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Final Report

Environmental Loadings Profile for Cook County, IL, and Lake County, IN

U.S. Environmental Protection Agency
Office of Pollution Prevention and Toxics
Washington, DC 20460

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ABSTRACT

The Environmental Loadings Profile for Cook County, Illinois, and Lake County, Indiana, is a multimedia environmental characterization and inventory of sources of pollution in the area, with a focus on the quantity of chemicals released to the environment. Also included is a characterization of the levels of contaminants in the air, water, soil, and other media. A product of the Chicago Cumulative Risk Initiative (CCRI), this report is intended to provide the basis for assessing risks to human health and for risk reduction decision making. This Environmental Loadings Profile should help decision makers, resource managers, and the public to make prudent, informed choices in shaping the environmental future in Cook County, IL, and Lake County, IN.

Substantial quantitative information is presented on point sources of pollution, their locations, the magnitude of loadings, and the types of contaminants released into the local environment. Included is information on air emissions, water discharges, toxic chemical releases, hazardous wastes, spills/accidents, and other forms of environmental releases. Rankings of the largest pollution sources are provided for each media, by geographic area, and for major chemicals. In addition to estimating loadings, the report characterizes ambient levels of contaminants in air, surface water, sediments, fish, drinking water, soil, and other media to which humans may be exposed. The final section of the Environmental Loadings Profile includes an integrated environmental characterization of select geographic areas (e.g., Southeast Chicago), for chemicals of interest (e.g., lead), and for particular types of industrial sources (e.g., steel mills). The integrated presentation is intended to give an overall, cumulative picture of the sources, chemicals, and geographic areas with the largest loadings. This report is accompanied by a computer data base, containing much of the loadings and environmental levels data discussed in the document.

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1.0 Introduction

1.0 INTRODUCTION

This report provides information on sources of pollution and environmental levels of contaminants in Cook County, Illinois (IL), and Lake County, Indiana (IN). It compiles information from researchers locally and nationwide for an evaluation of the state of the environment in the area, focusing on the quantity of pollutants released to the environment and the levels of contaminants in the air, water, soil, and other media. A product of the Chicago Cumulative Risk Initiative (CCRI), this report is intended to provide the basis for assessing risks to human health and for risk reduction decision making. Overall, this Environmental Loadings Profile should help decision makers, resource managers, and the public to make prudent, informed choices in shaping the environmental future in Cook County, IL, and Lake County, IN.

Scope of Report

- Cook County, IL, and Lake County, IN
- Environmental Setting and Historical Problems
- Sources and Loadings of Pollution to Air, Water, and Other Media
- Environmental Levels in Air, Water, Sediment, Fish Tissue, Soil, etc.
- Integrated Environmental Characterization

One of the first steps in determining where to focus risk reduction efforts is to better understand the current condition of the environment. This requires quantitative information on the variety of sources of pollution, their locations, the magnitude of loadings, the types of contaminants released, and the presence of these contaminants in the air, water, soil, food, and other media to which humans may be exposed. As a result, to produce this Environmental Loadings Profile, data collection efforts broadly focused on attempting to capture information on many different types of sources, on a multimedia basis, and on many types of pollutants. While a broad picture of the overall environmental condition is painted, some focus is provided on issues of particular concern to children's health (such as lead and the impacts of air pollution on asthma). This report presents some of the latest information and data, compiled from databases and researchers nationwide, into a value-added assessment of environmental loadings in Cook County, IL, and Lake County, IN.

> "Strong science provides the foundation for credible environmental decision making. With a better understanding of environmental risks to people and ecosystems, EPA can target the hazards that pose the greatest risks."
>
> Expert Panel on the Role of Science at EPA
> (U.S. EPA, 1992)

While pollution control efforts during the last three decades have successfully improved air quality and reduced contamination of rivers and streams, the problems we currently face require a new way of doing business. Twenty-five years ago, environmental problems were more obvious - huge smokestacks billowing smoke into the air, dead fish on the shorelines, and drums of hazardous wastes. Today, many of the challenges are less apparent - trace levels of chemicals in drinking water, lead dust from paints used years ago in houses, and stormwater runoff from streets and parking lots. These types of problems require new approaches to environmental protection. Solutions depend on a better understanding of the complex scientific and social policy issues which have led to local environmental conditions. This report begins the process to gain that understanding; it provides a foundation upon which upcoming CCRI efforts will build. These latter phases of CCRI will examine human health impacts to try to better determine associations with environmental conditions. Furthermore, they will try to quantify exposures and risks to the public (and certain sensitive subpopulations such as children, the elderly, or subsistence fishermen) from pollutants. Finally, these upcoming activities should help to identify, with some greater level of certainty, the best opportunities through which risk reduction might be achieved. These risk reduction effects may take many forms, possibly combining education programs with pollution prevention activities. Ultimately, this report will be successful if it helps the local groups, government agencies, and other decision makers set priorities and reduce environmental risks to the residents of Cook County, IL, and Lake County, IN.

This introductory section presents information on the purpose and scope of this study, background on CCRI, and the approaches used to obtain and evaluate data/information. Also described are some limitations of the data used in the study. The remainder of the report is organized in a manner that first presents basic facts and information and then builds details (and complexity) in the latter sections. Specifically:

- Section 2 - Introduces the environmental setting in Cook County, IL, and Lake County, IN; describes historical problems related to environmental quality in these areas; and presents some statistics on general indicators of environmental condition.

- Section 3 - Provides quantitative information on sources of pollution and loadings of specific chemicals to the environment. This section includes estimates of emissions to air, discharges to surface waters, releases of toxic chemicals from facilities and from spills/accidents, management of hazardous wastes, and information on sites with hazardous chemical releases.

- Section 4 - Summarizes information on the presence of pollutants in environmental media such as ambient air, surface water, fish tissue, drinking water, soils, sediments, and human exposure biomarkers.

- Section 5 - Provides an integrated environmental characterization, including multimedia loadings in geographic areas of interest (e.g., Southeast Chicago), chemicals of interest (e.g., lead) and particular types of industrial sources.

- Section 6 - References.

- Appendix - Glossary of Terms and List of Acronyms/Abbreviations

1.1 PURPOSE AND SCOPE

Scoping Questions

- What are the major sources of pollution?
- What pollutants are being emitted/released in the largest quantities?
- What geographic areas have the largest loadings?
- Are releases increasing or decreasing over time?
- What are levels of contaminants in various media to which humans may be exposed?

The purpose of the Environmental Lodings Profile is to document sources of pollution, loadings to the environment, and levels of contaminants in various media. This report is a multimedia, multipollutant assessment of environmental conditions in Cook County, IL, and Lake County, IN. Identified in this report are the largest sources, the pollutants released in the largest quantities, and the geographic areas that have the largest loadings to the environment. It must be noted, this is not a risk assessment, nor is it an exposure assessment. Rather, this document provides a scientific foundation on which exposure and risk assessments may be based.

The Environmental Loadings Profile focuses on the magnitude of the release. The chemicals described and the facilities ranked are examined based on the mass of the emission/release; not on a risk basis. That means that no attempt has been made to account for fate and transport of contaminants, or their toxicity, or other issues that are part of the risk assessment process. Specifically, risk is a function of exposure and hazard. Exposure is the mechanism by which a receptor (individual) comes into contact with a potentially hazardous constituent. Estimating the magnitude of human exposure calls for a variety of information on sources, the movement of pollutants through the environment, the type of contact made (ingestion, inhalation, or dermal contact), and the frequency and duration of such exposures. An exposure assessment would look at information on pathways by which humans may be exposed (e.g., breathing air downwind from a point source or consuming fish caught from polluted waterbodies), the concentrations of pollutants in these environmental media, the frequencies and durations of these exposures, and other information. Similarly, a risk assessment would take into account what is known about the toxicity of the chemical(s) involved. Toxicity is the inherent property of a chemical to produce adverse human health effects, such as cancer or other effects. All of these issues of exposure, toxicity and whether human health impacts might occur are very complex and are beyond the scope of the Environmental Loadings Profile.

