compare results.

5.10 DATA VALIDATION

This section is not applicable to this SOP.

5.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

- An airline measures drawdown during pumping. It is only accurate to 0.5 foot unless it is calibrated for various "drawdowns".

5.5 EQUIPMENT/APPARATUS

There are a number of devices which can be used to measure water levels, such as steel tape or airlines. The device should be adequate to attain an accuracy of 0.01 feet.

The following equipment is needed to measure water levels:

- air monitoring equipment
- water level measurement device
- electronic water level indicator
- metal tape measure
- airline
- steel tape
- chalk
- ruler
- notebook
- paper towels
- decontamination solution and equipment
- groundwater level data forms

5.6 REAGENTS

No chemical reagents are used in this procedure, with the exception of decontamination solutions. Where decontamination of equipment is required, refer to ERT SOP #2006, Sampling Equipment Decontamination and the site-specific work plan.

5.7 PROCEDURES

5.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Identify and mark all sampling locations.

5.7.2 Procedures

1. Make sure water level measuring equipment is in good operating condition.

2. If possible and where applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.

3. Clean all equipment entering the well by the following decontamination procedure:

   - Triple rinse equipment with deionized water.

   - Wash equipment with an Alconox solution followed by a deionized water rinse.

   - Rinse with an approved solvent (e.g., methanol, isopropyl alcohol, acetone) as per the work plan, if organic contamination is suspected.

   - Place equipment on clean surface such as a Teflon or polyethylene sheet.

4. Remove locking well cap, note location, time of day, and date in site notebook or an appropriate groundwater level data form.

5. Remove well casing cap.

6. If required by site-specific condition, monitor headspace of well with PID or FID to determine presence of volatile organic compounds and record in site logbook.

7. Lower electric water level measuring device or equivalent (i.e., permanently installed tranducers or airline) into the well until water surface is encountered.

8. Measure the distance from the water surface to the reference measuring point on the well casing or protective barrier post and record in the field logbook. In addition, note that the

5.0 WATER LEVEL MEASUREMENT: SOP #2151

5.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water in an open borehole, cased borehole, monitoring well or piezometer.

Generally, water level measurements from boreholes, piezometers, or monitoring wells are used to construct water table or potentiometric surface maps. Therefore, all water level measurements at a given site should be collected within a 24-hour period. Certain situations may necessitate that all water level measurements be taken within a shorter time interval. These situations may include:

- the magnitude of the observed changes between wells appears too large
- atmospheric pressure changes
- aquifers which are tidally influenced
- aquifers affected by river stage, impoundments, and/or unlined ditches
- aquifers stressed by intermittent pumping of production wells
- aquifers being actively recharged due to precipitation events

5.2 METHOD SUMMARY

A survey mark should be placed on the casing for use as a reference point for measurement. Many times the lip of the riser pipe is not flat. Another measuring reference should be located on the grout apron. The measuring point should be documented in the site logbook and on the groundwater level data form (see Appendix C).

Water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. In low yield situations, recovery may take longer.

Working with decontaminated equipment, proceed from the least to the most contaminated wells. Open the well and monitor headspace with the appropriate monitoring instrument to determine the presence of volatile organic compounds. Lower the water level measurement device into the well until water surface or bottom of casing is encountered. Measure distance from water surface to the reference point on the well casing and record in the site logbook and/or groundwater level data form. Remove all downhole equipment, decontaminate as necessary, and replace well casing cap.

5.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this SOP.

5.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The chalk used on steel tape may contaminate the well.
- Cascading water may obscure the water mark or cause it to be inaccurate.
- Many types of electric sounders use metal indicators at 5-foot intervals around a conducting wire. These intervals should be checked with a surveyor's tape to ensure accuracy.
- If there is oil present on the water, it can insulate the contacts of the probe on an electric sounder or give false readings due to thickness of the oil. Determining the thickness and density of the oil layer may be warranted, in order to determine the correct water level.
- Turbulence in the well and/or cascading water can make water level determination difficult with either an electric sounder or steel tape.

4 Sampling Equipment Decontamination (#2006)

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the priority pollutant list. If acetone is known to be a contaminant of concern at a given site or if target compound list analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

7 Photoionization Detector (PID) (#2056)

The PID is a useful general survey instrument at hazardous waste sites. A PID is capable of detecting and measuring real-time concentrations of many organic and inorganic vapors in air. A PID is similar to a flame ionization detector (FID) in application; however, the PID has somewhat broader capabilities in that it can detect certain inorganic vapors. Conversely, the PID is unable to respond to certain low molecular weight hydrocarbons, such as methane and ethane, that are readily detected by FID instruments. The PID employs the principle of photoionization. The analyzer will respond to most vapors that have an ionization potential less than or equal to that supplied by the ionization source, which is an ultraviolet (UV) lamp. Three probes, each containing a different UV light source, are available for use with the PID. Lamp energies typically available are 9.5, 10.2, and 11.7 electron volts (eV). All three detect many aromatic and large molecular hydrocarbons. The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable than the 11.7 eV probe and detects more compounds than the 9.5 eV probe.

Gases with ionization potentials near to or less than that of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials higher than that of the lamp will not be detected. The ionization potential of the major components of air, oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to about 15.6 eV and are not ionized by any of the three lamps.

6 Sediment Sampling (#2016)

Sediment samples may be collected using a variety of methods and equipment, depending on the depth of the aqueous layer, the portion of the sediment profile required (surface vs. subsurface), the type of sample required (disturbed vs. undisturbed), contaminants present, and sediment type.

Sediment is collected from beneath an aqueous layer either directly, using a hand held device such as a shovel, trowel, or auger, or indirectly, using a remotely activated device such as an Ekman or Ponar dredge. Following collection, sediment is transferred from the sampling device to a sample container of appropriate size and construction for the analyses requested. If composite sampling techniques are employed, multiple grabs are placed into a container constructed of inert material, homogenized, and transferred to sample containers appropriate for the analyses requested.

The homogenization procedure should not be used if sample analysis includes volatile organics; in this case, sediment, or multiple grabs of sediment, should be transferred directly from the sample collection device or homogenization container to the sample container.

5 Soil Sampling (#2012)

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, or scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

Record all field measurements on the field data sheets and in the field logbook.

Sampling will proceed once purging is completed, water quality measurements have stabilized, and the correct sample jars and/or vials have been prepared. The samplirg device (which may or may not be the same as the purging device) has been selected so as to not affect the integrity of the sample. Sampling will occur in a progression from the least to most contaminated well, if known. The water sample will be collected using a dedicated high density polyethylene bailer. The bailer will be attached to a clean, dedicated, nylon rope and introduced into the well. The bailer will be lowered to the approximate mid-point of the screened interval. Once the sample is collected, care will be taken not to unduly agitate or aerate the water while pouring into the appropriate sample containers.

3 Groundwater Well Sampling (#2007)

Prior to sampling existing monitoring wells, the well will be purged. For this project, this will be accomplished with dedicated high density polyethylene (HDPE) bailers.

Brush off well cap prior to opening, unlock and open well cap. A photoionization detector (PID) or flame ionization detector (FID) will be used on the escaping gases to determine the need for respiratory protection. Using a decontaminated water level indicator, the water level will be measured to the nearest 0.01 foot. Total depth of the well will be obtained with a depth sounder and the volume of water in the well will be calculated using the following procedure:

Well Volume = $\pi r2h$ (7.481 gal/ft^3)

Where: π = 3.1415687

r = radius of well casing in feet

h = height of water column of well from water level.

7.481 = conversion from ft^3 to number of gallons.

Three well volumes at a minimum should be purged if possible. Equipment must be decontaminated prior to use and between wells. Approximately 10 feet of plastic sheeting will be placed around the well upon which the assembly of the decontaminated purging equipment will be placed. The assembly will be lowered into the well to a point just below the surface of the water.

If a pump is used the following is applicable. When pumping the well, lower the pump slowly to a point three feet above the bottom of the well. Record the flow rate and calculate the length of pumping time required to purge the requisite three casing volumes. [Discharged to ground surface adjacent to the well or containerized if necessary.] Should the well yield be insufficient to produce the requisite three volumes, purging will continue to the point of well evacuation, then terminated and the well will be sampled upon recharge.

Measure the conductivity, temperature, and pH of the groundwater in a separate container.

2 Quality Assurance/Quality Control Samples (#2005)

Quality Assurance (QA) samples are used as an assessment tool to determine if environmental data meet the quality criteria established for a specific application. Quality Control (QC) samples are generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. The goal of including QA/QC samples with any sampling or analytical event is to be able to identify, measure and control the sources of error that may be introduced from the time of sample bottle preparation through analysis.

Analytical results for these samples can be used to assess accuracy as well as cross contamination. Accuracy refers to the correctness of the concentration value and the qualitative certainty that the analyte is present. It is a combination of both bias (systematic error) and precision (random error). Bias is defined as the deviation of a measured value from a reference value or known spiked amount, and is determined by calculating percent recovery. Precision is a measure of the closeness of agreement among individual measurements. Precision is determined by coefficient of variation calculations.

1. Sample Storage, Preservation, and Handling (#2003)

Samples should be collected using equipment and procedures appropriate to the matrix, parameters and sampling objective. The volume of the sample collected must be sufficient to perform the analysis requested. Samples must be stored in the proper types of containers and preserved in a manner appropriate to the analysis to be performed.

All samples must be cooled to 4°C from the time of collection until analysis. When a preservative other than cooling is used, the preservative is generally added after the sample is collected, unless the sample container has been pre-preserved by the laboratory. If necessary, the pH must be adjusted to the appropriate level and checked with pH paper in a manner which will not contaminate the sample.

Appendix A

Sampling SOPs

References

1 U.S. EPA, October 20, 1995b, Risk-Based Concentration Table, July - December 1995, U.S. EPA, Philadelphia, PA

2 U.S. EPA, March 1995a, Numeric Removal Action Levels for Contaminated Drinking Water Sites, U.S. EPA, Washington, DC

3 U.S. EPA, November 1991, Removal Program Representative Sampling Guidance, Volume 1 - Soil, U.S. EPA, Washington, DC

5.0 SCHEDULE

The following is the tentative schedule proposed for EE/CA extent of contamination sampling activities.

Proposed Schedule of Work

Activity	Start Date	End Date
piezometric measurements at wells	12/9/96	12/9/96
slug test	12/10/96	12/11/96
site survey, sampling grid	12/19/96	12/19/96
soil sampling (first round)	1/06/97	1/10/97
groundwater sampling (first round)	1/06/97	1/10/97
sediment sampling (first round)	1/06/97	1/10/97

4.0 HEALTH AND SAFETY PLAN

The site specific health and safety plan (SHASP) establishes the procedures and requirements to ensure the health and safety of E & E employees for the Vacant Lot project and is included as Appendix C. E & E's overall safety and health program is described in Corporate Health and Safety Program for Toxic and Hazardous Substances (CHSP). The SHASP has been prepared to meet the requirements of 29 Code of Federal Regulations section 1910.120 - Hazardous Waste Operations and Emergency Response (HAZWOPER). All personnel are required to read and sign the SHASP document before performing on-site work.

Name	Responsibility
Todd Ramaly	Interim E & E Project Manager
John Nordine	Consulting geologist
Not dedicated	Sample Technicians

3.8.2 Laboratory Information

The following laboratories will be providing the following analyses:

Lab Name/Location	Lab Type	Parameters
Not yet determined	Contract Laboratory	See Table 3-2

3.9 Attachments

The following sampling QA/QC Plan attachments are included in Appendix B.

- Inorganic Target Analyte List
- Target Compound List - Pesticides/PCBs
- Target Compound List - Semivolatiles
- Target Compound List - Volatiles

of screened samples will be analyzed at the QA2 data quality objective.

Verification data generated under this QA/QC Sampling Plan will be evaluated accordingly with appropriate criteria contained in the Removal Program Data Validation Procedures which accompany OSWER Directive #9360.4-01. The results of 10% of the samples in the analytical data packages should be evaluated for all of the elements listed in Appendix B of the sampling QA/QC Plan. The holding times, blank contamination, and detection capability will be reviewed for all remaining samples.

3.7 Deliverables

The E & E Project Manager, Raghu Nagam, will maintain contact with the U.S. EPA Remedial Project Manager, John O'Grady, to provide information regarding the technical and financial progress of the project. This communication began when the project was assigned. Activities under this project will be documented and reported in the deliverables described below.

Analysis

This sampling event requires Contract Laboratory Program (CLP) analytical services. Documentation of lab selection, raw data, and results will be provided in the analytical report.

Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain of custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

3.8 Project Organization and Responsibilities

3.8.1 Personnel Information

The U.S. EPA Remedial Project Manager, John O'Grady, will provide overall direction to the E & E staff concerning project objectives, sampling needs and schedule.

The E & E Project Manager, Raghu Nagam, is the primary point of contact with the U.S. EPA Remedial Project Manager. The Project Manager is responsible for the development and completion of the sampling QA/QC Plan, project team organization, and supervision of all project tasks. The following E & E personnel will also work on this project:

International Air Transport Association (IATA) Dangerous Goods Regulations, which applies to shipment and transportation of hazardous materials by air carrier. All IATA regulations will be followed for shipping samples to ensure compliance with U.S. DOT.

3.5 Quality Assurance Requirements

3.5.1 Screening Data (QA1)

Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. At least 10% of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality. The following specific requirements apply to field screening with QA1 data quality.

- Sample documentation (location, date and time collected, batch, etc.)
- Initial and continuing calibration (FID, PID) - will note background reading
- Determination and documentation of detection limits

3.5.2 Verification Data (QA2)

Verification analytical methods are more rigorous than QA1 regarding analytical methodology and quality assurance. This objective is analyte specific and allows for definitive identification and non-definitive quantitation of analytes. The following specific requirements apply to all data generated under the QA2 data quality objective.

- Sample documentation (location, date and time collected, batch, etc.)
- Maintenance of Chain of Custody
- Documentation and adherence to sample holding times
- Documentation of initial and continuing instrument calibration
- Analysis of method blanks, rinsate blanks, trip blanks, etc.
- Documentation of raw data (gas chromatograms, mass spectra, etc.)
- Documentation of calibration procedures, dilution factors, etc.

3.6 Data Validation

Data generated for this project will be validated as follows:

Screening data need only be evaluated for calibration and detection limits. In addition, 10%

- date and time the sample was collected
- sample preservation method
- analysis requested
- sampling location

Chain of Custody Record

A Chain of Custody Record will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept by each individual who has signed it.

The Chain of Custody Records (COCs) and Inorganic and Organic Traffic Reports will include at least the following information:

- sample identification
- sample location
- sample collection date
- sample information, i.e., matrix, number of bottles collected, etc.
- names and signatures of samplers
- signatures of all individuals who have had custody of the samples

When samples are not under direct control of the individual currently responsible for them, they will be stored in a locked container which has been sealed with a Custody Seal.

Custody Seal

Custody Seals demonstrate that a sample container has not been opened or tampered with. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

3.4.3 Sample Handling and Shipment

Each of the sample bottles will be sealed and caps will be secured with custody seals. Sample bottles will be labeled as described above. Sealed bottles will be placed in the appropriate transport containers and the containers will be packed with an appropriate absorbent material such as vermiculite. All sample documents will be affixed to the underside of each transport container lid. The lid will be sealed and custody seals will be affixed to the transport container.

Regulations for packaging, marking/labeling, and shipping of hazardous materials and wastes are promulgated by the U.S. Department of Transportation (U.S. DOT). Air carriers which transport hazardous materials, in particular Federal Express, require compliance with the current edition of the

3.4.2 Sample Documentation

All sample documents will be completed legibly and in ink. Any corrections or revisions will be made by lining through the original entry and initialling the change. The following sample documentation will be maintained:

Field Logbook

The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. All entries will be signed by the individuals making them. Entries will include at least the following:

- site name and project number
- names of personnel on site
- dates and times of all entries
- descriptions of all site activities, including site entry and exit times
- noteworthy events and discussions
- weather conditions
- site observations
- identification and description of samples and locations
- subcontractor information and names of on-site personnel, if applicable
- dates and times of sample collections and chain of custody information
- records of photographs
- site sketches

Field Data Sheets and Sample Labels

Field data sheets and corresponding sample labels are used to identify samples and document field sampling conditions and activities. Field data sheets will be completed at the time of sample collection and will include the following information:

- site name
- samplers
- sample location and sample number
- date and time the sample was collected
- type of sample collected
- brief description of the site
- weather parameters
- analyses to be performed
- sample container, preservation, and storage information

Sample labels will be securely affixed to the sample container. They will clearly identify the particular sample, and should include the following information:

- site name and project number

Table 3-3

ANALYTICAL SUMMARY
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Remedial Unit	Program Area/Sampling Objective	Matrix	Parameter	Action Level	Required Detection Limit	Analytical Method	Required Data Type
Groundwater	Site Assessment/ Extent of Contamination	Groundwater	Metals 8-RCRA + Be, Mn, Zn	Superfund RALs	method	200.7	QA2
Groundwater	Site Assessment/Extent of Contamination	Groundwater	PCBs	Superfund RALs	method	508	QA2
Groundwater	Site Assessment/ Extent of Contamination	Groundwater	VOCs	Superfund RALs	method	524.2	QA2
Sediment	Site Assessment/ Extent of Contamination	Sediment	SVOCs	RBCs for industrial soil	method	8270	QA2
Sediment	Site Assessment/ Extent of Contamination	Sediment	Pesticides/PCBs	RBCs for industrial soil	method	8080	QA2
Sediment	Site Assessment/ Extent of Contamination	Sediment	VOCs	RBCs for industrial soil	method	8240, 8260	QA2
Sediment	Site Assessment/ Extent of Contamination	Sediment	Metals (8-RCRA, + Be, Mn, and Zn)	RBCs for industrial soil	method	6010 7471 (mercury)	QA2
Soil	Site Assessment/ Extent of Contamination	Soil	Metals (8-RCRA, + Be, Mn, and Zn)	RBCS in industrial soil	method	6010 7471 (mercury)	QA2
Soil	Site Assessment/ Extent of Contamination	Soil	SVOCs	RBCS in industrial soil	method	8270	QA2
Soil	Site Assessment/ Extent of Contamination	Soil	Pesticides/PCBs	RBCS in industrial soil	method	8080	QA2
Soil	Site Assessment/ Extent of Contamination	Soil	VOCs	RBCS in industrial soil	method	8240, 8260	QA2

Key:
RCRA = Resource Conservation and Recovery Act (the 8 RCRA metals are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
Be = beryllium
Mn = manganese
Zn = zinc
RALs = Removal Action Levels for Contaminated Drinking Water Sites under Superfund
QA2 = Quality Assurance Level 2
PCBs = polychlorinated biphenyls
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
RBCs = Risk-Based Concentrations

as the sample container types and the volume of sample to be collected at each location, the preservation method to be used, and the sample holding times.. The following sampling equipment/media will be used to obtain environmental samples from the respective matrix:

Parameter/Matrix	Equipment/Media	Fabrication	Dedicated
Semivolatiles, Pesticides, PCBs, VOCs, and Metals/ Sediment	Trowel/Auger	Stainless Steel	non-dedicated
Metals, VOCs, and PCBs/Groundwater	Bailers	Polyethylene	dedicated
Semivolatiles, Pesticides, PCBs, VOCs, and Metals/ Soil	Trowel/Auger	Stainless Steel	non-dedicated

Table 3-3, Analytical Summary, contains the action levels, required detection limits, analytical method/instrument references, and the associated required data type designation.

3.4 Standard Operating Procedures (SOPs)

3.4.1 Sampling SOPs

E & E's sampling SOPs will be implemented for this project. These are applicable procedures which may be varied or changed as required, dependent upon site conditions and equipment limitations imposed by the procedure. In all instances, the ultimate procedures employed will be documented and associated with the final project deliverables.

The following SOPs are included in Appendix A.

Sample Storage, Preservation, and Handling (#2003)

Quality Assurance/Quality Control Samples (#2005)

Groundwater Well Sampling (#2007)

Sampling Equipment Decontamination (#2006)

Soil Sampling (#2012)

Sediment Sampling (#2016)

Photoionization Detector (PID) (#2056)

Table 3-2

SAMPLINGS REQUIREMENTS SUMMARY
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Remedial Unit	Program Area/Sampling Objective	Matrix	Parameter	Sample Container Number	Preservation	Sample Holding Time
Groundwater	Site Assessment/ Extent of Contamination	Groundwater	Metals	8 1-liter poly	HNO_3 to pH = 2 Ice to 4°C	6 months
Groundwater	Site Assessment/ Extent of Contamination	Groundwater	VOCs	27 40ml vials	HCl to pH = 2 Ice to 4°C	7 days
Groundwater	Site Assessment/ Extent of Contamination	Groundwater	PCBs	8 1-liter amber glass	Ice to 4°C	7 Days to extract 40 days to analyze
Sediment	Site Assessment/ Extent of Contamination	Sediment	SVOCs	17 8oz jars 1 1-liter amber (rinsate)	Ice to 4°C	7 days- extract 40 days to analyze
Sediment	Site Assessment/ Extent of Contamination	Sediment	Pesticides/PCBs	17 8oz jars 1 1-liter amber (rinsate)	Ice to 4°C	7 days-extract 40 days to analyze
Sediment	Site Assessment/ Extent of Contamination	Sediment	VOCs	17 4oz jars 3 40ml vials (rinsate)	Ice to 4°C rinsate - HCl to pH = 2	7 days
Sediment	Site Assessment/ Extent of Contamination	Sediment	Metals	17 8oz jars 1 1-liter poly (rinsate)	Ice to 4°C rinsate - HNO_3 to pH = 2	6 months
Soil	Site Assessment/ Extent of Contamination	Soil	Metals	110 8oz jars 1 1-liter poly (rinsate)	Ice to 4°C rinsate - HNO_3 to pH = 2	6 months
Soil	Site Assessment/ Extent of Contamination	Soil	SVOCs	55 8oz jars 1 1-liter amber (rinsate)	Ice to 4°C	7 days-extract 40 days to analyze
Soil	Site Assessment/ Extent of Contamination	Soil	Pesticides/PCBs	55 8oz jars 1 1-liter amber (rinsate)	Ice to 4°C	7 days-extract 40 days to analyze
Soil	Site Assessment/ Extent of Contamination	Soil	VOCs	est. 33 4oz jars 3 40ml vials (rinsate)	Ice to 4°C rinsate - HCl to pH = 2	7 days

Key:
poly = Polyethylene.
VOCs = Volatile organic compounds.
SVOCs = Semivolatile organic compounds.
HNO_3 = Nitric acid preservative.
ml = Milliliter.
oz = Ounce.
PCBs = Polychlorinated Biphenyls.
HCL = Hydorchloric acid preservative.

recycled paper

Table 3-1

FIELD SAMPLING SUMMARY
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Matrix	Parameter	Background Samples	Screening Samples	Confirm Samples	Trip Blanks	Field Blanks	Rinsate Blanks	Matrix Spikes	PE Samples	Replicate Samples	Located Samples	Total Samples
Groundwater	Metals	0	0	0	0	2	0	0	0	1	21	23
Groundwater	PCBs	0	0	0	0	2	0	0	0	1	21	23
Groundwater	VOCs	0	0	0	1	1	0	0	0	2	21	25
Soil	Metals	0	0	0	0	0	1	0	0	10	100	111
Soil	SVOCs	0	0	0	0	0	1	0	0	5	50	56
Soil	Pesticides and PCBs	0	0	0	0	0	1	0	0	5	50	56
Soil	VOCs	0	100	unknown est. 30	0	0	1	0	0	10% of confirmation est. 3	0	est. 34
Sediment	SVOC	4	0	N/A	0	0	1	0	0	1	12	18
Sediment	VOCs	4	0	N/A	0	0	1	0	0	1	12	18
Sediment	Metals	4	0	N/A	0	0	1	0	0	1	12	18
Sediment	Pesticides/PCBs	4	0	N/A	0	0	1	0	0	1	12	18

Key: PE = Performance evaluation.
PCBs = Polychlorinated biphenyls.
VOCs = Volatile organic compounds.
SVOCs = Semivolatile organic compounds.

background levels as measured by a OVA. Samples will be collected from depths of 0 - 12 inches and 1 - 2 feet. In the event that elevated readings are observed, several samples will be collected for VOC analysis in order to verify the QA1 field screening.

Sampling Design for Characterizing Sediments:

The biased or judgmental sampling approach will be implemented, choosing locations adjacent to or immediately downstream of potential source outfalls. Samples will be collected from the following locations and depths/areas: There will be 8 sample locations. At each sample location, two samples will be collected, one from a depth of 0 - 12 inches and the other from a depth of 1 - 2 feet.

Two of the eight locations are off-site and upstream of the site and will be considered as background samples.

Sampling Design for Characterizing Groundwater:

Samples will be collected from all existing shallow monitoring wells. Additional groundwater samples will be collected from about 15 new Geoprobe locations. Field sampling [illegible] is given in Table 3-1. Table 3-1 also identifies the number of field samples and QA/QC samples to be collected.

3.3 Sampling and Analysis

Sampling Requirements Summary (Table 3-2) contains information pertinent to sampling, such as the sampling container types and the volume of sample to be collected at each location, the preservation method to be used, and the sample holding times.

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The following chart summarizes sampling objectives.

Remedial Unit	Sampling Objective	Matrix	Parameter
sediment	Site Assessment/Extent of Contamination	Sediment	VOCs, Semivolatiles, Metals, Pesticides, and PCBs
groundwater	Site Assessment/Extent of Contamination	Groundwater	VOCs, Metals, PCBs
soil	Site Assessment/Extent of Contamination	Soil	VOCs, Semivolatiles,Metals, Pesticides, and PCBs

Sampling Design for Characterizing Metals in Soils:

The systematic grid sampling approach will be implemented. Samples will be collected from the following locations and depths/areas: Soil sampling will occur at the nodes of a rectangular grid. The grid will be 80' x 80' and have approximately 50 nodes. An elliptically shaped hotspot with approximate dimensions of 95 feet long and 45 feet wide will be detected with a probability of 95% using an 80 foot by 80 foot rectangular grid. At each node, samples will be collected from depths of 0 - 12 inches and 1 - 2 feet.

Sampling Design for Characterizing Semivolatiles, PCBs, and Pesticides in Soil:

The systematic grid sampling approach will be implemented. Samples will be collected from the following locations and depths/areas: Samples will be drawn from approximately 25 nodes on a 113' x 113' matrix grid. At each node, samples will be taken from depths of 0 - 12 inches and 1 - 2 feet. An elliptically shaped hotspot with approximate dimensions of 105 feet long and 53 feet wide will be detected with a probability of 95% using a 113 foot by 113 foot rectangular grid. On a site where many small point-source sources of contamination are present (tanks, drums, etc.) and where migration pathways may be narrow or otherwise confined, these grid sizes would not be adequate.

Sampling Design for Characterizing VOCs in Soil:

Samples will be collected from the following locations and depths/areas: Sample collection will occur at any node where field screening indicates the presence of organic vapors above

4 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a]

	Volatiles	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl chloride	75-01-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene chloride	75-09-2	10	10
6.	Acetone	67-64-1	10	10
7.	Carbon disulfide	75-15-0	10	10
8.	1,1-Dichloroethene	75-35-4	10	10
9.	1,1-Dichloroethane	75-34-3	10	10
10.	1,2-Dichloroethene (total)	540-59-0	10	10
11.	Chloroform	67-66-3	10	10
12.	1,2-Dichloroethane	107-06-2	10	10
13.	2-Butanone	78-93-3	10	10
14.	1,1,1-Trichloroethane	71-55-6	10	10
15.	Carbon tetrachloride	56-23-5	10	10
16.	Bromodichloromethane	75-27-4	10	10
17.	1,2-Dichloropropane	78-87-5	10	10
18.	cis-1,3-Dichloropropene	10061-01-5	10	10
19.	Trichloroethene	79-01-6	10	10
20.	Dibromochloromethane	124-48-1	10	10
21.	1,1,2-Trichloroethane	79-00-5	10	10

4 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a] (Cont.)

	Volatiles	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
22.	Benzene	71-43-2	10	10
23.	trans-1,3-Dichloropropene	10061-02-6	10	10
24.	Bromoform	75-25-2	10	10
25.	4-Methyl-2-pentanone	108-10-1	10	10
26.	2-Hexanone	591-78-6	10	10
27.	Tetrachloroethene	127-18-4	10	10
28.	Toluene	108-88-3	10	10
29.	1,1,2,2-Tetrachloroethane	79-34-5	10	10
30.	Chlorobenzene	108-90-7	10	10
31.	Ethyl benzene	100-41-4	10	10
32.	Styrene	100-42-5	10	10
33.	Xylenes (total)	1330-20-7	10	10

[a] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[b] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[c] Medium Soil/Sediment Quantitation Limits (QL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment QL.

Based on the Contract Laboratory Program Statement of Work, OLMO1.6 (6/91).

3 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a]

	Semivolatiles	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
34.	Phenol	108-95-2	10	330
35.	bis (2-Chloroethyl)ether	111-44-4	10	330
36.	2-Chlorophenol	95-57-8	10	330
37.	1,3-Dichlorobenzene	541-73-1	10	330
38.	1,4-Dichlorobenzene	106-46-7	10	330
39.	1,2-Dichlorobenzene	95-50-1	10	330
40.	2-Methylphenol	95-48-7	10	330
41.	2,2-oxybis (1-chloropropane)	108-60-1	10	330
42.	4-Methylphenol	106-44-5	10	330
43.	N-Nitroso-di-n-propylamine	621-64-7	10	330
44.	Hexachloroethane	67-72-1	10	330
45.	Nitrobenzene	98-95-3	10	330
46.	Isophorone	78-59-1	10	330
47.	2-Nitrophenol	88-75-5	10	330
48.	2,4-Dimethylphenol	105-67-9	10	330
49.	bis (2-Chloroethoxy) methane	111-91-1	10	330
50.	2,4-Dichlorophenol	120-83-2	10	330
51.	1,2,4-Trichlorobenzene	120-82-1	10	330
52.	Naphthalene	91-20-3	10	330
53.	4-Chloroaniline	106-47-8	10	330
54.	Hexachlorobutadiene	87-68-3	10	330
55.	4-Chloro-3-methylphenol	59-50-7	10	330
56.	2-Methylnaphthalene	91-57-6	10	330

3 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a] (Cont.)

	Semivolatiles	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
57.	Hexachlorocyclopentadiene	77-47-4	10	330
58.	2,4,6-Trichlorophenol	88-06-2	10	330
59.	2,4,5-Trichlorophenol	95-95-4	25	800
60.	2-Chloronaphthalene	91-58-7	10	330
61.	2-Nitroaniline	88-74-4	25	800
62.	Dimethylphthalate	131-11-3	10	330
63.	Acenaphthylene	208-96-8	10	330
64.	2,6-Dinitrotoluene	606-20-2	10	330
65.	3-Nitroaniline	99-09-2	25	800
66.	Acenaphthene	83-32-9	10	330
67.	2,4-Dinitrophenol	51-28-5	25	800
68.	4-Nitrophenol	100-02-7	25	800
69.	Dibenzofuran	132-64-9	10	330
70.	2,4-Dinitrotoluene	121-14-2	10	330
71.	Diethylphthalate	84-66-2	10	330
72.	4-Chlorophenyl-phenylether	7005-72-3	10	330
73.	Fluorene	86-73-7	10	330
74.	4-Nitroaniline	100-01-6	25	800
75.	4,6-Dinitro-2-methylphenol	534-52-1	25	800
76.	N-nitrosodiphenylamine	86-30-6	10	330
77.	4-Bromophenyl-phenyl ether	101-55-3	10	330
78.	Hexachlorobenzene	118-74-1	10	330
79.	Pentachlorophenol	87-86-5	25	800

3 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a] (Cont.)

	Semivolatiles	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
80.	Phenanthrene	85-01-8	10	330
81.	Anthracene	120-12-7	10	330
82.	Carbazole	86-74-8	10	330
83.	Di-n-butylphthalate	84-74-2	10	330
84.	Fluoranthene	206-44-0	10	330
85.	Pyrene	129-00-0	10	330
86.	Butylbenzylphthalate	85-68-7	10	330
87.	3,3-Dichlorobenzidine	91-94-1	20	660
88.	Benzo(a)anthracene	56-55-3	10	330
89.	Chrysene	218-01-9	10	330
90.	bis(2-Ethylhexyl)phthalate	117-81-7	10	330
91.	Di-n-octylphthalate	117-84-0	10	330
92.	Benzo(b)fluoranthene	205-99-2	10	330
93.	Benzo(k)fluoranthene	207-08-9	10	330
94.	Benzo(a)pyrene	50-32-8	10	330
95.	Indeno(1,2,3-cd)pyrene	193-39-5	10	330
96.	Dibenz(a,h)anthracene	53-70-3	10	330
97.	Benzo(g,h,i)perylene	191-24-2	10	330

[a] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[b] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[c] Medium Soil/Sediment Quantitation Limits (QL) for Semivolatile TCL Compounds are 60 times the individual Low Soil/Sediment QL.

Based on Contract Laboratory Program Statement of Work, OLMO1.6 (6/91).

2 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a]

	Pesticides/PCBs	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
98.	alpha-BHC	319-84-6	0.05	1.7
99.	beta-BHC	319-85-7	0.05	1.7
100.	delta-BHC	319-86-8	0.05	1.7
101.	gamma-BHC (Lindane)	58-89-9	0.05	1.7
102.	Heptaclor	76-44-8	0.05	1.7
103.	Aldrin	309-00-2	0.05	1.7
104.	Heptachlor epoxide	1024-57-3	0.05	1.7
105.	Endosulfan I	959-98-8	0.05	1.7
106.	Dieldrin	60-57-1	0.10	3.3
107.	4,4'-DDE	72-55-9	0.10	3.3
108.	Endrin	72-20-8	0.10	3.3
109.	Endosulfan II	33213-65-9	0.10	3.3
110.	4,4'-DDD	72-54-8	0.10	3.3
111.	Endosulfan sulfate	1031-07-8	0.10	3.3
112.	4,4'-DDT	50-29-3	0.10	3.3
113.	Methoxychlor	72-43-5	0.50	17.0
114.	Endrin ketone	53494-70-5	0.10	3.3
115.	Endrin aldehyde	7421-36-3	0.10	3.3
116.	alpha-Chlordane	5103-71-9	0.5	1.7
117.	gamma-Chlordane	5103-74-2	0.5	1.7
118.	Toxaphene	8001-35-2	1.0	170.0

2 TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL) [a] (Cont.)

	Pesticides/PCBs	CAS Number	Quantitation Limits [b] Water µg/L	Low Soil/Sediment [c] µg/Kg
119.	Aroclor-1016	12674-11-2	0.5	33.0
120.	Aroclor-1221	11104-28-2	0.5	33.0
121.	Aroclor-1232	11141-16-5	0.5	67.0
122.	Aroclor-1242	53469-21-9	0.5	33.0
123.	Aroclor-1248	12672-29-6	0.5	33.0
124.	Aroclor-1254	11097-69-1	1.0	33.0
125.	Aroclor-1260	11096-82-5	1.0	33.0

[a] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[b] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[c] Medium Soil/Sediment Quantitation Limits (QL) for Pesticides/PCB TCL compounds are 15 times the individual Low Soil/Sediment QL.

Based on the Contract Laboratory Program Statement of Work, OLMO1.6 (6/91).

Appendix B

Analytical Results QA/QC Memoranda

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: January 29, 1997

SUBJECT: Review of Data
Received for Review on January 22, 1997

FROM: Stephen L. Ostrodka, Chief (SRT-4J)
Superfund Technical Support Section

TO: Data User: E & E

We have reviewed the data by CADRE for the following case:

SITE NAME: Vacant Lot Site (IL)

CASE NUMBER: 25261 **SDG NUMBER:** MEMK64

Number and Type of Samples: 7 soil

Sample Numbers: MEMK64-66, 68-71

Laboratory: Sentinel Hrs. for Review: 3 + 0.5 wk

Following are our findings:

[illegible]

[illegible]

[illegible]

CC: Brian Freeman
Region 5 TPO
Mail Code: SM-5J

Appendix C

Figures

Figure	Title
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C-2	Site Features Map
C-3	Sample Location Map
C-4	Soil Inorganic Contamination Map
C-5	Soil Organic Contamination Map
C-6	Groundwater Inorganic Contamination Map
C-7	Groundwater Organic Contamination Map
C-8	Sediment Inorganic Contamination Map
C-9	Sediment Organic Contamination Map
C-10	Source Contamination Contour Map
C-11	Surface Water Drainage Map
C-12	Habitat Map
C-13	Land Use Map
C-14	Sites of Potential Concern Map

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Appendix D

Tables

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Table	Title
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Table D-1

HISTORICAL ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E & E S-1 9/94	E & E S-4 9/94	E & E S-5 9/94
Inorganics																		
Arsenic	23	610	ND	ND	ND	ND	ND	3.0	1.33	1.20	23.2	485	22.8	29.8	16.4	19.0	29.0	32.0
Barium	5,500	1.4E5	53.1	525	42.1	20.1	26.9	ND	ND	ND	364	120	294	210	227	70.0	395	337
Beryllium	0.15	1.3	NA	NA	NA	NA	NA	NA	NA	NA	54.9	2.10	58.1	57.7	15.90	3.50	0.78	21.5
Cadmium	39	100	0.68	9.46	0.68	ND	ND	0.26	2.99	0.89	35.0	8.80	18.5	19.1	21.7	3.0	18.6	29.9
Chromium	390	10,000	7.72	12.8	10.8	5.35	8.6	16	24.8	14.9	228	32.3	133	136	107	28.0	337	176
Copper	3,100	82,000	NA	NA	NA	NA	NA	NA	NA	NA	38.8	0.910	27.0	28.5	14.3	2,500	10,900	24,[illegible]
Lead	400	1,400	221	3,881	295	20.7	ND	79.3	1,250	227	12,600	558	8,300	8,810	8,680	1,000	6,020	6,210
Manganese	390	10,000	NA	NA	NA	NA	NA	NA	NA	NA	2,540	539	3,190	3,440	1,200	710	814	1,770
Mercury	23	610	0.417	0.35	0.089	0.189	0.023	0.03	0.07	0.04	1.13	0.66	0.33	0.29	3.23	1.7	3.33	0.51
Selenium	390	10,000	ND	ND	ND	ND	ND	ND	ND	ND	4.06	ND	5.57	5.50	6.41	ND	ND	ND
Silver	390	10,000	5.08	2.43	16.3	1.75	4.50	10.4	2.52	1.13	9.90	3.30	8.40	8.90	49.2	3.8	7.4	21.7
Zinc	23,000	6.1E5	NA	NA	NA	NA	NA	NA	NA	NA	99.0	1.97	82.5	89.3	37.2	8,400	22,100	54,900

Table D-1

HISTORICAL ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E & E S-1 9/94	E & E S-4 9/94	E & E S-5 9/94
Volatile Organic Compounds																		
Acetone	7,800	2.0E5	NA	NA	NA	NA	NA	NA	NA	NA	0.019	ND	ND	0.004	0.007	NA	NA	NA
2-Butanone	47,000	1.0E6	NA	NA	NA	NA	NA	NA	NA	NA	0.018	ND	ND	ND	ND	NA	NA	NA
1,1-Dichloroethene	1.1	9.5	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene	780	20,000	ND	ND	ND	ND	ND	NA	NA	NA	0.029	ND	ND	ND	0.056	5.1	NA	NA
Methylene chloride	85	760	ND	ND	ND	0.031	ND	NA	NA	NA	NA	NA	NA	NA	NA	2.40	NA	NA
1,1,1-Trichloroethane	7,000	1.8E5	ND	ND	ND	ND	0.0051	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA	NA
Trichloroethene	58	510	ND	ND	ND	ND	0.091	NA	NA	NA	0.44	ND	ND	ND	0.13	45	NA	NA
Tetrachloroethene	12	110	ND	ND	ND	ND	ND	NA	NA	NA	0.003	ND	ND	ND	0.024	0.93	NA	NA
Toluene	16,000	4.1E5	ND	0.0429	ND	ND	ND	0.014	0.030	0.024	0.007	ND	ND	ND	ND	ND	NA	NA
Vinyl chloride	0.34	3.0	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA
Semivolatile Organic Compounds																		
Benzo(a)anthracene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	0.19	2.30	ND	0.26	1.00	NA	NA	NA
Benzo(b)fluoranthene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	0.44	3.40	0.49	1.10	0.98	NA	NA	NA
Benzo(a)pyrene	0.088	0.78	ND	ND	ND	ND	ND	NA	NA	NA	ND	2.40	0.23	0.57	0.52	NA	NA	NA
Fluoranthene	3,100	82,000	ND	ND	ND	ND	ND	NA	NA	NA	0.270	4.00	0.19	0.34	1.10	NA	NA	NA

Table D-1

HISTORICAL ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E & E S-1 9/94	E & E S-4 9/94	E & E S-5 9/94
Ideno(1,2,3-cd)pyrene	0.88	7.8	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	NA	NA
Phenanthrene	NS	NS	ND	ND	ND	ND	ND	NA	NA	NA	0.25	3.80	0.18	0.23	0.70	NA	NA	NA
Pyrene	2,300	61,000	ND	ND	ND	ND	ND	NA	NA	NA	0.29	3.70	0.26	0.36	1.60	NA	NA	NA
Pesticides																		
Aldrin	0.038	0.34	NA	NA	NA	NA	NA	NA	NA	NA	0.066	0.067	0.024	0.028	0.049	NA	NA	NA
Chlordane	0.49	4.4	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	NA	NA	NA
4,4'-DDE	1.9	17	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	1.80	NA	NA	NA
4,4'-DDT	1.9	17	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.18	0.0089	0.012	1.40	NA	NA	NA
Dieldrin	0.04	0.36	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.016	0.0037	0.0049	ND	NA	NA	NA
Endrin	23	610	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.170	ND	ND	ND	NA	NA	NA
Heptachlor epoxide	0.07	0.63	NA	NA	NA	NA	NA	NA	NA	NA	0.027	ND	ND	ND	ND	NA	NA	NA

Table D-1

HISTORICAL ON-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection															
	R	I	MAEC B-1 1/89	MAEC B-2 1/89	MAEC B-3 1/89	MAEC B-4/C1 1/89	MAEC B-4/C2 1/89	Enviro S-1 5/91	Enviro S-2 5/91	Enviro S-3 5/91	IEPA X102 5/93	IEPA X103 5/93	IEPA X104 5/93	IEPA X105 5/93	IEPA X107 5/93	E & E S-1 9/94	E & E S-4 9/94	E & E S-5 9/94
Polychlorinated Biphenyls (PCBs)																		
Total PCBs	0.083	0.74	ND	ND	ND	0.238	2.25	36.3	12.8	13.9	2.57	7.50	1.26	1.28	5.80	17.4	ND	NA

Key:
- R = Residential risk-based concentration via exposure scenario by soil ingestion (U.S. EPA 1995a).
- I = Industrial risk-based concentration via exposure scenario by soil ingestion (U.S. EPA 1995a).
- MAEC = MAECORP, Inc.
- Enviro = Envirodyne Engineers, Inc.
- IEPA = Illinois Environmental Protection Agency.
- E & E = Ecology and Environment, Inc.
- ND = Not detected.
- NA = Not analyzed.
- NS = Not specified.
- mg/kg = Milligrams per kilogram.
- ▭ = Value exceeds the industrial risk-based concentration via exposure by soil ingestion.

Analytical Sources: (MAECORP 1989a,b,c), (Envirodyne 1991a,b), (IEPA 1995), and (Ecology and Environment 1995).

Table D-2

HISTORICAL OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection									
	R	I	Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E & E S-6 9/94
Inorganics												
Arsenic	23	610	0.07	1.27	4.00	7.73	9.68	8.06	5.01	9.47	9.47	180
Barium	5,500	1.4E5	ND	ND	ND	77.2	176	106	112	129	88.9	55.2
Beryllium	0.15	1.3	NA	NA	NA	1.00	2.00	1.40	1.00	1.30	0.97	0.63
Cadmium	39	100	3.26	1.90	2.71	0.82	17.6	8.8	ND	8.8	ND	3.79
Chromium	390	10,000	9.25	12.3	17.2	22.8	80.9	30.9	16.3	24.2	21.4	16.3
Copper	3,100	82,000	NA	NA	NA	0.033	3.02	1.96	1.38	1.16	0.38	ND
Lead	400	1,400	294	125	715	46.8	1,760	1,110	542	910	198	495
Manganese	390	10,000	NA	NA	NA	756	393	603	247	738	314	774
Mercury	23	610	0.03	0.20	0.02	0.07	1.77	0.61	0.41	0.36	0.11	0.20
Selenium	390	10,000	ND	ND	ND	0.26	2.79	ND	ND	ND	ND	ND
Silver	390	10,000	2.75	2.17	2.81	0.82	3.30	1.70	ND	0.70	ND	ND
Zinc	23,000	6.1E5	NA	NA	NA	0.124	8.47	4.83	5.81	10.7	1.84	ND

Table D-2

HISTORICAL OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection									
	R	I	Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E & E S-6 9/94
Volatile Organic Compounds												
Acetone	7,800	2.0E5	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
2-Butanone	47,000	1.0E6	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
1,1-Dichloroethene	1.1	9.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene	780	20,000	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Methylene chloride	85	760	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	7,000	1.8E5	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Trichloroethene	58	510	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Tetrachloroethene	12	110	NA	NA	NA	0.014	ND	ND	ND	ND	ND	NA
Toluene	16,000	4.1E5	0.010	0.014	0.015	0.014	ND	ND	ND	ND	ND	NA
Vinyl chloride	0.34	3.0	NA	NA	NA	NA	NA	ND	ND	ND	ND	NA
Semivolatile Organic Compounds												
Benzo(a)anthracene	0.88	7.8	NA	NA	NA	0.18	7.70	0.54	0.84	1.10	0.11	NA
Benzo(b)fluoranthene	0.88	7.8	NA	NA	NA	0.34	8.60	0.59	1.10	1.20	0.27	NA

Table D-2

HISTORICAL OFF-SITE SOIL SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentrations		Source Sample Identification Date of Collection									
	R	I	Enviro S-4 5/91	Enviro S-5 5/91	Enviro S-6 5/91	IEPA X101 5/93	IEPA X108 5/93	IEPA X109 5/93	IEPA X110 5/93	IEPA X111 5/93	IEPA X112 5/93	E & E S-6 9/94
Benzo(a)pyrene	0.088	0.78	NA	NA	NA	0.44	7.90	0.55	0.74	1.00	ND	NA
Fluoranthene	3.100	82.000	NA	NA	NA	0.49	16.0	1.00	1.80	2.00	0.20	NA
Ideno(1,2,3-cd)pyrene	0.88	7.8	NA	NA	NA	0.44	4.00	ND	0.42	0.57	ND	NA
Phenanthrene	NS	NS	NA	NA	NA	0.25	13.0	0.53	1.20	1.40	0.094	NA
Pyrene	2,300	61.000	NA	NA	NA	0.42	13.0	0.96	1.50	1.70	0.17	NA
Pesticides												
Aldrin	0.038	0.34	NA	NA	NA	0.001	0.017	0.0067	0.0048	ND	0.0032	NA
Chlordane	0.49	4.4	NA	NA	NA	0.0023	0.023	0.016	0.007	0.028	0.007	NA
4,4'-DDE	1.9	17	NA	NA	NA	0.0048	0.22	0.070	0.094	0.071	0.0048	NA
4,4'-DDT	1.9	17	NA	NA	NA	0.064	0.580	0.082	0.077	0.097	0.015	NA
Dieldrin	0.04	0.36	NA	NA	NA	0.0044	0.038	0.016	0.0081	0.0047	0.043	NA
Endrin	23	610	NA	NA	NA	0.0068	ND	0.025	ND	0.028	ND	NA
Heptachlor epoxide	0.07	0.63	NA	NA	NA	0.82	ND	0.0075	0.0035	0.0033	ND	NA
Polychlorinated Biphenyls (PCBs)												
Total PCBs	0.083	0.74	0.028	0.016	0.064	0.355	3.88	1.37	1.05	0.360	0.18	0.064

Key:	R =	Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
	I =	Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
	Enviro =	Envirodyne Engineers, Inc.
	IEPA =	Illinois Environmental Protection Agency.
	E & E =	Ecology and Environment, Inc.
	ND =	Not detected.
	NA =	Not analyzed.
	NS =	Not specified.
	mg/kg =	Milligram per kilogram.
	=	Value exceeds the industrial risk-based concentration via exposure by soil ingestion.

Analytical Sources: (Envirodyne 1991a,b), (IEPA 1995), and (Ecology and Environment 1995).

Table D-3

HISTORICAL GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Heptachlor epoxide	0.0002	0.0004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (PCBs)															
Total PCBs	0.0005	0.0005	ND	ND	ND	0.001	ND	1.9E-4	ND	NA	NA	NA	NA	NA	NA

Key:
MCL = Maximum contaminant level (National Primary Drinking Water Standard) (U.S. EPA 1995b).
RAL = Superfund removal action level for contaminated drinking water sites (U.S. EPA 1995b).
MAECORP = MAECORP, Inc.
IEPA = Illinois Environmental Protection Agency.
GMI = Geraghty & Miller, Inc.
ND = Not detected.
NA = Not analyzed
NS = Not specified.
Treat. = MCL is based on the capability of the treatment technology.
mg/L = Milligrams per liter.
= Value exceeds Superfund removal action level (RAL) for contaminated drinking water sites

Analytical Sources: (MAECORP 1989a,b,c), (IEPA 1995), and (Geraghty & Miller 1994)

Table D-3

HISTORICAL GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Semivolatile Organic Compounds															
Benzo(a)anthracene	0.0001	0.0001	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.0002	0.0002	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.0002	0.0002	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Fluoranthene	NS	NS	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Ideno(1,2,3-cd)pyrene	0.0004	0.0004	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Phenanthrene	NS	NS	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Pyrene	NS	1.1	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Pesticides															
Aldrin	NS	0.0002	NA	NA	NA	4E-6	4E-6	6E-6	ND	NA	NA	NA	NA	NA	NA
Chlordane	0.002	0.002	NA	NA	NA	3E-6	3E-5	4E-6	ND	NA	NA	NA	NA	NA	NA
4,4'-DDE	NS	NS	NA	NA	NA	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
4,4'-DDT	NS	NS	NA	NA	NA	8E-6	ND	8E-6	8E-6	NA	NA	NA	NA	NA	NA
Dieldrin	NS	0.0002	NA	NA	NA	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
Endrin	0.002	0.003	NA	NA	NA	0.0001	8E-6	ND	ND	NA	NA	NA	NA	NA	NA

Table D-3

HISTORICAL GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Volatile Organic Compounds															
Acetone	NS	3.5	NA	NA	NA	0.01	0.005	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	NS	21.0	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	0.007	0.070	ND	ND	ND	0.01	0.059	ND	ND	ND	0.047	ND	ND	ND	ND
1,2-Dichloroethene	0.07	0.40	ND	ND	ND	0.01	0.410	ND	ND	ND	13.0	ND	0.023	0.017	0.017
Methylene chloride	0.005	0.50	ND	ND	ND	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.200	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	0.005	0.30	ND	ND	ND	0.01	0.097	ND	ND	ND	0.11	ND	ND	ND	ND
Tetrachloroethene	0.005	0.070	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1.0	2.0	ND	[illegible]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	0.002	0.002	ND	ND	ND	0.01	2.80	ND	ND	ND	1.00	ND	ND	0.013	0.014

Table D-3

HISTORICAL GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection												
			MAECORP MW-1 2/89	MAECORP MW-2 2/89	MAECORP MW-3 2/89	IEPA G101 5/93	IEPA G102 5/93	IEPA G103 5/93	IEPA G104 5/93	GMI MW-1 11/93	GMI MW-3 11/93	GMI GMMW-1 11/93	GMI GMMW-2 11/93	GMI GMMW-3 11/93	GMI GMMW-4 11/93
Inorganics															
Arsenic	0.050	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.092
Barium	2.0	2.0	0.558	0.451	0.125	0.107	0.0617	0.0617	0.0632	0.089	0.069	0.032	0.12	0.15	0.15
Beryllium	0.004	0.001	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.005	0.006	0.004	ND	0.0164	ND	ND	ND	0.0019	ND	ND	ND	ND	ND
Chromium	0.100	0.200	0.212	0.157	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	Treat.	1.3	NA	NA	NA	0.188	ND	ND	ND	0.028	ND	ND	ND	ND	ND
Lead	Treat.	0.030	1.56	2.01	0.019	0.0061	ND	ND	0.0016	ND	ND	ND	ND	ND	ND
Manganese	NS	0.200	NA	NA	NA	0.0338	0.591	0.902	1.05	0.048	0.019	0.065	0.25	0.43	0.44
Mercury	0.002	0.010	0.0043	0.0222	0.0001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.050	0.200	0.016	0.02	0.015	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
Silver	NS	0.100	0.018	0.015	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	NS	3.0	NA	NA	NA	7.17	ND	ND	ND	0.26	ND	0.021	0.046	ND	ND

Table D-4

HISTORICAL PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
Inorganics																
Arsenic	23	610	3.39	3.37	4.87	5.54	22.0	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	25	NA
Barium	5,500	1.4E5	31.0	81.2	36.8	80.7	58.5	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	141	NA
Beryllium	0.15	1.3	0.51	5.10	ND	1.40	0.36	NA	NA	NA	NA	NA	NA	NA	2.22	NA
Cadmium	39	100	ND	3.30	ND	ND	ND	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	2.76	NA
Chromium	390	10,000	12.2	29.0	7.80	17.8	21.0	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	1.40[a]	22	NA
Copper	3,100	82,000	0.017	3.12	0.075	0.75	0.157	NA	NA	NA	NA	NA	NA	NA	1,300	NA
Lead	400	1,400	13.9	1,410	65.7	779	256	0.62[a]	0.14[a]	0.50[a]	0.673[a]	0.31[a]	0.13[a]	ND[a]	659	NA
Manganese	390	10,000	806	476	136	319	274	NA	NA	NA	NA	NA	NA	NA	348	NA
Mercury	23	610	0.16	0.47	0.09	0.09	0.30	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	0.16	NA
Selenium	390	10,000	NA	NA	NA	NA	NA	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND	NA
Silver	390	10,000	ND	0.80	ND	1.90	ND	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	3.1	NA
Zinc	23,000	6.1E5	0.071	9.48	0.30	3.27	0.69	NA	NA	NA	NA	NA	NA	12[a]	4,270	NA
Volatile Organic Compounds																
Acetone	7,800	2.0E5	0.007	0.021	1.20	ND	0.015	NA	NA	NA	NA	NA	NA	NA	NA	ND
2-Butanone	47,000	1.0E6	ND	0.004	0.007	ND	0.004	NA	NA	NA	NA	NA	NA	ND	NA	ND
1,1-Dichloroethene	1.1	9.5	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	ND	NA	0.189
1,2-Dichloroethene	780	20,000	ND	0.091	1.30	3.80	0.22	NA	NA	NA	NA	NA	NA	ND	NA	ND
Methylene chloride	85	760	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND

Table D-4

HISTORICAL PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
1,1,1-Trichloroethane	7,000	1.8E5	ND	ND	0.23	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.015
Trichloroethene	58	510	ND	0.080	0.082	0.55	ND	NA	NA	NA	NA	NA	NA	0.051	NA	ND
Tetrachloroethene	12	110	ND	ND	0.011	ND	ND	NA	NA	NA	NA	NA	NA	ND	NA	ND
Toluene	16,000	4.1E5	ND	ND	0.010	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	ND
Vinyl chloride	0.34	3.0	ND	ND	0.058	2.20	0.14	NA	NA	NA	NA	NA	NA	ND	NA	ND
Semivolatile Organic Compounds																
Benzo(a)anthracene	0.88	7.8	0.35	2.80	ND	2.70	7.50	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.88	7.8	0.78	ND	ND	3.10	7.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.088	0.78	0.41	2.00	ND	2.90	8.20	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3,100	82,000	0.52	3.90	3.40	7.40	14.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ideno(1,2,3-cd)pyrene	0.88	7.8	0.21	ND	ND	ND	2.90	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NS	NS	0.23	ND	2.10	5.50	9.50	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	2,300	61,000	0.47	4.20	3.50	5.40	13.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides																
Aldrin	0.038	0.34	0.0018	0.010	0.011	0.027	0.009	ND	ND	ND	ND	ND	ND	NA	NA	NA
Chlordane	0.49	4.4	0.0022	0.012	0.0031	0.016	0.030	ND	ND	ND	ND	ND	ND	NA	NA	NA

Table D-4

HISTORICAL PETTIBONE CREEK SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/kg

Parameter	Risk-Based Concentration		Source Sample Identification Date of Collection													
	R	I	IEPA X201 5/93	IEPA X202 5/93	IEPA X203 5/93	IEPA X204 5/93	IEPA X205 5/93	N.Chi AEL-1 8/94	N.Chi AEL-2 8/94	N.Chi AEL-3 8/94	N.Chi AEL-4 8/94	N.Chi AEL-5 8/94	N.Chi AEL-6 8/94	N.Chi CBC 9/94	E & E S-2 9/94	E & E S-3 9/94
4,4'-DDE	1.9	17	0.048	ND	ND	ND	ND	ND	ND	0.036	0.0027	ND	ND	NA	NA	NA
4,4'-DDT	1.9	17	0.056	0.0043	0.042	0.021	0.200	ND	ND	0.036	0.0787	ND	ND	NA	NA	NA
Dieldrin	0.04	0.36	0.0013	0.006	0.0023	0.028	0.0095	ND	ND	ND	ND	ND	ND	NA	NA	NA
Endrin	23	610	0.0033	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA
Heptachlor epoxide	0.07	0.63	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA	NA	NA
Polychlorinated Biphenyls (PCBs)																
Total PCBs	0.083	0.74	0.084	1.13	3.80	7.30	3.10	ND	14.9	ND	ND	ND	ND	1.7	0.87	NA

Key:
- R = Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
- I = Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
- IEPA = Illinois Environmental Protection Agency.
- N. Chi = City of North Chicago. (Analyses performed by American Environmental Analytical, Inc.)
- E & E = Ecology and Environment, Inc.
- ND = Not detected.
- NA = Not analyzed
- NS = Not specified
- * = Analyzed for toxicity characteristic leaching procedure (TCLP)
- mg/kg = Milligrams per kilogram
- [box] = Value exceeds the industrial risk-based concentration via exposure by soil ingestion

Analytical Sources: (IEPA 1995), (American Environmental Analytical, Inc. 1994), and (Geraghty & Miller 1994)

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES A1-1 THROUGH B3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	A1-1	A2-1	A3-1	B1-1	B2-1	B3-1
Inorganics								
Aluminum	78,000	1E6	6,260	6,070	11,100	4,580	6,660	4,110
Antimony	31	820	5.8	2.0 J	1.5	0.95 U	42.8	3.0
Arsenic	23	610	9.3	9.9	11.8	8.6	19.0	5.3 J
Barium	5,500	1.4E5	93.4	65.3	83.0	46.4	430	106
Beryllium	0.15	1.3	0.75	1.2	1.3	1.0	0.45	5.6
Cadmium	39	100	3.4	2.1	2.0	2.2	23.2	2.2
Calcium	NS	NS	76,800	48,200	34,000	51,200	23,700	27,300
Chromium	390	10,000	17.9	17.1	31.1	21.8	24.3	26.0
Cobalt	4,700	120,000	6.4	9.6	12.0	24.6	12.0	5.9
Copper	3,100	82,000	1,400	470	155	327	12,500 J	3,620 J
Iron	23,000	610,000	17,600	17,600	25,200	16,800	29,400	20,700
Lead	400	1,400	1,170	552	476	270	9,180 J	1,000
Magnesium	NS	NS	36,300	27,900	17,100	28,500	9,910	13,200
Manganese	390	10,000	402	561	463 J	321	499 J	371 J
Mercury	23	610	0.65	0.12 U	0.41	0.12 U	2.9	0.52
Nickel	1,600	41,000	23.4	31.4	31.0	25.5	134	51.2
Potassium	NS	NS	1,270 J	1,380 J	2,430 J	877 J	824	630 J
Selenium	390	10,000	1.2 U	1.4	1.2	2.2	2.8	2.8
Silver	390	10,000	1.3	1.6	1.2	3.0	5.7	2.6
Sodium	NS	NS	1,210	503	635	543	364	705
Thallium	NS	NS	2.4 U	2.3 U	2.4 U	2.4 U	2.6 U	3.2 U
Vanadium	550	14,000	14.2	19.8	28.0	18.6	20.3	12.2
Zinc	23,000	6.1E5	2,990	1,850	510	664	15,400 J	6,420 J

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES A1-1 THROUGH B3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	A1-1	A2-1	A3-1	B1-1	B2-1	B3-1
Semivolatile Organic Compounds								
Phenol	1,000,000	47,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Bis(2-chloroethyl)ether	0.58	5.2	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2-Chlorophenol	390	10,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
1,3-Dichlorobenzene	7,000	180,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
1,4-Dichlorobenzene	27	240	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
1,2-Dichlorobenzene	7,000	180,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2-Methylphenol	3,900	100,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Methylphenol	390	10,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
N-nitroso-di-n-propylamine	0.091	0.082	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Hexachloroethane	46	410	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Nitrobenzene	39	1,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Isophorone	670	6,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2-Nitrophenol	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2,4-Dimethylphenol	1,600	14,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Bis(2-chloroethoxy)methane	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2,4-Dichlorophenol	1,600	41,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
1,2,4-Trichlorobenzene	780	20,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Naphthalene	3,100	82,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Chloroaniline	310	8,200	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Hexachlorobutadiene	8.2	7.3	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Chloro-3-methylphenol	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2-Methylnaphthalene	NS	NS	0.380 U	0.380 U	0.410 U	0.082 J	0.360 U	0.460 U
Hexachlorocyclopentadiene	550	14,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2,4,6-Trichlorophenol	58	520	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES A1-1 THROUGH B3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	A1-1	A2-1	A3-1	B1-1	B2-1	B3-1
2,4,5-Trichlorophenol	7,800	200,000	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 U
2-Chloronaphthalene	6,300	160,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2-Nitroaniline	4.7	120	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 U
Dimethylphthalate	780,000	1,000,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Acenaphthylene	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
2,6-Dinitrotoluene	78	2,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
3-Nitroaniline	230	6,100	0.960 U	0.850 U	1.000 U	0.930 U	0.910 U	1.10 U
Acenaphthene	4,700	120,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460
2,4-Dinitrophenol	160	4,100	0.960 U	0.850 U	1.000 U	0.930 U	0.910 U	1.10 UJ
4-Nitrophenol	4,800	130,000	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 U
Dibenzofuran	310	8,200	0.380 U	0.380 U	0.410 U	0.040 J	0.360 U	0.460 U
2,4-Dinitrotoluene	160	4,100	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Diethylphthalate	63,000	1,000,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Chlorophenyl-phenylether	NS	NS	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Fluorene	3,100	82,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Nitroaniline	230	6,100	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 U
4,6-Dinitro-2-methylphenol	NS	NS	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 U
N-Nitrosodiphenylamine	0.091	0.082	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
4-Bromophenyl-phenylether	4,500	120,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Hexachlorobenzene	0.4	3.6	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Pentachlorophenol	5.3	48	0.960 U	0.950 U	1.000 U	0.930 U	0.910 U	1.10 UJ
Phenanthrene	NS	NS	0.350 J	0.049 J	0.270 J	0.350 J	0.360 U	0.320 J
Anthracene	23,000	610,000	0.052 J	0.380 U	0.035 J	0.052 J	0.360 U	0.047 J
Carbazole	32	290	0.052 J	0.380 U	0.029 J	0.380 U	0.360 U	0.050 J
Di-n-butylphthalate	7,800	200,000	0.380 U	0.024 J	0.410 U	0.380 U	0.018 J	0.036
Fluoranthene	3,100	82,000	0.600	0.130 J	0.530	0.790	0.094 J	0.440 J

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES A1-1 THROUGH B3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	A1-1	A2-1	A3-1	B1-1	B2-1	B3-1
Pyrene	2,300	61,000	0.530	0.140 J	0.440	0.770	0.110 J	0.550
Butylbenzylphthalate	16,000	410,000	0.380 U	0.380 U	0.640	0.380 U	0.360 U	0.460 U
3,3'-Dichlorobenzidine	1.4	13	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.460 U
Benzo(a)anthracene	0.88	7.8	0.270 J	0.095 J	0.230 J	0.490	0.088 J	0.180 J
Chrysene	88	780	0.310 J	0.120 J	0.260 J	0.590	0.067 J	0.210 J
Bis(2-ethylhexyl)phthalate	46	410	0.380 U	0.054 J	0.130 J	0.220 J	0.038 J	7.90
Di-n-octylphthalate	1,600	41,000	0.380 U	0.380 U	0.410 U	0.380 U	0.360 U	0.086 J
Benzo(b)fluoranthene	0.88	7.8	0.470 X	0.190 XJ	0.460 X	1.000	0.130 XJ	0.350 J
Benzo(k)fluoranthene	8.8	78	0.440 X	0.160 XJ	0.390 XJ	0.920	0.140 XJ	0.30 J
Benzo(a)pyrene	0.088	0.78	0.280 J	0.100 J	0.250 J	0.500	0.092 J	0.220 J
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.180 J	0.065 J	0.150 J	0.330 J	0.039 J	0.140 J
Dibenzo(a,h)anthracene	0.088	0.78	0.050 J	0.380 U	0.410 U	0.082 J	0.360 U	0.460 U
Benzo(g,h,i)perylene	NS	NS	0.300 J	0.090 J	0.110 J	0.380	0.063 J	0.150 J
Pesticides								
Alpha-BHC	0.100	0.910	0.002 U	0.002 U	0.0021 U	0.002 U	0.0019 U	0.0024 U
Beta-BHC	0.350	3.200	0.002 U	0.002 U	0.0021 U	0.002 U	0.0019 U	0.0024 U
Delta-BHC	NS	NS	0.0025 P	0.00011 JP	0.00011 JP	0.002 U	0.000097 JP	0.0024 U
Gamma-BHC	0.490	4.400	0.002 U	0.002 U	0.002 1 U	0.002 U	0.0026 P	0.00094 J
Heptachlor	0.140	1.300	0.002 U	0.002 U	0.0038 P	0.002 U	0.0018 J	0.001 J
Aldrin	0.038	0.340	0.002 U	0.00083 JP	0.0021 U	0.002 U	0.0019 U	0.00043 J
Heptachlor epoxide	0.07	0.630	0.002 U	0.00052 J	0.0021 U	0.002 U	0.00067 J	0.0024 U
Endosulfan I	NS	NS	0.002 U	0.002 U	0.00036 JP	0.002 U	0.00011 JP	0.00067 J
Dieldrin	0.040	0.360	0.0038 U	0.00 J	0.0024 JP	0.0034 J	0.0037 P	0.018
4,4'-DDE	1.9	17	0.0016 JP	0.00050 JP	0.0015 JP	0.0013 J	0.00076 JP	0.0023 J
Endrin	23	610	0.0038 U	0.0038 U	0.00057 JP	0.0038 U	0.0036 U	0.0046 U
Endosulfan II	NS	NS	0.0038 U	0.0038 U	0.0041 U	0.0038 U	0.0036 U	0.0046 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES C1-1 THROUGH D2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	C1-1	C2-1	C3-1	C4-1	D1-1	D2-1
Inorganics								
Aluminum	78.000	1E6	3.600	5.680	9.180	9.140	6.650	6.6
Antimony	31	820	0.9 U	0.92 U	6.1	1.4	1.0 U	5
Arsenic	23	610	5.0	7.4	18.6	9.7 J	15.1	9
Barium	5.500	1.4E5	30.0	48.4	120	83.2	46.1	1
Beryllium	0.15	1.3	0.67	1.1	1.5	1.8	2.4	1
Cadmium	39	100	0.87	2.3	6.6	5.8	0.26 U	6
Calcium	NS	NS	77.400	53.700	36.000	38.400	9.450	34.7
Chromium	390	10.000	7.9	33.7	28.4	20.9	14.8	2
Cobalt	4.700	120.000	5.2	39.2	9.2	15.5	14	
Copper	3.100	82.000	182	477	3.100 J	2.000	156	
Iron	23.000	610.000	12.200	24.000	19.400	22.700	30.400	22.4
Lead	400	1.400	89.2	350	1.550	640	67.8	1.4
Magnesium	NS	NS	45.500	28.800	19.600	13.700	1.590	17.5
Manganese	390	10.000	410	454	1.520 J	525 J	244	
Mercury	23	610	0.62	1.3	4.5	0.95	0.38	
Nickel	1.600	41.000	17.8	29.3	50.6	52.8	28.7	4
Potassium	NS	NS	1.140 J	1.370 J	2.080 J	1.720 J	686 J	1.08
Selenium	390	10.000	1.1 U	1.2 U	1.4 U	2.7	1.3 U	
Silver	390	10.000	0.89	1.9	2.0	2.0	0.55	
Sodium	NS	NS	257	465	407	401	322	
Thallium	NS	NS	2.2 U	2.3 U	2.8 U	2.3 U	2.6 U	2.
Vanadium	550	14.000	11.3	20.9	25.4	23.5	25.2	
Zinc	23.000	6.1E5	177	972	4.910 J	2.460 J	250	4.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES C1-1 THROUGH D2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	C1-1	C2-1	C3-1	C4-1	D1-1	D2-1
Semivolatile Organic Compounds								
Phenol	1,000,000	47,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Bis(2-chloroethyl)ether	0.58	5.2	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2-Chlorophenol	390	10,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
1,3-Dichlorobenzene	7,000	180,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
1,4-Dichlorobenzene	27	240	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
1,2-Dichlorobenzene	7,000	180,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2-Methylphenol	3,900	100,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,2'-Oxybis(1-chloropropane)	NS	NS	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.
4-Methylphenol	390	10,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
N-nitroso-di-n-propylamine	0.091	0.082	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Hexachloroethane	46	410	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Nitrobenzene	39	1,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Isophorone	670	6,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2-Nitrophenol	NS	NS	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,4-Dimethylphenol	1,600	14,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Bis(2-chloroethoxy) methane	NS	NS	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,4-Dichlorophenol	1,600	41,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
1,2,4-Trichlorobenzene	780	20,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Naphthalene	3,100	82,000	0.380 U	0.047 J	0.520 U	0.400 U	0.410 U	0.42
4-Chloroaniline	310	8,200	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Hexachlorobutadiene	8.2	7.3	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
4-Chloro-3-methylphenol	NS	NS	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
2-Methylnaphthalene	NS	NS	0.380 U	0.190 J	0.520 U	0.400 U	0.059 J	0.
Hexachlorocyclopentadiene	550	14,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES C1-1 THROUGH D2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	C1-1	C2-1	C3-1	C4-1	D1-1	D2-1
2,4,6-Trichlorophenol	58	520	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,4,5-Trichlorophenol	7,800	200,000	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.00
2-Chloronaphthalene	6,300	160,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2-Nitroaniline	4.7	120	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.00
Dimethylphthalate	780,000	1,000,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
Acenaphthylene	NS	NS	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,6-Dinitrotoluene	78	2,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
3-Nitroaniline	230	6,100	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.00
Acenaphthene	4,700	120,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.42
2,4-Dinitrophenol	160	4,100	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	
4-Nitrophenol	4,800	130,000	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.00
Dibenzofuran	310	8,200	0.380 U	0.086 J	0.520 U	0.400 U	0.410 U	0.0
2,4-Dinitrotoluene	160	4,100	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
Diethylphthalate	63,000	1,000,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
4-Chlorophenyl-phenylether	NS	NS	0.380 U	0.390 UJ	0.520 U	0.400 U	0.410 U	0.4
Fluorene	3,100	82,000	0.380 U	0.390 UJ	0.520 U	0.400 U	0.410 U	0.4
4-Nitroaniline	230	6,100	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.0
4,6-Dinitro-2-methylphenol	NS	NS	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.0
N-Nitrosodiphenylamine	0.091	0.082	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
4-Bromophenyl-phenylether	4,500	120,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
Hexachlorobenzene	0.4	3.6	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.4
Pentachlorophenol	5.3	48	0.910 U	0.950 U	1.300 U	1.000 U	1.000 U	1.0
Phenanthrene	NS	NS	0.380 U	0.660	0.310 J	0.400 U	0.360 J	
Anthracene	23,000	610,000	0.380 U	0.110 J	0.520 U	0.400 U	0.410 U	0.
Carbazole	32	290	0.380 U	0.044 J	0.520 U	0.400 U	0.410 U	0.
Di-n-butylphthalate	7,800	200,000	0.380 U	0.079 J	0.520 U	0.400 U	0.410 U	

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES C1-1 THROUGH D2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	C1-1	C2-1	C3-1	C4-1	D1-1	D2-1
Fluoranthene	3,100	82,000	0.074 J	0.330 J	0.700	0.400 U	0.120 J	0.270
Pyrene	2,300	61,000	0.073 J	1.100	0.550	0.400 U	1.200	0.6
Butylbenzylphthalate	16,000	410,000	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.420
3,3'-Dichlorobenzidine	1.4	13	0.380 U	0.390 U	0.520 U	0.400 U	0.410 U	0.420
Benzo(a)anthracene	0.88	7.8	0.049 J	0.270 J	0.300 J	0.400 U	0.180 J	0.14
Chrysene	88	780	0.040 J	0.360 J	0.360 J	0.400 U	0.400 J	0.26
Bis(2-ethylhexyl)phthalate	46	410	0.044 J	0.150 J	0.170 J	0.400 U	0.084 J	0.14
Di-n-octylphthalate	1,600	41,000	0.380 U	0.390 UJ	0.520 U	0.400 U	0.410 U	0.420
Benzo(b)fluoranthene	0.88	7.8	0.068 J	0.420	0.610 X	0.400 U	0.200 J	0.28
Benzo(k)fluoranthene	8.8	78	0.070 J	0.340 J	0.520 XJ	0.400 U	0.190 J	0.26
Benzo(a)pyrene	0.088	0.78	0.038 J	0.800	0.360 J	0.240 J	0.200 J	0.15
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.380 U	0.170 J	0.220 J	0.400 U	0.080 J	0.05
Dibenzo(a,h)anthracene	0.088	0.78	0.380 U	0.390 U	0.520 J	0.400 U	0.410 U	0.420
Benzo(g,h)perylene	NS	NS	0.040 J	0.500	0.190 J	0.400 U	0.240 J	0.25
Pesticides								
Alpha-BHC	0.100	0.910	0.0019 UJ	0.002 U	0.0027 U	0.002 U	0.0022 U	0.002
Beta-BHC	0.350	3.200	0.0019 UJ	0.02 U	0.0027 U	0.002 U	0.0022 U	0.002
Delta-BHC	NS	NS	0.0019 UJ	0.00037 J	0.00019 JP	0.002 U	0.0022 U	0.0005
Gamma-BHC	0.490	4.400	0.0019 U	0.002 U	0.0027 U	0.002 U	0.0022 U	0.002
Heptachlor	0.140	1.300	0.0019 UJ	0.002 U	0.0027 U	0.0054 P	0.0022 U	0.002
Aldrin	0.038	0.340	0.00031 J	0.0018 J	0.00014 JP	0.00020 JP	0.00088 J	0.0
Heptachlor epoxide	0.07	0.630	0.0019 UJ	0.002 U	0.00029 JP	0.002 U	0.0022 U	0.002
Endosulfan I	NS	NS	0.0019 UJ	0.002 U	0.0027 U	0.002 U	0.0017 J	0.002
Dieldrin	0.040	0.360	0.0014 J	0.0038 J	0.0081 P	0.004 U	0.0035 J	0.0
4,4'-DDE	1.9	17	0.00063 J	0.0012 J	0.013 P	0.004 U	0.001 J	0.00
Endrin	23	610	0.0038 UJ	0.0039 U	0.0052 U	0.004 U	0.0012 J	0.004
Endosulfan II	NS	NS	0.0038 UJ	0.0039 U	0.0052 U	0.004 U	0.0042 U	0.004