This data compilation can assist with both source- and receptor-based assessments of exposures/risks to populations in this area. This never-before-attempted Environmental Loadings Profile for Cook and Lake Counties provides data that can be augmented with computer modeling approaches to estimate exposures to chemicals from multiple sources to populations of concern. Similarly, assessments of risks from "background" exposures can be completed using data on levels of contaminants in the air we breathe, the water we drink, and the food we eat.

This study was designed to take a broad perspective of environmental conditions in this area. The information presented was compiled from more than 400 different sources[1], including researchers in Federal, State, and local agencies; colleges and universities; environmental advocacy groups; and data bases. Much of the information is summarized (based on the original authors' interpretations) to the county level, where possible. In some cases, the original data address areas smaller (e.g., just Chicago or specific areas within the two counties) than the entire study area or county. In other instances, where information primarily represents areas broader in size than the two counties, an attempt is made to show its relevance to Cook County, IL, and Lake County, IN. While extensive data exist to quantify environmental loadings and levels in these areas, there are uncertainties and limitations to the data. (See Section 1.4.)

[1]The original references used to prepare this document have been provided to the Environmental Protection Agency

1.2 BACKGROUND ON THE CHICAGO CUMULATIVE RISK INITIATIVE (CCRI)

The Chicago Cumulative Risk Initiative (CCRI) was initiated by the U.S. Environmental Protection Agency (EPA or Agency) to better understand the cumulative impacts of environmental loadings in the Cook County, IL, and Lake County, IN, area. This four-phase effort was undertaken in response to a petition received from local environmental groups. The timeline of activities is summarized on Figure 1-1 and is described in more detail below.

Four Phases of CCRI

- Phase I: Environmental Loadings Profile
- Phase II: Facilitated Workshop (Status Meeting - May 1998)
- Phase III: Risk Assessment
- Phase IV: Pollution Prevention and Remediation

On February 23, 1996, the Agency received a Section 21 petition from the Chicago Legal Clinic (representing 11 community advocacy groups).[2] The petition requested that the Agency issue a Toxic Substances Control Act (TSCA) Section 6 Rule regulating the disposal of dioxins, furans, mercury, cadmium, and lead through air deposition from eight incinerators slated to begin operating (or in one case, already operating) in Cook County, IL, and Lake County, IN. The petition alternatively requested the issuance of a TSCA Section 4 Rule that would require data collection on cumulative effects, focusing on those risks posed by the aforementioned chemicals. Under Section 21 of TSCA, EPA had 90 days from receipt of the petition to prepare and issue a response.

A workgroup of EPA employees was assembled to evaluate the petition and generate a response. The workgroup, after analyzing information collected during the investigation, determined

[2]The petitioners were all not-for-profit organizations located in Cook County. IL. and Lake County. IN. and included. People for Community Recovery. Lake Michigan Federation. Grand Cal Task Force, Center for Neighborhood Technology. Citizens for a Better Environment. Southeast Environmental Task Force. South Cook County Environmental Action Coalition. Human Action Community Organization. South Suburban Citizens Opposed to Polluting Our Environment. Lyons Incinerator Opponent Network. and Westside Alliance for a Safe Toxic-Free Environment

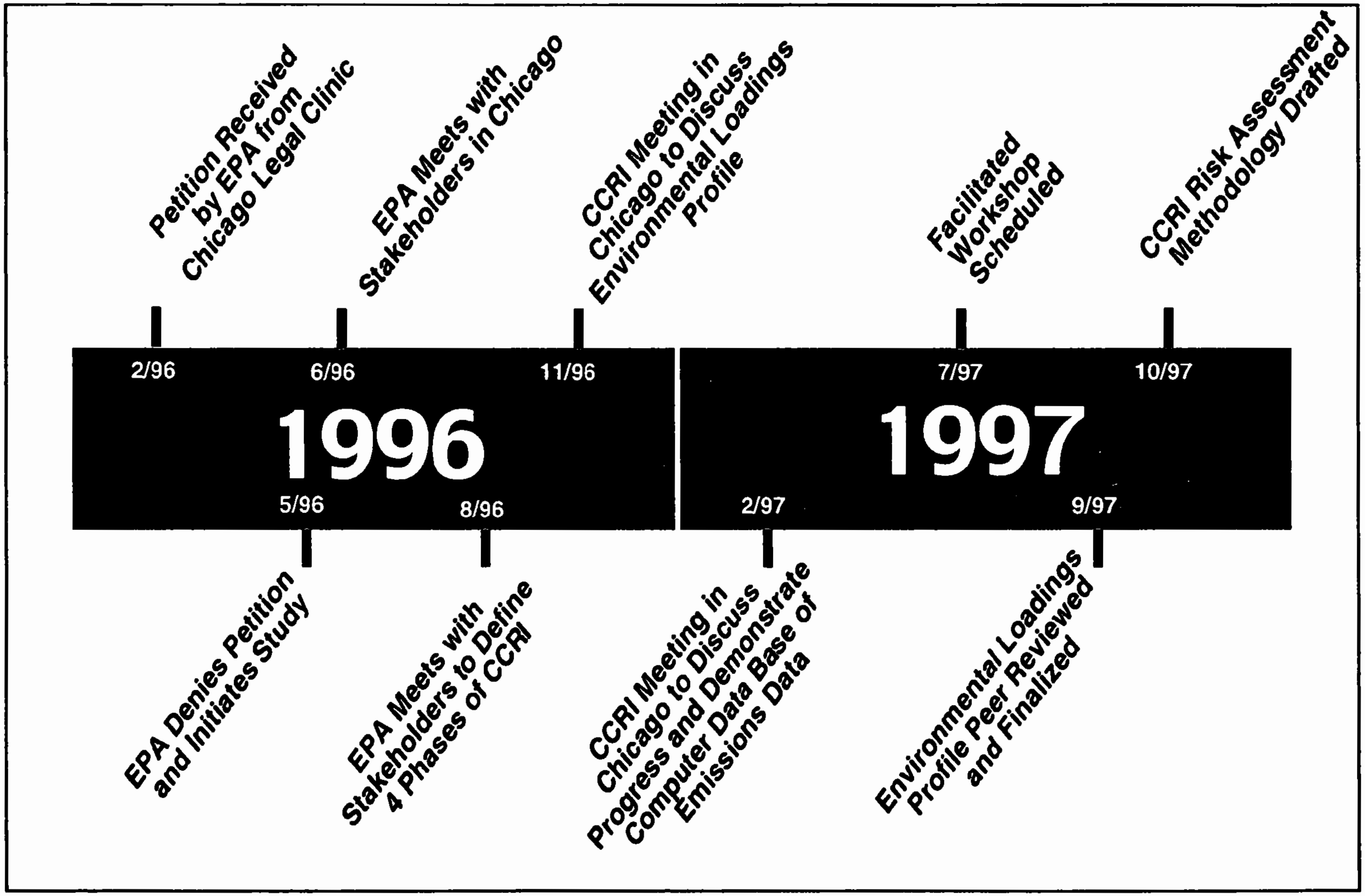

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Figure 1-1. CCRI Timeline

that insufficient information existed to support the initiation of Section 6 activity. The workgroup also determined that due to the uncertain status of the planned incinerators targeted by the petition, committing to Section 4 activity was not the most appropriate course of action. The workgroup did conclude that several significant issues were raised during the petition investigatory process. Those issues included: cumulative effects, loadings, and risk posed by incinerators and other point, area, and mobile sources.