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES C1-1 THROUGH D2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	C1-1	C2-1	C3-1	C4-1	D1-1	D2-1
4,4'-DDD	2.7	24	0.00055 J	0.0027 J	0.0052 U	0.004 U	0.0059	0.0042 I
Endosulfan sulfate	NS	NS	0.00035 J	0.0014 J	0.0013 JP	0.004 U	0.002 J	0.0042 I
4,4'-DDT	1.9	17	0.00034 J	0.0034 J	0.032 PB	0.004 U	0.0042 U	0.008
Methoxychlor	390	1,000	0.019 UJ	0.020 U	0.0046 U	0.020 U	0.022 U	0.0013
Endrin ketone	NS	NS	0.0038 UJ	0.0019 J	0.0052 U	0.00030 JP	0.0034 J	0.0018
Endrin aldehyde	NS	NS	0.0038 UJ	0.0019 J	0.0052 U	0.0037 JP	0.0078	0.0023
Alpha-chlordane	0.490	4.4	0.00076 J	0.0011 J	0.0027 U	0.002 U	0.0016 J	0.00048
Gamma-chlordane	NS	NS	0.0019 UJ	0.0015 J	0.0049 P	0.002 U	0.0004 J	0.001
Toxaphene	0.580	5.2	0.190 UJ	0.200 U	0.270 U	0.200 U	0.220 U	0.210
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	5.5	140	0.038 UJ	0.039 U	0.052 U	0.040 U	0.042 U	0.041
Aroclor 1221	NS	NS	0.076 UJ	0.079 U	0.110 U	0.081 U	0.085 U	0.084
Aroclor 1232	NS	NS	0.038 UJ	0.039 U	0.052 U	0.040 U	0.042 U	0.041
Aroclor 1242	NS	NS	0.038 UJ	0.039 U	0.052 U	0.040 U	0.042 U	0.041
Aroclor 1248	NS	NS	0.038 UJ	0.039 U	0.052 U	0.040 U	0.042 U	0.041
Aroclor 1254	1.6	41	0.038 UJ	0.039 U	0.052 U	0.840 EP	0.042 U	0.041
Aroclor 1260	NS	NS	0.038 UJ	0.039 U	0.180 U	0.040 U	0.042 U	0.041

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SURFACE SAMPLING RESULTS
SAMPLES D3-1 THROUGH F2-1 VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	D3-1	E1-1	E2-1	E3-1	E1-1	F2-1
Inorganics								
Aluminum	78,000	1E6	13,600	9,340	5,030	9,360	7,890	10,0
Antimony	31	820	0.96 U	0.94 U	1.0 U	0.96 U	89.2	9
Arsenic	23	610	17.3	20.9	6.7	25.4	30.4	11
Barium	5,500	1.4E5	255	184	116	120	447	1
Beryllium	0.15	1.3	30.1	0.57	1.4	6.9	0.96	0.
Cadmium	39	100	14.8	0.24 U	5.2	3.2	33.3	. 6
Calcium	NS	NS	19,600	70,480	25,300	32,000	24,500	18,0
Chromium	390	10,000	123	17.6	20.4	42.7	34.3	2
Cobalt	4,700	120,000	23.8	29.3	17.9	12.1	13.8	1
Copper	3,100	82,000	26,900 J	97.1	513	4,140	19,300	5.6
Iron	23,000	610,000	41,700	102,000	16,900	25,200	32,600	26,6
Lead	400	1,400	6,560 J	295	392	1,490	13,600	4,3
Magnesium	NS	NS	9,640	41,000	12,600	17,400	11,200	9,6
Manganese	390	10,000	1,700 J	1,110	357	814	742	6
Mercury	23	610	1.2	5.2	8.9	0.12 U	6.1	
Nickel	1,600	41,000	385	61.2	37.5	95.2	156	5
Potassium	NS	NS	1,490 J	2,080 J	1,130 J	1,540 J	1,090 J	1,66
Selenium	390	10,000	7.8	1.2 U	5.6	1.2 U	4.2	1.2
Silver	390	10,000	8.9	0.74	3.1	1.7	8.8	
Sodium	NS	NS	3,340 J	412	352	1,400	376	
Thallium	NS	NS	2.4 U	2.4 U	2.5 U	2.4 U	3.0	2.4
Vanadium	550	14,000	19.8	30.4	19.5	20.5	27.8	2
Zinc	23,000	6.1E5	54,900 J	254	1,190	10,300	25,800	11.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SURFACE SAMPLING RESULTS
SAMPLES D3-1 THROUGH F2-1 VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	D3-1	E1-1	E2-1	E3-1	E1-1	F2-1
Semivolatile Organic Compounds								
Phenol	1,000,000	47,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Bis(2-chloroethyl)ether	0.58	5.2	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
2-Chlorophenol	390	10,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
1,3-Dichlorobenzene	7,000	180,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
1,4-Dichlorobenzene	27	240	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
1,2-Dichlorobenzene	7,000	180,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
2-Methylphenol	3,900	100,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.420 U	0.390 U	0.420 UJ	0.380 U	0.380 UJ	0.400 U
4-Methylphenol	390	10,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	[illegible]
N-nitroso-di-n-propylamine	0.091	0.082	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	[illegible]
Hexachloroethane	46	410	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Nitrobenzene	39	1,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Isophorone	670	6,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
2-Nitrophenol	NS	NS	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
2,4-Dimethylphenol	1,600	14,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Bis(2-chloroethoxy)methane	NS	NS	0.420 U	0.390 U	[illegible] U	0.380 U	0.380 U	0.400 U
2,4-Dichlorophenol	1,600	41,000	0.420 U	0.390 U	[illegible]	0.380 U	0.380 U	0.400 U
1,2,4-Trichlorobenzene	780	20,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Naphthalene	3,100	82,000	0.420 U	0.390 U	0.070 J	0.380 U	0.380 U	0.400 U
4-Chloroaniline	310	8,200	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Hexachlorobutadiene	8.2	7.3	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
4-Chloro-3-methylphenol	NS	NS	0.420 U	0.390 U	0.4720 U	0.380 U	0.380 U	0.400 U
2-Methylnaphthalene	NS	NS	0.420 U	0.069 J	0.530 J	0.380 U	0.380 U	0.041
Hexachlorocyclopentadiene	550	14,000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
2,4,6-Trichlorophenol	58	520	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
2,4,5-Trichlorophenol	7,800	200,000	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	[illegible]

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SURFACE SAMPLING RESULTS
SAMPLES D3-1 THROUGH F2-1 VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	D3-1	E1-1	E2-1	E3-1	E1-1	F2-1
2-Chloronaphthalene	6.300	160.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
2-Nitroaniline	4.7	120	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
Dimethylphthalate	780.000	1.000.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
Acenaphthylene	NS	NS	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
2,6-Dinitrotoluene	78	2.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
3-Nitroaniline	230	6.100	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
Acenaphthene	4.700	120.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
2,4-Dinitrophenol	160	4.100	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
4-Nitrophenol	4.800	130.000	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
Dibenzofuran	310	8.200	0.420 U	0.061 J	0.130 J	0.380 U	0.380 U	0.400
2,4-Dinitrotoluene	160	4.100	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
Diethylphthalate	63.000	1.000.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
4-Chlorophenyl-phenylether	NS	NS	0.420 U	0.390 U	0.420 UJ	0.380 U	0.380 UJ	0.400
Fluorene	3.100	82.000	0.420 U	0.390 U	0.420 UJ	0.380 U	0.380 UJ	0.400
4-Nitroaniline	230	6.100	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
4,6-Dinitro-2-methylphenol	NS	NS	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
N-Nitrosodiphenylamine	0.091	0.082	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
4-Bromophenyl-phenylether	4.500	120.000	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
Hexachlorobenzene	0.4	3.6	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400
Pentachlorophenol	5.3	48	1.000 U	0.960 U	1.000 U	0.920 U	0.380 U	1.000
Phenanthrene	NS	NS	0.130 J	0.670	0.940	0.260 J	0.380 U	0.30
Anthracene	23.000	610.000	0.420 U	0.060 J	0.100 J	0.380 U	0.110 J	0.04
Carbazole	32	290	0.420 U	0.390 U	0.055 J	0.380 U	0.380 U	0.40
Di-n-butylphthalate	7.800	200.000	0.028 J	0.390 U	0.077 J	0.380 U	0.023 J	0.0
Fluoranthene	3.100	82.000	0.200 J	0.230 J	0.460	0.440	0.078 J	0.
Pyrene	2.300	61.000	0.220 J	1.200	1.600	0.380	0.460	0.
Butylbenzylphthalate	16.000	410.000	0.420 U	0.390 U	0.120 J	0.380 U	0.380 U	0.40

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SURFACE SAMPLING RESULTS
SAMPLES D3-1 THROUGH F2-1 VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	D3-1	E1-1	E2-1	E3-1	E1-1	F2-1
3,3'-Dichlorobenzidine	1.4	13	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	0.400 U
Benzo(a)anthracene	0.88	7.8	0.088 J	0.190 J	0.280 J	0.190 J	0.082 J	0.300 J
Chrysene	88	780	0.110 J	0.360 J	0.400 J	0.220 J	0.140 J	0.320 J
Bis(2-ethylhexyl)phthalate	46	410	0.420 U	0.091 J	0.270 J	0.200 J	0.380 U	0.110 J
Di-n-octylphthalate	1,600	41,000	0.420 U	0.390 U	0.420 UJ	0.380 U	0.380 UJ	0.400 U
Benzo(b)fluoranthene	0.88	7.8	0.150 XJ	0.130 J	0.444	0.270 J	0.200 J	0.560 X
Benzo(k)fluoranthene	8.8	78	0.130 XJ	0.120 J	0.380 J	0.280 J	0.170 J	0.470 X
Benzo(a)pyrene	0.088	0.78	0.096 J	0.150 J	0.650	0.150	0.340 J	0.330 J
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.051 J	0.054 J	0.110 J	0.064 J	0.380 U	0.200 J
Dibenzo(a,h)anthracene	0.088	0.78	0.420 U	0.390 U	0.420 U	0.380 U	0.380 U	[illegible]
Benzo(g,h)perylene	NS	NS	0.057 J	0.150 J	0.440	0.085 J	0.380 U	[illegible]
Pesticides								
Alpha-BHC	0.100	0.910	0.0021 U	0.002 U	0.0022 U	0.002 UJ	0.0019 U	0.0021 U
Beta-BHC	0.350	3.200	0.0021 U	0.002 U	0.0022 U	0.002 UJ	0.0019 U	0.0021 U
Delta-BHC	NS	NS	0.0021 U	0.00024 J	0.00078 J	0.00040 J	0.0026 J	0.0021 U
Gamma-BHC	0.490	4.400	0.0021 U	0.002 U	0.0022 U	0.002 UJ	0.0019 U	0.0021 U
Heptachlor	0.140	1.300	0.0021 U	0.002 U	0.0022 U	0.002 UJ	0.0019 U	0.0021 U
Aldrin	0.038	0.340	0.0021 U	0.0009 J	0.0042	0.0012 J	0.0019 U	0.0021 [illegible]
Heptachlor epoxide	0.07	0.630	0.0021 U	0.002 U	0.0023	0.002 UJ	0.0019 U	0.00086 [illegible]
Endosulfan I	NS	NS	0.0021 U	0.00079 J	0.0024	0.0024 J	0.0019 U	0.0021 U
Dieldrin	0.040	0.360	0.0042 U	0.0082	0.0095 J	0.0024 J	0.0038 U	0.004 U
4,4'-DDE	1.9	17	0.0025 JP	0.0015 J	0.0078	0.0019 J	0.013 J	0.0092 J
Endrin	23	610	0.00020 JP	0.004 U	0.0042 UJ	0.0038 UJ	0.0038 U	0.004 U
Endosulfan II	NS	NS	0.0042 U	0.004 U	0.0042 U	0.0038 UJ	0.0038 U	0.0047 [illegible]
4,4'-DDD	2.7	24	0.0042 U	0.004 U	0.011	0.0038 UJ	0.0038 U	0.004 U
Endosulfan sulfate	NS	NS	0.00030 JP	0.00089 J	0.0042 U	0.00016 J	0.0038 U	0.004 U
4,4'-DDT	1.9	17	0.0042 U	0.004 U	0.0078	0.0038 UJ	0.0038 U	[illegible]

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SURFACE SAMPLING RESULTS
SAMPLES D3-1 THROUGH F2-1 VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	D3-1	E1-1	E2-1	E3-1	E1-1	F2-1
Methoxychlor	390	1,000	0.021 U	0.020 U	0.022 U	0.019 UJ	0.0026 J	0.012
Endrin ketone	NS	NS	0.00024 JP	0.0023 J	0.005	0.00097 J	0.0038 U	0.0064
Endrin aldehyde	NS	NS	0.0019 JP	0.004 U	0.0015 J	0.0038 UJ	0.0038 U	0.004
Alpha-chlordane	0.490	4.4	0.0012 JP	0.002 U	0.0018 J	0.002 UJ	0.015 J	0.0021
Gamma-chlordane	NS	NS	0.0021 U	0.0057	0.0041 J	0.003 J	0.0019 U	0.00041
Toxaphene	0.580	5.2	0.210 U	0.200 U	0.220 U	0.190 UJ	0.190 U	0.210
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	5.5	140	0.042 U	0.040 U	0.042 U	0.038 UJ	0.038 U	0.040
Aroclor 1221	NS	NS	0.084 U	0.081 U	0.086 U	0.077 UJ	0.076 U	0.081
Aroclor 1232	NS	NS	0.042 U	0.040 U	0.042 U	0.038 UJ	0.038 U	0.040
Aroclor 1242	NS	NS	0.042 U	0.040 U	0.042 U	0.038 UJ	0.038 U	0.040
Aroclor 1248	NS	NS	0.042 U	0.040 U	0.042 U	0.038 UJ	0.038 U	0.040
Aroclor 1254	1.6	41	0.110	0.040 U	0.042 U	0.038 UJ	2.200 J	0.040
Aroclor 1260	NS	NS	0.042 U	0.040 U	0.042 U	0.038 UJ	0.038 U	0.040

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES F3-1 THROUGH G4-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	F3-1	F4-1	G1-1	G2-1	G3-1	G4-1
Inorganics								
Aluminum	78,000	1E+6	9,090	14,100	6,520	7,760	13,100	10,800
Antimony	31	820	1.7 J	1.4	0.96 U	1.1 U	1.1 J	31.9
Arsenic	23	610	137	10.2 J	8.7	12.1	25.6	20.8
Barium	5,500	1.4E5	50.2	70.4	55.7	243	52.2	360
Beryllium	0.15	1.3	1.0	0.74	1.2	0.74	0.94	0.9
Cadmium	39	100	0.24 U	0.24 U	1.9	3.2	0.24 U	23.
Calcium	NS	NS	62,000	45,800	28,600	60,000	80,500	49,00
Chromium	390	10,000	20.0	22.9	18.5	24.9	24.6	[illegible]
Cobalt	4,700	120,000	10.7	10.9	19.7	11.8	10.4	[illegible]
Copper	3,100	82,000	504	109	620	820	230	11,70
Iron	23,000	610,000	21,400	22,900	20,700	35,400	22,500	35,70
Lead	400	1,400	202	100	399	1,560	85.8	7,50
Magnesium	NS	NS	32,000	26,600	15,100	18,000	41,400	27,80
Manganese	390	10,000	546	546 J	570	493	569	65
Mercury	23	610	0.12 U	0.12 U	5.0	1.0	0.12 U	5.
Nickel	1,600	41,000	33.4	26.7	28.9	36.9	31.6	89.
Potassium	NS	NS	2,730 J	3,410 J	1,220 J	1,950 J	5,390 J	1,720
Selenium	390	10,000	2.6	1.2 U	2.4	1.4 U	1.2 U	2.
Silver	390	10,000	0.56	0.47 U	2.2	1.8	0.47 U	6
Sodium	NS	NS	398	705	288	624	486	1,1
Thallium	NS	NS	2.4 U	2.4 U	2.4 U	2.8 U	2.4 U	2.5
Vanadium	550	14,000	29.2	31.0	20.1	25.8	29.6	25
Zinc	23,000	6.1E5	1,350	333	1,030	2,660	784	16.9

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES F3-1 THROUGH G4-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	F3-1	F4-1	G1-1	G2-1	G3-1	G4-1
2,4,6-Trichlorophenol	58	520	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2,4,5-Trichlorophenol	7,800	200,000	0.380 U	1.000 U	0.950 U	1.100 U	0.980 U	1.000
2-Chloronaphthalene	6,300	160,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2-Nitroaniline	4.7	120	0.380 U	1.000 U	0.950 U	1.100 U	0.980 U	1.000
Dimethylphthalate	780,000	1,000,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Acenaphthylene	NS	NS	0.380 U	0.400 U	0.390 U	0.110 J	0.390 U	0.440
2,6-Dinitrotoluene	78	2,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
3-Nitroaniline	230	6,100	0.95 U	1.000 U	0.950 U	1.100 U	0.980 U	1.000
Acenaphthene	4,700	120,000	0.038 J	0.400 U	0.390 U	0.050 J	0.390 U	0.5
2,4-Dinitrophenol	160	4,100	0.95 U	1.000 U	0.950 U	1.100 U	0.980 U	2.100
4-Nitrophenol	4,800	130,000	0.95 U	1.000 U	0.950 UJ	1.100 UJ	0.980 U	1.000
Dibenzofuran	310	8,200	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.27
2,4-Dinitrotoluene	160	4,100	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Diethylphthalate	63,000	1,000,000	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
4-Chlorophenyl-phenylether	NS	NS	0.38 U	0.400 U	0.390 UJ	0.450 UJ	0.390 U	0.440
Fluorene	3,100	82,000	0.38 U	0.400 U	0.390 UJ	0.450 UJ	0.390 U	0.52
4-Nitroaniline	230	6,100	0.95 U	1.000 U	0.950 U	1.100 U	0.980 U	1.000
4,6-Dinitro-2-methylphenol	NS	NS	0.95 U	1.000 U	0.950 U	1.100 U	0.980 U	1.000
N-nitrosodiphenylamine	0.091	0.082	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.44
4-Bromophenyl-phenylether	4,500	120,000	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.44
Hexachlorobenzene	0.4	3.6	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.44
Pentachlorophenol	5.3	48	0.95 U	1.000 U	0.950 U	1.100 U	0.980 U	1.00
Phenanthrene	NS	NS	0.52	0.045 J	0.096 J	0.710	0.050 J	5.
Anthracene	23,000	610,000	0.098 J	0.400 U	0.390 U	0.120 J	0.390 U	0.
Carbazole	32	290	0.061 J	0.400 U	0.390 U	0.140 J	0.390 U	0

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES F3-1 THROUGH G4-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	F3-1	F4-1	G1-1	G2-1	G3-1	G4-1
Semivolatile Organic Compounds								
Phenol	47,000	1E6	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
Bis(2-chloroethyl)ether	0.58	5.2	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
2-Chlorophenol	390	10,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
1,3-Dichlorobenzene	7,000	180,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
1,4-Dichlorobenzene	27	240	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
1,2-Dichlorobenzene	7,000	180,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
2-Methylphenol	3,900	100,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	
4-Methylphenol	390	10,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
N-nitroso-di-n-propylamine	0.091	0.082	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440 U
Hexachloroethane	46	410	0.380 U	0.400 U	0.390 UJ	0.450 UJ	0.390 UJ	0.440
Nitrobenzene	39	1,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Isophorone	670	6,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2-Nitrophenol	NS	NS	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2,4-Dimethylphenol	1,600	14,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Bis(2-chloroethoxy)methane	NS	NS	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2,4-Dichlorophenol	1,600	41,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
1,2,4-Trichlorobenzene	780	20,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Naphthalene	3,100	82,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
4-Chloroaniline	310	8,200	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
Hexachlorobutadiene	8.2	7.3	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
4-Chloro-3-methylphenol	NS	NS	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.440
2-Methylnaphthalene	NS	NS	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	0.09
Hexachlorocyclopentadiene	550	14,000	0.380 U	0.400 U	0.390 U	0.450 U	0.390 U	

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES F3-1 THROUGH G4-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	F3-1	F4-1	G1-1	G2-1	G3-1	G4-1
Di-n-butylphthalate	7.800	200.000	0.045 J	0.400 U	0.390 U	0.450 J	0.390 U	0.026
Fluoranthene	3.100	82.000	0.92	0.070 J	0.110 J	2.200	0.082 J	7.0
Pyrene	2.300	61.000	0.84	0.076 J	0.110 J	1.700	0.100 J	5.3
Butylbenzylphthalate	16.000	410.000	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.870 U
3,3'-Dichlorobenzidine	1.4	13	0.38 U	0.400 U	0.390 U	0.450 U	0.390 U	0.870 U
Benzo(a)anthracene	0.88	7.8	0.44	0.038 J	0.082 J	1.400	0.048 J	2.1
Chrysene	88	780	0.44	0.036 J	0.110 J	1.400	0.079 J	2.6
Bis(2-ethylhexyl)phthalate	46	410	0.18 J	0.052 J	0.390 U	0.450 U	0.051 J	0.870 U
Di-n-octylphthalate	1.600	41.000	0.38 U	0.400 U	0.390 UJ	0.450 UJ	0.390 U	0.870 U
Benzo(b)fluoranthene	0.88	7.8	0.92 X	0.049 XJ	0.200 J	0.450 U	0.130 XJ	2.4
Benzo(k)fluoranthene	8.8	78	0.78 X	0.042 XJ	0.180 J	0.450 UJ	0.110 XJ	3.0
Benzo(a)pyrene	0.088	0.78	0.45	0.400 U	0.140 J	1.800	0.062 J	2.1
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.27 J	0.400 U	0.057 J	0.740	0.041 J	1.2
Dibenzo(a,h)anthracene	0.088	0.78	0.053 J	0.400 U	0.390 U	0.160 J	0.390 U	0.22
Benzo(g,h)perylene	NS	NS	0.30 J	0.400 U	0.073 J	0.720	0.064 J	1.2
Pesticides								
Alpha-BHC	0.100	0.910	0.002 U	0.002 U	0.010 U	0.0023 U	0.002 U	0.0023
Beta-BHC	0.350	3.200	0.002 U	0.002 U	0.010 U	0.0023 U	0.002 U	0.0023
Delta-BHC	NS	NS	0.002 U	0.002 U	0.0020 J	0.0022 J	0.002 U	0.0023
Gamma-BHC	0.490	4.400	0.00022 JP	0.002 U	0.010 U	0.0023 U	0.002 U	0.0023
Heptachlor	0.140	1.300	0.002 U	0.00045 JP	0.010 U	0.0023 U	0.002 U	0.0023
Aldrin	0.038	0.340	0.002 U	0.002 U	0.019	0.0023 U	0.002 U	0.0
Heptachlor epoxide	0.07	0.630	0.002 U	0.002 U	0.010 U	0.0023 U	0.002 U	0.0007
Endosulfan I	NS	NS	0.002 U	0.000088 JP	0.006 J	0.0023 U	0.002 U	0.0023
Dieldrin	0.040	0.360	0.0038 U	0.004 U	0.020 U	0.0045 U	0.0039 U	0.0044

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES F3-1 THROUGH G4-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	F3-1	F4-1	G1-1	G2-1	G3-1	G4-1
4,4'-DDE	1.9	17	0.0094 P	0.011 P	0.012 J	0.018	0.0016 JP	0.00
Endrin	23	610	0.00066 JP	0.004 U	0.020 U	0.0045 U	0.00055 J	0.0044 U
Endosulfan II	NS	NS	0.0038 U	0.004 U	0.020 U	0.0045 U	0.0039 U	0.0044 U
4,4'-DDD	2.7	24	0.0057 P	0.004 U	0.020 U	0.0045 U	0.00097 JP	0.0044 U
Endosulfan sulfate	NS	NS	0.00099 JP	0.004 U	0.0079 J	0.0045 U	0.00031 JP	0.0044 U
4,4'-DDT	1.9	17	0.018 P	0.004 U	0.020 U	0.056	0.0024 J	0.01
Methoxychlor	390	1,000	0.020 U	0.020 U	0.0024 J	0.220	0.00045 JP	0.023 U
Endrin ketone	NS	NS	0.00022 JP	0.004 U	0.0083 J	0.00058 J	0.0039 U	0.00067
Endrin aldehyde	NS	NS	0.0018 JP	0.004 U	0.020 U	0.0045 U	0.0039 U	[illegible]
Alpha-chlordane	0.490	4.4	0.002 U	0.002 U	0.010 U	0.0023 U	0.002 U	0.0023 U
Gamma-chlordane	NS	NS	0.0011 JP	0.00069 JP	0.0012 J	0.0037	0.00081 JP	0.00062
Toxaphene	0.580	5.2	0.200 U	0.200 U	1.000 U	0.230 U	0.200 U	0.230 U
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	5.5	140	0.038 U	0.040 U	0.200 U	0.045 U	0.039 U	0.044
Aroclor 1221	NS	NS	0.077 U	0.080 U	0.400 U	0.091 U	0.080 U	0.089
Aroclor 1232	NS	NS	0.038 U	0.040 U	0.200 U	0.045 U	0.039 U	0.044
Aroclor 1242	NS	NS	0.038 U	0.040 U	0.200 U	0.045 U	0.039 U	0.044
Aroclor 1248	NS	NS	0.038 U	0.040 U	0.200 U	0.045 U	0.039 U	0.044
Aroclor 1254	1.6	41	0.038 U	0.040 U	2.500	0.180	0.039 U	0.5
Aroclor 1260	NS	NS	0.038 U	0.810 E	0.200 U	0.045 U	0.039 U	0.044

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES H1-1 THROUGH I2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	H1-1	H2-1	H3-1	I0-1	I1-1	I2-1
Inorganics								
Aluminum	78,000	1E+6	5,780	18,800	11,900	9,180	7,360	14,100
Antimony	31	820	0.98 U	1.0 U	2.3 J	1.2	7.1	0.98 U
Arsenic	23	610	7.8	14.7	17.5	9.0	13.7	11.3
Barium	5,500	1.4E5	43.6	107	117	262	128	115
Beryllium	0.15	1.3	0.76	1.3	14.0	0.81	1.5	8.7
Cadmium	39	100	1.3	0.25 U	5.5	6.8	6.4	6.0
Calcium	NS	NS	75,600	17,100	36,000	30,800	28,700	19,000
Chromium	390	10,000	29.3	30.0	65.3	31.9	33.4	58.4
Cobalt	4,700	120,000	17.9	18.0	15.8	13.0	20.8	14.8
Copper	3,100	82,000	561	154	8,200	4,290	2,440	6,480
Iron	23,000	610,000	18,100	34,600	29,600	29,800	20,100	30,000
Lead	400	1,400	329	93.9	2,770	3,280	1,470	2,290
Magnesium	NS	NS	42,800	12,400	20,100	16,500	12,300	11,000
Manganese	390	10,000	621	992	1,160	582	888	798
Mercury	23	610	2.7	0.74	0.12 U	5.5	12.4	0.12 U
Nickel	1,600	41,000	35.2	51.0	174	47.4	45.1	134
Potassium	NS	NS	1,550 J	4,380 J	2,100 J	1,390 J	1,300 J	2,320 J
Selenium	390	10,000	3.0	1.3 U	3.3	1.3	3.9	1.6
Silver	390	10,000	3.8	1.1	5.2	3.8	5.4	3.1
Sodium	NS	NS	380	345	1,830	1,150	454	672
Thallium	NS	NS	2.4 U	2.5 U	2.4 U	2.3 U	2.4 U	2.4 U
Vanadium	550	14,000	21.7	41.8	22.2	17.7	17.6	28.1
Zinc	23,000	6.1E5	960	481	24,440	9,670	3,790	14,700

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES H1-1 THROUGH I2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	H1-1	H2-1	H3-1	I0-1	I1-1	I2-1
Semivolatile Organic Compounds								
Phenol	47,000	1,000,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.-
Bis(2-chloroethyl)ether	0.58	5.2	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.42
2-Chlorophenol	390	10,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.42
1,3-Dichlorobenzene	7,000	180,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.42
1,4-Dichlorobenzene	27	240	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.42
1,2-Dichlorobenzene	7,000	180,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.42
2-Methylphenol	3,900	100,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
2,2'-Oxybis(1-chloropropane)	NS	NS	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
4-Methylphenol	390	10,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
N-Nitroso-di-n-propylamine	0.091	0.082	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
Hexachloroethane	46	410	0.400 U	0.420 UJ	0.410 U	0.360 U	0.390 UJ	0.42
Nitrobenzene	39	1,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
Isophorone	670	6,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
2-Nitrophenol	NS	NS	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
2,4-Dimethylphenol	1,600	14,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
Bis(2-chloroethoxy)methane	NS	NS	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
2,4-Dichlorophenol	1,600	41,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
1,2,4-Trichlorobenzene	780	20,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.4
Naphthalene	3,100	82,000	0.041 J	0.420 U	0.024 J	0.050 J	0.390 U	0.-
4-Chloroaniline	310	8,200	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.-
Hexachlorobutadiene	8.2	7.3	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.-
4-Chloro-3-methylphenol	NS	NS	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.-
2-Methylnaphthalene	NS	NS	0.110 J	0.420 U	0.044 J	0.130 J	0.390 U	0
Hexachlorocyclopentadiene	550	14,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES H1-1 THROUGH I2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	H1-1	H2-1	H3-1	I0-1	I1-1	I2-1
2,4,6-Trichlorophenol	58	520	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
2,4,5-Trichlorophenol	7,800	200,000	0.970 U	1.000 U	1.000 U	0.870 U	0.960 U	1.000 U
2-Chloronaphthalene	6,300	160,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
2-Nitroaniline	4.7	120	0.970 U	1.000 U	1.000 U	0.870 U	0.960	1.000 U
Dimethylphthalate	780,000	1,000,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
Acenaphthylene	NS	NS	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
2,6-Dinitrotoluene	78	2,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
3-Nitroaniline	230	6,100	0.970 U	1.000 U	1.000 U	0.870 U	0.960 U	1.000 U
Acenaphthene	4,700	120,000	0.400 U	0.420 U	0.079 J	0.360 U	0.040 J	0.420 U
2,4-Dinitrophenol	160	4,100	0.970 UJ	1.000 U	1.000 U	0.870 UJ	0.960 U	1.000 U
4-Nitrophenol	4,800	130,000	0.970 U	1.000 UJ	1.000 U	0.870 U	0.960 UJ	1.000 UJ
Dibenzofuran	310	8,200	0.400 U	0.420 U	0.046 J	0.059 J	0.390 U	0.420 U
2,4-Dinitrotoluene	160	4,100	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
Diethylphthalate	63,000	1,000,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
4-Chlorophenyl-phenylether	NS	NS	0.400 U	0.420 UJ	0.410 U	0.360 U	0.390 UJ	0.420 UJ
Fluorene	3,100	82,000	0.400 U	0.420 UJ	0.081 J	0.360 U	0.390 UJ	0.420 UJ
4-Nitroaniline	230	6,100	0.970 U	1.000 U	1.000 U	0.870 U	0.960 U	1.000 U
4,6-Dinitro-2-methylphenol	NS	NS	0.970 U	1.000 U	1.000 U	0.870 U	0.960 U	1.000 U
N-Nitrosodiphenylamine	0.091	0.082	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
4-Bromophenyl-phenylether	4,500	120,000	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
Hexachlorobenzene	0.4	3.6	0.400 U	0.420 U	0.410 U	0.360 U	0.390 U	0.420 U
Pentachlorophenol	5.3	48	0.970 U	1.000 U	1.000 U	0.870 U	0.960 U	1.000 U
Phenanthrene	NS	NS	0.093 J	0.190 J	0.950	0.480	0.540	0.120 J
Anthracene	23,000	610,000	0.400 U	0.420 U	0.280 J	0.062 J	0.091 J	0.420 U
Carbazole	32	290	0.400 U	0.420 U	0.047 J	0.043 J	0.081 J	0.420 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES H1-1 THROUGH I2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	H1-1	H2-1	H3-1	I0-1	I1-1	I2-1
Di-n-butylphthalate	7,800	200,000	0.026 J	0.420 U	0.052 J	0.051 J	0.390 U	0.420 U
Fluoranthene	3,100	82,000	0.092 J	0.300 J	1.600	0.430	1.300	0.200 J
Pyrene	2,300	61,000	0.097 J	0.300 J	1.500	0.540	0.820	0.200 J
Butylbenzylphthalate	16,000	410,000	0.400 UJ	0.420 U	0.043 J	0.360 UJ	0.390 U	0.420 U
3,3'-Dichlorobenzidine	1.4	13	0.400 UJ	0.420 U	0.410 U	0.360 UJ	0.390 U	0.420 U
Benzo(a)anthracene	0.88	7.8	0.054 J	0.200 J	0.790	0.260 J	0.570	0.120 J
Chrysene	88	780	0.072 J	0.140 J	0.680	0.320 J	0.530	0.096 J
Bis(2-ethylhexyl)phthalate	46	410	0.400 UJ	0.420 U	0.160 J	0.360 UJ	0.390 U	0.420 U
Di-n-octylphthalate	1,600	41,000	0.400 UJ	0.420 UJ	0.047 J	0.360 UJ	0.390 UJ	0.420 UJ
Benzo(b)fluoranthene	0.88	7.8	0.100 J	0.310 J	1.200 X	0.360 U	0.390 UJ	0.210 J
Benzo(k)fluoranthene	8.8	78	0.130 J	0280 J	1.000 X	0.360 U	0.390 UJ	0.190 J
Benzo(a)pyrene	0.088	0.78	0.071 J	0.180 J	0.660	0.240 J	0.360 J	0.130 J
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.400 U	0.110 J	0.390 J	0.210 J	0.160 J	0.085 J
Dibenzo(a,h)anthracene	0.088	0.78	0.400 U	0.420 U	0.081 J	0.070 J	0.390 U	0.420 U
Benzo(g,h)perylene	NS	NS	0.400 U	0.110 J	0.450	0.260 J	0.130 J	0.061 J
Pesticides								
Alpha-BHC	0.100	0.910	0.0021 U	0.0022 U	0.0021 U	0.0092 U	0.002 U	0.0022 U
Beta-BHC	0.350	3.200	0.0020 J	0.0022 U	0.0021 U	0.0092 U	0.002 U	0.0022 U
Delta-BHC	NS	NS	0.0021 U	0.0022 U	0.0013 JP	0.0014 J	0.002 U	0.00052 J
Gamma-BHC	0.490	4.400	0.0021 U	0.0022 U	0.0021 U	0.0092 U	0.002 U	0.0022 U
Heptachlor	0.140	1.300	0.0021 U	0.0022 U	0.0021 U	0.0092 U	0.002 U	0.0022 U
Aldrin	0.038	0.340	0.0021 U	0.0022 U	0.0003 JP	0.0028 J	0.016	0.036
Heptachlor epoxide	0.07	0.630	0.0012 J	0.0022 U	0.0021 U	0.00086 J	0.005	0.0022 U
Endosulfan I	NS	NS	0.0021 U	0.0022 U	0.0021 U	0.0012 J	0.002 U	0.00050 J
Dieldrin	0.040	0.360	0.004 U	0.0042 U	0.0041 U	0.018 U	0.004 U	0.0042 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES H1-1 THROUGH I2-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I	H1-1	H2-1	H3-1	I0-1	I1-1	I2-1
4,4'-DDE	1.9	17	0.0074	0.0094	0.044	0.0071 J	0.011	0.0048
Endrin	23	610	0.0040 U	0.0042 U	0.0019 J	0.018 U	0.004 U	0.0042 U
Endosulfan II	NS	NS	0.0040 U	0.0042 U	0.0041 U	0.018 U	0.004 U	0.0042 U
4,4'-DDD	2.7	24	0.0040 U	0.0042 U	0.0078 P	0.018 U	0.004 U	0.0014 J
Endosulfan sulfate	NS	NS	0.0040 U	0.0042 U	0.0041 U	0.018 U	0.0031 J	0.0042 U
4,4'-DDT	1.9	17	0.0012 J	0.012	0.042	0.018 U	0.004 U	0.0042 U
Methoxychlor	390	1,000	0.021 U	0.022 U	0.0017 J	0.092 U	0.020 U	0.011 J
Endrin ketone	NS	NS	0.004 U	0.0042 U	0.0041 U	0.018 U	0.004 U	0.0042 U
Endrin aldehyde	NS	NS	0.011	0.0031 J	0.00066 JP	0.015 J	0.004 U	0.0042 U
Alpha-chlordane	0.490	4.4	0.0021 U	0.0022 U	0.0021 U	0.0092 U	0.002 U	0.0022 U
Gamma-chlordane	NS	NS	0.0021 U	0.0022 U	0.0003 J	0.00065 J	0.0099	0.0022 U
Toxaphene	0.580	5.2	0.210 U	0.220 U	0.210 U	0.920 U	0.220 U	0.220 U
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	5.5	140	0.040 U	0.042 U	0.041 U	0.180 U	0.040 U	0.042 U
Aroclor 1221	NS	NS	0.082 U	0.086 U	0.083 U	0.360 U	0.081 U	0.086 U
Aroclor 1232	NS	NS	0.040 U	0.042 U	0.041 U	0.180 U	0.040 U	0.042 U
Aroclor 1242	NS	NS	0.040 U	0.042 U	0.041 U	0.180 U	0.040 U	0.042 U
Aroclor 1248	NS	NS	0.040 U	0.042 U	0.041 U	0.180 U	0.040 U	0.042 U
Aroclor 1254	1.6	41	0.750 EJ	0.071	0.041 U	0.690 EJ	4.700 EJ	0.310
Aroclor 1260	NS	NS	0.040 U	0.042 U	0.041 U	0.180 U	0.040 U	0.042 U

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES I3-1 THROUGH J3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	I3-1	J0-1	J1-1	J2-1	J3-1
Inorganics							
Aluminum	78,000	1E6	11,300	8,010	9,540	9,530	16,000
Antimony	31	820	3.8 J	41.9	29.6	5.1 J	1.2 U
Arsenic	23	610	25.0	25.9	20.6	98.0	51.9
Barium	5,500	1.4E5	100	408	264	405	243
Beryllium	0.15	1.3	0.83	0.97	1.8	3.0	9.29
Cadmium	39	100	3.4	24.6	22.6	9.9	22.0
Calcium	NS	NS	30,800	29,600	31,200	17,900	23,500
Chromium	390	10,000	21.2	25.6	31.1	38.6	87.0
Cobalt	4,700	120,000	9.8	17.1	16.9	11.4	21.5
Copper	3,100	82,000	2,080	11,500	14,000	5,450	7,420
Iron	23,000	610,000	22,300	35,100	25,900	17,100	83,900
Lead	400	1,400	1,050	7,820	5,520	2,390	3,530
Magnesium	NS	NS	18,500	14,100	16,600	7,610	10,400
Manganese	390	10,000	473	1,080	769	540	52,000
Mercury	23	610	0.13 U	57.9	8.2	17.2	7.0
Nickel	1,600	41,000	44.6	96.4	96.4	89.6	162
Potassium	NS	NS	2,690 J	1,100 J	1,410 J	1,030	2,700 J
Selenium	390	10,000	1.8	3.2	3.1	6.0	7.1
Silver	390	10,000	0.94	9.5	15.9	48.8	14.0
Sodium	NS	NS	355	338	514	394	4,380
Thallium	NS	NS	2.6 U	2.5 U	2.6 U	2.9 U	2.9 U
Vanadium	550	14,000	31.0	19.8	23.1	6.6	48.6
Zinc	23,000	6.1E5	2970	16,600	16,300	8,240	18,500

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES I3-1 THROUGH J3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	I3-1	J0-1	J1-1	J2-1	J3-1
Semivolatile Organic Compounds							
Phenol	47,000	1,000,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Bis(2-chloroethyl)ether	0.58	5.2	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2-Chlorophenol	390	10,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
1,3-Dichlorobenzene	7,000	180,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
1,4-Dichlorobenzene	27	240	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
1,2-Dichlorobenzene	7,000	180,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2-Methylphenol	3,900	100,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
4-Methylphenol	390	10,000	0.430 U	0.390 U	0.440 U	0.100 J	2.000 U
N-nitroso-di-n-propylamine	0.091	0.082	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Hexachloroethane	46	410	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Nitrobenzene	39	1,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Isophorone	670	6,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2-Nitrophenol	NS	NS	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2,4-Dimethylphenol	1,600	14,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Bis(2-chloroethoxy)methane	NS	NS	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2,4-Dichlorophenol	1,600	41,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
1,2,4-Trichlorobenzene	780	20,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Naphthalene	3,100	82,000	0.046 J	0.390 U	0.440 U	7.900 DJ	2.000 U
4-Chloroaniline	310	8,200	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Hexachlorobutadiene	8.2	7.3	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
4-Chloro-3-methylphenol	NS	NS	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2-Methylnaphthalene	NS	NS	0.052 J	0.390 U	0.440 U	3.900	2.000 U
Hexachlorocyclopentadiene	550	14,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2,4,6-Trichlorophenol	58	520	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES I3-1 THROUGH J3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	I3-1	J0-1	J1-1	J2-1	J3-1
2,4,5-Trichlorophenol	7,800	200,000	1.100 U	0.950 U	1.100 U	1.900 U	5.000 U
2-Chloronaphthalene	6,300	160,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2-Nitroaniline	4.7	120	1.100 U	0.950 U	1.100 U	1.900 U	5.000 U
Dimethylphthalate	780,000	1,000,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
Acenaphthylene	NS	NS	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
2,6-Dinitrotoluene	78	2,000	0.430 U	0.390 U	0.440 U	0.760 U	2.000 U
3-Nitroaniline	230	6,100	1.100 U	0.950 U	1.100 U	1.900 U	5.000 U
Acenaphthene	4,700	120,000	0.270 J	0.390 U	0.057 J	18.000 DJ	2.000 U
2,4-Dinitrophenol	160	4,100	2.200 U	0.950 U	1.100 U	1.900 U	5.000 U
4-Nitrophenol	4,800	130,000	2.200 U	0.950 U	1.100 U	1.900 U	5.000 U
Dibenzofuran	310	8,200	0.860 U	0.390 U	0.440 U	8.500 DJ	2.000 U
2,4-Dinitrotoluene	160	4,100	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
Diethylphthalate	63,000	1,000,000	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
4-Chlorophenyl-phenylether	NS	NS	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
Fluorene	3,100	82,000	0.340 J	0.390 U	0.046 J	20.00 DJ	2.000 U
4-Nitroaniline	230	6,100	2.200 U	0.950 U	1.100 U	1.900 U	5.000 U
4,6-Dinitro-2-methylphenol	NS	NS	2.200 U	0.950 U	1.100 U	1.900 U	2.000 U
N-Nitrosodiphenylamine	0.091	0.082	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
4-Bromophenyl-phenylether	4,500	120,000	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
Hexachlorobenzene	0.4	3.6	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
Pentachlorophenol	5.3	48	2.200 U	0.950 U	1.100 U	1.900 U	5.000 U
Phenanthrene	NS	NS	3.000	0.390 U	0.560	140.00 D	0.310 J
Anthracene	23,000	610,000	0.620	0.065 J	0.110 J	32.00 DJ	2.000 U
Carbazole	32	290	0.440	0.390 U	0.074 J	20.00 DJ	2.000 U
Di-n-butylphthalate	7,800	200,000	0.860 U	0.390 U	0.440 U	0.130 J	2.000 U
Fluoranthene	3,100	82,000	4.400 D	0.480	1.00	160.00 D	0.530 J

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES I3-1 THROUGH J3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	I3-1	J0-1	J1-1	J2-1	J3-1
Pyrene	2,300	61,000	4.000 D	0.540 J	0.900 J	96.00 D	0.590 J
Butylbenzylphthalate	16,000	410,000	0.430 U	0.390 U	0.440 U	0.760 U	8.200
3,3'-Dichlorobenzidine	1.4	13	0.860 U	0.390 U	0.440 U	0.760 U	2.000 U
Benzo(a)anthracene	0.88	7.8	2.600	0.290 J	0.480	51.00 D	0.280 J
Chrysene	88	780	2.300	0.350 J	0.520	55.00 D	0.270 J
Bis(2-ethylhexyl)phthalate	46	410	0.100 DJ	0.390 U	0.440 U	0.760 U	1.500 J
Di-n-octylphthalate	1,600	41,000	0.860 U	0.390 UJ	0.440 UJ	0.760 U	2.000 U
Benzo(b)fluoranthene	0.88	7.8	4.500 XE	0.390 U	0.440 U	69.00 DX	0.410 XJ
Benzo(k)fluoranthene	8.8	78	3.900 XE	0.390 U	0.440 U	65.00 DX	0.340 XJ
Benzo(a)pyrene	0.088	0.78	2.500	0.270 J	0.510	37.00 DJ	0.250 J
Indeno(1,2,3-cd)pyrene	0.88	7.8	1.300	0.160 J	0.310 J	14.00 DJ	0.170 J
Dibenzo(a,h)anthracene	0.088	0.78	0.310 J	0.046 J	0.078 J	4.20	2.000 U
Benzo(g,h)perylene	NS	NS	1.500	0.230 J	0.350 J	12.00 DJ	0.230 J
Pesticides							
Alpha-BHC	0.100	0.910	0.0022 U	0.002 U	0.0023 U	0.002 U	0.00018 JP
Beta-BHC	0.350	3.200	0.0022 U	0.002 U	0.0023 U	0.002 U	0.0026 U
Delta-BHC	NS	NS	0.0022 U	0.002 U	0.0023 U	0.002 U	0.0026 U
Gamma-BHC	0.490	4.400	0.0022 U	0.002 U	0.0023 U	0.002 U	0.0026 U
Heptachlor	0.140	1.300	0.0022 U	0.002 U	0.0023 U	0.0064 P	0.0026 U
Aldrin	0.038	0.340	0.00094 JP	0.002 U	0.024	0.023	0.0026 U
Heptachlor epoxide	0.07	0.630	0.0022 U	0.00068 J	0.0079	0.002 U	0.0026 U
Endosulfan I	NS	NS	0.0022 U	0.002 U	0.0023 U	0.002 U	0.0026 U
Dieldrin	0.040	0.360	0.0043 U	0.0039 U	0.0044 U	0.0038 U	0.005 U
4,4'-DDE	1.9	17	0.0064 P	0.0044	0.012	0.0038 U	0.0085 P
Endrin	23	610	0.00070 JP	0.0039 U	0.0044 U	0.0038 U	0.00034 JP
Endosulfan II	NS	NS	0.0043 U	0.0039 U	0.0044 U	0.0038 U	0.0039 JP

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES I3-1 THROUGH J3-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	I3-1	J0-1	J1-1	J2-1	J3-1
4,4'-DDD	2.7	24	0.0036 J	0.0039 U	0.0044 U	0.0038 U	0.005 U
Endosulfan sulfate	NS	NS	0.0043 U	0.0039 U	0.0019 J	0.0038 U	0.0021 JP
4,4'-DDT	1.9	17	0.010	0.0039 U	0.0044 U	0.0038 U	0.005 U
Methoxychlor	390	1,000	0.011 JP	0.020 U	0.023 U	0.020 U	0.0051 JP
Endrin ketone	NS	NS	0.0028 JP	0.0039 U	0.0044 U	0.045 P	0.00027 JP
Endrin aldehyde	NS	NS	0.0043 U	0.0081	0.003	0.0038 U	0.005 U
Alpha-chlordane	0.490	4.4	0.0022 U	0.002 U	0.0023 U	0.002 U	0.0026 U
Gamma-chlordane	NS	NS	0.00038 JP	0.0014 J	0.018	0.002 P	0.003 P
Toxaphene	0.580	5.2	0.220 U	0.200 U	0.230 U	0.200 U	0.260 U
Polychlorinated Biphenyls (PCBs)							
Aroclor 1016	5.5	140	0.043 U	0.039 U	0.044 U	0.038 U	0.050 U
Aroclor 1221	NS	NS	0.088 U	0.079 U	0.090 U	0.078 U	0.100 U
Aroclor 1232	NS	NS	0.043 U	0.039 U	0.044 U	0.38 U	0.050 U
Aroclor 1242	NS	NS	0.043 U	0.039 U	0.044 U	0.038 U	0.050 U
Aroclor 1248	NS	NS	0.043 U	0.039 U	0.044 U	0.038 U	0.050 U
Aroclor 1254	1.6	41	0.43 U	0.480	8.000 EJ	5.900 EJ	0.050 U
Aroclor 1260	NS	NS	0.043 U	0.039 U	0.044 U	0.038 U	0.050 U

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES K0-1 THROUGH H-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification				
	R	I	K0-1	K1-1	K2-1	K3-1	H-1
Inorganics							
Aluminum	78,000	1E+6	7,750	9,560	8,530	23,600	18,200
Antimony	31	820	22.6	54.8	0.95 U	2.8 J	113
Arsenic	23	610	17.0	35.6	12.9	6.0 J	56.0
Barium	5,500	1.4E5	170	517	200	85.6	747
Beryllium	0.15	1.3	1.4	1.0	1.4	0.51	2.4
Cadmium	39	100	12.2	49.9	5.7	0.25 U	43.7
Calcium	NS	NS	15,400	9,310	36,600	23,200	16,600
Chromium	390	10,000	17.9	27.9	26.0	64.7	75.2
Cobalt	4,700	120,000	16.7	12.6	14.9	11.6	39.0
Copper	3,100	82,000	6,800	26,000	2,860	633	17,400
Iron	23,000	610,000	21,300	31,500	20,600	68,500	53,800
Lead	400	1,400	5,120	17,800	1,710	148	11,000
Magnesium	NS	NS	6,880	3,090	18,300	8,110	5,410
Manganese	390	10,000	1,480	626	905	852	5,110
Mercury	23	610	58.1	10.4	257	3.0	127
Nickel	1,600	41,000	58.3	210	61.4	66.0	181
Potassium	NS	NS	1,230	1,380	1,860	7,460 J	8,210
Selenium	390	10,000	3.8	1.4 U	3.6	1.3 U	9.5
Silver	390	10,000	13.8	10.6	19.8	5.8	35.1
Sodium	NS	NS	350	870	490	1,700	3,440
Thallium	NS	NS	2.6 U	14.1	8.3	2.5 U	2.7 U
Vanadium	550	14,000	16.8	24.2	6.1	36.0	0.27 U
Zinc	23,000	6.1E5	10,300	35,000	4,160	614	27,800

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES K0-1 THROUGH H-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification				
	R	I	K0-1	K1-1	K2-1	K3-1	H-1
Semivolatile Organic Compounds							
Phenol	47,000	1E6	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Bis(2-chloroethyl)ether	0.58	5.2	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2-Chlorophenol	390	10,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
1,3-Dichlorobenzene	7,000	180,000	0.380 U	0.460 U	1.100 DJ	0.410 U	0.450 U
1,4-Dichlorobenzene	27	240	0.380 U	0.460 U	1.200 DJ	0.410 U	0.450 U
1,2-Dichlorobenzene	7,000	180,000	0.380 U	0.460 U	12.000 D	0.390 J	0.450 U
2-Methylphenol	3,900	100,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
4-Methylphenol	390	10,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
N-nitroso-di-n-propylamine	0.091	0.082	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Hexachloroethane	46	410	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Nitrobenzene	39	1,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Isophorone	670	6,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2-Nitrophenol	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,4-Dimethylphenol	1,600	14,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Bis(2-chloroethoxy)methane	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,4-Dichlorophenol	1,600	41,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
1,2,4-Trichlorobenzene	780	20,000	0.380 U	0.460 U	1.200 U	1.400	0.450 U
Naphthalene	3,100	82,000	0.380 U	0.067 J	1.200 U	0.410 U	0.450 U
4-Chloroaniline	310	8,200	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Hexachlorobutadiene	8.2	7.3	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
4-Chloro-3-methylphenol	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2-Methylnaphthalene	NS	NS	0.380 U	0.062 J	1.200 U	0.410 U	0.086 J
Hexachlorocyclopentadiene	550	14,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,4,6-Trichlorophenol	58	520	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES K0-1 THROUGH H-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification				
	R	I	K0-1	K1-1	K2-1	K3-1	H-1
2,4,5-Trichlorophenol	7,800	200,000	0.380 U	1.200 U	3.000 U	1.000 U	1.100 U
2-Chloronaphthalene	6,300	160,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2-Nitroaniline	4.7	120	0.380 U	1.200 U	3.000 U	1.000 U	1.100 U
Dimethylphthalate	780,000	1,000,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Acenaphthylene	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,6-Dinitrotoluene	78	2,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
3-Nitroaniline	230	6,100	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
Acenaphthene	4,700	120,000	0.043 J	0.460 U	1.200 U	0.410 U	0.450 U
2,4-Dinitrophenol	160	4,100	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
4-Nitrophenol	4,800	130,000	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
Dibenzofuran	310	8,200	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
2,4-Dinitrotoluene	160	4,100	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Diethylphthalate	63,000	1,000,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
4-Chlorophenyl-phenylether	NS	NS	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Fluorene	3,100	82,000	0.049 J	0.460 U	1.200 U	0.410 U	0.450 U
4-Nitroaniline	230	6,100	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
4,6-Dinitro-2-methylphenol	NS	NS	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
N-nitrosodiphenylamine	0.091	0.082	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
4-Bromophenyl-phenylether	4,500	120,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Hexachlorobenzene	0.4	3.6	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Pentachlorophenol	5.3	48	0.960 U	1.200 U	3.000 U	1.000 U	1.100 U
Phenanthrene	NS	NS	0.600	0.610	0.410 J	0.180 J	0.490
Anthracene	23,000	610,000	0.130 J	0.110 J	1.200 U	0.410 U	0.070 J
Carbazole	32	290	0.065 J	0.058 J	1.200 U	0.410 U	0.048 J
Di-n-butylphthalate	7,800	200,000	0.039 J	0.035 J	1.200 U	0.410 U	0.033 J
Fluoranthene	3,100	82,000	0.580	0.900	1.400	0.280 J	0.840

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES K0-1 THROUGH H-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification				
	R	I	K0-1	K1-1	K2-1	K3-1	H-1
Pyrene	2,300	61,000	0.640	0.890	1.300	0.240 J	0.750
Butylbenzylphthalate	16,000	410,000	0.380 U	0.460 U	1.200 U	0.050 J	0.450 U
3,3'-Dichlorobenzidine	1.4	13	0.380 U	0.4650 U	1.200 U	0.410 U	0.450 U
Benzo(a)anthracene	0.88	7.8	0.350 J	0.480	0.420 J	0.130 J	0.460
Chrysene	88	780	0.410	0.570	0.570 J	0.140 J	0.580
Bis(2-ethylhexyl)phthalate	46	410	0.038 J	0.034 J	1.200 U	0.200 J	0.570
Di-n-octylphthalate	1,600	41,000	0.380 U	0.460 U	1.200 U	0.410 U	0.450 U
Benzo(b)fluoranthene	0.88	7.8	0.460 X	0.720 X	1.400 X	0.230 XJ	0.760 X
Benzo(k)fluoranthene	8.8	78	0.560 X	0.820 X	1.300 X	0.170 XJ	0.870 X
Benzo(a)pyrene	0.088	0.78	0.310 J	0.480	0.480 J	0.098 J	0.480
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.220 J	0.270 J	0.320 J	0.080 J	0.360 J
Dibenzo(a,h)anthracene	0.088	0.78	0.380 U	0.110 J	1.200 U	0.410 U	0.450 U
Benzo(g,h)perylene	NS	NS	0.330 J	0.310 J	0.330 J	0.090 J	0.390 J
Pesticides							
Alpha-BHC	0.100	0.910	0.002 U	0.0024 U	0.040 U	0.010 U	0.0023 U
Beta-BHC	0.350	3.200	0.002 U	0.0024 U	0.040 U	0.010 U	0.0023 U
Delta-BHC	NS	NS	0.002 U	0.0024 U	0.040 U	0.010 U	0.0023 U
Gamma-BHC	0.490	4.400	0.002 U	0.0024 U	0.040 U	0.010 U	0.00074 JP
Heptachlor	0.140	1.300	0.002 U	0.0025 P	0.040 U	0.010 U	0.0023 U
Aldrin	0.038	0.340	0.008	0.021 P	0.320 JDP	0.010 U	0.033
Heptachlor epoxide	0.07	0.630	0.0026 P	0.0024 U	0.040 U	0.010 U	0.0023 U
Endosulfan I	NS	NS	0.002 U	0.0024 U	0.230	0.010 U	0.0023 U
Dieldrin	0.040	0.360	0.0038 U	0.0046 U	0.078 U	0.020 U	0.0045 U
4,4'-DDE	1.9	17	0.016 P	0.0046 U	0.160 JYDP	0.020 U	0.0045 U
Endrin	23	610	0.0038 U	0.0046 U	0.078 U	0.020 U	0.0045 U
Endosulfan II	NS	NS	0.0038 U	0.0046 U	0.078 U	0.020 U	0.0045 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES K0-1 THROUGH H-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification				
	R	I	K0-1	K1-1	K2-1	K3-1	H-1
4,4'-DDD	2.7	24	0.0038 U	0.0046 U	0.078 U	0.0042 JP	0.0045 U
Endosulfan sulfate	NS	NS	0.0038 U	0.0046 U	0.078 U	0.020 U	0.0045 U
4,4'-DDT	1.9	17	0.0038 U	0.0046 U	0.078 U	0.020 U	0.0045 U
Methoxychlor	390	1,000	0.020 U	0.024 U	0.035 JP	0.100 U	0.023 U
Endrin ketone	NS	NS	0.00015 JP	0.0046 U	0.078 U	0.020 U	0.0045 U
Endrin aldehyde	NS	NS	0.012 P	0.041	0.520 JD	0.020 U	0.0045 U
Alpha-chlordane	0.490	4.4	0.002 U	0.0024 U	0.040 U	0.010 U	0.0023 U
Gamma-chlordane	NS	NS	0.0051 P	0.0024 U	0.320 JDP	0.0024 JP	0.0023 U
Toxaphene	0.580	5.2	0.200 U	0.240 U	4.00 U	1.00 U	0.230 U
Polychlorinated Biphenyls (PCBs)							
Aroclor 1016	5.5	140	0.038 U	0.046 U	0.780 U	0.200 U	0.045 U
Aroclor 1221	NS	NS	0.077 U	0.094 U	1.600 U	0.420 U	0.091 U
Aroclor 1232	NS	NS	0.038 U	0.046 U	0.780 U	0.200 U	0.045 U
Aroclor 1242	NS	NS	0.038 U	0.046 U	0.780 U	0.200 U	0.045 U
Aroclor 1248	NS	NS	0.038 U	0.046 U	0.780 U	0.200 U	0.045 U
Aroclor 1254	1.6	41	1.500 EJ	5.300 EJ	68.00 CDP	0.200 U	7.600 EJ
Aroclor 1260	NS	NS	0.038 U	0.046 U	0.780 U	7.900 C	0.045 U

Key is presented at the end of Table D-5.

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES L1-1 THROUGH M1-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification					
	R	I	L1-1	F1	F2	L3-1	M0-1	M1-1
Inorganics								
Aluminum	78,000	1E+6	10,500	13,600	6,620	8,610	9,630	10,000
Antimony	31	820	19.5	1.8	40.8	0.95 U	34.3	5.7 J
Arsenic	23	610	29.1	15.4	17.4	10.5	24.8	18.0
Barium	5,500	1.4E5	281	195	818	44.8	418	232
Beryllium	0.15	1.3	1.4	0.91	0.43	0.49	1.0	2.0
Cadmium	39	100	46.1	4.5	34.3	0.29	31.4	30.4
Calcium	NS	NS	19,500	60,000	9,180	61,200	24,600	19,800
Chromium	390	10,000	21.8	27.7	27.4	15.5	34.8	3[illegible]
Cobalt	4,700	120,000	12.8	13.4	7.8	8.5	11.9	16.8
Copper	3,100	82,000	14,600	3,060	11,500	68.1	12,000	7,380
Iron	23,000	610,000	23,800	33,000	20,800	18,400	33,000	23,200
Lead	400	1,400	7,420	2,410	5,840	48.3	6,360	4,220
Magnesium	NS	NS	8,540	31,700	2,990	33,900	10,600	11,000
Manganese	390	10,000	1,020	637	494	539	874	705
Mercury	23	610	8.3	.7	12.5	0.12 U	5.8	7.7
Nickel	1,600	41,000	89.0	56.5	73.4	21.3	87.4	120
Potassium	NS	NS	1,310	2,990 J	1,020 J	2,800	1,760	1,380
Selenium	390	10,000	3.4	1.8	1.3 U	1.2 U	1.4	6.0
Silver	390	10,000	12.4	4.9	5.0	0.47 U	10.4	36.4
Sodium	NS	NS	394	1,160	5.5	300	387	445
Thallium	NS	NS	2.8 U	2.4 U	2.5 U	2.4 U	2.5 U	2.6 U
Vanadium	550	14,000	22.8	25.2	16.7	23.6	20.3	11.6
Zinc	23,000	6.1E5	23,000	6,400	24,500	206	18,700	11,000

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES L1-1 THROUGH M1-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification					
	R	I	L1-1	F1	F2	L3-1	M0-1	M1-1
Semivolatile Organic Compounds								
Phenol	47,000	1E6	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Bis(2-chloroethyl)ether	0.58	5.2	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2-Chlorophenol	390	10,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
1,3-Dichlorobenzene	7,000	180,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
1,4-Dichlorobenzene	27	240	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
1,2-Dichlorobenzene	7,000	180,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2-Methylphenol	3,900	100,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
4-Methylphenol	390	10,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
N-nitroso-di-n-propylamine	0.091	0.082	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Hexachloroethane	46	410	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Nitrobenzene	39	1,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Isophorone	670	6,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2-Nitrophenol	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2,4-Dimethylphenol	1,600	14,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Bis(2-chloroethoxy)methane	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2,4-Dichlorophenol	1,600	41,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
1,2,4-Trichlorobenzene	780	20,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Naphthalene	3,100	82,000	0.440 U	0.380 U	0.430	0.370 U	0.460 U	0.400 U
4-Chloroaniline	310	8,200	0.440 U	0.380 U	0.410 UJ	0.370 U	0.460 U	0.400 U
Hexachlorobutadiene	8.2	7.3	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
4-Chloro-3-methylphenol	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2-Methylnaphthalene	NS	NS	0.440 U	0.380 U	0.074 J	0.370 U	0.150 J	0.400 U
Hexachlorocyclopentadiene	550	14,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2,4,6-Trichlorophenol	58	520	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES L1-1 THROUGH M1-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification					
	R	I	L1-1	F1	F2	L3-1	M0-1	M1-1
2,4,5-Trichlorophenol	7,800	200,000	1.100 U	0.920 U	0.990 U	0.930 U	1.200 U	1.000 U
2-Chloronaphthalene	6,300	160,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2-Nitroaniline	4.7	120	1.100 U	0.920 U	0.990 U	0.930 U	1.200 U	1.000 U
Dimethylphthalate	780,000	1,000,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Acenaphthylene	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
2,6-Dinitrotoluene	78	2,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
3-Nitroaniline	230	6,100	1.100 U	0.920 U	0.990 UJ	0.930 U	1.200 U	1.000 U
Acenaphthene	4,700	120,000	0.440 U	0.380 U	0.160 J	0.370 U	0.460 U	0.400 U
2,4-Dinitrophenol	160	4,100	1.100 U	0.920 U	0.990 UJ	0.930 U	1.200 U	1.0[illegible]
4-Nitrophenol	4,800	130,000	1.100 U	0.920 U	0.990 UJ	0.930 U	1.200 U	1.000 U
Dibenzofuran	310	8,200	0.440 U	0.380 U	0.098 J	0.370 U	0.460 U	0.400 U
2,4-Dinitrotoluene	160	4,100	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Diethylphthalate	63,000	1,000,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
4-Chlorophenyl-phenylether	NS	NS	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Fluorene	3,100	82,000	0.440 U	0.380 U	0.110 J	0.370 U	0.460 U	0.400 U
4-Nitroaniline	230	6,100	1.100 U	0.920 U	0.990 UJ	0.930 U	1.200 U	1.000 U
4,6-Dinitro-2-methylphenol	NS	NS	1.100 U	0.920 U	0.990 U	0.930 U	1.200 U	1.000 U
N-Nitrosodiphenylamine	0.091	0.082	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
4-Bromophenyl-phenylether	4,500	120,000	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Hexachlorobenzene	0.4	3.6	0.440 U	0.380 U	0.410 U	0.370 U	0.460 U	0.400 U
Pentachlorophenol	5.3	48	1.100 U	0.920 U	0.990 UJ	0.930 U	1.200 U	1.000 U
Phenanthrene	NS	NS	0.190 J	0.100 J	1.200	0.370 U	0.180 J	0.250 J
Anthracene	23,000	610,000	0.440 U	0.380 U	0.200 J	0.370 U	0.460 U	0.042 J
Carbazole	32	290	0.440 U	0.380 U	0.180 J	0.370 U	0.460 U	0.400 U
Di-n-butylphthalate	7,800	200,000	0.038 J	0.380 U	0.410 U	0.370 U	0.460 U	[illegible]
Fluoranthene	3,100	82,000	0.160 J	0.220 J	1.900	0.046 J	0.230 J	0.400 J

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES L1-1 THROUGH M1-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification					
	R	I	L1-1	F1	F2	L3-1	M0-1	M1-1
Pyrene	2,300	61,000	0.130 J	0.140 J	1.600 J	0.370 U	0.400 J	0.350
Butylbenzylphthalate	16,000	410,000	0.440 U	0.380 U	0.410 UJ	0.370 U	0.460 U	0.400 U
3,3'-Dichlorobenzidine	1.4	13	0.440 U	0.380 UJ	0.410 UJ	0.370 U	0.460 U	0.400 U
Benzo(a)anthracene	0.88	7.8	0.078 J	0.099 J	0.910	0.370 U	0.170 J	0.220
Chrysene	88	780	0.100 J	0.120 J	0.920	0.370 U	0.250 J	0.240
Bis(2-ethylhexyl)phthalate	46	410	0.060 J	0.064 J	0.410 UJ	0.051 J	0.460 U	0.075
Di-n-octylphthalate	1,600	41,000	0.440 U	0.380 U	0.410 UJ	0.370 U	0.460 U	0.400 U
Benzo(b)fluoranthene	0.88	7.8	0.130 XJ	0.170 J	1.400	0.041 JX	0.270 JX	0.350 X
Benzo(k)fluoranthene	8.8	78	0.150 XJ	0.200 J	1.500	0.040 JX	0.270 JX	0.400 X
Benzo(a)pyrene	0.088	0.78	0.086 J	0.098 J	0.860	0.370 U	0.160 J	0.220
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.049 J	0.066 J	0.450	0.370 U	0.150 J	0.140
Dibenzo(a,h)anthracene	0.088	0.78	0.440 U	0.380 U	0.120 J	0.370 U	0.460 U	0.400 U
Benzo(g,h)perylene	NS	NS	0.058 J	0.076 J	0.500	0.370 U	0.380 J	0.160
Pesticides								
Alpha-BHC	0.100	0.910	0.0022 U	0.002 U	0.0021 U	0.0019 U	0.0024 U	0.0021 U
Beta-BHC	0.350	3.200	0.0022 U	0.002 U	0.0021 U	0.0019 U	0.001 JP	0.0021 U
Delta-BHC	NS	NS	0.0022 U	0.0019 J	0.0023 J	0.00082 JP	0.00084 JP	0.0021 U
Gamma-BHC	0.490	4.400	0.0022 U	0.002 U	0.0021 U	0.0019 U	0.00012 JP	0.0021 U
Heptachlor	0.140	1.300	0.00024 JP	0.002 U	0.0021 U	0.0019 U	0.0024 U	0.00021 J
Aldrin	0.038	0.340	0.0022 U	0.002 U	0.0014 J	0.0019 U	0.015	0.0016
Heptachlor epoxide	0.07	0.630	0.0027 P	0.00081 J	0.0021 U	0.00011 JP	0.0024 U	0.0021
Endosulfan I	NS	NS	0.0022 U	0.002 U	0.0021 U	0.0019 U	0.0067 P	0.00047 J
Dieldrin	0.040	0.360	0.0044 U	0.0038 U	0.0041 U	0.0014 JP	0.0046 U	0.0041
4,4'-DDE	1.9	17	0.0026	0.007	0.00088 J	0.0013 JP	0.00058 JP	0.0091
Endrin	23	610	0.0044 U	0.0038 U	0.0041 U	0.0036 U	0.0046 U	0.0041
Endosulfan II	NS	NS	0.0044 U	0.0038 U	0.0041 U	0.0036 U	0.0046 U	0.0041

Table D-5

SUMMARY OF EE/CA 0-1 FOOT SOIL SAMPLING RESULTS
SAMPLES L1-1 THROUGH M1-1
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Source Identification					
	R	I	L1-1	F1	F2	L3-1	M0-1	M1-1
4,4'-DDD	2.7	24	0.0044 U	0.0038 U	0.0041 U	0.0014 JP	0.0046 U	0.0041 U
Endosulfan sulfate	NS	NS	0.0044 U	0.0038 U	0.0041 U	0.0036 U	0.0046 U	0.0041 U
4,4'-DDT	1.9	17	0.0044 U	0.0038 U	0.0041 U	0.00097 JP	0.0046 U	0.0041 U
Methoxychlor	390	1,000	0.022 U	0.019 U	0.0013 J	0.00084 JP	0.024 U	0.021 U
Endrin ketone	NS	NS	0.0044 U	0.0038 U	0.0041 U	0.0036 U	0.0059 P	0.0041 U
Endrin aldehyde	NS	NS	0.023 P	0.0038 U	0.005 J	0.0036 U	0.0046 U	0.0022 JP
Alpha-chlordane	0.490	4.4	0.0022 U	0.0068	0.0021 U	0.00052 JP	0.0024 U	0.0021 U
Gamma-chlordane	NS	NS	0.0056 P	0.002 U	0.0021 U	0.0019 U	0.013	0.0[illegible]
Toxaphene	0.580	5.2	0.220 U	0.190 U	0.210 U	0.190 U	0.240 U	0.210 U
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	5.5	140	0.044 U	0.038 U	0.041 U	0.036 U	0.046 U	0.041 U
Aroclor 1221	NS	NS	0.089 U	0.077 U	0.083 U	0.074 U	0.094 U	0.083 U
Aroclor 1232	NS	NS	0.044 U	0.038 U	0.041 U	0.036 U	0.046 U	0.041 U
Aroclor 1242	NS	NS	0.044 U	0.038 U	0.041 U	0.036 U	0.046 U	0.041 U
Aroclor 1248	NS	NS	0.044 U	0.038 U	0.041 U	0.036 U	0.046 U	0.041 U
Aroclor 1254	1.6	41	1.600 EJ	1.000	0.041 U	0.036 U	0.270	0.280
Aroclor 1260	NS	NS	0.044 U	0.038 U	0.041 U	0.088	0.046 U	0.041 U

Key: mg/kg = Milligrams per kilogram.

R = Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).

I = Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).

NS = Not specified.

B = The analyte is detected in the associated blank as well a.. the sample.

Y = The analyte was attempted to be confirmed by gas chromatography/ mass spectrography but was unsuccessful.

E = The analyte exceeds the calibration range of the instrument.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J = The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may not represent the actior limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

D = If a sample or extract is reanalyzed at a higher dilution factor, for example when the concentration of an analyte exceeds the upper calibration range, the DL suffix appended to the sample number for the more diluted sample, and all reported concentrations are flagged with the D flag.

X = Benzo(b)fluoranthene and benzo(k)fluoranthene isomers in the sample could not be chromatographically resolved. This is indicated with "X" flag.

P = This flag is used for a pesticide/Aroclor target analyte, and other GC or HPLC analytes, when there is greater than 25% difference for detected concentrations betw the two GC or HPLC columns. The lower of the two values is reported and flagged with a "P".

C = This flag applies to GC or HPLC results where the identification has been confirmed by GC/MS. If GC/MS confirmation was attempted but was unsuccessful, this is not applied; a laboratory defined flag is used instead.

= Value exceeds the industrial risk-based concentration via exposure by soil ingested.

Analytical Sources: U.S. EPA CLP, 1997, sampling conducted by Ecology and Environment, Inc. (Appendix B).