The workgroup then generated a response, signed on May 23, 1996. In that response, EPA denied the petition and proposed that the petitioners work with the Agency to plan and implement a community-based effort to investigate the cumulative issues (but covering a wider range of toxics and sources) faced by residents of Cook County, IL, and Lake County, IN. (The aforementioned petitioners are currently referred to as Stakeholders.)

At a June 1996 meeting in Chicago, the Stakeholders requested that the EPA workgroup develop an outline of the proposed project. The workgroup assembled the requested material and presented it at an August meeting. The Stakeholders reacted favorably and discussed modifications to the project, proposed deliverables, and the nature of Stakeholder participation. The new project, CCRI, developed into a four-phase activity:

- Phase I: Generating an Environmental Loadings Profile;
- Phase II: Convening a Status Meeting to Discuss CCRI-relevant Issues (Loadings Profile Data and Risk Assessment);
- Phase III: Performing "Cumulative" Risk Assessment; and
- Phase IV: Initiating Pollution Prevention/Remediation Activity.

Phase I involved the use of a contractor to develop an environmental loadings profile (ELP). The ELP is an inventory of the source and nature of toxics emissions into various media (e.g., air, water) in the two county study area that will enable CCRI participants to create a relevant list of toxicants and approximate the cumulative exposures and risks from chemical substances. The first draft of the ELP was completed in the 4th Quarter of FY 97. The contractor for Phase I was chosen due to its experience in assembling similar exposure profiles for EPA's Office of Pollution

Prevention and Toxics (OPPT) as well as for EPA Region 3. This exposure assessment contractor performed data identification, gathering, and analysis tasks that were comprehensive in scope and address chemical releases and ambient pollution concentrations in many media. The effort produced a preliminary indication of major sources, pollutants that are released in the largest quantities, and the presence of contaminants in environmental media to which humans may be exposed.

Phase II, convening a status meeting took place in May 1998. The meeting involved the Stakeholders, EPA Headquarters and Region 5, Illinois, Indiana, local-level officials, and other nongovernment organizations discussing and reaching accords on the aforementioned profile (Phase I), a concept plan for performing a cumulative risk assessment (Phase III), and customer service issues.

Phase III will be undertaken via an Interagency Agreement with Argonne National Laboratory to generate a concept plan for assessing risks (it will be a cumulative/comparative hybrid approach using the policies assembled by the Agency's Science Policy Council). The contractor will then proceed to create a responsive methodology for performing the cumulative risk assessment. Subsequent to approval of this methodology, the contractor will be directed to perform that assessment. Phase III will involve the implementation of a cumulative risk analysis. Because the scope of a comprehensive, cumulative risk analysis is potentially enormous, the workgroup intends to conduct a focused assessment that will address:

- The most significant environmental hazards;
- Their sources and exposure pathways;
- Risks of various health effects from multiple exposure sources and pathways; and
- Locations and other characteristics defining sensitive populations.

An assessment process will be implemented that focuses on a small number of contaminants, made significant by their toxicity or carcinogenicity, in combination with (1) the volume released, (2) their potential synergistic effects with other contaminants in the area, (3) their tendency to bioaccumulate, (4) their potential for relatively high exposures or the exposures of particularly sensitive populations (e.g., children), or (5) their possible contribution to high incidence health effects in the Chicago-area population.

Phase IV (pollution prevention, remediation, and education activities) has not been planned. To some degree, this Phase will rely on information produced by each of the first three phases. It is possible that some activities will be triggered by Phase I, while others may result from Phases II and III.

An introductory meeting was held on November 1, 1996, at Region 5's offices with the community groups (Stakeholders) to discuss the contractor selected for Phase I, its approach for data gathering/analysis, and other issues. Subsequently, a meeting was held on February 28, 1997, to review progress on development of the environmental loadings profile. At that meeting, a computer system was demonstrated showing the multitude of loadings data collected to date. Discussions on the review of more than 400 documents identified to date assisted in forming plans for future data collection efforts.

In the next phase of the Cumulative Risk Initiative, Argonne National Laboratories has been tasked to perform a hazard assessment and hazard mapping exercise designed to provide information for resource allocation and better decision making. This assessment focuses only on air toxics and their sources in the two county area, Cook County, Illinois and Lake County, Indiana. The project uses off the shelf tools to provide a weight of evidence approach to identify geographic areas within the study area that may merit further attention. These tools include the Toxics Release Inventory, the Regional Air Pollutant Inventory Development System, the Cumulative Exposure Project and monitored ambient air data. Hazards are assessed using toxicity weights and comparison levels as toxicity screening tools. The products of the screening assessment include cumulative hazard measures for air toxics emissions and concentrations, as well as limited information on disease rates. This information is summarized to identify the most hazardous pollutants, sources and regions within the study area. The base year for the assessment is 1996, although some analyses include data for other years. The screening assessment is currently under development and should be completed in 2001.

1.3 APPROACH TO DATA COLLECTION, ASSESSMENT, AND INTERPRETATION

This characterization of environmental loadings and levels in various media is based on data previously collected by government agencies, universities, private organizations, and other individuals who have studied these topics. This section summarizes the approaches used to identify, collect, evaluate, and analyze the information included in this report.

Approach

- Identify Existing Data/Information
- Contact Researchers Locally and Nationwide
- Quantify Loadings and Environmental Levels
- Analyze, Interpret, and Present Data

1.3.1 Data Collection

This study relied exclusively on existing data; no new monitoring was conducted. As a result, a significant portion of the effort was dedicated to identifying existing information from organizations that had studied some of these issues. In general, previous studies looked into some portion of the issue; however, these previous studies often only addressed a limited geographic area, select chemicals, or only one medium. This document attempts to take a broader perspective. Such a comprehensive multimedia environmental assessment has never been completed for Cook County, IL, and Lake County, IN.

In general, data collection was accomplished through the following means:

- Use of in-house libraries/journals/newsletters;
- Electronic literature searches of published scientific journals;
- Telephone calls to Federal, State, and local government agencies, as well as private organizations and colleges/universities;
- Internet searches; and

- Electronic data base searches for environmental emissions and levels data. (See Section 3.)

More than 100 organizations[3] were contacted to either obtain specific reports or to inquire about previous studies that these investigators/organizations may have conducted in the area (Table 1-1). From these efforts, almost 400 references were identified, most of which were believed to be relevant to this effort. Documents and data sets were obtained from researchers or from libraries. These documents were used in combination with data bases to complete this Environmental Loadings Profile for Cook County, IL, and Lake County, IN.

1.3.1.1 *Major EPA Data Bases Accessed for CCRI Environmental Loadings Profile*

To collect information on environmental emissions/releases and levels, a variety of data bases were accessed. These data bases included several of EPA's mainframe systems that are used to track the regulatory status and compliance of facilities under legislative mandates such as the Clean Air Act (CAA), Clean Water Act (CWA), and the Resource Conservation Recovery Act (RCRA). The primary data bases accessed are presented in Figure 1-2 and are described briefly below. Additional description of these systems and the data derived from them are included in Sections 3 and 4 of this report.

Aerometric Information Retrieval System Facility Subsystem (AIRS/AFS)

The Aerometric Information Retrieval System Facility Subsystem (AIRS/AFS) contains emissions and compliance data on air pollution point sources regulated by the EPA and/or State and local air regulatory agencies under the CAA. AFS contains data on industrial plants and their components: stacks, the points at which emissions are introduced into the atmosphere; points, the emission point or process within a plant that produces the pollutant emissions; and segments, components of the processes that produce emissions. In general, emissions data are provided for

[3]In addition to these organizations the petitioners provided a wealth of information through initial scoping meetings, formal data submissions, feedback on drafts, and at the status meeting A list of the petitioners can be found in the footnote in Section 1.2.

Table 1-1. Organizations Contacted for CCRI Environmental Loadings Profile

Access Indiana Information Network
Air and Waste Management Association
American Lung Association of Indiana
American Lung Association of Metropolitan Chicago
American Automobile Association - Chicago
Argonne National Laboratory
Army Corps of Engineers, Chicago District
Association of Local Air Pollution Control Officials
ATSDR - Agency for Toxic Substances and Disease Registry
Calumet City Emergency Disaster Agency
Calumet
Calumet Environmental Resource Center - website
CDC - Centers for Disease Control & Prevention
Center for Neighborhood Technology
Chicago Fire Department (Office of Public Information)
Chicago Legal Clinic
Chicago - website
Chicago Area Transportation Study
Chicago Reporter
Chicago Sun Times
Chicago Tribune
Chicago Transit Authority
City of Chicago Department of Aviation
City of Chicago Environmental Committee
City of Chicago Department of Public Health
Cook County Commissioner's Office
Cook County Department of Environmental Control
Cook County Department of Public Health
Cook County Government
Cook County/Chicago South Unit - website
DePaul University
DNR Lake Michigan
EPA - Environmental Protection Agency
EPA - Region 5
EPA - NERL - RTP
EPA - OAQPS
EPA's Envirofacts - website
ERM Inc.
Federal Register - online via Government Printing Office (GPO) Access
Fisheries and Oceans - Canada

Table 1-1. Organizations Contacted for CCRI Environmental Loadings Profile (continued)

Gary, IN - website
Gary Post-Tribune
GLNPO - Great Lakes National Program Office
Health and Welfare Canada
HWRIC - Hazardous Waste Research & Information Center
(also known as Illinois Waste Management and Research Center)
IDEM - Indiana Department of Environmental Management
IDEM - Office of Legal Counsel
IDEM - Office of Solid and Hazardous Waste Management
IDEM - Office of Air Management
IDEM - Office of Water Management
IDENR - Illinois Department of Energy and Natural Resources (old)
IDNR - Illinois Department of Natural Resources
IDPH - Illinois Department of Public Health
IEPA - Illinois Environmental Protection Agency
IEPA - Bureau of Water
IEPA - Bureau of Air
Illinois Department of Transportation
Illinois Pollution Control Board
Illinois Academy of Science
Illinois Emergency Management Agency
Illinois Department of Conservation
Illinois State Museum
Illinois Center for Health Statistics
Illinois Institute of Technology at Chicago
Indiana University
Indiana Department of Labor
Indiana Department of Transportation
ISDH - Indiana State Board of Health
ISGS - Illinois State Geological Survey
ISWS - Illinois State Water Survey
IT Corp
Lake County, IN (Local Environmental Planning Committee)
LOC - Library of Congress
Loyola University - Chicago
Metropolitan Water Reclamation District of Greater Chicago
Michigan State University
MRI - Midwest Reseach Institute
NASA Information Service

Table 1-1. Organizations Contacted for CCRI Environmental Loadings Profile (continued)

National Biological Service of USGS (Indiana Dunes Lakeshore)
NIPC - Northeast Indiana Planning Commission
NIRPC - Northwest Indiana Regional Planning Commission
NLM - National Library of Medicine
NOAA - National Oceanic and Atmospheric Agency
NPCA - National Parks and Conservation Association website
NRDC - Natural Resources Defense Council
NTIS - National Technical Information Service
PAHLS Inc. - People Against Hazardous Landfill Sites
Queens College, NY
Research Triangle Institute
RTA - Regional Transportation Authority
Right-to-Know Net
SMART - Suburban Mutual Assistance Response Team
The Better Government Association
U.S. Census Bureau - website
U.S. Fish and Wildlife Service - website
University of Chicago
University of Illinois at Chicago
University of Illinois at Chicago - School of Public Health
USGS - United States Geological Survey
West Cook County Solid Waste Agency
Wisconsin State Laboratory of Hygiene
Wisconsin Division of Health

- Aerometric Information Retrieval System (AIRS) 
  - –Facility Subsystem (AFS)
  - –Air Quality Subsystem (AQS)

- Biennial Reporting System (BRS)
- Resource Conservation and Recovery Information System (RCRIS)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) 
- Emergency Response Notification System (ERNS)
- Accidental Release Information Program (ARIP)
- Permit Compliance System (PCS) 
- Regional Air Pollutant Inventory Development System (RAPIDS)
- Safe Drinking Water Information System (SDWIS) 
- Storage and Retrieval of U.S. Waterways Parametric Data (STORET)
- Toxic Release Inventory System (TRIS)

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Figure 1-2. Data Bases Accessed for CCRI Loadings Profile

criteria air pollutants (sulfur oxides, nitrogen oxides, particulates, carbon monoxide, volatile organic compounds, and lead) and regulated hazardous air pollutants. In addition to air emissions estimates for pollutants, AIRS/AFS also contains general source identification information such as: name, address, industrial classification, and operating status.

Aerometric Information Retrieval System Air Quality Subsystem (AIRS/AQS)

The Aerometric Information Retrieval System Air Quality Subsystem (AIRS/AQS) contains information on air quality such as measurements of ambient concentrations of air pollutants and associated meteorological data. This information comes from input by the various State and local agencies that manage the clean air programs within their jurisdictions. For example, States are required to report ambient air quality data on a quarterly basis. EPA uses AQS to assess the overall status of the Nation's air quality and to prepare reports for Congress as mandated by the CAA. The AQS contains data on monitoring locations, parameters monitored (e.g., criteria pollutants), and data from photochemical assessment monitoring station (PAMS) sites.

Biennial Reporting System (BRS)

The Biennial Reporting System (BRS) is a national system that contains data on the generation, management, and minimization of hazardous waste from facilities regulated under RCRA. BRS captures data on the generation of hazardous waste from large quantity generators as well as waste management practices from treatment, storage, and disposal facilities. These data have been collected every other year since 1985 and allow trends analyses. On even years, the data are reported by the facilities to EPA about the hazardous waste activities of the previous year. BRS contains information on the amount (tons/year) and nature of the waste (the waste code), but does not have detailed characterization of the chemicals contained in each wastestream.

Resource Conservation and Recovery Information System (RCRIS)

The Resource Conservation and Recovery Information System (RCRIS) tracks information on all phases ("cradle-to-grave") of hazardous waste generation, storage, treatment, and disposal.

Containing information on permitted facilities, RCRIS provides enforcement/compliance-related information to support permit writing as well as corrective action programs. In general, RCRIS does not contain data to characterize the amount of waste or the types of waste codes that are managed by facilities. BRS contains much of this type of information for large quantity generators and facilities that treat, store, and dispose of hazardous wastes.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS)

The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) is the official repository for site and nonsite specific Superfund data in support of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It contains an inventory of abandoned, inactive, or uncontrolled hazardous waste sites (inventory of sites, assessment and remediation activities, and financial information). The sites included in CERCLIS are either National Priorities List (NPL or "Superfund" sites) or non-NPL sites that have received some degree of investigation or action to remedy hazards.

Emergency Response Notification System (ERNS)

The Emergency Response Notification System (ERNS) is a data base that contains records of all telephone calls made to the National Response Center (NRC) as a result of many different types of spills or releases of hazardous substances. Information is collected on transportation-related spills, U.S. Coast Guard sightings of spills at sea, and other events involving the unintentional release of hazardous substances. Data contained in ERNS describe the organization(s) responsible for the release, location and time of the spill, substances released, medium effected, and severity of impact. For purposes of compiling this report, ERNS was accessed through the Right-to-Know Network (ERNS, 1997).