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I						
			A1-2	A2-2	A3-2	B1-2	B2-3	B3-2
Inorganics								
Beryllium	0.15	1.3	BAL	BAL	BAL	1.6	BAL	7.0
Lead	400	1,400	2,790	BAL	BAL	BAL	7,790 J	2,570
Polychlorinated Biphenyls (PCBs)								
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	1.268 U	BDL	BDL	BDL	BDL	BDL
			C1-2	C2-2	C3-2	C4-2	D1-2	D2-2
Inorganics								
Beryllium	0.15	1.3	BAL	BAL	BAL	1.3	1.4	BAL
Lead	400	1,400	BAL	2,210	BAL	2,860 J	BAL	6,580
Semivolatile Organic Compounds								
Benzo(a)pyrene	0.088	0.78	BAL	BAL	BDL	BAL	BAL	BAL
Polychlorinated Biphenyls (PCBs)								
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	BDL	BDL	BDL	1.086 U	BDL	BDL
			D3-2	E1-2	E2-2	E3-2	F1-2	F2-2
Inorganics								
Beryllium	0.15	1.3	11.4	2.2	BAL	2.0	BAL	BAL
Lead	400	1,400	2,200	8,450	6,850	BAL	2,940	3,210
Semivolatile Organic Compounds								
Benzo(a)pyrene	0.088	0.78	BDL	BAL	BAL	BAL	1.30 U	BAL

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I						
			F3-2	F3-3	F4-2	G1-2	G2-2	G3-2
Inorganics								
Beryllium	0.15	1.3	BAL	BAL	BAL	BAL	BAL	1.4
Lead	400	1,400	BAL	BAL	BAL	8,390	2,310	BAL
Semivolatile Organic Compounds								
N-nitroso-di-n-propylamine	0.091	0.820	1.1 U	BDL	BDL	BDL	BDL	BDL
Benzo(a)pyrene	0.088	0.78	1.70	BAL	BDL	BAL	1.5	1.00
Polychlorinated Biphenyls (PCBs)								
Total PCBs	0.083	0.74	BDL	BDL	BDL	BDL	1.702 U	BDL
			H0-2	H2-2	H3-2	I1-2	I2-2	I3-2
Inorganics								
Beryllium	0.15	1.3	BAL	1.5	BAL	1.3	4.4	BAL
Lead	400	1,400	11,000	BAL	BAL	5,010	BAL	1,530
Manganese	390	10,000	BAL	BAL	BAL	BAL	BDL	BAL
Volatile Organic Compounds								
Tetrachloroethene	12	110	BAL	BAL	BAL	BAL	170	NAV
Semivolatile Organic Compounds								
N-nitroso-di-n-propylamine	0.091	0.82	BAL	BAL	BAL	BAL	BDL	BDL
Benzo(b)fluoranthene	0.88	7.8	BAL	BAL	BAL	BAL	BDL	BAL
Benzo(a)pyrene	0.088	7.8	BAL	BAL	BAL	BAL	1.0	1.9
Pesticides								
Aldrin	0.038	0.34	BAL	BAL	BAL	BAL	BDL	BDL
Aroclor 1254	1.6	41	BAL	BAL	BAL	BAL	BDL	BDL

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS*
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I						
			H0-2	H2-2	H3-2	I1-2	I2-2	I3-2
Polychlorinated Biphenyls (PCBs)								
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	BDL	BDL	BDL	1.575 UJ	3.688 U	BDL
			J0-2	J1-2	J2-2	J3-2	J3-3	K0-2
Inorganics								
Beryllium	0.15	1.3	BAL	1.5	2.2	1.5	1.4	BAL
Lead	400	1,400	4,000	15,200	6,040	BAL	BAL	8,680
Manganese	390	10,000	BDL	BDL	BDL	BAL	BAL	BAL
Volatile Organic Compounds								
Tetrachloroethene	12	110	NAV	BDL	NAV	BDL	BDL	BAL
Semivolatile Organic Compounds								
N-nitroso-di-n-propylamine	0.091	0.82	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene	0.88	7.8	BAL	BAL	28.0 E	BDL	BAL	BAL
Benzo(b)fluoranthene	0.88	7.8	BDL	BAL	24.0 XE	BAL	BAL	BAL
Benzo(a)pyrene	0.088	0.78	BAL	BAL	15.0 E	BAL	BAL	BAL
Indeno(1,2,3-cd)pyrene	[illegible]	7.8	BAL	BAL	BAL	BAL	BAL	BAL
Dibenzo(a,h)anthracene	[illegible]8	0.78	BAL	BDL	1.8	BAL	BAL	BAL
Pesticides								
Aldrin	0.038	0.34	BAL	BAL	BDL	BDL	BDL	BAL
Dieldrin	0.04	0.36	BAL	BAL	BAL	BAL	BAL	BDL
Toxaphene	0.58	5.2	BAL	BAL	BAL	BAL	BAL	BDL

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I						
Polychlorinated Biphenyls (PCBs)								
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	BDL	BDL	BDL	1.575 UJ	3.688 U	BDL
			J0-2	J1-2	J2-2	J3-2	J3-3	K0-2
Inorganics								
Beryllium	0.15	1.3	BAL	1.5	2.2	1.5	1.4	BAL
Lead	400	1,400	4,000	15,200	6,040	BAL	BAL	8,680
Manganese	390	10,000	BDL	BDL	BDL	BAL	BAL	BAL
Volatile Organic Compounds								
Tetrachloroethene	12	110	NAV	BDL	NAV	BDL	BDL	BAL
Semivolatile Organic Compounds								
N-nitroso-di-n-propylamine	0.091	0.82	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene	0.88	7.8	BAL	BAL	28.0 E	BDL	BAL	BAL
Benzo(b)fluoranthene	0.88	7.8	BDL	BAL	24.0 XE	BAL	BAL	BAL
Benzo(a)pyrene	0.088	0.78	BAL	BAL	15.0 E	BAL	BAL	BAL
Indeno(1,2,3-cd)pyrene	0.88	7.8	BAL	BAL	BAL	BAL	BAL	BAL
Dibenzo(a,h)anthracene	0.088	0.78	BAL	BDL	1.8	BAL	BAL	BAL
Pesticides								
Aldrin	0.038	0.34	BAL	BAL	BDL	BDL	BDL	BAL
Dieldrin	0.04	0.36	BAL	BAL	BAL	BAL	BAL	BDL
Toxaphene	0.58	5.2	BAL	BAL	BAL	BAL	BAL	BDL

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification					
	R	I						
			J0-2	J1-2	J2-2	J3-2	J3-3	K0-2
Polychlorinated Biphenyls (PCBs)								
Aroclor 1254	1.6	41	BAL	BAL	100.02 CE	BDL	BDL	BAL
Total PCBs (Aroclor 1016,1221,1232,1232, 1242,1248,1254, & 1260)	0.083	0.74	BDL	BDL	105.50 U	BDL	BDL	3.268 U
			K1-2	K2-2	K2-3 Dup.K2-2	K3-2	K3-3 Dup.K2-2	H-2
Inorganics								
Beryllium	0.15	1.3	BAL	BAL	BAL	BAL	BAL	2.4
Lead	400	1,400	6,730	8,960	6,620	BAL	BAL	12,600
Semivolatile Organic Compounds								
N-nitroso-di-n-propylamine	0.091	0.82	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)pyrene	0.088	0.78	0.79	BAL	BAL	BAL	BDL	BAL
Pesticides								
Aldrin	0.038	0.34	BDL	BDL	BDL	BDL	BDL	BDL
Dieldrin	0.04	0.36	BDL	0.41 U	BDL	BAL	BDL	BDL
Toxaphene	0.58	5.2	BDL	21.0 U	BDL	9.9 U	BDL	BDL
Polychlorinated Biphenyls (PCBs)								
Aroclor 1254	1.6	41	110.0 CE	BAL	BAL	BDL	BDL	BAL
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	115.60 U	61.80 U	22.610 U	BDL	BDL	5.455 U

Table D-6

SUMMARY OF EE/CA 1-2 FEET SOIL SAMPLING RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY - APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Identification				
	R	I	L1-2	F2	L3-2	M0-2	M1-2
Inorganics							
Beryllium	0.15	1.3	1.4	BAL	BAL	1.4	BAL
Lead	400	1,400	24,100	5,840	BAL	12,100	BAL
Semivolatile Organic Compounds							
Benzo(a)pyrene	0.088	0.78	BAL	0.86	BDL	BAL	BAL
Pesticides							
Aldrin	0.038	0.034	BAL	BAL	BDL	BDL	BDL
Polychlorinated Biphenyls							
Total PCBs (Aroclor 1016,1221,1232,1242, 1248,1254, & 1260)	0.083	0.74	BDL	BDL	BDL	BDL	BDL

Key: U = This flag indicates the compound was analyzed for but not detected.

J = This flag indicates an estimated value. The flag is used as detailed below:

1. When estimating a concentration for tentatively identified compounds (TICs) where a response factor of 1.0 is assumed for the TIC analyte.
2. When the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MSidentification criteria, and the result is less than the CRQL but greater than zero, and
3. When the retention time data indicate the presence of a compound that meets the pesticide/Aroclor or other GC or HPLC identification criteria, and the result is less than the CRQL but greater than zero. For example. If the sample quantitation limit is 10μg/L is calculated, it is reported as 3J.

E= This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis. If one or more compounds have a response greater than the upper level of the calibration range, the sample or extract will be diluted and reanalyzed. All such compounds with a response greater than the upper level of the calibration range will have the E flag.

C = This flag applies to GC or HPLC results where the identification has been confirmed by GC/MS. If GC/MS confirmation was attempted but was unsuccessful, this flag is not applied.

X = The isomers of the analyte was not resolved.

NAV = Not analyzed for volatile organic compounds.

BDL = Below detection level.

BAL = Below action level.

[a] = Any sample from the EE/CA 1-2 foot soil sampling which had a hit above the industrial risk-based concentrations via exposure by soil ingestion (U.S. EPA 1995a) is included in this table.

= Value exceeds the industrial risk-based concentration via exposure by soil ingested.

Analytical Sources: U.S. EPA CLP, 1997; sampling conducted by Ecology and Environment, Inc. (Appendix B).

Table D-7

SUMMARY OF EE/CA 4-8 FEET SECOND SOIL SAMPLING EVENT RESULTS[a]
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Designation		
	R	I	I2-4	I2-6	I2-8
Inorganics					
TCLP lead	5 mg/L	NS	81.6 mg/L	BAL	8.86 mg/L
Volatile Organic Compounds					
Tetrachloroethene	12.0	110.0	BAL	BAL	15.0
Semivolatile Organic Compounds					
Benzo(b)fluoranthene	0.880	7.800	0.960	BAL	BAL
Benzo(a)pyrene	0.088	0.780	0.440 J	0.110 J	0.390 J
Benzo(a,h)anthracene	0.088	0.780	0.120 J	BAL	BAL

Key:
R = Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
I = Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995a).
NS = Not specified.
J = The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
BAL = Below action level.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
[a] = Any sample from the EE/CA 4-8 feet soil sampling which had a hit above the industrial risk-based concentrations via exposure by soil ingestion (U.S. EPA 1995a) is included in this table.

= Value exceeds the industrial risk-based concentration via exposure by soil ingested.

Analytical Source: Weston Environmental Metrics, Inc. arranged by Ecology and Environment analytical TDD S05-9704-804 (Appendix B).

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES MW-1 THROUGH MW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection															
			MW-1						MW-2					MW-3				
			MAE MW-1 2/89	MAE MW-1 5/93	IEPA MW-1 11/93	E & E MW1-A 1/97	E & E MW1-A Duplicate 1/97	E & E MW1-B 2/97	MAE MW-2 2/89	IEPA MW-2 5/93	IEPA MW-2 5/93	E & E MW2-A 1/97	E & E MW2-B 2/97	MAE MW-3 2/89	IEPA MW-3 5/93	IEPA MW-3 11/93	E & E MW3-A 1/97	E & E MW3-B 2/97
Inorganics																		
Antimony	0.006	0.006	NA	NA	NA	0.0026 U	0.0026 U	0.0229 U	NA	NA	NA	0.0026 U	0.023 U	NA	NA	NA	0.0026 U	0.023 U
Arsenic	0.050	0.050	ND	ND	ND	0.0019 U	0.0027	0.0045	ND	ND	ND	0.0019 U	41E-4 U	ND	ND	ND	0.0019 U	41E-4 U
Barium	2.0	2.0	0.558	0.107	0.089	0.114	0.106	0.119	0.451	0.0617	0.0632	0.0804	0.0817	0.125	0.0617	0.069	0.0768	0.0667
Beryllium	0.004	0.001	NA	ND	ND	1E-4 U	1E-4 U	4E-4 U	NA	ND	ND	1E-4 U	4E-4 U	NA	ND	ND	0.0001 U	4E-4 U
Cadmium	0.005	0.005	0.006	0.0164	0.0019	0.0067	0.0063	0.0141 J	0.004	ND	ND	3E-4 U	25E-4 U	ND	ND	ND	0.0003	25E-4 U
Chromium	0.100	0.200	0.212	ND	ND	7E-4 U	7E-4 U	20E-4 U	0.157	ND	ND	7E-4 U	20E-4 U	0.019	ND	ND	0.0007 U	20E-4 U
Copper	Treat.	1.3	NA	0.188	0.028	0.054	0.0518	0.154	NA	ND	ND	0.0057	0.0121	NA	ND	ND	0.0065	0.010
Lead	Treat.	0.030	1.56	0.0061	ND	0.078 J	0.0079 J	0.0062	2.01	ND	0.0016	0.0044 J	28E-4 U	0.019	ND	ND	0.0038 J	28E-4 U
Manganese	NS	0.200	NA	0.0338	0.048	0.310	0.0284	0.0053	NA	0.902	1.05	0.416	0.801	NA	0.591	0.019	0.0666	0.0283
Mercury	0.002	0.010	0.0043	ND	ND	1E-4 U	1E-4 U	1E-4 U	0.0222	ND	ND	1E-4 U	1E-4 U	0.0001	ND	ND	0.0001 U	1E-4 U
Nickel	0.100	0.500	NA	NA	NA	0.0053	0.0059	0.0246	NA	NA	NA	0.0022	45E-4 U	NA	NA	NA	0.0022	45E-4 U

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES MW-1 THROUGH MW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection															
			MW-1						MW-2					MW-3				
			MAE MW-1 2/89	MAE MW-1 5/93	IEPA MW-1 11/93	E & E MW1-A 1/97	E & E MW1-A Duplicate 1/97	E & E MW1-B 2/97	MAE MW-2 2/89	IEPA MW-2 5/93	IEPA MW-2 5/93	E & E MW2-A 1/97	E & E MW2-B 2/97	MAE MW-3 2/89	IEPA MW-3 5/93	IEPA MW-3 11/93	E & E MW3-A 1/97	E & E MW3-B 2/97
Selenium	0.050	0.200	0.016	NA	ND	0.0023 U	0.0023 U	42E-4 U	0.02	NA	NA	0.0023 U	42E-4 U	0.015	NA	ND	0.0023 U	42E-4 U
Silver	NS	0.100	0.018	ND	ND	9E-4 U	9E-4 U	34E-4 U	0.015	ND	ND	9E-4 U	34E-4 U	0.003	ND	ND	0.0009 U	34E-4 U
Thallium	0.002	0.002	NA	NA	NA	0.0035 U	0.0035 U	54E-4 U	NA	NA	NA	0.0035 U	54E-4 U	NA	NA	NA	0.0035 U	54E-4 U
Vanadium	NS	0.250	NA	NA	NA	0.0023 U	0.023 U	24E-4 U	NA	NA	NA	0.0023 U	0.0026	NA	NA	NA	0.0023 U	24E-4 U
Zinc	NS	3.0	NA	7.17	0.26	0.724	0.664	5.42	NA	ND	ND	0.0187	0.0264 J	NA	ND	ND	0.0452	0.0071 J
Volatile Organic Compounds																		
Vinyl chloride	0.002	0.002	ND	0.01	ND	0.010 U	0.010 U	0.010 U	ND	ND	ND	0.010 U	0.010 U	ND	2.80	1.0	0.051	1.1
1,1-Dichloroethene	0.007	0.070	ND	0.01	ND	0.010 U	0.010 U	0.010 U	ND	ND	ND	0.010 U	0.010 U	ND	0.059	0.047	0.019	0.023
1,1-Dichloroethane	NS	3.5	NA	NA	NA	0.010 U	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.010 U	NA	NA	NA	0.003 J	0.500 U
1,2-Dichloroethene (total isomers)	0.07	0.40	ND	0.001	ND	0.010 U	0.010 U	0.010 U	ND	ND	ND	0.010 U	0.010 U	ND	0.410	13.0	3.9	7.6
1,1,1-Trichloroethane	0.200	0.100	NA	NA	NA	0.010 U	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.500 U

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES MW-1 THROUGH MW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source / Sample Identification / Date of Collection															
			MW-1						MW-2					MW-3				
			MAE MW-1 2/89	MAE MW-1 5/93	IEPA MW-1 11/93	E & E MW1-A 1/97	E & E MW1-A Duplicate 1/97	E & E MW1-B 2/97	MAE MW-2 2/89	IEPA MW-2 5/93	IEPA MW-2 5/93	E & E MW2-A 1/97	E & E MW2-B 2/97	MAE MW-3 2/89	IEPA MW-3 5/93	IEPA MW-3 11/93	E & E MW3-A 1/97	E & E MW3-B 2/97
Trichloroethene	0.005	0.30	NA	0.01	ND	0.010 U	0.010 U	0.002 J	ND	ND	ND	0.010 U	0.010 U	ND	0.097	0.11	0.073	0.094
Benzene	0.005	0.100	NA	NA	NA	0.010 U	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.500 U
1,1,2,2-Tetrachloroethane	NS	0.002	NA	NA	NA	0.010 U	0.010 UJ	0.010 U	NA	NA	NA	0.010 U	0.010 U	NA	NA	NA	0.010 U	0.500 U
Semivolatile Organic Compounds																		
2,4,5-Trichlorophenol	NS	0.300	NA	NA	NA	0.025 U	0.025 U	0.025 U	NA	NA	NA	0.025 U	0.025 U	NA	NA	NA	0.025 U	0.025 U
4-Nitrophenol	NS	0.300	NA	NA	NA	0.025 U	0.025 U	0.025 UJ	NA	NA	NA	0.025 U	0.025 UJ	NA	NA	NA	0.025 U	0.025 UJ
Pentachlorophenol	0.001	0.030	NA	NA	NA	0.025 U	0.025 U	0.025 U	NA	NA	NA	0.025 U	0.025 U	NA	NA	NA	0.025 U	0.025 U
Pesticides																		
Gamma-BHC (Lindane)	0.0002	0.002	NA	NA	NA	5E-5 U	5E-5 UJ	5E-5 UJ	NA	NA	NA	5E-5 U	5E-5 UJ	NA	NA	NA	NA	5E-5 UJ
Heptachlor	0.0004	0.0008	NA	NA	NA	5E-5 U	5E-5 UJ	0.0 J	NA	NA	NA	5E-5 U	0.0 J	NA	NA	NA	NA	0.0 J

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES MW-1 THROUGH MW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection															
			MW-1						MW-2					MW-3				
			MAE MW-1 2/89	MAE MW-1 5/93	IEPA MW-1 11/93	E & E MW1-A 1/97	E & E MW1-A Duplicate 1/97	E & E MW1-B 2/97	MAE MW-2 2/89	IEPA MW-2 5/93	IEPA MW-2 5/93	E & E MW2-A 1/97	E & E MW2-B 2/97	MAE MW-3 2/89	IEPA MW-3 5/93	IEPA MW-3 11/93	E & E MW3-A 1/97	E & E MW3-B 2/97
Endrin	0.002	0.003	NA	0.0001	NA	1E-4 U	1E-4 UJ	1E-4 U	NA	ND	ND	1E-4	1E-4 UJ	NA	8E-6	NA	NA	1E-4 U
Toxaphene	0.003	0.003	NA	NA	NA	0.005 U	0.005 UJ	0.005 U	NA	NA	NA	0.005 U	0.005 UJ	NA	NA	NA	NA	0.005 U
Polychlorinated Biphenyls (PCBs)																		
Total PCBs	0.0005	0.0005	ND	0.001	NA	0.008 U	0.008 UJ	0.008 U	ND	1.9E-4	ND	0.008 U	0.008 UJ	ND	ND	NA	NA	0.008 U

ey is presented at the end of Table D-8.

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES GMMW-1 THROUGH GMMW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source / Sample Identification / Date of Collection									
			GMMW-1			GMMW-2			GMMW-3			
			IEPA GMMW-1 11/93	E & E GMMW1-A 1/97	E & E GMMW1-B 2/97	IEPA GMMW-2 11/93	E & E GMMW2-A 1/97	E & E GMMW2-B 2/97	IEPA GMMW-3 11/93	IEPA GMMW-3 Duplicate 11/93	E & E GMMW3-A 1/97	E & E GMMW3-B 2/97
Inorganics												
Antimony	0.006	0.010	NA	0.0026 U	0.0229 U	NA	0.0026 U	0.0229 U	NA	NA	0.0026 U	0.0229 U
Arsenic	0.050	0.050	ND	0.0019 U	0.0045	ND	0.0019 U	0.0041 U	0.1	0.092	0.0948	0.0322
Barium	2.0	2.0	0.032	0.0217 U	0.021	0.12	0.1040	0.0959	0.15	0.15	0.1560	0.131
Beryllium	0.004	0.001	ND	1E-4 U	4E-4 U	ND	1E-4 U	4E-4 U	ND	ND	1E-4 U	4E-4 U
Cadmium	0.005	0.005	ND	3E-4 U	0.0025 U	ND	3E-4 U	0.0025 U	ND	ND	3E-4 U	0.0025 U
Chromium	0.100	0.200	ND	7E-4 U	0.0021	ND	7E-4 U	0.002 U	ND	ND	7E-4 U	0.002 U
Copper	Treat.	1.3	ND	0.0046	0.0041 U	ND	0.0042	0.0084	ND	ND	0.0045	0.0072
Lead	Treat.	0.030	ND	0.0035 J	0.0286	ND	0.0072 J	0.0028 U	ND	ND	0.0054 J	0.0028 U
Manganese	NS	0.200	0.065	0.0243	0.0301	0.25	0.250	0.225	0.43	0.44	0.5890	0.593
Mercury	0.002	0.010	ND	1E-4 U	1E-4 U	ND	1E-4 U	1E-4 U	ND	ND	1E-4 U	1E-4 U

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES GMMW-1 THROUGH GMMW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source / Sample Identification / Date of Collection									
			GMMW-1			GMMW-2			GMMW-3			
			IEPA GMMW-1 11/93	E & E GMMW1-A 1/97	E & E GMMW1-B 2/97	IEPA GMMW-2 11/93	E & E GMMW2-A 1/97	E & E GMMW2-B 2/97	IEPA GMMW-3 11/93	IEPA GMMW-3 Duplicate 11/93	E & E GMMW3-A 1/97	E & E GMMW3-B 2/97
Nickel	0.100	0.500	NA	0.0024	0.0045 U	NA	0.0024	0.0045 U	NA	NA	0.0052	0.0045 U
Selenium	0.050	0.200	ND	0.0023 U	0.0042 U	ND	0.0023 U	0.0042 U	ND	ND	0.0023 U	0.0042 U
Silver	NS	0.100	ND	9E-4 U	0.0034 U	ND	9E-4 U	0.0034 U	ND	ND	9E-4 U	0.0034 U
Thallium	0.002	0.002	NA	0.0035 U	0.054 U	NA	0.0035 U	0.0054 U	NA	NA	0.0035 U	0.0054 U
Vanadium	NS	0.250	NA	0.0023 U	0.0024 U	NA	0.0023 U	0.0024 U	NA	NA	0.0023 U	0.0024 U
Zinc	NS	3.0	0.021	0.0233	0.0075	0.046	0.0384	0.0273 J	ND	ND	0.0325	0.221 J
Volatile Organic Compounds												
Vinyl chloride	0.002	0.002	ND	0.010 U	0.010 U	ND	0.010 U	0.010 U	0.013	0.014	0.008 J	0.010 U
1,1-Dichloroethene	0.007	0.070	ND	0.010 U	0.010 U	ND	0.010 U	0.010 U	ND	ND	0.010 U	0.010 U
1,1-Dichloroethane	NS	3.5	NA	0.010 U	0.010 U	NA	0.010 U	0.010 U	NA	NA	0.010 U	0.010 U
1,2-Dichloroethene (total isomer)	0.07	0.40	ND	0.010 U	0.010 U	0.023	0.110	0.130	0.017	0.017	0.044	0.017

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES GMMW-1 THROUGH GMMW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection									
			GMMW-1			GMMW-2			GMMW-3			
			IEPA GMMW-1 11/93	E & E GMMW1-A 1/97	E & E GMMW1-B 2/97	IEPA GMMW-2 11/93	E & E GMMW2-A 1/97	E & E GMMW2-B 2/97	IEPA GMMW-3 11/93	IEPA GMMW-3 Duplicate 11/93	E & E GMMW3-A 1/97	E & E GMMW3-B 2/97
1,1,1-Trichloroethane	0.200	0.100	NA	0.003 J	0.010 U	NA	0.010 U	0.010 U	ND	ND	0.010 U	0.010 U
Trichloroethene	0.005	0.30	ND	0.010 U	0.010 U	ND	0.026	0.026	ND	ND	0.010 U	0.010 U
Benzene	0.005	0.100	NA	0.010 U	0.010 U	NA	0.010 U	0.010 U	NA	NA	0.010 U	0.010 UJ
1,1,2,2-Tetrachloroethane	NS	0.002	NA	0.003 J	0.010 U	NA	0.010 U	0.010 U	NA	NA	0.010 UJ	0.010 U
Semivolatile Organic Compounds												
2,4,5-Trichlorophenol	NS	0.300	NA	0.025 U	0.025 U	NA	0.025 U	0.025 U	NA	NA	0.025 U	0.025 U
4-Nitrophenol	NS	0.300	NA	0.025 U	0.025 UJ	NA	0.025 U	0.025 UJ	NA	NA	0.025 U	0.025 UJ
Pentachlorophenol	0.001	0.030	NA	0.025 U	0.025 U	NA	0.025 U	0.025 U	NA	NA	0.025 U	0.050 U
Pesticides												
Gamma-BHC(Lindane)	0.0002	0.002	NA	5E-5 U	5E-5 UJ	NA	5E-5 UJ	5E-5 UJ	NA	NA	5E-5 UJ	5E-5 UJ
Heptachlor	0.0004	0.0008	NA	5E-5 U	0 J	NA	5E-5 UJ	0 J	NA	NA	5E-5 UJ	5E-5 U

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES GMMW-1 THROUGH GMMW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source Sample Identification Date of Collection									
			GMMW-1			GMMW-2			GMMW-3			
			IEPA GMMW-1 11/93	E & E GMMW1-A 1/97	E & E GMMW1-B 2/97	IEPA GMMW-2 11/93	E & E GMMW2-A 1/97	E & E GMMW2-B 2/97	IEPA GMMW-3 11/93	IEPA GMMW-3 Duplicate 11/93	E & E GMMW3-A 1/97	E & E GMMW3-B 2/97
Aldrin	NS	0.0002	NA	5E-5 UJ	5E-5 U	NA	5E-5 UJ	5E-5 U	NA	NA	5E-5 UJ	5E-5 U
Dieldrin	NS	0.0002	NA	1E-4 U	1E-4 U	NA	1E-4 UJ	1E-4 UJ	NA	NA	1E-4 UJ	1E-4 U
Endrin	0.002	0.003	NA	1E-4 U	1E-4 U	NA	1E-4 UJ	1E-4 UJ	NA	NA	1E-4 UJ	1E-4 U
Toxaphene	0.003	0.003	NA	0.005 U	0.005 U	NA	0.005 UJ	0.005 U	NA	NA	0.005 UJ	0.005 U

Table D-8

SUMMARY OF EE/CA AND HISTORICAL GROUNDWATER SAMPLING RESULTS
SAMPLES GMMW-1 THROUGH GMMW-3
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

units = mg/L

Parameter	MCL	RAL	Source / Sample Identification / Date of Collection									
			GMMW-1			GMMW-2			GMMW-3			
			IEPA GMMW-1 11/93	E & E GMMW1-A 1/97	E & E GMMW1-B 2/97	IEPA GMMW-2 11/93	E & E GMMW2-A 1/97	E & E GMMW2-B 2/97	IEPA GMMW-3 11/93	IEPA GMMW-3 Duplicate 11/93	E & E GMMW3-A 1/97	E & E GMMW3-B 2/97
Polychlorinated Biphenyls (PCBs)												
Total PCBs	0.0005	0.0005	NA	0.008 U	0.008 U	NA	0.008 U	0.008 U	NA	NA	0.008 U	0.008 U

Key:
- MCL = Maximum contaminant level (National Primary Drinking Water Standard) (U.S. EPA 1995b).
- RAL = Superfund removal action level for contaminated drinking water sites (U.S. EPA 1995b).
- NA = Not analyzed.
- ND = Not detected.
- IEPA = Illinois Environmental Protection Agency.
- E & E = Ecology and Environment, Inc.
- MAE = MAECORP, Inc.
- Treat. = MCL is based on the capability of treatment technology.
- NS = Not specified for MCL values.
- U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J = The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
- mg/L = Milligrams per liter.
- = Value exceeds the Superfund removal action level for contaminated drinking water sites.

Analytical Sources: MAECORP (1989a), IEPA (1993), Ecology and Environment (1997) and U.S. EPA CLP, 1997 sampling conducted by Ecology and Environment, Inc. (Appendix B).

Table D-9

SUMMARY OF EE/CA GEOPROBE GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY AND FEBRUARY 1997

units = mg/L

Parameter	MCL	RAL	Sample Designation								
			GEO-2	GEO-3	GEO-4	GEO-5	GEO-5A Duplicate of GEO-5	GEO-6	GEO-7	GEO-8	GEO-9
Inorganics											
Antimony	0.006	0.010	0.0026 U	NA	NA	0.0229 U	0.0229 U	NA	0.029 U	NA	NA
Arsenic	0.050	0.050	0.0019 U	NA	NA	0.0041 U	0.0041 U	NA	0.004 U	NA	NA
Barium	2.0	2.0	0.0786	NA	NA	0.0685	0.0677	NA	0.583	NA	NA
Beryllium	0.004	0.001	1E-4 U	NA	NA	4E-4 U	4E-4 U	NA	4E-4 U	NA	NA
Cadmium	0.005	0.005	3E-4 U	NA	NA	25E-4 U	25E-4 U	NA	25E-4 U	NA	NA
Chromium	0.100	0.200	7E-4 U	NA	NA	0.0035	20E-4 U	NA	20E-4 U	NA	NA
Copper	Treat.	1.3	0.0045 U	NA	NA	41E-4 U	41E-4 U	NA	41E-4 U	NA	NA
Lead	Treat.	0.030	0.0045 J	NA	NA	28E-4 U	28E-4 U	NA	28E-4 U	NA	NA
Manganese	NS	0.200	0.495	NA	NA	0.0212	0.0208	NA	0.512	NA	NA
Mercury	0.002	0.010	1E-4 U	NA	NA	1E-4 U	1E-4 U	NA	1E-4 U	NA	NA
Nickel	0.100	0.500	0.0018 U	NA	NA	45E-4 U	45E-4 U	NA	45E-4 U	NA	NA
Selenium	0.050	0.200	0.0023 U	NA	NA	42E-4 U	42E-4 U	NA	42E-4 U	NA	NA
Silver	NS	0.100	9E-4 U	NA	NA	34E-4 U	34E-4 U	NA	34E-4 U	NA	NA
Thallium	0.002	0.002	0.0035 U	NA	NA	54E-4 U	54E-4 U	NA	54E-4 U	NA	NA
Vanadium	NS	0.250	0.0023 U	NA	NA	24E-4 U	24E-4 U	NA	0.0028	NA	NA
Zinc	NS	3.0	0.0094	NA	NA	0.0046 J	44E-4 U	NA	0.0161 J	NA	NA
Volatile Organic Compounds											
Vinyl chloride	0.002	0.002	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
1,1-Dichloroethene	0.007	0.070	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
1,1-Dichloroethane	NS	3.5	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
1,2-Dichloroethene (total isomers)	0.07	0.40	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.012 J	0.031	0.010 U

Table D-9

SUMMARY OF EE/CA GEOPROBE GROUNDWATER SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY AND FEBRUARY 1997

units = mg/L

Parameter	MCL	RAL	Sample Designation								
			GEO-2	GEO-3	GEO-4	GEO-5	GEO-5A Duplicate of GEO-5	GEO-6	GEO-7	GEO-8	GEO-9
1,1,1-Trichloroethane	0.200	1.0	0.003 J	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
Trichloroethene	0.005	0.30	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	5.0	0.420	0.180	0.002 J
Benzene	0.005	0.100	0.001 U	0.010 UJ	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
1,1,2,2-Tetrachloroethane	NS	0.002	0.003 J	0.010 U	0.010 U	0.010 U	0.010 U	0.500 U	0.050 U	0.010 U	0.010 U
Semivolatile Inorganic Compounds											
2,4,5-Trichlorophenol	NS	0.300	0.025 U	NA	NA	0.025 U	0.025 U	0.025 U	0.025 U	NA	NA
4-Nitrophenol	NS	0.300	0.025 U	NA	NA	0.025 U	0.025 U	0.025 UJ	0.025 UJ	NA	NA
Pentachlorophenol	0.001	0.030	0.025 U	NA	NA	0.025 UJ	0.025 UJ	0.025 U	0.025 U	NA	NA
Pesticides											
Gamma-BHC (Lindane)	0.0002	0.002	5E-5 U	NA	NA	5E-5 U	5E-5 UJ	0.50 UJ	5E-5 UJ	NA	NA
Heptachlor	0.0004	0.0008	5E-5 U	NA	NA	5E-5 UJ	5E-5 UJ	4E-5 J	5E-5 U	NA	NA
Aldrin	NS	0.0002	5E-5 U	NA	NA	5E-5 UJ	5E-5 UJ	6E-5 J	5E-5 U	NA	NA
Dieldrin	NS	0.0002	1E-4 U	NA	NA	1E-4 UJ	1E-4 UJ	8E-5 J	1E-4 U	NA	NA
Endrin	0.002	0.003	1E-4 U	NA	NA	1E-4 UJ	4E-5 J	7.8E-4 J	1E-4 U	NA	NA
Toxaphene	0.003	0.003	0.005 U	NA	NA	0.005 UJ	0.005 UJ	0.050 UJ	0.005 U	NA	NA
Polychlorinated Biphenyls (PCBs)											
Total PCBs	0.0005	0.0005	0.008 U	NA	NA	0.008 UJ	0.008 UJ	0.008 UJ	0.08 UJ	NA	NA

Key: MCL = Maximum contaminant level (National Primary Drinking Water Standard) (U.S. EPA 1995b).
RAL = Superfund removal action level for contaminated drinking water sites (U.S. EPA 1995b).
Treat. = MCL is based on the capability of the treatment technology.
NA = Not analyzed.
NS = Not specified for MCL values.
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J = The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
mg/L = Milligrams per liter.
= Value exceeds the Superfund removal action level for contaminated drinking water sites.

Analytical Source: U.S. EPA CLP, 1997 sampling conducted by Ecology and Environment. (Appendix B).