Accidental Release Information Program (ARIP)

The Accidental Release Information Program (ARIP) contains information on the causes of accidents as well as industry prevention practices. Supplementing information contained in the Emergency Response Notification System (ERNS), ARIP summarizes questionnaire information on select spills/accidents where significant releases of hazardous substances have taken place. While ERNS addresses a wide range of spills and accidents from both transportation and fixed facilities, ARIP targets accidental releases from facilities that resulted in off-site impact or environmental damage (ARIP, 1997). The type of information that ARIP contains (in addition to some basic information similar to ERNS on the chemical substances spilled) includes the circumstances/causes of the incident, public notification procedures, mitigation techniques, and other controls. For the purposes of compiling this report, ARIP information was accessed through the Right-to-Know Network (RTK NET).

Permit Compliance System (PCS)

The Permit Compliance System (PCS) is a national computerized management information system that tracks surface water discharges under the National Pollutant Discharge Elimination System (NPDES) of the CWA. The NPDES permit program regulates direct discharges from municipal and industrial wastewater treatment facilities that discharge into the navigable waters of the United States. Wastewater treatment facilities (also called "point sources") are issued NPDES permits regulating their discharge. PCS contains data and tracks permit issuance, permit limits, and monitoring data, and other data pertaining to facilities regulated under NPDES. PCS records water-discharge permit data on more than 75,000 facilities nationwide, with more complete data on discharges for "major" facilities. A separate program, called Effluent Data Statistics (EDS), is used to calculate loadings based on the PCS discharge data.

Safe Drinking Water Information System (SDWIS)

SDWIS is the repository for data on public water systems and violations of EPA's regulations for safe drinking water. Data contained in SDWIS includes the location of the drinking water system, the number of people served, and tracking data on violations of drinking water standards. Under the Safe Drinking Water Act (SDWA), EPA establishes regulations, maximum contaminant levels (MCLs), treatment techniques, and monitoring and reporting requirements to ensure that water provided to customers is safe for human consumption.

Storage and Retrieval of U.S. Waterways Parametric Data System (STORET)

The Storage and Retrieval of U.S. Waterways Parametric Data System (STORET) is the national data base for water quality information. STORET includes information on ambient, intrusive survey, effluent, and biological water quality measures for the United States. Data from monitoring efforts conducted by Federal, State, local, academic, and private organizations are housed in STORET. Much of these data on the presence of contaminants in water, biological, and sediment samples are used by State agencies in their biennial water quality, or 305(b), reports.

Toxic Release Inventory System (TRIS)

The Toxic Release Inventory (TRI) System (TRIS) contains information about releases and transfers of more than 300 toxic chemicals and compounds to the environment, as reported to EPA under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). TRIS stores release-transfer data hierarchically by facility, by year and chemical, and by medium of release (air, water, underground injection, land disposal, and off-site transfer). TRIS also stores treatment and source-reduction data. At the facility level, TRIS stores facility name, address, latitude-longitude, and parent company. At the chemical level, TRIS stores Standard Industrial Classification (SIC) Codes, EPA identification numbers (EPA ID), and pollution prevention data (e.g., recycling, energy recovery, treatment, and disposal). At the medium level, TRIS stores names and addresses of off-site transfer recipient facilities.

Regional Air Pollutant Inventory Development System (RAPIDS)

The Regional Air Pollutant Inventory Development System (RAPIDS) contains statewide air emissions inventories of 49 pollutants of concern to the Great Lakes. The inventory contains emissions estimations for point and area sources of toxic air pollutants. RAPIDS and the Great Lakes Emissions Inventory is a project of the eight Great Lakes States and Ontario working under the Great Lakes Commission with funding from EPA. The first regional (8 State, 1 province) pilot inventory contains point and area source data from 1993.

1.3.1.2 *ACCESS Data Base*

The ACCESS Data Base is a computer system designed to manage the wealth of data on emissions, hazardous wastes, toxic chemicals, and related information. ACCESS, built on a statistical software program called SAS, displays graphs, maps, and tables on environmental loadings (the quantities of emissions/releases to air, water, etc.) in Cook County, IL, and Lake County, IN. The system is user friendly and facilitates access to information about environmental loadings and levels according to: year, county, ZIP Code, facility, industry type, chemical, etc. This system integrates multimedia data for Cook County, IL, and Lake County, IN, describing air emissions, discharges to surface waters, generation/management of hazardous wastes, accidental releases, and releases of toxic chemicals, and others. ACCESS was developed as a tool primarily to assist with the voluminous data assembled to complete the CCRI environmental loadings profile; however, it is flexible and can be expanded as more data are obtained. Also, ACCESS may be made available in the future to interested parties in the community to access the data for custom inquiries.

1.3.2 Assessment of Data

Because this environmental loadings profile was compiled from data and reports prepared by many other researchers and existing data bases, it reflects a variety of topics of interest to the scientific/regulatory community at large. In general, environmental data are collected to meet particular needs (regulatory, compliance, programmatic), and rarely reflect the overall condition of the ambient environment. Although a more extensive discussion of the limitations of the data is provided in Section 1.4, it should be noted that challenges to completing this Environmental Loadings Profile included determining the quality of the data and the reliability of the results.

While assessing the quality of data coming from hundreds of articles, reports, and data bases, is a subjective endeavor; review of the level of confidence one might have in the data and conclusions of the investigators is possible. A relatively high level of confidence was placed on the computer data bases used in assembling this report. These sources of information generally undergo thorough review for data quality. For example, the AIRS/AFS data are typically collected by State environmental agencies and are forwarded to EPA. Various data quality checks are conducted throughout this process. PCS loadings data are derived from the monthly discharge monitoring reports that are submitted by permittees to State environmental agencies and/or EPA. Also, the TRI data, submitted by industry to EPA, undergo quality control checks as they are entered into EPA's data base. This does not mean that these data are perfect (See limitations in Section 1.4.); however, the data may be more applicable for developing annual loadings estimates than others.

Assessing the quality of data from reports and journal articles was included as part of the data collection and analysis process. Three general considerations (not criteria) used in examining data/information include: (1) level of peer review, (2) rigor of study design/data collection strategy, and (3) substantiality of conclusions.

(1) Level of Peer Review

- The level of peer review that a document has received can provide an indication of the quality of data collection/analyses, as well as the confidence one might have in the conclusions.

- Generally, articles published in professional journals have received a high level of peer review. Similarly, final government reports often undergo peer review prior to publication. Other types of documents/reports may not have received as stringent review and the quality of the data and conclusions may not be as reliable.

(2) Rigor of Study Design/Data Collection Strategy

- It is preferable to be able to review the approaches used by the authors to collect data. Such a review can determine if the approach used was consistent with the objectives of the study. This includes assessing the design of a study with respect to such features as the number of samples/observations and the representativeness or bias of sample selection. Such criteria are applicable to either chemical measurement or survey/questionnaire studies.

- Review of these types of information may not only reveal deficiencies in the quality of the results but may also help in determining the utility of results for assessing environmental conditions.

(3) Substantiality of Conclusions

- One way to determine the reliability of data/results from a report may be to examine the conclusions to determine if they comport with the objectives of the study. Also, the conclusions should be clearly supported by the data and approaches used for interpreting the data.

- It is also desirable if a report has a discussion of the uncertainties and limitations of the conclusions.

1.3.3 Interpretation of Data

This report compiles, summarizes, and presents data from a variety of sources to describe environmental conditions. The approaches used to interpret data used in the Environmental Loadings Profile varied depending on the source of the data and the topic of discussion. Discussion of data interpretation issues that were particular to the data source/section of the report are provided in their respective sections (e.g., Section 5 contains discussion of approaches used to analyze the data, as well as the limitations of data sets used in multimedia loadings estimates). Typically, when presenting findings from previously-conducted projects, the interpretation of the authors was utilized. This preference for using the investigators' interpretation comes from the standpoint that they are the people most familiar with the data collection and analyses efforts.

Much of Section 3 on sources/loadings relies on data from EPA's data bases and is augmented by data, articles, and reports from State agencies and other organizations. Interpretation of loadings data from these mainframe systems (e.g., TRI, PCS) included decisions on the data fields of interest, conversion of loadings/units to reflect an annual loading (pounds per year), and identification of data gaps. For example, in some cases where latitude/longitude data were not available in a data base for a particular source, other data bases were used for such information.

Further, for certain other data sets that lacked latitude/longitude data, ZIP Code centroids were used to approximate the location for mapping purposes. Augmentation of the data from EPA's mainframe data bases on environmental loadings was possible in several instances. For example, point-source data on air emissions were primarily derived from AIRS/AFS, but other point-, area- and mobile-source data were obtained from Illinois Environmental Protection Agency (IEPA), Indiana Department of Environmental Management (IDEM), the RAPIDS data base, the Chicago Area Transit Study (CATS), and other studies.

1.4 LIMITATIONS AND UNCERTAINTIES

It is important to recognize that there are limitations to this study and report. First, this study relied on existing data - no new data were collected (no sampling was conducted). Rather, information was compiled from many agencies, organizations, and individuals (drawing from the knowledge of hundreds of experts). In general, the information compiled is "the best there is," and it must be pulled together to estimate environmental loadings; however, it is not possible to account for all sources and all chemicals. As is the case with all of these data bases, they only account for those facilities and chemicals that are permitted and/or monitored for reporting to State and Federal regulatory agencies.

Limitations

- Reliance on Existing Data
- No Single Source Exists for Information on Multimedia Environmental Loadings
- Data Generally Represent 1995 Loadings
- Use of EPA Data Bases and Other Sources of Environmental Monitoring Data

This report attempts to identify the most applicable sources of data to describe environmental loadings in this area. Presented are estimates of the magnitude of chemical releases to a variety of media and the locations where the loadings are the largest. As with most data sources, they are very useful but they can be incomplete and have errors. Below is an overview of some of the limitations of data presented in this report. The discussion is not exhaustive; rather, it introduces the nature of some of the recognized uncertainties. This report contains data collected from the fall of 1996 through the summer of 1997, which usually represent environmental loadings in 1995. Similarly, environmental levels data generally represent this same time period, as well as preceeding years. No attempt has been made to evaluate more recent data to see if information has changed in the last 18 months.

As introduced earlier, numerous data bases were used in compiling loadings estimates for air, water, waste, and toxic chemical releases. No single source of data exists to compile a document of this size and scope. Estimates of environmental loadings are based on 1995 data from AFS, PCS, and TRI; 1993 data from BRS; and 1996 data from RAPIDS (based on 1993 emission inventories). While these systems are well suited for determining annual loadings estimates, there are some limitations. Some of the limitations result from the nature of the data bases and the different reporting procedures required by State and Federal regulatory agencies in tracking compliance under different statues. For example, while the TRI data are very useful in estimating releases of toxic chemicals, not all businesses that use (and release) these compounds are required to report to EPA. Specifically, TRI reporting under EPCRA generally is required for larger businesses (more than 10 employees) that exceed the reporting thresholds; however, certain industries are exempt, such as utilities. Other limitations result from changes in the reporting requirements (such as the addition or deletion of specific chemicals), which hinder one from making definitive statements about changes in TRI release estimates since the beginning of the program in 1987.

Certain shortcomings in these data become apparent when they are used for environmental loadings estimates. Uncertainties result because of multiple "forms" of chemicals, focus on different types of sources or chemical parameters, lack of chemical-specific information on hazardous wastes, and many more. One result is a potential overlap among data bases, which can result in double counting of some types of loadings and/or chemicals. This is true of estimating air emissions using AFS, portions of TRI, and RAPIDS. Estimates from these three data sources can overlap to some degree even though they may address different types of facilities and different chemicals. The degree of overlap may vary from facility to facility because of the different reporting requirements (different chemicals, reporting thresholds, etc) for data that are reported in AFS, RAPIDS, and TRI. Because of the differences in reporting procedures (and reporting years) among the three systems with air emission data, no attempt was made to compare or combine the data sets. Therefore, the rankings presented are best taken within the context of the same systems.

Limitations are also recognized in the estimates of pollutant loadings to surface waters from data contained in EPA's PCS. Unlike TRI or AFS, which present annual loadings numbers, PCS data require additional analysis to derive annual loadings. The approach used has been applied for more than a decade by EPA's Office of Water in its effluent guidelines program. PCS contains monitoring, compliance, and enforcement data for facilities with NPDES discharge permits. Facilities that are "major" must submit monthly Discharge Monitoring Reports (DMRs), which contain measured concentration and effluent flow data for that month. A separate program, called Effluent Data Statistics (EDS), estimates annual loadings based on the DMR data in PCS. Sources of uncertainty come from calculations performed by EDS, such as extrapolating for missing data and accounting for nondetected analytes. In the case of nondetects, the approach used follows standard procedures which substitute one-half the nondetected concentration for loadings calculations. Also, such estimates will not include loadings for all chemicals actually discharged; DMR data contain only those pollutants/chemicals specified in their NPDES permits. Uncertainty in the loadings estimates also results because of the lack of DMR data for some of the "minor" facilities. Facilities are designated major or "minor" in their NPDES permits based on factors such as effluent flow, physical/chemical characteristics of the wastestream, and location of the discharge. Because of the lack of loadings data for "minor" facilities, total loadings to waterbodies from point source discharges can be underestimated.

Overall, it should be recognized that environmental data have not been collected extensively to assess the overall condition of our environment. Rather, environmental data are usually collected for specific regulatory and management purposes to answer very site-, pollutant-, or media-specific questions. Data are often collected using different methods, over different time periods and spatial scales, and are difficult to compare and contrast. Such data collection results in data of limited use for overall assessment purposes and may artificially bias evaluation of environmental condition (e.g., more samples tend to be collected in polluted areas than in pristine areas). As a result of this fragmented approach, assessing the environmental condition of an area of interest has many uncertainties.

1.5 PEER REVIEW

The Environmental Loadings Profile was peer reviewed by four individuals, in addition to undergoing numerous rounds of review by EPA staff and the Stakeholders. This formal peer review evaluated data collection, analysis, and presentation as well as the general utility of the document. Reviewers included individuals from environmental advocacy groups, state and local government agencies, and other interested organizations. In general, the review found that the document (Draft Dated April 1999) was suitable for publication with some revisions. Many minor changes were made to the document to respond to the reviewers' comments, most of which improved the clarity of the text. Additionally, other comments that were not directly used in the final document addressed issues that were beyond the scope of the effort, mostly calling for additional/newer data and addition of a conclusions section. As stated in the introduction, the objective of the ELP was to present the most current data available in 1997 on loadings to the environment and concentrations of chemicals in the environment to which people may be exposed. By design, the document does not draw conclusions because it is intended to be used as a data compilation for assessing risks to human health and making risk management decisions. To help clarify this point a "summary/next steps" section has been added to the ELP in an effort to place the document in the context of the remaining two phases of CCRI. It is hoped that the ELP will assist in these activities that will lead to risk-based conclusions and more informed decision making.