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
Sodium	NS	NS	244	206	1,240	334	293	402	499	2,670	1,090	914	2,110	407	[illegible]
Thallium	NS	NS	0.98 U	0.86 U	0.86 U	0.82 U	0.83 U	0.90 U	0.90 U	4.3 U	3.0	3.2 U	3.7 U	2.9 U	2.8 U
Vanadium	550	14,000	20.9	17.9	9.2	17.1	20.7	12.8	14.7	22.8	15.2	23.9	16.1	25.4	34.5
Zinc	23,000	6.1E5	2,200	1,700	2,070	1,640	1,650	2,200	2,540	5,270	4,890	1,230	4,270 J	4,910	6,890
Volatile Organic Compounds															
Chloromethane	49	440	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Bromomethane	110	2,900	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Vinyl chloride	0.34	3.0	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Chloroethane	31,000	820,000	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.019	0.038	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Methylene chloride	85	760	0.015 U	0.013 U	0.013 U	0.016 U	0.018 U	0.014 U	0.012 UJ	0.004 J	0.014 U	0.055 U	NA	NA	0.014 U
Acetone	7,800	2.0E5	0.015 UJ	0.013 UJ	0.009 J	0.012 UJ	0.012 UJ	0.010 J	0.012 UJ	0.100 BU	0.014 U	0.055 U	NA	NA	0.0[illegible] U
Carbon disulfide	7,800	200,000	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,1-Dichloroethene	1.1	9.5	0.015 U	0.013 U	0.013 U	0.012 UJ	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,1-Dichloroethane	7,800	200,000	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.051	0.018 U	14 U	0.055 U	NA	NA	0.014 U
1,2-Dichloroethene (total isomers)	780	20,000	0.015 U	0.013 U	0.013 U	0.005 J	0.012 U	0.014 U	0.012 U	0.004 J	0.010 U	0.710	NA	NA	0.014 U
Chloroform	100	940	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,2-Dichloroethane	7,800	2E5	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
2-Butanone	47,000	1.0E6	0.015 U	0.013 U	0.013 U	0.012 U	0.012 U	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,1,1-Trichloroethane	7,000	1.8E5	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.029 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Carbon tetrachloride	4.9	44	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
Inorganics															
Aluminum	78,000	1E+6	8,420	7,000	3,050	6,250	7,820	4,300	5,180	9,420	6,210	8,790	8,760	9,180	14,200
Antimony	31	820	1.6 J	1.5 J	0.65 J	2.4 J	7.0 J	4.4 J	3.4 J	1.7 U	3.9	2.2	1.5 U	6.1 B	1.5 B
Arsenic	23	610	22.4	38.0	2.5	15.8	14.0	8.7	9.4	12.0	6.6 J	12.4 J	11.2 J	18.6	9.9
Barium	5,500	1.4E5	56.6	55.4	39.7	78.3	78.3198	48.1	46.4	202	120	85.6	80.4	120	58.4
Beryllium	0.15	1 3	1.0	0.77	2.2	1.1	0.87	0.38	0.35	2.2	0.60	0.84	3.0	1.5	0.62
Cadmium	39	100	3.8	4.0	1.7	2.6	8.4	3.2	1.6	4.8	2.3	1.3	0.37 U	6.6	23.1
Calcium	NS	NS	41,100 J	37,400 J	58,300	34,600	29,500 J	26,200	63,800 J	46,700	68,900	52,100	42,800	36,000	43,400
Chromium	390	10,000	21.3	16.0	40.1	27.7	27.8	13.6	13.1	39.7	24.3	47.5	20.0	28.4	21.0
Cobalt	4,700	120,000	9.6	10.0	5.4	9.7	11.1	6.8	6.9	10.3 B	8.9	7.8	7.7	9.2 B	9.7 B
Copper	3,100	82,000	534	388	247	538	688	970	707	1.650	1,420	378	554	3,100	72
Iron	23,000	610,000	19,900	19,000	12,900	17,100	18,800	12,500	17,000	25,100	20,400	20,000	19,000	19,400	22,500
Lead	400	1,400	544	431	259	522	730	683	784	1,040	1,040	854	506	1,550	204
Magnesium	NS	NS	24,200	22,000	27,000	19,300	16,600	15,000	23,000	25,550	36,600	28,100	22,000	19,600	21,800
Manganese	390	10,000	433	502	351	564	554	221	348	426	379 J	310 J	408	1,520	403
Mercury	23	610	1.3	1.6	0.07	1.2	4.3	6.5	4.4	1.3	0.54	0.40	0.26	4.5	0.14 U
Nickel	1,600	41,000	31.6 J	25.9 J	22.2 J	44.9 J	51.1 J	23.3 J	20.0 J	74.1	31.0	31.1	36.1	50.6	23.9
Potassium	NS	NS	1,140 J	1,120 J	427 J	1,020 J	952 J	658 J	888 J	1,840 B	946	1,580 J	1,180 J	2,080	3,370
Selenium	390	10,000	1.1	1.2	0.57 U	1.4	3.7 J	0.740	0.59 U	2.2 U	1.5 U	1.6 U	1.8 U	1.4 U	1.9
Silver	390	10,000	0.97	0.81	0.22 U	2.1	[illegible]	3.3	0.44	2.7 B	0.98	0.921	0.73 U	2.0 B	0.55 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
Bis(2-chloroethyl)ether	0.58	5.2	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2-Chlorophenol	390	10,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
1,3-Dichlorobenzene	7,000	180,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
1,4-Dichlorobenzene	27	240	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
1,2-Dichlrobenzene	7,000	180,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2-Methylphenol	3,900	100,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2,2'-Oxybis(1-chloropropane)	NS	NS	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
4-Methylphenol	390	10,000	0.480 U	0.430 U	0.095 J	0.410 U	0.400 U	0.160 J	0.400 U	0.250 J	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
N-nitroso-di-n-propylamine	0.091	0.82	0.480 U	0.430 U	0.430 U	0.470	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Hexachloroethane	46	410	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Nitrobenzene	39	1,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Isophorone	670	6,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2-Nitrophenol	NS	NS	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2,4-Dimethylphenol	1,600	14,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Bis(2-chloroethoxy)methane	NS	NS	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
2,4-Dichlorophenol	1,600	41,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
1,2,4-Trichlorobenzene	780	20,000	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Naphthalene	3,100	82,000	0.140 J	0.220 J	1.1	0.570	1.1	0.230 J	0.120 J	0.110 J	12.000	0.110 J	0.099 J	0.520 U	0.470 U
4-Chloroaniline	310	8,200	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Hexachlorobutadiene	8.2	7.3	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
romodichloromethane	10	92	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
2-Dichloropropane	9.4	84	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
is-1,3-dichloropropane	3.7	33	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
richloroethene	58	520	0.015 U	0.013 U	0.013 U	0.054	0.170 J	0.014 U	0.012 U	0.002 J	0.009 J	0.055 U	NA	NA	0.014 U
ibromochloromethane	NS	NS	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,2-Trichloroethane	11	100	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
enzene	22	200	0.015 U	0.013 U	0.013 U	0.012 UJ	0.006 J	0.006 J	0.016	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
rans-1,3-dichloropropane	3.7	33	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
romoform	81	720	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Methyl-2-pentanone	NS	NS	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
Hexanone	NS	NS	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
etrachloroethene	12	110	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
1,2,2-Tetrachloroethane	3.2	29	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
oluene	16,000	4.1E5	0.006 J	0.004 J	0.013 U	0.016	0.030 J	0.006 J	0.012	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
hlorobenzene	1,600	4.1E4	0.015 U	0.013 U	0.013 U	0.012 UJ	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
thylbenzene	7,800	2E5	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
tyrene	16,000	4.1E5	0.015 U	0.013 U	0.013 U	0.012 U	0.004 J	0.014 U	0.007 J	0.018 U	0.014 U	0.055 U	NA	NA	0.014 U
ylene (total isomers)	1.6E5	1E6	0.015 U	0.013 U	0.013 U	0.012 U	0.012 UJ	0.014 U	0.012 U	0.018 U	0.014	0.055 U	NA	NA	0.014 U
emivolatile Organic Compounds															
henol	47,000	1E6	0.480 U	0.430 U	0.430 U	0.410 U	0.4[illegible]	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	[illegible]520 U	0.470 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
6-Dinitro-2-methylphenol	NS	NS	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
-nitrosodiphenylamine	0.091	0.082	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Bromophenyl-phenylether	4,500	120,000	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
exachlorobenzene	0.4	3.6	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
entachlorophenol	5.3	48	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
henanthrene	NS	NS	2.700	4.500 J	57.00 J	34.00 J	16.00 J	2.200 J	4.000 J	2.000	12.000 U	2.500 J	3.900	0.310 J	0.470 U
nthracene	23,000	610,000	0.720	0.970 J	9.700 J	5.000 J	2.300 J	0.470 J	0.740 J	0.320 J	12.000 U	0.510 J	0.580	0.520 U	0.470 U
arbazole	32	290	0.310 J	0.450 J	5.600 J	3.400 J	1.500 J	0.320 J	0.450 J	0.280 J	12.000 U	0.420 J	0.380 J	0.520 U	0.470 U
i-n-butylphthalate	7,800	200,000	0.480 U	0.430 UJ	1.200 J	0.410 UJ	2.000 UJ	0.440 UJ	0.400 UJ	0.120 J	12.000 U	0.057 J	0.490 U	0.520 U	0.470 U
luoranthene	3,100	82,000	4.100	5.700 J	70.00 J	39.000 J	20.000 J	4.500 J	6.800 J	2.600	1.400 J	3.600 J	6.200 E	0.700	0.470 U
yrene	2,300	61,000	5.000 J	4.700 J	26.000	21.000 J	11.000 J	3.400 J	4.900 J	2.800	1.100 J	0.610 J	4.200 E	0.550	0.470 U
utylbenzylphthalate	16,000	410,000	1.200 J	0.062 J	0.290 J	0.077 J	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.230 J	0.051 J	0.520 U	0.470 U
,3'-Dichlorobenzidine	1.4	1.3	0.480 UJ	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
enzo(a)anthracene	0.88	7.8	3.500 J	2.700 J	18.000	11.000 J	6.200 J	1.300 J	2.100 J	1.200	12.000 U	1.500 J	1.900	0.300 J	0.470 U
hrysene	88	780	7.700 J	4.000 J	21.000	16.000 J	8.700 J	2.200 J	2.900 J	1.700	12.000 U	1.100 J	2.400	0.360 J	0.470 U
is(2-ethylhexyl) phthalate	46	410	2.200 J	0.730 J	2.400	1.600 J	0.730 J	11.000 J	3.600 J	3.800 B	38.000	1.100 J	0.480 J	0.170 J	0.053 J
i-n-octylphthalate	1,600	41,000	0.480 U	0.430 U	0.160 J	0.410 UJ	0.400 UJ	0.440 U	0.400 U	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
enzo(b)fluoranthene	0.88	7.8	10.000	2.400	33.000	15.000 J	8.300 J	1.600	1.900	2.000 X	1.100 JX	1.100 J	3.500 X	0.610 X	0.470 U
enzo(k)fluoranthene	8.8	78	3.500	3.000	7.600	6.400 J	4.900 J	1.400	1.800	1.900 X	1.100 JX	0.620 J	3.000 X	0.520 XJ	0.470 U
enzo(a)pyrene	0.088	0.78	5.800	2.900	25.000	12.000 J	6.600 J	1.400	2.000	1.100	12.000 U	0.120 J	2.000	0.360 J	0.470 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
Chloro-3-methylphenol	NS	NS	0.480 U	0.430 U	0.430 U	0.410 U	0.400 U	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Methylnaphthalene	NS	NS	0.130 J	0.170 J	0.330 J	0.300 J	0.500	0.140 J	0.077 J	0.072 J	12.000 U	0.061 J	0.490 U	0.520 U	0.470 U
xachlorocyclopentadiene	550	14,000	0.480 UJ	0.430 UJ	0.430 U	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
4,6-Trichlorophenol	58	520	0.480 U	0.430 UJ	0.430 U	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
4,5-Trichlorophenol	7,800	200,000	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
Chloronaphthalene	6,300	160,000	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Nitroaniline	4.7	120	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
methylphthalate	7.8E5	1E6	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
enaphthylene	NS	NS	0.260 J	0.210 J	0.150 J	0.170 J	0.260 J	0.130 J	0.098 J	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
5-Dinitrotoluene	78	2,000	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Nitroaniline	230	6,100	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
enaphthene	4,700	120,000	0.140 J	0.340 J	4.400 J	2.500 J	1.400 J	0.230 J	0.210 J	0.230 J	12.000 U	0.310 J	0.490 U	0.520 U	0.470 U
4-Dinitrophenol	160	4,100	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 UJ
Nitrophenol	4,800	130,000	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960 UJ	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U
benzofuran	310	8,200	0.130 J	0.210 J	2.300 J	1.100 J	0.770 J	0.440 UJ	0.140 J	0.130 J	12.000 U	0.260 J	0.140 J	0.520 U	0.470 U
4-Dinitrotoluene	160	4,100	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
ethylphthalate	63,000	1E6	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
Chlorophenyl-phenylether	NS	NS	0.480 U	0.430 UJ	0.430 UJ	0.410 UJ	0.400 UJ	0.440 UJ	0.400 UJ	0.610 U	12.000 U	0.540 UJ	0.490 U	0.520 U	0.470 U
uorene	3,100	82,000	0.170 J	0.350 J	4.600 J	2.100 J	1.200 J	0.420 J	0.410 J	0.200 J	12.000 U	0.560 J	0.260 J	0.520 U	0.470 U
Nitroaniline	230	6,100	1.200 U	1.000 UJ	1.000 UJ	0.990 UJ	0.960	1.100 UJ	0.960 UJ	1.500 U	31.000 U	1.300 UJ	1.200 U	1.300 U	1.100 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
Endrin ketone	NS	NS	0.072	0.022 U	0.220 U	0.020 U	0.020 U	0.022 U	0.020 U	0.0061 U	0.00064 JP	0.011	0.0049 U	0.0052 U	0.0066
Endrin aldehyde	NS	NS	0.062	0.042	0.220	0.080	0.190	0.035	0.020 U	0.00030 JP	0.0061 P	0.0022 J	0.0049 U	0.0052 U	0.0047 U
Alpha-chlordane	0.490	4.4	0.012 U	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.010 U	0.012	0.0021 JP	0.012 U	0.017	0.0027 U	0.0024 U
Gamma-chlordane	NS	NS	0.021	0.011 U	0.014	0.010 U	0.010 U	0.011 U	0.010 U	0.0031 U	0.0018 JP	0.0028 U	0.022 P	0.0049 P	0.0024 U
Toxaphene	0.580	5.2	1.200 U	1.100 U	1.100 U	1.000 U	1.000 U	1.100 U	1.000 U	0.310 U	0.230 U	0.280 U	0.250 U	0.270 U	0.240 U
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	5.5	140	0.240 U	0.220 U	0.220 U	0.200 U	0.200 U	0.220 U	0.200 U	0.061 U	0.044 U	0.054 U	0.049 U	0.052 U	0.047 U
Aroclor 1221	NS	NS	0.490 U	0.440 U	0.440 U	0.410 U	0.400 U	0.450 U	0.400 U	0.120 U	0.090 U	0.110 U	0.100 U	0.110 U	0.096
Aroclor 1232	NS	NS	0.240 U	0.220 U	0.220 U	0.200 U	0.200 U	0.220 U	0.200 U	0.061 U	0.044 U	0.054 U	0.049 U	0.052 U	0.047 U
Aroclor 1242	NS	NS	0.240 U	0.220 U	0.220 U	0.200 U	0.200 U	0.220 U	0.200 U	0.061 U	0.044 U	0.054 U	0.049 U	0.052 U	0.047 U
Aroclor 1248	NS	NS	0.240 U	0.220 U	0.220 U	0.200 U	0.200 U	0.220 U	0.200 U	0.061 U	0.044 U	0.054 U	0.049 U	0.052 U	0.047 U
Aroclor 1254	1.6	41	0.240 U	0.220 U	2.200 U	2.000 U	0.200 U	2.000	0.860	0.840 Y	0.044 U	0.054 U	0.049 U	0.052 U	0.047 U
Aroclor 1260	NS	NS	0.590	0.300	0.120 J	1.100	2.000	0.220 U	0.200 U	0.061 U	0.044 U	0.054 U	0.150	0.180	0.047 U

Table D-10

SUMMARY OF EE/CA SEDIMENT SAMPLING RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
JANUARY 1997

units = mg/kg

Parameter	Risk-Based Concentration		Sample Identification												
	R	I	SED 1-1	SED 1-2	SED 2-1	SED 3-1	SED 3-2	SED 4-1	SED 4-2	SED 5-1	SED 6-1	SED 7-1	SED 7-2	SEDC3-1	SEDC3-2
ieno(1,2,3-cd)pyrene	0.88	7.8	0.650	2.100	9.700	4.900 J	2.400 J	0.530	0.990	0.770	12.000 U	0.088 J	0.930	0.220 J	0.470 U
ɔenzo(a,h)anthracene	0.088	0.78	0.480 U	0.430 U	0.430 U	0.410 UJ	2.000 UJ	2.200 UJ	0.400 U	0.190 J	12.000 U	0.140 J	0.150 J	0.520 U	0.470 U
nzo(g,h,i)perylene	NS	NS	4.400	2.200	9.600	4.900 J	2.400 J	0.550	1.000	0.870	12.000 U	0.540 UJ	0.710	0.190 J	0.470 U
sticides															
ɔha-BHC	0.100	0.910	0.012 U	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.010 U	0.0031 U	0.0023 U	0.0028 U	0.0025 U	0.00027 U	0.0024 U
ta-BHC	0.350	3.200	0.012 U	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.010 U	0.0031 U	0.0023 U	0.0028 U	0.0025 U	0.00027 U	0.0024 U
lta-BHC	NS	NS	0.012 U	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.010 U	0.0031 U	0.0023 U	0.0028 U	0.0011 JP	0.00019 JP	0.0024 U
mma-BHC (Lindane)	0.490	4.400	0.012 U	0.011 U	0.011 U	0.010 R	0.010 U	0.011 U	0.010 U	0.0031 U	0.0023 U	0.0028 UJ	0.0025 U	0.00027 U	0.00009 J
ptachlor	0.140	1.300	0.012 U	0.011 U	0.011 U	0.010 R	0.010 U	0.011 U	0.010 U	0.0031 U	0.0023 U	0.0042	0.0031	0.00027 U	0.00022 J
drin	0.038	0.340	0.012 U	0.011 U	0.011 U	0.010 R	0.010 U	0.011 U	0.010 U	0.0031 U	0.00064 JP	0.0023 J	0.0025 U	0.00014 JP	0.0024 U
ptachlor epoxide	0.07	0.63	0.012 U	0.011 U	0.100 U	0.010 U	0.010 U	0.034	0.014	0.00069 JP	0.0023 U	0.0028 U	0.0015 JP	0.00029 JP	0.0024 U
dosulfan I	NS	NS	0.079 U	0.011 U	0.230	0.010 U	0.170	0.014	0.010 U	0.0031 U	0.0023 U	0.0028 U	0.0025 U	0.00027 U	0.0024 U
eldrin	0.040	0.360	0.024 U	0.022 U	0.022 U	0.020 R	0.020 U	0.022 U	0.020 U	0.0061 U	0.00078 JP	0.026 J	0.018 P	0.0081 P	0.00057 J
4'-DDE	1.9	17	0.082	0.052	0.220 U	0.150	0.150	0.022 U	0.020 U	0.0019 JP	0.0044 U	0.0081	0.0098	0.013 P	0.0047 U
ıdrin	23	610	0.024 U	0.022 U	0.022 U	0.020 R	0.020 U	0.022 U	0.020 U	0.0061 U	0.0059 P	0.0054 U	0.0049 U	0.0052 U	0.0047 U
ıdosulfan II	NS	NS	0.028	0.024	0.220 U	0.026	0.045	0.022 U	0.020 U	0.0061 U	0.0054 P	0.0054 U	0.0049 U	0.0052 U	0.0047 U
4'-DDD	2.7	24	0.051	0.037	0.035	0.130	0.130	0.033	0.020 U	0.0061 U	0.0044 U	0.0091	0.0049 U	0.0052 U	0.0047 U
ıdosulfan sulfate	NS	NS	0.024 U	0.022 U	0.022 U	0.020 U	0.020 U	0.022 U	0.020 U	0.0061 U	0.0044 U	0.0044 U	0.0049 U	0.0013 JP	0.0047 U
4'-DDT	1.9	17	0.180	0.110	0.068	0.930	0.490	0.022 U	0.020 U	0.0061 U	0.0018 JP	0.012	0.0049 U	0.032 PB	0.0047 U
ethoxychlor	390	1,000	0.120 U	0.110 U	0.110 U	0.100 U	0.10[illegible]	0.110 U	0.100 U	0.072 P	0.018 JP	0.012 J	0.0058 JP	0.[illegible] JP	0.024 U

Table 9-11

SUMMARY OF EE/CA SECOND SEDIMENT SAMPLING EVENT RESULTS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS
APRIL 1997

units = mg/kg

Parameter	Risk-Based Concentrations		Sample Designation				
	R	I	SED3C-4	SED4-4	SED7-4	SED7-6	SED7-8 Duplicate of SED7-4
Benzo(a)anthracene	0.88	7.8	1.0	2.2	1.3	1.1	0.94
Benzo(b)fluoranthene	0.88	7.8	1.8	2.7	1.6	1.2	1.3
Benzo(a)pyrene	0.088	0.78	1.2	1.9	1.2	0.98	0.96
Indeno(1,2,3-cd)pyrene	0.88	7.8	0.98	1.5	BAL	BAL	BAL
Dibenzo(a,h)anthracene	0.088	0.78	0.18 J	0.30 J	BAL	BAL	BAL

Key:
R = Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995b).
I = Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995b).
J = The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
mg/kg = Milligrams per kilogram.
BAL = Below action level.
☐ = Value exceeds the industrial risk-based concentration via exposure by soil ingested.

Analytical Source: Weston Environmental Metrics, Inc. arranged by Ecology and Environment analytical TDD S05-9704-804. (Appendix B).

mg/kg =	Milligrams per kilogram.
R =	Residential risk-based concentration via exposure by soil ingestion (U.S. EPA 1995b).
I =	Industrial risk-based concentration via exposure by soil ingestion (U.S. EPA 1995b).
U =	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J =	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
UJ =	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
X =	Benzo(b)fluoranthene and benzo(k)fluoranthene isomers in the sample could not be chromatographically resolved. This is indicated with "X" flag.
NA =	Not analyzed for volatile organic compounds.
Y =	The analyte was unsuccessfully confirmed by gas chromatography/ mass spectrography.
R =	The data are unusable. The analyte may or may not be present.
E =	The analyte exceeds the upper level of the calibration range of the instrument for that specific analysis.
B =	The analyte is found in the associated blank as well as in the sample.
NS =	Not specified.
P =	This flag is used for a pesticide/Aroclor target analyte, and other GC or HPLC analytes, when there is greater than 25% difference for detected concentrations between the two GC or HPLC columns. The lower of the two values is reported.
[ ] =	Value exceeds the industrial risk-based concentration via exposure by soil ingested.

alytical Source: U.S. EPA CLP, 1997, arranged by Ecology and Environment, Inc. (Appendix B)

Table D-13

BIRDS POTENTIALLY EXISTING ON SITE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Common Name	Scientific Name	Season
American Crow	*Corvus brachyrhynchos*	Y
Dark-eyed Junco	*Junco hyemalis*	W
Song Sparrow	*Melospiza melodia*	Y
Northern Cardinal	*Cardinalis cardinalis*	Y
Downy Woodpecker	*Picoides pubescens*	S
Northern Mockingbird	*Mimus polyglottos*	Y
Tufted Titmouse	*Parus bicolor*	Y
Rufous-sided Towhee	*Pipilo erythrophthalmus*	S
Purple Finch	*Carpodacus purpureus*	W
Black-capped Chickadee	*Parus atricapillus*	Y
Turkey Vulture	*Cathartes aura*	S
Canada Goose	*Branta canadensis*	Y
Mourning Dove	*Zenaida macroura*	Y
Killdeer	*Charadrius vociferus*	S
Red-tailed Hawk	*Buteo jamaicensis*	Y
Brown-headed Cowbird	*Molothrus ater*	Y
Chipping Sparrow	*Spizella passerina*	S
Field Sparrow	*Spizella pusilla*	S
Common Grackle	*Quiscalus quiscula*	Y
Eastern Meadowlark	*Sturnella magna*	S
Gray Catbird	*Dumetella carolinensis*	S
Brown Thrasher	*Toxostoma rufum*	S
American Robin	*Turdus migratorius*	S
Blue-gray Gnatcatcher	*Polioptila caerulea*	S
Red-bellied Woodpecker	*Melanerpes carolinus*	S
European Starling	*Sturnus vulgaris*	Y
Great-crested Flycatcher	*Myiarchus crinitus*	S

Table D-12

VEGETATION OBSERVED ON SITE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Common Name	Scientific Name	Habitat
Eastern Cottonwood	*Populus deltoides*	MD
Ashleaf Maple	*Acer negundo*	MD
Red Maple	*Acer rubrum*	MD
Silver Maple	*Acer saccharinum*	MD
Red Oak	*Quercus rubra*	MD
Smooth Sumac	*Rhus glabra*	MD
Northern Catalpa	*Catalpa speciosa*	MD
Grape species	*Vitis spp.*	MD
Grasses	*Graminae spp.*	OF
Goldenrods	*Solidago spp.*	OF

Key: MD = Disturbed Mixed Deciduous Forest.
OF = Early Successional Old Field

Source: Kricher and Morrison 1988.

Table D-14

MAMMALS POTENTIALLY EXISTING ON SITE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Common Name	Scientific Name
Shorttail Shrew	*Blarina brevicauda*
Least Shrew	*Cryptotis parva*
Opossum	*Didelphis marsupialis*
Big Brown Bat	*Eptesicus fuscus*
Silver-haired Bat	*Lasionycteris noctivagans*
Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Woodchuck	*Marmota monax*
Striped Skunk	*Mephitis mephitis*
Meadow Vole	*Microtus pennsylvanicus*
Keen's Bat	*Myotis keeni*
Little Brown Bat	*Myotis lucifugus*
Evening Bat	*Nycticeius humeralis*
Muskrat	*Ondatra zibethica*
White-footed Mouse	*Peromyscus leucopus*
Eastern Pipistrel	*Pipistrellus subflavus*
Raccoon	*Procyon lotor*
Eastern Mole	*Scalopus aquaticus*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Chipmunk	*Tamias striatus*
Red Squirrel	*Tamiasciurus hudsonicus*
Meadow Jumping Mouse	*Zapus hudsonius*
Deer Mouse	*Peromyscus maniculatus*
Prairie Vole	*Microtus ochrogaster*

Source: IESPB 1994; U.S. FWS 1997.

Table D-13

BIRDS POTENTIALLY EXISTING ON SITE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Common Name	Scientific Name	Season
Golden-crowned Kinglet	*Regulus satrapa*	W
Red-eyed Vireo	*Vireo olivaceus*	S
Orchard Oriole	*Icterus spurius*	S
Northern Oriole	*Icterus galbula*	S
American Kestrel	*Falco sparverius*	Y
Eastern Kingbird	*Tyrannus tyrannus*	S
Horned Lark	*Eremophila alpestris*	Y
American Goldfinch	*Carduelis tristis*	Y
Eastern Phoebe	*Sayornis phoebe*	S
Common Yellowthroat	*Geothlypis trichas*	S
House Wren	*Troglodytes aedon*	S
Chimney Swift	*Chaetura pelagica*	S
Yellow-billed Cuckoo	*Coccyzus americanus*	S
Blue-winged Warbler	*Vermivora pinus*	S
Yellow Warbler	*Dendroica petechia*	S
Grasshopper Sparrow	*Ammodramus savannarum*	S
Vesper Sparrow	*Pooecetes gramineus*	S
Savannah Sparrow	*Passerculus sandwichensis*	S
Red-winged Blackbird	*Agelaius phoeniceus*	Y
Cedar Waxwing	*Bombycilla cedrorum*	Y
Wood Thrush	*Hylocichla mustelina*	S
Blue Jay	*Cyanocitta cristata*	Y
Eastern Wood-pewee	*Contopus virens*	S
Yellow-throated Vireo	*Vireo flavifrons*	S
White-crowned Sparrow	*Zonotrichia leucophrys*	W

Key: Y = Year-round resident.
S = Summer resident only.
W = Winter resident only.

Source: IESPB 1994; U.S. FWS 1997

Table D-15

REPTILES AND AMPHIBIANS POTENTIALLY EXISTING ON SITE
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Common Name	Scientific Name
Chicago Garter Snake	*Thamnophis sirtalis semifasciatus*
Midland Brown Snake	*Storeria dekayi wrightorum*
Blue Racer	*Coluber constrictor foxii*
Eastern Milk Snake	*Lampropeltis triangulum triangulum*
American Toad	*Bufo americanus*
Gray Treefrog	*Hyla versicolor*
Western Chorus Frog	*Pseudacris triseriata triseriata*
Northern Spring Peeper	*Pseudacris crucifer crucifer*
Blanchard's Cricket Frog	*Acris crepitans blanchardi*
Green Frog	*Rana clamitans melanota*
Northern Leopard Frog	*Rana pipiens*
Pickerel Frog	*Rana palustris*

Source: IESPB 1994; U.S. FWS 1997.

Table D-16

CONTAMINANT SCREENING OF PETTIBONE CREEK SEDIMENT
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Frequency of Detection[1]	Percent Detected[1]	Range of Sample Quantitation Limits[1]	Range of Detected Concentrations	Background Concentration[a]	Number of Samples Exceeding Background	Sediment Screening Benchmark	Number of Samples Exceeding Benchmark
Potassium	6/6	100	NA	658 J-2,080 J	934	5	NA	NA
Selenium	2/6	33	NA	0.74-1.4	0.69	2	NA	NA
Silver[b]	6/6	100	NA	0.92-3.3	0.54	6	1.0[1]	4
Sodium	6/6	100	NA	334-2,670 P	742	3	NA	NA
Vanadium	6/6	100	NA	12.8-25.4	15.1	5	NA	NA
Zinc	6/6	100	NA	1,230-5,270 P	2,135	4	120[2]	6
Volatile Organic Compounds (μg/kg)								
Acetone[b]	1/5	20	12-100	10 J	8	1	8.77[2]	1
Benzene	1/5	20	12-55	6 J	7	0.00	57[2]	0.00
Chloroethane	1/5	20	12-55	19	7	1	NA	NA
1,2-Dichloroethene[b]	3/5	60	12-55	4 J-710	7	1	400[3]	1
Toluene	2/5	40	12-55	6 J-16	6	1	670[2]	0.00
Trichloroethene	3/5	40	12-55	2 J-54	7	2	1,600[2]	0.00
Semivolatile Organic Compounds (μg/kg)								
Acenaphthene[b]	4/6	67	410-12,000	230 J-2,500 J	2,270	1	620[2]	1
Acenaphthylene[b]	2/6	33	410-12,000	130 J-170 J	205	0.00	44[3]	2
Anthracene[b]	4/6	67	410-12,000	320 J-5,000 J	5,210	0.00	220[3]	4
Benzo(a)anthracene[b]	5/6	83	410-12,000	300 J-11,000 J	10,750	1	320[3]	4

Table D-16

CONTAMINANT SCREENING OF PETTIBONE CREEK SEDIMENT
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Frequency of Detection[1]	Percent Detected[1]	Range of Sample Quantitation Limits[1]	Range of Detected Concentrations	Background Concentration[a]	Number of Samples Exceeding Background	Sediment Screening Benchmark	Number of Samples Exceeding Benchmark
Inorganics (mg/kg)								
Aluminum	6/6	100	NA	4,300-9,240 P	5,735	5	NA	NA
Antimony[b]	5/6	83	NA	2.2-6.1	1.13	6	2[3]	6
Arsenic	6/6	100	NA	6.6 J-22.4	12.5	2	6[2]	6
Barium[b]	6/6	100	NA	48.1-202 P	48.2	5	NA	NA
Beryllium	6/6	100	NA	0.38-2.2 P	1.6	1	NA	NA
Cadmium	6/6	100	NA	1.3-4.8 P	2.8	3	0.6[2]	6
Calcium	6/6	100	NA	26,200 J-68,900	49,700	2	NA	NA
Chromium	6/6	100	NA	13.6-47.5	30.7	2	26[2]	4
Cobalt	6/6	100	NA	6.8-10.3 BP	7.5	5	NA	NA
Copper[b]	6/6	100	NA	378-3,100 J	391	5	16[2]	6
Iron	6/6	100	NA	12,500-25,100 P	16,400	5	20,000[4]	2
Lead[b]	6/6	100	NA	522-1,550	402	6	31[3]	6
Magnesium	6/6	100	NA	15,000-36,600	25,600	2	NA	NA
Manganese[b]	6/6	100	NA	221-1,520 J	392	3	460[4]	2
Mercury[b]	6/6	100	NA	0.40-6.5	0.69	4	0.2[2]	6
Nickel	6/6	100	NA	23.3 J-74.1 P	26.9	5	16[3]	6

Table D-16

CONTAMINANT SCREENING OF PETTIBONE CREEK SEDIMENT
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Frequency of Detection[1]	Percent Detected[1]	Range of Sample Quantitation Limits[1]	Range of Detected Concentrations	Background Concentration[a]	Number of Samples Exceeding Background	Sediment Screening Benchmark	Number of Samples Exceeding Benchmark
Phenanthrene[b]	5/6	83	410-12,000	310 J-34,000 J	29,850	1	850[2]	4
Pyrene[b]	6/6	100	410-12,000	550-21,000 J	15,500	1	490[2]	6
Pesticides (μg/kg)								
Delta-BHC	1/6	17	2.3-12	0.19 JP	5.8	0.00	0.2[4]	0.00
Alpha-chlordane[b]	2/6	33	2.3-12	2.1 JP-12	5.8	1	5[4]	1
Gamma-chlordane	2/6	33	2.3-12	1.8 JP-4.9 P	17.5	0.00	5[4]	0.00
4,4'-DDD[b]	3/6	50	4.4-24	9.1-130	43	1	8[4]	3
4,4'-DDE[b]	4/6	67	4.4-24	1.9 JP-150	46.5	1	5[4]	3
4,4'-DDT[b]	4/6	67	4.4-24	1.8 JP-820 J	124	1	7[3]	4
Dieldrin	3/6	50	4.4-24	0.78 JP-26 J	11.5	1	52[2]	0.00
Endosulfan I[b]	1/6	17	2.3-12	14	155	0.00	2.9[2]	1
Endosulfan II[b]	2/6	33	2.3-12	5.4 P-26	19.5	1	14[2]	1
Endrin	1/6	17	4.4-24	5.9 P	11.5	0.00	20[2]	0.00
Endrin aldehyde[b]	5/6	83	4.4-24	0.30 JP-80	91	0.00	NA	NA
Endrin ketone[b]	2/6	33	4.4-24	0.64 JP-11	41.5	0.00	NA	NA
Heptachlor[b]	1/6	17	2.3-12	4.2	5.8	0.00	0.3[4]	1
Heptachlor epoxide[b]	3/6	50	2.3-12	0.29 JP-34	5.8	1	5[4]	1
Methoxychlor[b]	4/6	67	4.4-24	4.6 JP-72 P	57.5	1	19[2]	1

Table D-16

CONTAMINANT SCREENING OF PETTIBONE CREEK SEDIMENT
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Frequency of Detection[1]	Percent Detected[1]	Range of Sample Quantitation Limits[1]	Range of Detected Concentrations	Background Concentration[a]	Number of Samples Exceeding Background	Sediment Screening Benchmark	Number of Samples Exceeding Benchmark
Benzo(b)fluoranthene[b]	6/6	100	410-12,000	610 X-15,000	21,500	0.00	NA	NA
Benzo(k)fluoranthene[b]	6/6	100	410-12,000	520 JX-6,400 J	5,550	1	240[4]	6
Benzo(g,h,i)perylene[b]	4/6	67	410-12,000	190 J-4,900 J	7,000	0.00	170	4
Benzo(a)pyrene[b]	5/6	83	410-12,000	120 J-12,000 J	15,400	0.00	370[2]	4
Butylbenzylphthalate	2/6	33	410-12,000	77 J-230 J	745	0.00	11,000[2]	0.00
Carbazole[b]	4/6	67	410-12,000	280 J-3,400 J	2,955	1	NA	NA
Chrysene[b]	5/6	83	410-12,000	360 J-16,000 J	14,350	1	340[3]	5
Dibenzo(a,h)anthracene[b]	2/6	33	410-12,000	140 J-190 J	228	0.00	60[3]	2
Dibenzofuran	3/6	50	410-12,000	130 J-1,100 J	1,215	0.00	2,000[2]	0.00
Di-n-butylphthalate	2/6	33	410-12,000	57 J-120 J	720	0.00	11,000[2]	0.00
Bis(2-ethylhexyl)phthalate	6/6	100	410-12,000	170 J-38,000	2,300	3	892,732[3]	0.00
Fluoranthene[b]	6/6	100	410-12,000	520-39,000 J	37,050	1	2,900[2]	3
Fluorene[b]	[illegible]	67	410-12,000	170 J-2,100 J	2,385	0.00	540[2]	22
Indeno(1,2,3-cd)pyrene[b]	[illegible]	83	410-12,000	88 J-4,900 J	5,175	0.00	200[4]	4
2-Methylnaphthalene[b]	[illegible]	67	410-12,000	61 J-300 J	230	1	70[3]	3
4-Methylphenol	2/6	33	410-12,000	160 J-250 J	168	1	670[3]	0.00
Naphthalene[b]	4/6	67	410-12,000	110 J-570	620	0.00	480[2]	1
N-nitroso-di-n-propylamine	1/6	17	410-12,000	470	228	1	NA	NA

Table D-17

SEDIMENT SCREENING BENCHMARKS
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE

Parameter	Maximum Detected Sediment Concentration	Benchmark									
		EPA SQC[a]	EPA SQB[a]	NOAA ER-L[a]	NOAA ER-M[b]	MOE Low[c]	MOE Severe[c]	Secondary Chronic Value[b]	Lowest Chronic Value Fish[b]	Lowest Chronic Value Daphnids[b]	NAWQC Chronic[b]
Inorganics (mg/kg)											
Antimony	6.1	NS	NS	2	25	NS	NS	NS	NS	NS	NS
Copper	3,100	NS	NS	34	270	16	110	NS	NS	NS	NS
Lead	1,550	NS	NS	46.7	218	31	250	NS	NS	NS	NS
Manganese	1,520	NS	NS	NS	NS	460	1,110	NS	NS	NS	NS
Mercury	6.5	NS	NS	0.15	0.71	0.2	2	NS	NS	NS	NS
Silver	3.3	NS	NS	1.0	3.7	NS	NS	NS	NS	NS	NS
Volatile Organic Compounds (μg/kg)											
Acetone	10	NS	NS	NS	NS	NS	NS	8.77	2,968	9.12	NS
1,2-Dichloroethene	710	NS	NS	NS	NS	NS	NS	400	6,466	NS	NS
Semivolatile Organic Compounds (μg/kg)											
Acenaphthene	2,270	620	NS	16	500	NS	NS	NS	5,314	477,222	1,300
Acenaphthylene	205	NS	NS	44	640	NS	NS	NS	NS	NS	NS
Anthracene	5,210	NS	NS	85.3	1,100	220	3,700	218	26.9	628	NS
Benzo(a)anthracene	11,000	NS	NS	261	1,600	320	14,800	109	NS	2,623	NS
Benzo(k)fluoranthene	6,400	NS	NS	NS	NS	240	13,400	NS	NS	NS	NS
Benzo(a)pyrene	12,000	NS	NS	430	1,600	370	14,400	143	NS	3,062	NS
Chrysene	16,000	NS	NS	384	2,800	340	4,600	NS	NS	NS	NS
Dibenzo(a,h)anthracene	190	NS	NS	63.4	260	NS	NS	NS	NS	NS	NS
Fluoranthene	39,000	2,900	NS	600	5,100	750	10,200	NS	32,575	16,287	6,200
Fluorene	2,100	NS	540	19	540	190	1,600	540	NS	NS	NS
Indeno(1,2,3-cd)pyrene	4,900	NS	NS	NS	NS	200	3,200	NS	NS	NS	NS

Table D-16

CONTAMINANT SCREENING OF PETTIBONE CREEK SEDIMENT
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Frequency of Detection[1]	Percent Detected[1]	Range of Sample Quantitation Limits[1]	Range of Detected Concentrations	Background Concentration[a]	Number of Samples Exceeding Background	Sediment Screening Benchmark	Number of Samples Exceeding Benchmark
Polychlorinated Biphenyls PCBs (µg/kg)								
Aroclor 1254[b]	2/6	33	44-240	840 Y-2,000	115	2	60[4]	2
Aroclor 1260[b]	2/6	33	44-240	180-1,100	355	1	5[4]	2

Key:
[a] = Background concentrations are the means of two upstream samples collected by START.
[b] = Chemical of potential concern.
mg/kg = Milligrams per kilogram.
µg/kg = Micrograms per kilogram.
NA = No information available.
X = Benzo(b)fluoranthene and benzo(k)fluoranthene isomers in the sample could not be chromatographically resolved. This is indicated with "X" flag.
Y = The analyte was unsuccessfully confirmed by gas ch[illegible]aphy/ mass spectrography.
B = The analyte is found in the associated blank as w[illegible] sample.
P = This flag is used for a pesticide/Aroclor targ[illegible]ther GC or HPLC analytes, when there is greater than 25% difference for detected concentrations between the two GC or HPLC columns. The lower of the two values is reported.
J = The analyte was positively identified [illegible]rical value is an approximate concentration of the analyte in the sample.

Sources:
[1] Ecology and Environment, Inc., 1997 [illegible]
[2] U.S. Environmental Protection Age[illegible] *[illegible]e: Ecotox Thresholds*, Office of Solid Waste and Emergency Response, Intermittent Bulletin Vol. 3, No. 2, EPA/540/F-95/038.
[3] Jones, D.S., R.N. Hull, and G.W[illegible] *[illegible]. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1996 Revision*, Oak Ridge National Laboratory, Oak R[illegible] [illegible]TM-95/R2.
[4] Persaud, D., R. Jaagumag[illegible] [illegible]gust 1993, *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*, Ontario Ministry of the Environment.

Key:	EPA SQC =	U.S. Environmental Protection Agency Sediment Quality Criteria.
	EPA SQB =	U.S. Environmental Protection Agency Sediment Quality Benchmark.
	NOAA ER-L =	National Oceanic and Atmospheric Administration Effects Range-Low.
	NOAA ER-M =	National Oceanic and Atmospheric Administration Effects Range-Medium.
	MOE Low =	Ontario Ministry of the Environment Low Effects Level.
	MOE Severe =	Ontario Ministry of the Environment Severe Effects Level.
	NAWQC Chronic =	National Ambient Water Quality Criteria Chronic Value.
	mg/kg =	Milligrams per kilogram.
	µg/kg =	Micrograms per kilogram.
	NS =	Not specified.

Sources:
- U.S. Environmental Protection Agency, 1996, *Eco Update: Ecotox Thresholds*, Office of Solid Waste and Emergency Response, Intermittent Bulletin, Vol. 3, No. 2, EPA/540/F-95/038.
- Jones, D.S., R.N. Hull, and G.W. Suter II, June 1996, *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1996 Revision*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, ES/ER/TM-95/R2.
- Persaud, D., R. Jaagumagi, and A. Hayton, August 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*, Ontario Ministry of the Environment.