EPA has established a public record for the peer review under Administrative Record 211045. The record is available in the TSCA Nonconfidential Information Center, which is open from noon to 4 PM Monday through Friday, except legal holidays. The TSCA Nonconfidential Information Center is located in Room NE-B607, Northeast Mall, 401 M Street, SW, Washington, DC.

An additional public record has been established at the EPA Region 5 Office. This record contains the peer review record and also contains the references used to develop the report. This record is available at the following location: USEPA Region 5, 77 West Jackson, 12th Floor Library, Chicago, IL 60604. The library phone number is: (312) 353-2022. The library hours are Monday-Friday 10AM to 4PM.

2.0 Environmental Setting

2.0 ENVIRONMENTAL SETTING AND HISTORICAL PROBLEMS IN COOK COUNTY, ILLINOIS, AND LAKE COUNTY, INDIANA

Environmental Setting

- Introduction to the Area
- Population/Demographics
- Historical Environmental Problems
- General Indicators of Environmental Condition (Air, Water, Toxics, Waste, Parks, and Others)
- Lake Michigan

This section presents an overview of environmental conditions in Cook County, IL, and Lake County, IN. Various facts and statistics are presented to introduce and illustrate the "environmental setting" and historical environmental problems in the area. Included are descriptions of general environmental indicators related to human health, how they have changed over time (trends), and how this area compares to other metropolitan areas nationwide. Overall, this section is intended to introduce Cook and Lake Counties' environmental health and provide the context for the following sections that describe in more detail the sources of pollution and environmental levels of contaminants.

In a sense, the environment is a living, breathing organism. There are measures, or indicators, that can tell us something about the health of the environment. These indicators, much like a human being's vital signs, can be examined to determine the health of the environment. Similar to when one visits the doctor, who takes measures of pulse, blood pressure, and weight - the environment has vital signs that we can examine to get a picture of its condition. In many respects, the health of the environment in this area has been significantly impacted by more than 100 years of urbanization, industrial development, and other anthropogenic stresses. Despite these impacts, some indicators are showing positive signs that the quality of the air, water, and other media are improving due to the pollution control efforts of the last 25 years.

The remainder of this section describes these two counties, presents information on their populations, introduces historical environmental issues, and summarizes a variety of indicators related to air quality, water quality, toxic chemicals, parks, and other general indicators of environmental health. Later sections of this report provide much more detail on specific sources of pollution; environmental levels of chemicals detected in air, water, and other media; and multimedia assessments of loadings in select areas.

2.1 POPULATION AND DEMOGRAPHICS

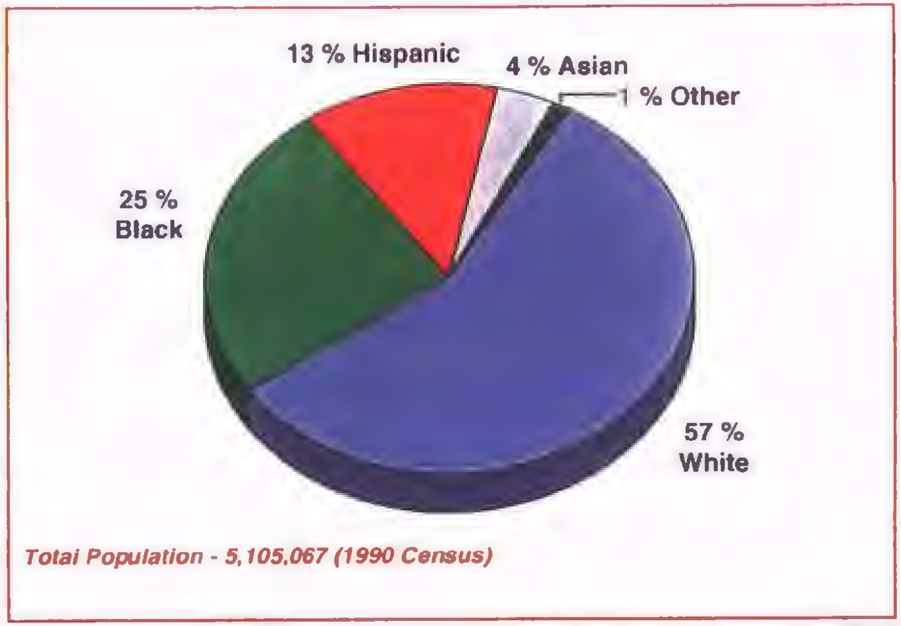
2.1.1 Cook County, Illinois

Cook County is located in the northeast portion of Illinois, on the shores of Lake Michigan (Figure 2-1). The total population in 1990 was more than 5.1-million people, 99.8 percent of whom lived in urban areas, including Chicago's population of almost 2.8 million (U.S. Census Bureau, 1997). The demographic makeup of the population in Cook County is displayed in Figure 2-2 (U.S. Bureau of the Census, 1990a). There are about 1,280,000 children (or about 25 percent of the population) under age of 18 in Cook County (U.S. Bureau of the Census, 1997). Of residents in Cook County, more than 2.3-million commute to work, with a mean travel time of almost 30 minutes, and 2.4-million people (over 16 years old) are employed in a variety of industries. The largest employers include retail trade, manufacturing, health services, finance, educational, and other professional services (U.S. Bureau of the Census, 1990a).

2.1.2 Lake County, Indiana

Lake County is located in the northwest corner of Indiana (Figure 2-3) and had a population of approximately 476,000 people based on the 1990 census (U.S. Bureau of the Census, 1997). The demographic makeup of the population in Lake County, IN, is displayed in Figure 2-4. There are about 130,000 children (or 28 percent of the population) under the age of 18 in Lake County, IN. The county covers about 500 square miles and includes major incorporated areas such as Gary, Hammond, and East Chicago. Primary industries include petroleum, steel, and chemical products, as well as numerous manufacturing companies. Agriculture, once a prime industry in Lake County, IN, currently comprises less than 30 percent of the land area (U.S. Bureau of the Census, 1990b).

Figure 2-1. Map of Cook County, IL

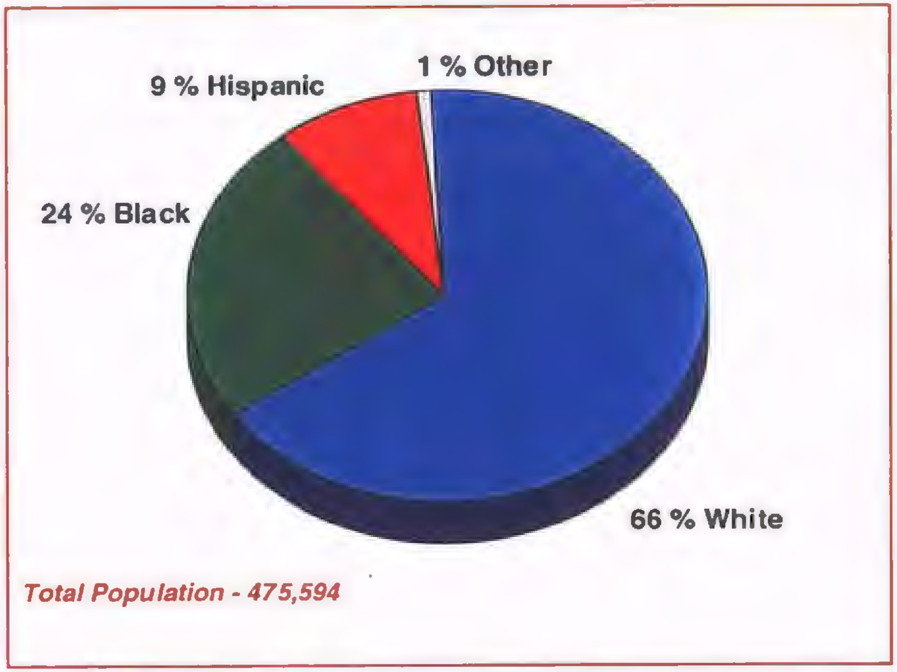


99-056

Source: U.S. Bureau of the Census, 1990a.