Table D-17

SEDIMENT SCREENING BENCHMARKS
ECOLOGICAL RISK EVALUATION
VACANT LOT SITE

Parameter	Maximum Detected Sediment Concentration	Benchmark									
		EPA SQC[a]	EPA SQB[a]	NOAA ER-L[a]	NOAA ER-M[b]	MOE Low[c]	MOE Severe[c]	Secondary Chronic Value[b]	Lowest Chronic Value Fish[b]	Lowest Chronic Value Daphnids[b]	NAWQC Chronic[b]
2-Methylnaphthalene	300	NS	NS	70	670	NS	NS	NS	NS	NS	NS
Naphthalene	570	NS	480	160	2,100	NS	NS	242	12,533	23,510	NS
Phenanthrene	34,000	850	NS	240	1,500	560	9,500	NS	NS	59,770	1,800
Pyrene	21,000	NS	NS	665	2,600	NS	NS	NS	NS	NS	NS
Pesticides (μg/kg)											
Alpha-chlordane	12	NS	NS	0.5	60	NS	NS	NS	NS	NS	2,790
4,4'-DDD	130	NS	NS	2	20	8	60	NS	NS	NS	NS
4,4'-DDE	150	NS	NS	2.2	27	8	710	NS	NS	NS	NS
4,4'-DDT	820	NS	NS	1.58	46.1	7	120	NS	NS	NS	NS
Endosulfan I	14	NS	2.9	NS	NS	NS	NS	NS	NS	NS	NS
Endosulfan II	26	NS	14	NS	NS	NS	NS	NS	NS	NS	NS
Heptachlor	4.2	NS	NS	NS	NS	NS	NS	68.8	12,574	31,734	NS
Heptachlor epoxide	34	NS	NS	NS	NS	5	50	NS	NS	NS	NS
Methoxychlor	72	NS	19	NS	NS	NS	NS	18.8	NS	NS	NS
Polychlorinated Biphenyls (PC[illegible]											
Aroclor 1254	[illegible],000	NS	NS	NS	NS	60	340	814	NS	71,564	NS
Aroclor 1260	1,100	NS	NS	NS	NS	5	240	4,574,333	63,262	NS	NS

Table D-19

SUMMARY OF ESTIMATED HAZARD INDICES FOR NONCARCINOGENIC EFFECTS
SCREENING HUMAN HEALTH RISK ASSESSMENT
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Receptor	Total Hazard Index	Hazard Quotients Greater than 1 by Chemical	Risk Contribution by Exposure Route	Significant Risk Contribution by Medium
Future industrial worker	2.7	PCBs - 1.7	Incidental ingestion - 96.7% Dermal contact - 3.3%	Surface soil - 100%

Table D-18

SUMMARY OF ESTIMATED EXCESS CANCER RISKS
SCREENING HUMAN HEALTH RISK ASSESSMENT
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Receptor	Total Risk	Exposure Medium	Risk Contribution by Exposure Route	Significant Risk Contribution by Chemical[a]
Future industrial worker	4.2×10^{-4}	Surface soil	Dermal contact - 56% Incidental ingestion - 28%	Benzo(a)pyrene - 61.6% Benzo(b)fluoranthene - 10.8% Benzo(a)anthracene - 7.7% PCB - 5.8% Dibenzo(a,h)anthracene - 5.5% Beryllium - 5.4% Indeno(1,2,3-cd)pyrene - 2.3%
		Sediment	Dermal contact - 16%	

Key:
[a] Contribution of gre[illegible] to total risk.

Table D-20

PRELIMINARY REMEDIATION GOALS
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Parameter	Calculated Preliminary Remediation Goal (mg/kg)[a]	Potential ARAR (mg/kg)
Benzo(a)anthracene	7.8	8[b]
Benzo(a)pyrene	0.79	0.8[b]
Benzo(b)flouranthene	7.8	8[b]
Dibenz(a,h)anthracene	0.79	0.8[b]
Indeno(1,2,3-cd)pyrene	7.8	8[b]
Benzo(k)flouranthene	78	78[b]
PCBs	2.9	1, 10, 25[b,c]
Beryllium	1.3	1[d]

Key:

[a] Calculated preliminary remediation goals are based on incidental ingestion of and dermal contact with surface soil, and dermal contact with sediment for an industrial receptor. The target risk is based on a 1:1,000,000 chance of developing excess cancers.

[b] Tier 1 soil remediation objective taken from the Illinois Pollution Control Board's Tiered Approach to Cleanup Objectives (TACO), July 1997.

[c] A value of 10 ppm may be used in an unrestricted area with 10 inches of soil cover, and a value of 25 ppm may be used in restricted ares with 10 inches of soil cover.

[d] Background levels may also be taken into consideration for inorganic compounds.

Table D-21

APPLICABLE STATE ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Title 35 of the Illinois Administrative Code; Paragraph	Abbreviated Title	Description of Regulation	Target	Meets Requirements
201	Clean Air Act Ambient Air Quality	Federal Clean Air Act Ambient Air Quality Standards are implemented under this code.	Pertains to emissions of air contaminants occurring as a result of construction/excavation activities and operation of the air stripper unit.	Dust control measures are to be implemented during construction/excavation activities. Emission control units are to be utilized for air emissions.
201.141	Prohibits air pollution.	Cannot cause or threaten or allow the discharge or emission of any contaminant to cause air pollution in Illinois.	Pertains to emissions of air contaminants occurring as a result of operation of the air stripping unit.	Test studies will be performed to determine if the air stripping releases VOCs in excess of regulated concentrations. If the VOCs exceed the emission standards, a granular activated carbon (GAC) treatment will be added.
201.42	Construction permit for new emission source.	Requires a permit for the construction of a new emission source.	Pertains to the construction of the air stripper as a new emission source. The permit for construction may require the addition of a GAC unit to the air stripper.	All necessary permits shall be obtained prior to the construction of the units.
201.43	Operating permit required for new emission sources.	Prohibits operation of new emission source or new air pollution control equipment without an operating permit.	Pertains to any site that operates a new emission source, which requires new air pollution control equipment (air stripper and a GAC system).	All operating permits shall be obtained prior to operation of the air stripping unit and the GAC system.
201.241(h)	Contents of compliance program.	Provide information on the proposed air pollution control equipment which has been chosen to achieve compliance.	Applicable to both the air stripper and GAC unit combined to achieve compliance.	Compliance information will be provided to the proper agency prior to on-site work.
232	Standards for hazardous pollutants in air.	National Emissions Standards for Hazardous Air Pollutants (Federal) are implemented under this code.	Pertains to emissions of air contaminants occurring as a result of construction/excavation activities and operation of the air stripper unit.	Dust control measures are to be implemented during construction/excavation activities. Emission control units are to be utilized for air emissions.

Table D-21

APPLICABLE STATE ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Title 35 of the Illinois Administrative Code; Paragraph	Abbreviated Title	Description of Regulation	Target	Meets Requirements
742 Subparts AA and BB	Substantive RCRA standards for air strippers.	Substantive RCRA standards applicable to air stripper operations.	Air stripper to be used for groundwater remediation.	Air stripper operations shall meet these requirements.
721	Hazardous waste identification.	Establishes standards for identification of hazardous wastes.	Pertains to any site where hazardous waste is present.	All hazardous waste constituents will be identified prior to any remediation or disposal.
722	Standards for hazardous waste generators.	Establishes standards for hazardous waste generators.	Pertains to any site where hazardous waste is generated.	Proper identification of generators shall be made prior to commencement of work.
723	Standards for hazardous waste transporters.	Establishes standards for hazardous waste transporters.	Pertains to any site from where hazardous waste will be transported.	Licensed hazardous waste transporters will be used for transporting hazardous wastes.
728	Standards for soil excavation and treatment residuals.	Establishes standards for soil excavation and treatment residuals.	Pertains to excavation and treatment of site soil.	Excavation and treatment work shall be performed in accordance with these standards.
808	Standards for soil that are not hazardous waste under RCRA.	Establishes standards for soil that is nonhazardous waste under RCRA.	Pertains to nonhazardous soil on site.	Nonhazardous waste shall be classified according to these standards.
2175.535(e)	RCRA Subtitle C regulations.	Regulates identification of hazardous waste.	Pertains to identification of hazardous waste during treatment, transportation, and disposal.	The hazardous material shall be properly identified prior to treatment, transportation, and disposal.
728.Table T	Treatment standards.	Regulates treatment standard.	Pertains to meeting standards after treatment.	Treated material will meet all applicable treatment standards.
728.101	Wastes restricted from landfill.	Identifies wastes restricted from landfill.	Pertains to hazardous soil and sediment.	Hazardous waste will be stabilized to meet landfill requirements.

Table D-21

APPLICABLE STATE ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Title 35 of the Illinois Administrative Code; Paragraph	Abbreviated Title	Description of Regulation	Target	Meets Requirements
728.140	Treatment standards.	Applicability of treatment standards.	Lists treatment standards for on-site treatment.	Selected treatment alternatives will meet treatment standards.
742.275	Determination of compliance with remediation objectives.	Requires compliance with groundwater remediation objectives.	Pertains to any site where groundwater is being remediated.	Requirements of the regulations shall be met during the remediation of groundwater.
240.930	Water discharge permit requirements.	Requires permit for discharging water from treatment operations.	Pertains to on-site treatment and discharge of groundwater.	All necessary permits shall be obtained prior to groundwater treatment.
309.103	NPDES permit.	Requires NPDES permit for wastewater discharge.	Pertains to discharge of treated groundwater to navigable waters.	NPDES permit shall be obtained prior to discharge of treated groundwater.
742.410	Determination of area background for groundwater.	Samples shall be collected from areas of the site or adjacent to the site that are unaffected by the release of the contaminants.	Pertains to any site where remediation is proposed.	Samples from three upgradient locations will be collected for background concentrations.
742.505(B)	Lists Tier 1 soil remediation objectives for inhalation exposure route based upon industrial/ commercial property.	Soil remediation objective determinations.	Pertains to soil remediation sites.	TACO removal values for soil COCs will be used.
732 Table A	Groundwater and soil remediation objectives.	Lists cleanup objectives for contaminants in groundwater and soil.	Applicable to the site remediation objectives.	Remedial objectives for the contaminant of concern shall be accomplished.

Table D-21

APPLICABLE STATE ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Title 35 of the Illinois Administrative Code; Paragraph	Abbreviated Title	Description of Regulation	Target	Meets Requirements
611.311(b)	Identifies the best available technology (BAT) for achieving compliance with VOC MCLs.	Lists contaminants and BAT to achieve MCLs.	Identifies packed tower aeration and GAC for achieving MCL goals.	The air stripper/GAC unit will meet requirements set forth in the regulations.

Table D-22

APPLICABLE FEDERAL ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Code; Section	Abbreviated Title	Description of Regulation	Target	Meets Requirements
40 CFR §268.7	Resource Conservation and Recovery Act.	Regulates identification of hazardous waste.	Pertains to identification of hazardous waste during treatment, transportation, and disposal.	The hazardous material shall be properly identified prior to treatment, transportation, and disposal.
40 CFR §141.61	MCLs for organic chemicals.	Presents MCLs for organics.	Pertains to any site which has contaminated groundwater or surface water that is either being used or has the potential for use as a drinking water source.	All treatments will reduce tetrachloroethene (PCE) concentrations below MCLs.
40 CFR §141.61	MCLs for inorganic chemicals.	Presents MCLs for inorganics.	Pertains to any site which has contaminated groundwater or surface water that is either being used or has the potential for use as a drinking water source.	All treatments shall reduce TCE concentrations below MCLs.
40 CFR §122.26	Stormwater discharges.	Presents requirements and conditions for stormwater discharges.	Pertains to treated water from treatment alternative.	All requirements and conditions will reduce organic concentrations below discharge criteria.

Table D-22

APPLICABLE FEDERAL ARARS AND COMPLIANCE OF ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Code; Section	Abbreviated Title	Description of Regulation	Target	Meets Requirements
40 CFR §50	Ambient Air Quality Standards.	Clean Air Act Ambient Air Quality Standards.	Air emissions from air stripper and from excavation and construction activities.	Dust control measures are to be implemented during construction/excavation activities. Emission control units are to be utilized for air emissions.
40 CFR §61	Emissions Standard for Hazardous Air Pollutants.	National Emissions Standards for Hazardous Air Pollutants.	Air emissions from air stripper and from excavation and construction activities.	Measures shall be taken not to exceed these standards.
40 CFR §264 Subparts AA and BB	Substantive RCRA standards for air strippers.	Substantive RCRA standards applicable to air stripper operations.	Air stripper to be used for groundwater remediation.	Air stripper operations shall meet these requirements.
40 CFR §261	Standards for hazardous waste generators.	Establishes standards for hazardous waste generators.	Pertains to any site where hazardous waste is generated.	Proper identification of generators shall be made prior to commencement of work.
40 CFR §262	Hazardous waste identification.	Establishes standards for identification of hazardous wastes.	Pertains to any site where hazardous waste is present.	All hazardous waste constituents will be identified prior to any remediation or disposal.
40 CFR §263	Standards for hazardous waste transporters.	Establishes standards for hazardous waste transporters.	Pertains to any site from where hazardous waste will be transported.	Licensed hazardous waste transporters will be used for transporting hazardous wastes.
40 CFR §268	Standards for soil excavation and treatment residuals.	Establishes standards for soil excavation and treatment residuals.	Pertains to excavation and treatment of site soil.	Excavation and treatment work shall be performed in accordance with these standards.
42 CFR §112	Clean Air Act.	Regulates the concentration of air pollutants.	Pertains to the emissions of all air pollutants, including the emissions from the air stripper or from the air filtered through the GAC.	All pollution discharges shall be below the regulated concentrations.

Table D-23

COMPARATIVE ANALYSIS OF SOIL AND SEDIMENT REMOVAL ACTION ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Criteria	Alternatives					
	Nonhazardous Soil and Sediment	Hazardous Soil and Sediment				
	Excavation and Off-Site Direct Disposal	Capping	In-Situ Stabilization	SVE and In-Situ Stabilization	Excavation and Off-Site Stabilization and Disposal	Excavation and On-Site Stabilization and Off-Site Disposal
Reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume.	No reduction of toxicity, mobility, and volume.	No reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume.
Short-term effectiveness.	Will provide short-term effectiveness.	Will provide short-term effectiveness.	Will not provide short-term effectiveness.	Will provide short-term effectiveness.	Will provide short-term effectiveness.	Will provide short-term effectiveness.
Implementability						
Technical feasibility.	Low degree of difficulty in construction and operation.	Low degree of difficulty in construction and operation.	Moderate degree of difficulty in construction and operation.	Moderate degree of difficulty in construction and operation.	Low degree of difficulty in construction and operation.	Low to moderate degree of difficulty in construction and operation.
Administrative feasibility.	Low degree of difficulty in obtaining permits and waivers.	Low degree of difficulty in obtaining permits and waivers.	Moderate degree of difficulty in obtaining permits and waivers.	Moderate degree of difficulty in obtaining permits and waivers.	Low degree of difficulty in obtaining permits and waivers.	Low to moderate degree of difficulty in obtaining permits and waivers.
Costs						
Direct capital.	Soil: $1,251,768 Sediment: $88,725	$987,200	$3,136,300	$3,203,600	Soil: $1,440,000 Sediment: $41,625	Soil: $1,300,600 Sediment: $41,340
Indirect capital.	Soil: $75,000 Sediment: $12,000	$75,000	$110,000	$135,000	Soil: $65,000 Sediment: $4,000	Soil: $60,000 Sediment: $15,000
Total capital.	Soil: $1,326,800 Sediment: $100,725	$1,062,200	$3,246,300	$3,338,600	Soil: $1,505,000 Sediment: $45,625	Soil: $1,360,600 Sediment: $56,340

Table D-23

COMPARATIVE ANALYSIS OF SOIL AND SEDIMENT REMOVAL ACTION ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Criteria	Alternatives					
	Nonhazardous Soil and Sediment	Hazardous Soil and Sediment				
	Excavation and Off-Site Direct Disposal	Capping	In-Situ Stabilization	SVE and In-Situ Stabilization	Excavation and Off-Site Stabilization and Disposal	Excavation and On-Site Stabilization and Off-Site Disposal
Effectiveness						
Protection of health and environment.	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will not abate groundwater contamination.	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will not abate groundwater contamination.	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will not abate groundwater contamination since VOCs will be left in place.	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will also reduce/eliminate groundwater contamination that is attributable to on-site source(s).	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will also reduce/eliminate groundwater contamination that is attributable to on-site source(s).	Adequate protection to human health and will reduce, control, and/or eliminate soil exposure risks. Will also reduce/eliminate groundwater contamination that is attributable to on-site source(s).
ARAR and other compliance.	Adequately abates actual and potential exposures from soil and sediment contamination. Will not meet groundwater ARARs.	Adequately abates actual and potential exposures from soil and sediment contamination. Will not meet groundwater ARARs.	Adequately abates actual and potential exposures from soil and sediment contamination. Will not meet groundwater ARARs.	Adequately abates all on-site soil and sediment contamination exposure ARARs. Will not meet groundwater ARARs for metal contamination.	Adequately abates all on-site soil and sediment contamination exposure ARARs. Will not meet groundwater ARARs for metal contamination.	Adequately abates all on-site soil and sediment contamination exposure ARARs. Will not meet groundwater ARARs for metal contamination.
Long-term effectiveness and permanence.	Will provide long-term effectiveness and permanence.	Will not provide long-term effectiveness and permanence.	Will not provide long-term effectiveness and permanence.	Will provide long-term effectiveness and permanence.	Will provide long-term effectiveness and permanence.	Will provide long-term effectiveness and permanence.

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Table D-24

COMPARATIVE ANALYSIS OF GROUNDWATER REMOVAL ACTION ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Criteria	Alternatives		
	On-site Remediation	Perimeter Remediation	
	On-Site Source Excavation and Stabilization	SVE and Air Sparging	Air Stripping and GAC Treatment
Effectiveness			
Protection of health and environment.	Inadequate protection to human health and will not completely reduce, control, and/or eliminate groundwater contamination migrating from off site.	Adequate protection to both human health and the environment, and will reduce, control, and/or eliminate risks. Will abate groundwater contamination.	Adequate protection to human health and will reduce, control, and/or eliminate exposure risks, if on-site groundwater contamination is addressed first.
ARAR and other compliance.	Adequately abates actual on-site VOC contamination. Does not abate potential groundwater contamination from off-site sources and therefore, will not meet groundwater ARARs.	Adequately abates actual and potential exposures from groundwater contamination. Will meet all groundwater ARARs.	Adequately abates actual or potential groundwater contamination.
Long-term effectiveness and permanence.	Will not provide long-term effectiveness and permanence due to off-site sources.	Will provide long-term effectiveness and permanence.	Will provide long-term effectiveness and permanence.
Reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume of on-site source, but will not address off-site sources.	Provides reduction of toxicity, mobility, and volume.	Provides reduction of toxicity, mobility, and volume.
Short-term effectiveness.	Will provide short-term effectiveness.	Will provide short-term effectiveness.	Will provide short-term effectiveness.
Implementability			
Technical feasibility.	Low degree of difficulty in implementing on-site work.	Moderate degree of difficulty in installation and operation of units.	Moderate degree of difficulty in construction and operation.
Administrative feasibility.	Low degree of difficulty in obtaining permits and waivers.	Moderate degree of difficulty in obtaining permits and waivers.	Moderate degree of difficulty in obtaining permits and waivers.

Table D-23

COMPARATIVE ANALYSIS OF SOIL AND SEDIMENT REMOVAL ACTION ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Criteria	Alternatives					
	Nonhazardous Soil and Sediment	Hazardous Soil and Sediment				
	Excavation and Off-Site Direct Disposal	Capping	In-Situ Stabilization	SVE and In-Situ Stabilization	Excavation and Off-Site Stabilization and Disposal	Excavation and On-Site Stabilization and Off-Site Disposal
Long-term operation and maintenance per year.	None	$6,000	$5,000	$5,000	None	None

Table D-24

COMPARATIVE ANALYSIS OF GROUNDWATER REMOVAL ACTION ALTERNATIVES
VACANT LOT SITE
NORTH CHICAGO, ILLINOIS

Criteria	Alternatives		
	On-site Remediation	Perimeter Remediation	
	On-Site Source Excavation and Stabilization	SVE and Air Sparging	Air Stripping and GAC Treatment
Costs			
Direct capital.	$189,400	$250,200	$462,800
Indirect capital.	$35,000	$85,000	$75,100
Total capital.	$224,400	$335,200	$537,900
Long-term operation and maintenance per year.	None	$35,000	1st year $152,200 2nd to 5th year $143,900

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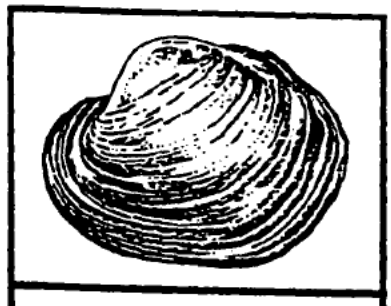
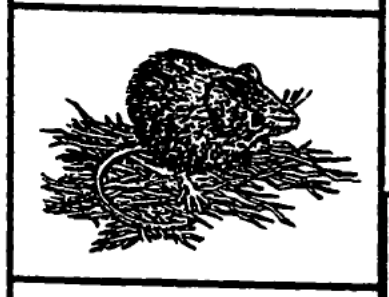
Appendix E

U.S. FWS and IESPB List of Threatened and Endangered Plants and Animals





CHECKLIST OF ENDANGERED AND THREATENED ANIMALS AND PLANTS OF ILLINOIS

Illinois Endangered Species
Protection Board

1994

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ecology and environment

This booklet contains a list of all species which have been designated as endangered or threatened by the Illinois Endangered Species Protection Board. Species are listed alphabetically by scientific name. Species listed at the Federal level are indicated by asterisks -

** = Federally Endangered

* = Federally Threatened

The Illinois Endangered Species Protection Act prohibits the possession, taking , transportation, sale, offer for sale, or disposal of any listed animal or products of listed animals without a permit issued by the Department of Conservation. Also prohibited are the taking of listed plants without the expressed written permission of the landowner and the sale or offer to sell plants or plant products of endangered species.

STRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDAN D (E), AND PROPOSED (P) SPECIES IN ILLINOIS

ANTS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
nall whorled pogonia *otria medeoloides*	T	Dry woodland	Randolph		
airie bush-clover *spedeza leptostachya*	T	Dry to mesic prairies with gravelly soil	Cook, DuPage, Lee, Ogle, McHenry, *Winnebago * = introduced	Search for this species whenever prairie remnants are encountered	
inning buffao clover *ifolium stoloniferum*	E	Disturbed bottomland meadows	NONE		St. Clair, Tazewell Williamson
kside daisy *ymenoxis herbacea*	T	Dry rocky prairies	*Tazewell, *Will * = introduced		
ead's milkweed *sclepias meadii*	T	Virgin prairies	*Ford, Saline, *Will * = introduced	Search for this species whenever prairie remnants are encountered	Cook, Fulton, Hancock, Henderson, Peoria
ecurrent false uster *oltonia decurrens*	T	Disturbed alluvial soils	St. Clair (Mississippi River floodplain); Bureau, Fulton, Jers , Madison, Marshall, on Morgan, Peoria, Pik Putnam, Schuyler, S tt, Tazewell, Woodford ilinois River floodplain)	Brown, Calhoun, Cass, Green, Grundy LaSalle, Pike, (Illinois River floodplain); Alexander, Jackson, Monroe, Randolph, St. Clair (Mississippi River floodplain)	Logan, Menard
afy prairie clover *lea foliosa*	E	PrairiE remnants on thin soil over limestone	Will (Des Plaines River floodplain)		Boone, Kane, LaSalle Kankakee, Ogle
stern prairie fringed orchid *tanthera leucophaea*	T	Mesic to wet prairies	Cook, DuPage, Grundy, Henry, Iriquois, Kane Lake, McHenry	Search for this species whenever prairie remnants are encountered	Adams, Champaign, DeKalb Fayette, Fulton, Ford, Hancock, Henderson, Jo Daviess, Kankakee, Knox, Lee, M Macoupin, Madison, McDonough, McLean, Menard, Ogle, Peoria, Stark, Stephenson, Will, Winnebago, Union

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STRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES IN ILLINOIS (page 5 of 5)

ANTS (cont.)	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
ce's potato bean *ios priceana*	•	Wet flood plain forests, shrubby swamps	EXTIRPATED		Union
ine thistle *rsium pitcheri*	T	Lakeshore dunes	Lake (introduced)		Cook

TRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES IN ILLINOIS (page 3 of 5)

SELS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
shell mussel *rogenia stegaria (=C. irrorata)*	E	Rivers	White (Wabash River)	Gallatin (Wabash River)	
pocketbook pearly mussel *ilus capax*	E	Rivers	*Hancock, *Pike (Mississippi River); White, Gallatin (Wabash River) * Transplanted populations		
gins' eye pearly mussel *npsilis higginsi*	E	Rivers	Jo Daviess, Rock Island, Mercer, Henderson (Mississippi River); Rock River below Steel Dam at Milan	Adams, Carroll, Hancock Pike, Whiteside (Mississippi River upstream of Lock and Dam 22)	
		Essential Habitat: Rock Island (Sylvan Slough)			
k mucket pearly mussel *npsilis orbiculata (=P. abrupta)*	E	Rivers	Massac (Ohio River)	Alexander, Gallatin Hardin, Pope, Pulaski (Ohio River)	
erculed-blossom arly mussel *blasma tondosa tondosa*	E	Rivers	EXTIRPATED		Clark, Crawford, Lawrence, Wabash (Wabash River)
nge-footed pearly mussel *thobasis cooperianus (=P. striatus)*	E	Rivers	Pulaski (Ohio River)	Alexander, Massac, Pope Ohio River below mouth of Cumberland River)	
e warty-back rly mussel *nobasis cicatricosus*	E	Rivers	EXTIRPATED	Clark, Gallatin, White (Wabash River)	
shell *obema clava*	E	Rivers	EXTIRPATED	Vermilion County (N.Fork Vermilion River)	Clark, Crawford Lawrence, Vermilion Wabash (Wabash R.)
h pigtoe *oberna plenum*	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River
	E	Rivers	EXTIRPATED		Wabash River and Lower Ohio River

STRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERE[illegible]E), AND PROPOSED [illegible]

MMALS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORD
y bat *otis grisescens*	E	Caves	Alexander, Hardin, Johnson, Pike, Pope, Pulaski	*	Adams, Jersey, Madison
iana bat *otis sodalis*	E	Caves, mines; small stream corridors with well developed riparian woods; upland forests	#Adams, #Alexander, Bond Cass, Ford, Hardin, Henderson, #Jackson, Jersey, Johnson, #LaSalle, Lawrence Macoupin, McDonough, #Monroe, Perry, Pike, #Pope, Pulaski, Saline, Schuyler, Scott, #Union, Vermilion	Statewide *	Cook, Christian, JoDaviess, Madison Morgan

Counties with hibernacula. Critical Habitat: Blackball Mine, Lasalle County.
* Search for bats prior to any cave-impacting project, particularly in southern and southwestern Illinois.

[illegible]	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
llid sturgeon *aphirynchus albus*	E	Rivers	Randolph (Mississippi River)	Mississippi River downstream of its con fluence with the Missouri River; Ohio River below Dam #53	

VERTEBRATES	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
na pleistocene snail s[illegible] *macclintocki*	E	North-facing algific talus slopes	Jo Daviess		
rner blue butterfly *casides melissa samuelis*	E	Pine barrens and oak savannas on sandy soils and containing wild lupines *(Lupinus perennis)*, the only known food plant of larvae.	Lake	Carroll, Iriquois, Jo Daviess, Kankakee, Lee, Ogle, Winnebago	
ns emerald dragonfly *nstochlora hineana*	E	Spring fed wetlands, wet mea-	Cook, Will, DuPage (Des Plaines River		

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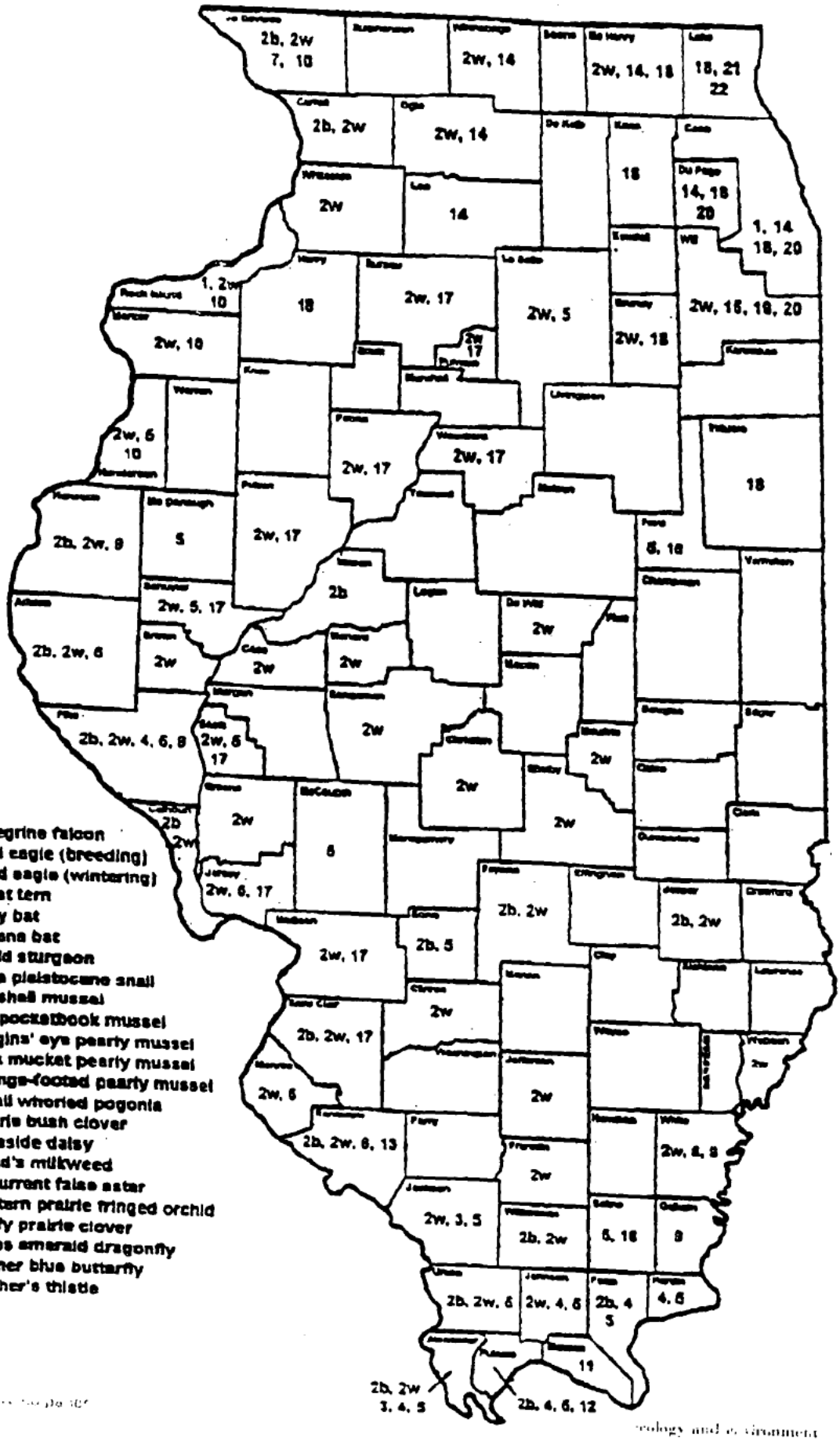
Current Distribution of Federally-Listed Threatened and Endangered Species in Illinois



1. Peregrine falcon
2b. Bald eagle (breeding)
2w. Bald eagle (wintering)
3. Least tern
4. Gray bat
5. Indiana bat
6. Pallid sturgeon
7. Iowa pleistocene snail
8. Fanshell mussel
9. Fat pocketbook mussel
10. Higgins' eye pearly mussel
11. Pink mucket pearly mussel
12. Orange-footed pearly mussel
13. Small whorled pogonia
14. Prairie bush clover
15. Lakeside daisy
16. Mead's milkweed
17. Decurrent false aster
18. Eastern prairie fringed orchid
19. Leafy prairie clover
20. Hines emerald dragonfly
21. Karner blue butterfly
22. Pitcher's thistle

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STRIBUTION OF FEDERALLY-LISTED THREATENED (T), ENDANGERED (E), AND PROPOSED (P) SPECIES IN ILLINOIS (page 1 of 5)

ised March 12, 1997

DS	STATUS	HABITAT	CURRENT DISTRIBUTION	POTENTIAL HABITAT	HISTORICAL RECORDS
ogrine falcon *co peregrinus*	E	Breeding	Cook	Rock Island	
d eagle *liaeetus leucocephalus*	T	Breeding	Adams, Alexander, Bond, Calhoun, Carroll, Fayette, Green, Jo Daviess, Mason, Pike, Pope, Randolph, St. Clair, Union, Winnebago Williamson	Hancock, Jasper	
		Wintering	Adams, Alexander, Brown, Bureau, Calhoun, Carroll, *Cass, Christian, Clinton, De Witt, Fayette, Franklin, *Fulton, Greene, Grundy, Hancock, *Henderson, Jackson, Jasper, Jefferson, *Jersey, Jo Daviess, Johnson, LaSalle, Madison, Marshall, Mason, McHenry, Menard, *Mercer, Monroe, *Morgan, Moultrie, Ogle, Peoria, Pike, Pulaski, *Putnam, Randolph, *Rock Island, Sangamon, *Schuyler, Scott, Shelby, St. Clair, Tazewell, Union, Wabash, White, *Whiteside, Will, Winnebago, Williamson, Woodford * Counties with night roosts		
ast tern *rna antillarum*	E	Bare aluvial and dredged spoil islands	Alexander, Jackson (Mississippi River)	Gallatin, Hardin, Massac, Pope, Pulaski (Ohio River); Wabash, White, (Wabash River); Madison (Mississippi River)	Cook, Gallatin, Lake, Madison, Pope
ing Plover	E	Lakeshore	EXTIRPATED	Lake, Cook (Lake Michigan shoreline) (Great Lakes drainage)	

PLANTS

Endangered (Continued)

Sparganium americanum	American Burreed
Sparganium chlorocarpum	Green-fruited Burreed
Sphaeralcea angusta	Globe Mallow
Spiranthes lucida	Yellow-lipped Ladies' Tresses
Spiranthes romanzoffiana	Hooded Ladies' Tresses
Spiranthes vernalis	Spring Ladies' Tresses
Stellaria pubera	Great Chickweed
Stenanthium gramineum	Grass-leaved Lily
Stylisma pickeringii	Patterson Bindweed
Styrax grandifolia	Bigleaf Snowbell Bush
Symphoricarpos albus var. *albus*	Snowberry
Synandra hispidula	Hairy Synandra
Talinum calycinum	Fameflower
Thalia dealbata	Powdery Thalia
Thelypteris noveboracensis	New York Fern
Thelypteris phegopteris	Long Beech Fern
Thismia americana	Thismia
Tilia heterophylla	White Basswood
Tradescantia bracteata	Prairie Spiderwort
Triadenum virginicum	Marsh St. John's Wort
Trifolium reflexum	Buffalo Clover
Triglochin maritima	Common Bog Arrow Grass
Triglochin palustris	Slender Bog Arrow Grass
Trillium cernuum	Nodding Trillium
Trillium erectum	Ill-scented Trillium
Ulmus thomasii	Rock Elm
Utricularia cornuta	Horned Bladderwort
Utricularia intermedia	Flat-leaved Bladderwort
Utricularia minor	Small Bladderwort
Vaccinium corymbosum	Highbush Blueberry
Vaccinium macrocarpon	Large Cranberry
Vaccinium oxycoccos	Small Cranberry
[illegible]	Marsh Valerian

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PLANTS

Endangered (Continued)

Valerianella chenopodifolia	Corn Salad
Valerianella umbilicata	Corn Salad
Veronica americana	American Brooklime
Viburnum molle	Arrowwood
Viola canadensis	Canada Violet
Viola incognita	Hairy White Violet
Viola primulifolia	Primrose Violet
Viola viarum	Plains Violet
Waldsteinia fragarioides	Barren Strawberry
Woodsia ilvensis	Rusty Woodsia
Zigadenus glaucus	White Camass

Threatened

Acalypha deamii	Large-seeded Mercury
Agalinis skinneriana	Pale False Foxglove
Aristolochia serpentaria var. *hastata*	Virginia Snakeroot
Asclepias stenophylla	Narrow-leaved Green Milkweed
Aster furcatus	Forked Aster
Aster schreberi	Schreber's Aster
Aster undulatus	Aster
Besseya bullii	Kittentails
*Boltonia decurrens**	Decurrent False Aster
Cakile edentula	Sea Rocket
Calamagrostis insperata	Bluejoint Grass
Carex crawei	Sedge
Carex laxiculmis	Spreading Sedge
Carex rostrata	Beaked Sedge
Chamaedaphne calyculata	Leatherleaf
Cimicifuga rubifolia	Black Cohosh
Cirsium hillii	Hill's Thistle
*Cirsium pitcheri**	Pitcher's (Dune) Thistle
Corallorhiza maculata	Spotted Coral-root Orchid
Corydalis curvisiliqua var. *grandibracteata*	Corydalis
Cyperus grayioides	Umbrella Sedge (Galingale)

PLANTS

Threatened (Continued)

Dennstaedtia punctilobula	Hay-scented Fern
Drosera intermedia	Narrow-leaved Sundew
Eleocharis rostellata	Spike Rush
Epilobium strictum	Downy Willow Herb
Filipendula rubra	Queen-of-the-Prairie
Galium labradoricum	Bog Bedstraw
Helianthus angustifolius	Narrow-leaved Sunflower
Juniperus communis	Ground Juniper
Larix laricina	Tamarack
Lathyrus ochroleucus	Pale Vetchling
Liatris scariosa var. *nieuwlandii*	Blazing Star
Matelea obliqua	Climbing Milkweed
Melanthium virginicum	Bunchflower
Oryzopsis racemosa	Rice Grass
Polygonatum pubescens	Downy Solomon's Seal
Quercus phellos	Willow Oak
Quercus prinus	Rock Chestnut Oak
Ranunculus rhomboideus	Prairie Buttercup
Rhynchospora alba	Beaked Rush
Rubus pubescens	Dwarf Raspberry
Salvia azurea subsp. *pitcheri*	Blue Sage
Sambucus pubens	Red-berried Elder
Scirpus polyphyllus	Bulrush
Solidago sciaphila	Cliff Goldenrod
Styrax americana	Storax
Sullivantia renifolia	Sullivantia
Thuja occidentalis	Arbor Vitae
Tofieldia glutinosa	False Asphodel
Tomanthera auriculata	Ear-leafed Foxglove
Trichomanes boschianum	Filmy Fern
Trie[illegible]s borealis	Star-flower
Trill[illegible]ride	Green Trillium

Nettle

PLANTS

Threatened (Continued)

Veratrum woodii	False Hellebore
Veronica scutellata	Marsh Speedwell
Viola conspersa	Dog Violet

PLANTS

Endangered (Continued)

Hydrocotyle ranunculoides	Water-pennywort
Hydrolea uniflora	One-flowered Hydrolea
Hymenoxys acaulis var. *glabra**	Lakeside Daisy
Hypericum adpressum	Shore St. John's Wort
Hypericum kalmianum	Kalm's St. John's Wort
Iliamna remota	Kankakee Mallow
Iresine rhizomatosa	Bloodleaf
Isoetes butleri	Quillwort
*Isotria medeoloides***	Small Whorled Pogonia
Isotria verticillata	Whorled Pogonia
Juncus alpinus	Richardson's Rush
Juncus vaseyi	Vasey's Rush
Juniperus horizontalis	Trailing Juniper
Justicia ovata	Water Willow
Lactuca hirsuta	Wild Lettuce
Lactuca ludoviciana	Western Wild Lettuce
Lathyrus maritimus	Beach Pea
Lechea intermedia	Pinweed
Leptochloa panicoides	Salt Meadow Grass
*Lespedeza leptostachya**	Prairie Bush Clover
Lesquerella ludoviciana	Silvery Bladderpod
Lilium superbum	Turk's Cap Lily
Lipocarpha maculata	Mottled Lipocarpha
Lonicera dioica var. *glaucescens*	Red Honeysuckle
Lonicera flava	Yellow Honeysuckle
Luzula acuminata	Hairy Woodrush
Lycopodium clavatum	Running Pine
Lycopodium dendroideum	Ground Pine
Lycopodium inundatum	Bog Clubmoss
Lysimachia fraseri	Loosestrife
Lysimachia radicans	Creeping Loosestrife
Malus angustifolia	Narrow-leaved Crabapple
Matelea decipiens	Climbing Milkweed

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PLANTS

Endangered (Continued)

Medeola virginiana	Indian Cucumber Root
Melampyrum lineare	Cow Wheat
Melanthera nivea	White Melanthera
Melica mutica	Two-flowered Melic Grass
Melothria pendula	Squirting Cucumber
Microseris cuspidata	Prairie Dandelion
Milium effusum	Millet Grass
Mimulus glabratus	Yellow Monkey Flower
Mirabilis hirsuta	Hairy Umbrella-wort
Oenothera perennis	Small Sundrops
Opuntia fragilis	Fragile Prickly Pear
Orobanche fasciculata	Clustered Broomrape
Orobanche ludoviciana	Broomrape
Oxalis illinoensis	Illinois Wood Sorrel
Panicum boreale	Northern Panic Grass
Panicum columbianum	Hemlock Panic Grass
Panicum joori	Panic Grass
Panicum longifolium	Long-leaved Panic Grass
Panicum ravenelii	Panic Grass
Panicum stipitatum	Panic Grass
Panicum yadkinense	Panic Grass
Paspalum dissectum	Bead Grass
Penstemon brevisepalus	Short-sepaled Beard Tongue
Penstemon grandiflorus	Large-flowered Beard Tongue
Phacelia gilioides	Phacelia
Phaeophyscia leana	Lea's Bog Lichen
Phlox pilosa subsp. *sangamonensis*	Sangamon Phlox
Pinus banksiana	Jack Pine
Pinus echinata	Shortleaf Pine
Pinus resinosa	Red Pine
Planera aquatica	Water Elm
Plantago cordata	Heart-leaved Plantain

PLANTS

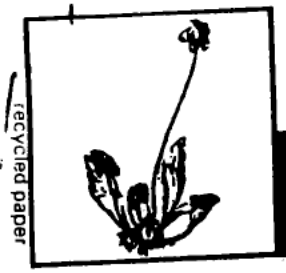
Endangered (Continued)

Platanthera ciliaris	Orange Fringed Orchid
Platanthera clavellata	Wood Orchid
Platanthera flava var. *flava*	Tubercled Orchid
Platanthera flava var. *herbiola*	Tubercled Orchid
*Platanthera leucophaea**	Prairie White Fringed Orchid
Platanthera psycodes	Purple Fringed Orchid
Poa alsodes	Grove Bluegrass
Poa autumnalis	Bluegrass
Poa languida	Weak Bluegrass
Poa wolfii	Wolf's Bluegrass
Pogonia ophioglossoides	Snake-mouth
Polanisia jamesii	James' Clammyweed
Polygala incarnata	Pink Milkwort
Polygonum arifolium	Halbred-leaved Tearthumb
Polygonum careyi	Carey's Heartsease
Populus balsamifera	Balsam Poplar
Potamogeton gramineus	Grass-leaved Pondweed
Potamogeton praelongus	White-stemmed Pondweed
Potamogeton pulcher	Spotted Pondweed
Potamogeton robbinsii	Fern Pondweed
Potamogeton strictifolius	Stiff Pondweed
Potamogeton vaseyi	Vasey's Pondweed
Potentilla millegrana	Cinquefoil
Primula mistassinica	Bird's-eye Primrose
Ptilimnium nuttallii	Mock Bishop's Weed
Puccinellia pallida	Grass
Pycnanthemum albescens	White Mountain Mint
Pycnanthemum torrei	Mountain Mint
Quercus nuttallii	Nutall's Oak
Ranunculus cymbalaria	Seaside Crowfoot
Rhamnus alnifolia	Alder Buckthorn
Rhync[illegible]ora globularis	Grass Beak Rush
Rhync[illegible]ra glomerata	Clustered Beak Rush

PLANTS

Endangered (Continued)

Ribes hirtellum	Northern Gooseberry
Rorippa islandica subsp. *hispida*	Hairy Marsh Yellow Cress
Rosa acicularis	Rose
Rubus odoratus	Purple-flowering Raspberry
Rubus setosus	Bristly Blackberry
Rudbeckia missouriensis	Missouri Orange Coneflower
Rumex hastatulus	Sour Dock
Sabatia campestris	Prairie Rose Gentian
Sagittaria longirostris	Arrowhead
Salix serissima	Autumn Willow
Salix syrticola	Dune Willow
Sanguisorba canadensis	American Burnet
Sarracenia purpurea	Pitcher Plant
Saxifraga virginiensis	Early Saxifrage
Scheuchzeria palustris	Arrow Grass
Schizachne purpurascens	False Melic Grass
Scirpus cespitosus	Tufted Bulrush
Scirpus hallii	Bulrush
Scirpus hattorianus	Bulrush
Scirpus paludosus	Alkali Bulrush
Scirpus purshianus	Weak Bulrush
Scirpus smithii	Bulrush
Scirpus torreyi	Bulrush
Scirpus verecundus	Bulrush
Scleria reticularis var. *muhlenbergii*	Netted Nut Rush
Shepherdia canadensis	Buffaloberry
Silene regia	Royal Catchfly
Silphium pinnatifidum	Rosinweed
Silphium trifoliatum	Rosinweed
Sisyrinchium atlanticum	Eastern Blue-eyed Grass
Sisyrinchium montanum	Mountain Blue-eyed Grass
Solidago arguta (sensu lato: incl. *S. strigosa & S. bootii)*	[illegible]oldenrod
Sorbus americana	American [illegible]tain Ash



PLANTS

306 Endangered, 57 Threatened

Endangered

Adoxa moschatellina	Moschatel
Agropyron subsecundum	Bearded Wheat Grass
Alnus rugosa	Speckled Alder
Amelanchier interior	Shadbush
Amelanchier sanguinea	Shadbush
Ammophila breviligulata	Marram Grass
Amorpha nitens	Smooth False Indigo
Andropogon ternarius	Silver Broom Sedge
*Apios priceana**	Price's Groundnut
Arctostaphylos uva-ursi	Bearberry
Arenaria patula	Slender Sandwort
Artemisia dracunculus	Dragon Wormwood
Asclepias lanuginosa	Wooly Milkweed
*Asclepias meadii**	Mead's Milkweed
Asclepias ovalifolia	Oval Milkweed
Asplenium bradleyi	Bradley's Spleenwort
Asplenium resiliens	Black Spleenwort
Astragalus crassicarpus var. *trichocalyx*	Large Ground Plum
Astragalus tennesseensis	Tennessee Milk Vetch
Bartonia paniculata	Screwstem
Beckmannia syzigachne	American Slough Grass
Berberis canadensis	Allegheny Barberry
Berchemia scandens	Supple-jack
Betula alleghaniensis	Yellow Birch
Betula populifolia	Gray Birch
Bidens beckii	Water Marigold
Botrychium biternatum	Southern Grape Fern
Botrychium matricariaefolium	Daisyleaf Grape Fern
Botrychium multifidum	Northern Grape Fern
Botrychium simplex	Dwarf Grape Fern
	Wooly Buckthorn

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PLANTS

Endangered (Continued)

Calopogon tuberosus	Grass Pink Orchid
Camassia angusta	Wild Hyacinth
Cardamine pratensis var. *palustris*	Cuckoo Flower
Carex alata	Winged Sedge
Carex arkansana	Sedge
Carex aurea	Golden Sedge
Carex baileyi	Sedge
Carex brunnescens	Brownish Sedge
Carex canescens var. *disjuncta*	Sedge
Carex chordorrhiza	Cordroot Sedge
Carex communis	Fibrous-rooted Sedge
Carex crawfordii	Sedge
Carex cryptolepis	Sedge
Carex decomposita	Cypress-knee Sedge
Carex disperma	Shortleaf Sedge
Carex echinata	Sedge
Carex garberi	Sedge
Carex gigantea	Large Sedge
Carex heliophila	Sedge
Carex intumescens	Swollen Sedge
Carex lucorum	Sedge
Carex nigromarginata	Black-edged Sedge
Carex oligosperma	Few-seeded Sedge
Carex oxylepis	Sharp-scaled Sedge
Carex pallescens	Pale Sedge
Carex physorhyncha	Bellows Beak Sedge
Carex prasina	Drooping Sedge
Carex reniformis	Sedge
Carex striatula	Lined Sedge
Carex styloflexa	Bent Sedge
Carex tonsa	Shaved Sedge
Carex trisperma	Three-seeded Sedge
Carex tuckermani	Tuckerman's Sedge

PLANTS

Endangered (Continued)

Carex viridula	Little Green Sedge
Carex willdenowii	Willdenow's Sedge
Carex woodii	Pretty Sedge
Carya pallida	Pale Hickory
Castilleja sessiliflora	Downy Yellow Painted Cup
Ceanothus ovatus	Redroot
Chamaesyce polygonifolia	Seaside Spurge
Chimaphila maculata	Spotted Wintergreen
Chimaphila umbellata	Pipsissewa
Cimicifuga americana	American Bugbane
Cimicifuga racemosa	False Bugbane
Circaea alpina	Small Enchanter's Nightshade
Cladrastis lutea	Yellowwood
Clematis crispa	Blue Jasmine
Clematis occidentalis	Mountain Clematis
Clematis viorna	Leatherflower
Collinsia violacea	Violet Collinsia
Comptonia peregrina	Sweetfern
Conioselinum chinense	Hemlock Parsley
Cornus canadensis	Bunchberry
Corydalis aurea	Golden Corydalis
Corydalis halei	Hale's Corydalis
Corydalis sempervirens	Pink Corydalis
Corylus cornuta	Beaked Hazelnut
Cynosciadium digitatum	Cynosciadium
Cyperus lancastriensis	Galingale
Cypripedium acaule	Moccasin Flower
Cypripedium calceolus var. *parviflorum*	Small Yellow Lady's Slipper
Cypripedium candidum	White Lady's Slipper
Cypripedium reginae	Showy Lady's Slipper
Cystopteris laurentiana	Fragile Fern
*Dalea foliosa***	Leafy Prairie Clover
Diocle[illegible]liflora	Boykin's Dioclea

PLANTS

Endangered (Continued)

Draba cuneifolia	Whitlow Grass
Drosera rotundifolia	Round-leaved Sundew
Dryopteris celsa	Log Fern
Echinodorus tenellus	Small Burhead
Eleocharis olivacea	Spikerush
Eleocharis pauciflora	Few-flowered Spikerush
Equisetum pratense	Meadow Horsetail
Equisetum scirpoides	Dwarf Scouring Rush
Equisetum sylvaticum	Horsetail
Eriophorum virginicum	Rusty Cotton Grass
Eriophorum viridi-carinatum	Tall Cotton Grass
Eryngium prostratum	Eryngo
Erythronium mesochoreum	Prairie Trout-Lily
Euonymus americanus	American Strawberry Bush
Eupatorium incarnatum	Thoroughwort
Euphorbia spathulata	Spurge
Fimbristylis annua	Baldwin's Fimbristylis
Fimbristylis vahlii	Vahl's Fimbristylis
Galium virgatum	Dwarf Bedstraw
Gaultheria procumbens	Wintergreen
Geranium bicknellii	Northern Cranesbill
Glyceria arkansana	Manna Grass
Glyceria borealis	Northern Manna Grass
Gymnocarpium dryopteris	Oak Fern
Gymnocarpium robertianum	Scented Oak Fern
Gymnopogon ambiguus	Beard Grass
Hackelia americana	Stickseed
Halesia carolina	Silverbell Tree
Helianthus giganteus	Tall Sunflower
Heliotropium tenellum	Slender Heliotrope
Heteranthera reniformis	Mud Plantain
Hexalectris spicata	Crested Coral[illegible] Orchid
Hudsonia tomentosa	F[illegible] [illegible]eather

BIRDS

Endangered (Continued)

Xanthocephalus xanthocephalus	Yellow-headed Blackbird

Threatened

Casmerodius albus	Great Egret
Catharus fuscescens	Veery
Certhia americana	Brown Creeper
Gallinula chloropus	Common Moorhen
Lanius ludovicianus	Loggerhead Shrike
Nyctanassa violacea	Yellow-crowned Night Heron
Phalacrocorax auritus	Double-crested Cormorant
Podilymbus podiceps	Pied-billed Grebe
Rallus elegans	King Rail

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MAMMALS

6 Endangered, 3 Threatened

Endangered

Lutra canadensis	River Otter
Myotis austroriparius	Southeastern Myotis
*Myotis grisescens***	Gray Bat
*Myotis sodalis***	Indiana Bat
Neotoma floridana	Eastern Wood Rat
Plecotus rafinesquii	Rafinesque's Big-eared Bat

Threatened

Lynx rufus	Bobcat
Ochrotomys nuttalli	Golden Mouse
Oryzomys palustris	Rice Rat

INVERTEBRATE ANIMALS

40 Endangered, 9 Threatened

Endangered

Snails

*Discus macclintocki***	Iowa Pleistocene Snail

Mussels

Alasmidonta viridis	Slippershell
Cumberlandia monodonta	Spectaclecase
*Cyprogenia stegaria***	Fanshell
Epioblasma propinqua	Tennessee Riffleshell
Epioblasma triquetra	Snuffbox
Lampsilis fasciola	Wavy-rayed Lampmussel
*Lampsilis higginsi***	Higgins' Eye Pearly Mussel
Obovaria subrotunda	Round Hickorynut
*Plethobasus cooperianus***	Orange-footed Pearly Mussel
Plethobasus cyphyus	Sheepnose
*Pleurobema clava***	Clubshell
Pleurobema cordatum	Ohio Pigtoe
Pleurobema rubrum	Pyramid Pigtoe
*Potamilus capax***	Fat Pocketbook
Ptychobranchus fasciolaris	Kidneyshell
Quadrula cylindrica	Rabbitsfoot
Simpsonaias ambigua	Salamander Mussel
Toxolasma lividus	Purple Lilliput
Villosa fabalis	Rayed Bean
Villosa iris	Rainbow
Villosa lienosa	Little Spectaclecase

Crustaceans

Caecidotea lesliei	Isopod
Caecidotea spatulata	Isopod
Crangonyx anomalus	Anomalous Spring Amphipod
Cra[illegible] antennatus	Appalachian Valley Cave Amphipod
Cran[illegible] packardi	Packard's Cave Amphipod
[illegible]	[illegible] Cave Amphipod

INVERTEBRATE ANIMALS

Endangered (Continued)

Orconectes indianensis	Indiana Crayfish
Orconectes kentuckiensis	Kentucky Crayfish
Orconectes lancifer	Oxbow Crayfish
Orconectes placidus	Crayfish
Stygobromus iowae	Iowa Amphipod

Insects

Atrytone arogos	Arogos Skipper
Calephelis muticum	Swamp Metalmark
Incisalia polios	Hoary Elfin
*Lycaeides melissa samuelis***	Karner Blue Butterfly
Papaipema eryngii	Eryngium Stem Borer
Paraphlepsius lupalus	Leafhopper
Somatochlora hineana	Hine's Emerald Dragonfly

Threatened

Mussels

Ellipsaria lineolata	Butterfly Mussel
Elliptio crassidens	Elephant-ear
Elliptio dilatata	Spike
Fusconaia ebena	Ebonyshell

Crustaceans

Gammarus bousfieldi	Bousfield's Amphipod

Insects

Aflexia rubranura	Redveined Prairie Leafhopper
Hesperia metea	Cobweb Skipper
Hesperia ottoe	Ottoe Skipper
Nannothemis bella	Elfin Skimmer

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DEFINITIONS:

FEDERALLY ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range.

FEDERALLY THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

STATE ENDANGERED SPECIES - Any species which is in danger of extinction as a breeding species in Illinois.

STATE THREATENED SPECIES - Any breeding species which is likely to become a state endangered species within the foreseeable future in Illinois.

TAKE - In reference to animals and animal products, to harm, hunt, shoot, pursue, lure, wound, kill, destroy, harass, gig, spear, ensnare, trap, capture, collect, or to attempt to engage in such conduct. In reference to plants and plant products, to collect, pick, cut, dig up, kill, destroy, bury, crush, or harm in any manner.

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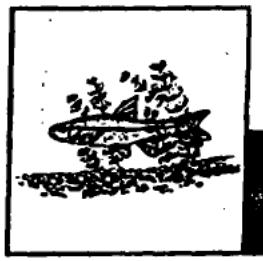

FISHES

21 Endangered, 9 Threatened

Endangered

Acipenser fulvescens	Lake Sturgeon
Etheostoma camurum	Bluebreast Darter
Etheostoma clarum	Western Sand Darter
Etheostoma exile	Iowa Darter
Etheostoma histrio	Harlequin Darter
Etheostoma pellucidum	Eastern Sand Darter
Hybognathus hayi	Cypress Minnow
Ichthyomyzon fossor	Northern Brook Lamprey
Macrhybopsis gelida	Sturgeon Chub
Moxostoma valenciennesi	Greater Redhorse
Nocomis micropogon	River Chub
Notropis amblops	Bigeye Chub
Notropis amnis	Pallid Shiner
Notropis anogenus	Pugnose Shiner
Notropis boops	Bigeye Shiner
Notropis heterolepis	Blacknose Shiner
Notropis hubbsi	Bluehead Shiner
Notropis maculatus	Taillight Shiner
Notropis texanus	Weed Shiner
Noturus stigmosus	Northern Madtom
*Scaphirhynchus albus***	Pallid Sturgeon

Threatened

Catostomus catostomus	Longnose Sucker
Coregonus artedi	Cisco
Fundulus diaphanus	Banded Killifish
Lampetra aepyptera	Least Brook Lamprey
Lepomis punctatus	Spotted Sunfish
Lepomis symmetricus	Bantam Sunfish
Moxostoma carinatum	River Redhorse
Notropis chalybaeus	Ironcolor Shiner
Notropis heterodon	Blackchin Shiner

REPTILES AND AMPHIBIANS

9 Endangered, 9 Threatened

Endangered

Ambystoma platineum	Silvery Salamander
Clemmys guttata	Spotted Turtle
Cryptobranchus alleganiensis	Hellbender
Desmognathus fuscus	Dusky Salamander
Kinosternon flavescens	Illinois Mud Turtle
Nerodia fasciata	Broad-banded Watersnake
Pseudemys concinna	River Cooter
Sistrurus catenatus	Eastern Massasauga
Thamnophis sauritus	Eastern Ribbon Snake

Threatened

Clonophis kirtlandi	Kirtland's Snake
Crotalus horridus	Timber Rattlesnake
Elaphe guttata emory.	Great Plains Rat Snake
Hemidactylium scutatum	Four-toed Salamander
Heterodon nasicus	Western Hognose Snake
Macroclemys temmincki	Alligator Snapping Turtle
Masticophis flagellum	Coachwhip Snake
Nerodia cyclopion	Green Watersnake
Pseudacris streckeri	Illinois Chorus Frog

BIRDS

33 Endangered, 9 Threatened

Endangered

delisted 3/4/9

~~*Accipiter cooperii*~~	~~Cooper's Hawk~~
Accipiter striatus	Sharp-shinned Hawk
Aimophila aestivalis	Bachman's Sparrow
Ammodramus henslowii	Henslow's Sparrow
Asio flammeus	Short-eared Owl
Asio otus	Long-eared Owl
Bartramia longicauda	Upland Sandpiper
Botaurus lentiginosus	American Bittern
Buteo lineatus	Red-shouldered Hawk
Buteo swainsoni	Swainson's Hawk
*Charadrius melodus***	Piping Plover
Chlidonias niger	Black Tern
Circus cyaneus	Northern Harrier
Coturnicops noveboracensis	Yellow Rail
Egretta caerulea	Little Blue Heron
Egretta thula	Snowy Egret
*Falco peregrinus***	Peregrine Falcon
Grus canadensis	Sandhill Crane
*Haliaeetus leucocephalus***	Bald Eagle
Ictinia mississippiensis	Mississippi Kite
Ixobrychus exilis	Least Bitt[illegible]n
Laterallus jamaicensis	Black R[illegible]
Limnothlypis swainsonii	Swainson's Warbler
Nycticorax nycticorax	Black-crowned Night Heron
Pandion haliaetus	Osprey
Phalaropus tricolor	Wilson's Phalarope
*Sterna antillarum***	Least Tern
Sterna forsteri	Forster's Tern
Sterna hirundo	Common Tern
Thryomanes bewickii	Bewick's Wren
Tympanuchus cupido	Greater P[illegible]ie Chicken
Tyto alba	C[illegible] Barn Owl

Appendix F

Endangered Species of Vacant Lot - IDNR

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ILLINOIS DEPARTMENT OF NATURAL RESOURCES

524 South Second Street, Springfield 62701-1787 Jim Edgar, Governor ● Brent Manning, Director

ENDANGERED SPECIES CONSULTATION PROGRAM
AGENCY ACTION REPORT

PROJCODE: 43510
Date Due: 7-20-97
For Office Use Only

Date Submitted: June 20, 1997
Is this a Resubmittal? [Yes / No] Please circle one
If 'Yes', enter PROJCODE:
Agency Name: Ecology & Environment, Inc. under contract to U.S. EPA
Contact Person: Andrew J. Chartrand
Agency Address: 6777 Engle Rd., Suite N Middleburg Hts., OH 44130
Phone: (216) 243-3330
E-mail:

DESCRIBE PRECISE LOCATION OF PROPOSED ACTION

Project Name: Vacant Lot
County(ies): Lake County, Illinois
City/Town: North Chicago
Township/Range/Section: T44N R12E S4
S.G.S. Quad Map Name(s): Waukegan, Illinois Quad
Brief Description of the Proposed Action: The Vacant Lot site is a U.S. EPA Superfund site. The information obtained from Illinois DNR will assist in the assessment of ecological risk associated with the contamination at the site.

Please enclose a map delineating the location of the proposed action, and return to Dr. Deanna Glosser at the SPRINGFIELD address above.

FOR NATURAL RESOURCE REVIEW & COORDINATION USE ONLY

QUADCODES: [illegible] 2121

Are there threatened/endangered species or Natural Areas known to be located within the vicinity of the project? [Yes | No]
Is the proposed project likely to adversely affect the threatened/endangered species or INAI sites? [Yes | No]
The consultation process is terminated? [Yes | No]
If "No", complete the enclosed Detailed Agency Action Report to continue the consultation process.
Comments: Nearest listed records are on south section line and in Section 9

Evaluation Approved by:

Kent M Shank 7-21-97

Deanna Glosser, Ph.D. Date
Chief, Div. of Natural Resource Review & Coordination

Effective July 1, 1995, the Illinois Department of Natural Resources was created through the consolidation of the Illinois Department of Conservation, Department of Mines and Minerals, Abandoned Mined Lands Reclamation Council, the Department of Transportation's Division of Water Resources, and the Illinois State Museum and Scientific Surveys from the Illinois Department of Energy and Natural Resources.

Appendix G

Determination of a Cleanup Goal for Lead by U.S. EPA

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energy and environment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

WA-16J

MEMORANDUM

SUBJECT: Vacant Lot Site: Determination of a Clean-Up Goal for Lead

FROM: Lara Pullen, Ph.D.
Human Health Risk Assessor
Water Division

TO: John O'Grady
Project Manager
Superfund

April 10, 1997

I. Purpose

This memorandum presents soil clean-up goals (CUGs) for lead at the Vacant Lot site. The calculation of the CUG is done under the assumption that exposure will occur under a light industrial/commercial scenario.

II. Background

The Vacant Lot site is a former parking lot located in the City of North Chicago, Lake County, Illinois, which reportedly received industrial fill of unknown quantity and ty[illegible] In addition, several storm sewers and industrial outfalls from neighboring facilities reportedly discharged into Pettibone Creek that flows north to south across the site. The nearest residents are located within ½ mile to the north.

III. Methodology and Data Gaps

To determine a lead clean up goal (CUG) under an occupational scenario, this assessment utilizes the methodology presented by the Technical Review Workgroup for Lead, "Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil," (December, 1996). The assessment assumes that individuals are exposed to a background (or baseline) level of lead in their homes and that their occupational exposure represents an incremental risk. The U.S. EPA has determined a blood level level which is considered acceptable (see toxicity section). An individual will

accumulate blood lead through various exposures to lead (i.e. drinking water, paint chips, lead at the workplace, etc.). The lead exposure in the workplace is therefore assumed to be only one source of that individual's total lead exposure. It is assumed that exposure to drinking water and other household sources of lead create a background (or baseline) blood lead level in the population. This background level is subtracted from the acceptable maximal level to yield the maximum amount that occupational exposure to lead can safely contribute to the total blood lead level. The acceptable level of incremental exposure to lead will therefore be dependent upon the baseline blood lead level. Ideally, the baseline blood lead level would represent the blood lead level of individuals who would potentially work on site (but before they have begun to work on site) and would be specific for the geographic location of the site. A site-specific baseline blood lead level would require sampling and calculation of current blood level in the neighborhhood around the site. Measurement of background blood lead levels of women of child-bearing age in the community would be ideal. In the absence of this data, this assessment utilizes the value of 2.2 ug/dl which is recommended by the national lead workgroup and is consistent with national data for african-american women of child-bearing age (Brody et al, 1994). The national average includes women from both urban as well as rural sites and therefore the exposure to lead is expected to be quite varied.

IV. Exposure Pathways

A residential lead risk assessment focuses on the risk to young children. This is because children are especially vulnerable to lead contamination due to: their behavior patterns which tend to result in higher lead exposures than older children or adults; their tendency to absorb more lead than do adults; and, their susceptibility to the adverse effects of lead on the nervous system.

The calculation of soil CUGs for this site is being done under the assumption that the site will be used for commercial purposes only and will be of limited access to children (i.e. not used as a day care center). Therefore, this risk assessment focuses to lead risks to workers, assumed to be adults. Within this population of workers, the subpopulation most likely to be at risk from lead exposure are pregnant women. Pregnant women are identified as the sensitive subpopulation under an occupational exposure scenario because: they may tend to absorb more lead than non-pregnant women or men; and because the fetus of the pregnant woman is likely to be especially susceptible to the adverse effects of lead.

Exposure to contaminated soil can occur via incidental ingestion and dermal absorption. Dermal absorption was not considered to be an exposure pathway for this assessment since lead does not absorb well through the skin. Another possible exposure pathway for soil is via dust inhalation. This pathway is not considered to b of significnt concern and consequently is not included in the calculation of the CUG.

The CUG only addresses exposure which would occur upon utilization of the site

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under a light industrial/ commercial scenario. The CUG calculated in this risk evaluation has been calculated specifically for occupational use. Residential use would necessitate a lower CUG. Therefore, it is important that any remedial alternative based on the CUG in this memo ensure that the site not be put to residential use.

V. Toxicity

The toxic effects from lead form a continuum from overt symptoms to subtle biological changes. These effects involve several target organ systems with the most sensitive effects in infants and children occurring in the central nervous system. Studies have indicated that deficits in mental development can occur in children born to mothers with elevated blood lead levels. While pregnant women are not per se at risk from slightly elevated blood lead levels, they are considered a sensitive population due to the transfer of lead via blood through the umbilical cord and to the fetus. In addition, studies indicate that the fetal brain may have an increased sensitivity to lead toxicity when compared to the more mature brain. It appears that the immature endothelial cells forming the capillaries of the developing brain are less resistant to the effects of lead than are capillaries from mature brains. Therefore, it may be easier for lead both to reach the fetal brain and damage it as it is being formed.

EPA recommends that there should be no more than a 5% likelihood that a young child should have a PbB value greater than 10 ug/dL (Technical Review Workgroup for Lead, 1996). In addition, the National Research Council Committee on Measuring Lead in Critical Populations recommends in their report (1993) a target blood lead level of 10 ug/dL in the fetus. Since the population of exposed workers are assumed to include pregnant women, and because the fetus is exposed to lead levels nearly equal to those of the mother, the health criterion selected for use in this evaluation is that there should be no more than a 5% chance that the fetus of a pregnant woman should have a PbB above 10 ug/dL. This health goal is equivalent to specifying that the 95th percentile of the PbB distribution in fetuses does not exceed 10 ug/dL.

It is important to note that the choice of 10 ug/dL as the upper 95th percentile limit for the fetus not imply that exposures above this will definitely result in unacceptable health effects and levels below this are without risk. Rather, there is a graded increase in the severity of adverse effects as blood lead levels increase.

VI. Risk and Clean Up Goals (CUG)

This evaluation assumes that the site will be used for an occupational scenario and it will not be frequented by small children. Any deviation from this use will change the CUG for the site.

This assessment does not use the 1994 U.S. EPA IEUBK Model for lead in children. The IEUBK Model as it currently exists in the EPA is appropriate only for sites in which children are directly exposed to lead. It is inappropriate to use the U.S. EPA IEUBK

Model model to calculate lead levels in adults. Indeed, the U.S. EPA Technical Review Workgroup agreed that the U.S. EPA IEUBK Model for children was inappropriate for the establishment of soil CUG's based on adult exposures and have recommended a methodology for calculating risk associated with adult exposures to lead (Technical Review Workgroup for Lead, 1996).

The equation recommended by the Technical Review Workgroup for Lead (1996) predicts the blood lead level in an adult exposed to lead in an ocupational setting. It does this by adding the baseline blood lead level to the increment in blood lead which is expected as a result of occupational exposure to soil. The increment in blood lead level is estimated by multiplying the absorbed dose of lead by a biokinetic slope factor (BKSF).

$$CUG = \frac{PbB_{GM}target - PbB_0}{BKSF \times IR \times AF}$$

where:

CUG	clean up goal for soil which is risk based
$Pb_{GM}target$	target geometic mean blood level concentration
PbB_0	baseline blood lead level
BKSF	biokinetic slope factor
IR	ingestion rate
AF	absorption fraction

The calculated CUG is 1,400 ppm.

Variable	Units	Value Used
$Pb_{GM}target$	ug/dL (lead)	4.22
PbB_0	ug/dL (lead)	2.2
BKSF	ug/dL / ug/day (lead)	0.4
IR	g/day (soil)	0.03
AF	unitless	0.12

The $PbB_{GM}target$ is calculated using the following three parameters: the targeted 95th percentile PbB of the fetus, the fetal/maternal PbB ratio and the geometric standard deviation (GSD) of the PbB distribution for the population of women of child-

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bearing age. The target blood lead concentration is intended to protect against the developmental effects of lead that might result from exposure of a fetus to lead in utero when a pregnant woman works on the site. This target blood lead level in the fetus is 10 ug/dL (National Research Council, 1993). The fetal/maternal PbB ratio of 0.9 was used based on the weight of evidence from studies which examined the relationship between umbilical cord PbB and maternal PbB and is recommended by the TRW.

The GSD is a measure of the inter-individual variability in PbB in a population whose members are exposed to the same environmental lead levels. While ideally, this number is determined by site specific data, assumptions can be made regarding the GSD. The NHANES III study of blood lead levels in the U.S. (Brody et al, 1994) reports the blood lead levels in the American population and GSD vales can be extrapolated from this report. The Technical review Workgroup (1996) recommends a value that falls within the range of 1.8-2.1 ug/dL. The high end of the range is extrapolated from the U.S. popluation GSD for adult women obtained from phase 1 of NHANES III which has been estimated to be within the range of 2.1-2.6 (Brody et al, 1994). In theory, one would expect GSD values measured in populations to reflect the combined effect of variability in environmental lead concentrations in addition to the inter-individual variability in activity-weighted lead exposures and lead biokinetics. Thus the GSD values extrapolated from the national NHANES III study are likely to provide the upper bound for GSD values for individuals in a community exposed to a single, or relatively homogeneous source of lead (as is assumed for this risk assessment) and therefore overestimate the inter-individual GSD which this term is intended to represent. This assessment assumes a GSD of 1.8 ug/dl as a default value for this term, reflecting the assumption that variability in blood lead levels beween members of the community is relatively small. The value of 1.8 is at the low end of the range of possible GSD values, however, and may underestimate the inter-individual variability.

The baseline PbB_0 is intended to represent the best estimate of the geometric mean PbB in adults which have not been exposed to lead-contaminated soil from the site. The national estimate of PbB_0 is based on data for the general U.S. population of african-american women of child-bearing age (Brody et al, 1994). The population around the Vacant Lot site is primarily african-american and therefore, the value of 2.2 ug/dl is used. While this data is the best available estimation of background blood level in the neighborhood, this data may not be an accurate representation of subpopulations or activity patterns present around the Vacant Lot site.

The BKSF parameter relates PbB to dietary lead uptakes. There is some controversy around this number, and the calculated BKSF is very much dependent on the assumptions used to analyze the pharmacokinetic data. In general, however, studies examining the biokinetics of lead absorption into the blood suggest a BKSF value of 0.4. In addition, a BKSF value of 0.4 was recommended by the Technical Review Workgroup (1996).

The occupational incidental soil ingestion rate is 0.05 g/day (U.S. EPA, 1993). The worker spends an average of 250 days per year at work, reducing the average occupational ingestion rate over the year to 0.03 g/day.

Limited data are available for estimating the fraction of ingested lead which is absorbed through the gastrointestinal tract in humans. Data suggest that the AF depends upon whether the individual is in a fasted state or not. In general, individuals who have fasted absorb a higher fraction of lead from the gut. The Technical Review Workgroup (1996) recommends a value of 0.2, which was used in this calculation. The absorption value of 0.2 is further modified to account for the fact that the lead absorption range reflects lead absorption from food as opposed to dirt. A relative absorption factor of 0.6 (lead from soil/lead from food) multiplied by the 0.2 absorption value yields a lead from dirt absorption value of 0.12.

Calculation of a risk-based CUG resulted in target levels of **1,400 ppm** lead in the soil.

In order for the risk at the Vacant Lot site to fall within an acceptable range, the average concentration of lead at the Vacant Lot site should approximate 1,400 ppm. In addition, it is recommended that any hot spots which are significantly higher than the 1,400 ppm be remediated even if, when averaged, they contribute to an acceptable range. The recommended remediation of hot spots stems from the uncertainty surrounding the CUG as well as the uncertainty surrounding the future behavior patterns and movements of workers on the Vacant Lot site.

VII. Risk Characterization

The calculation of a risk-based CUG for the Vacant Lot Site is based on the U.S. EPA recommendation that there should be no more than a 5% likelihood that a young child should have a PbB value greater than 10 ug/dl. The choice of a health limit of 10 ug/dL by EPA is based on a consensus among agency scientists that effects which begin to appear at this exposure level are sufficiently undesirable to warrant avoidance. In the case of an occupational scenario, children are not expected to be exposed to the site and therefore the sensitive subpopulation becomes the developing fetus and consequently pregnant women. It is assumed that the blood lead level recommended for the protection of the young child will also be protective of the developing fetus.

VIII. Uncertainty

All assessments of risk involve factors that are uncertain and vary from individual to individual. The assumptions made in this risk evaluation include exposure assumptions, as well as science policy assumptions. The assessment is only as accurate as the assumptions that go into it. In addition, the assessment aims to protect that population that is most vulnerable to the contaminant.

The following are some examples of assumptions that are surrounded by technical and science policy uncertainty:

- the fetal/maternal PbB ratio of 0.9
- the baseline PbB lead level of 2.2 ug/dL
- the BKSF value of 0.4 $\frac{\text{ug/dL}}{\text{ug/day}}$
- the lead absorption fraction of 0.12
- the target blood lead level of 4.22 ug/dL as protective of the developing fetus.

These values were chosen based on guidance from the Technical Review Workgroup and are designed to be protective. In the instance of the BKSF value, data and precedence suggest use of 0.4. The baseline blood lead level for women in the community is not known. Therefore, this assessment uses the national average of blood lead levels for african-american women of child bearing age.

In the case of the lead absorption fraction, an AF value of 0.2 was chosen. This value is intended to represent lead absorption, primarily in the presence of food. In addition, the calculation uses a relative absorption value of 60% to estimate the amount of lead which would be absorbed from dirt as opposed to food, resulting in an input AF of 0.12. If an individual were to be consistently exposed to lead-contaminated soil while in a fasted state, this AF value would likely underestimate her risk.

IX. Conclusion

A CUG of 1,400 ppm is recommended for lead in the soil of the Vacant Lot site. This CUG was calculated for a light industrial/commercial scenario and would not apply to a residential scenario. In addition, this CUG would not be protective for a day care center or school or any commercial facility that is frequented by small children.

X. References

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