Figure 2-2. Cook County, IL Demographics

Figure 2-3. Map of Lake County, IN



Source: U.S. Bureau of the Census, 1997.

99-056

Figure 2-4. Lake County, IN Demographics

2.2 ENVIRONMENTAL SETTING AND HISTORICAL PERSPECTIVE

2.2.1 Cook County, Illinois

Cook County is a highly industrialized area, with extensive signs of environmental degradation to many resources including air, water, and land from more than a century of intense development. Starting in the mid-1800s, industries such as steel mills, metal and building material manufacturing, food processing, chemical-petroleum factories, and many others located in the Chicago area (Colten, 1985). Water resources were of vital importance to these industries for transportation and waste disposal. Waste materials from these industries were dumped on the ground, used for fill, or discharged into the rivers, lakes, and marshes (Bhowmik and Fitzpatrick, 1988). These types of practices continued for many decades, contaminating surface waterbodies such as Lake Michigan, Lake Calumet and the Calumet, Little Calumet, and Grand Calumet Rivers. In the early 1900s, regulations were enacted to prohibit the dumping of organic and other types of sewage into Lake Michigan and the rivers (Baden and Coursey, 1997). Concern over drinking water supplies prompted the diversion of the polluted Calumet and Chicago Rivers away from Lake Michigan (Colten, 1985). As the transportation infrastructure expanded, so did the opportunity for industry to locate facilities further inland (Baden and Coursey, 1997).

The 20th century has seen population growth and further industrialization of the area. Sources of pollution included the addition of municipal solid waste incinerators, hazardous waste incinerators, sewage sludge incinerators, steel mills, foundries, and smelters. This expanded industrial output of the area was somewhat concentrated in the southeast portion of Cook County, in the Lake Calumet area. Waste management practices were altered after World War II to reduce the burden on waterways and to increasingly rely on land disposal of municipal and industrial wastes "in areas otherwise considered useless" (Colten, 1985). This shift in waste disposal practices from water bodies to sanitary landfills created new types of problems. In the mid-1980s, 31 known landfills were operating in the southeast Chicago area (Bhowmik and Fitzpatrick, 1988). Several of these have been closed, and activities are underway to investigate and remediate some of these sites.

2.2.2 Lake County, Indiana

Lake County, located in the northwest corner of Indiana, is an area "full of contrasts and dilemmas, between natural beauty and environmental degradation ..." (PAHLS, 1993). Bordered by Lake Michigan to the north and the Kankakee River to the south, Lake County's heavily industrialized areas are located in the northern part of the County, along the major waterbodies - Lake Michigan, the Grand Calumet River, and Indiana Harbor Ship Canal. Similar to Cook County, IL, the history of industrialization and pollution can be traced back more than 100 years when the first major industries, such as Standard Oil and Inland Steel, established their presence along the shore. Much of the environmental degradation of the northern portion of Lake County, IN, was associated with the expanding industrial base in the East Chicago, Hammond, Whiting, and Gary areas and the need for access to water.

Anthropogenic impacts to the environment included moving the Grand Calumet River a ½-mile south to flow straight through a cement-lined ditch. Much of the flow of the river has been associated with waste discharges from industry and municipal wastewater treatment plants. As a result of these discharges, dredging the contaminated sediments from these waterbodies in Lake County, IN, has been a historical problem (U.S. ACOE, 1996). In fact, the Indiana Harbor Ship Canal has not been dredged in 25 years by the U.S. Army Corps of Engineers (U.S. ACOE) because of controversy over how to dispose of contaminated sediments. Abandoned landfills and other hazardous wastes sites are located in Lake County, IN, including six Superfund sites. "Over $70 million has been spent to cleanup waste sites in Northwest Indiana, with another $100 million planned over the next 10 years" (PAHLS, 1993). Other problems include an estimated 16-million gallons of oil in the groundwater near the Amoco refinery in Whiting (PAHLS, 1993). Air quality in the northern Lake County, IN, area occasionally fails to meet the National Ambient Air Quality Standard (NAAQS) for ozone and particulate matter; this may be somewhat attributed to industrial emissions and motor vehicles (IDEM, 1994a).

2.3 POPULATION DENSITY

General Environmental Indicators

- Population Density
- Air Quality
- Toxic Chemicals and Hazardous Wastes
- Water Quality and Aquatic Resources
- Access to Parks
- Green Metro Index

Chicago, IL, is among the more densely populated cities in the United States, with a density of 12,183 individuals per square mile (U.S. Bureau of the Census, 1997). Population density can indicate the burden that urbanization can place on the environment. In general, higher population densities can be related to increases in energy consumption, challenges in providing drinking water, air pollution from motor vehicles, modification of wetlands and water bodies, and other man-induced threats to the environment. Table 2-1 compares the population density in Chicago to other major U.S. cities. Population density per square mile of land area was calculated for a selected number of cities in the United States. Population data were obtained from 1992 census data, while the land area data were obtained from the 1990 census data (U.S. Bureau of the Census, 1997).

2.4 AIR QUALITY

The quality of the air is an important indicator of environmental conditions and certain widespread air pollutants, such as particulate matter, ozone, and air toxics, pose serious public health risks for susceptible members of the population. The Chicago metropolitan area (and other areas of northeastern Illinois as well as Lake County, IN) has been designated by EPA as a severe nonattainment area because of high levels of ozone (CATS, 1995; IDEM, 1997a). The Lake Calumet and McCook areas of Cook County, IL, are nonattainment areas because of particulate matter (IEPA, 1995a). In addition, northern portions of Lake County, IN, are nonattainment areas for particulate matter and sulfur dioxide (IDEM, 1997a). Ground-level

Table 2-1. Population Density in Major U.S. Cities

	City	Population/Square Mile	Qualifier
1	New York, NY	23,671	Higher Density
2.	San Francisco, CA	15,610	
3.	**Chicago, IL**	**12,183**	
4.	Philadelphia, PA	11,495	
5.	Boston, MA	11,405	
6.	Miami, FL	10,309	
7.	Washington, DC	9,528	
8.	Baltimore, MD	8,985	
9.	Los Angeles, CA	7,437	
10.	Detroit, MI	7,296	
11.	Milwaukee, WI	6,420	
12.	Seattle, WA	6,198	
13.	San Jose, CA	4,676	
14.	Ann Arbor, MI	4,247	Lower Density
15.	San Diego, CA	3,546	

Source: U.S. Bureau of the Census (1997).

ozone, commonly known as smog, is harmful to human health and may cause coughing, shortness of breath, headache, and nausea, even at relatively low concentrations.

Ground-level ozone (Figure 2-5) is created by sunlight acting on emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) from a variety of sources such as cleaning products, gasoline vapors, and vehicle exhaust, and tends to be worse in the summer. Ozone problems extend well beyond Cook County, IL, and Lake County, IN, because of the unique geography and meteorology of the lakeside locations. Emissions of ozone precursors flow out over the lake, "cook" in the sunlight, and are transported back over the land as ozone. Depending on the wind patterns, the high levels of ozone can impact eastern Wisconsin, eastern Indiana, western Michigan, or the Chicago metro area.

The NAAQS for ozone is 0.120 parts per million (ppm), measured as a 1-hour average, and levels in metropolitan Chicago have exceeded the standard about 5 days/year over the last 7 years (ALAMC, 1994). Figure 2-6 displays trends in the number of ozone exceedance days for metropolitan Chicago (including Cook and other Illinois counties) from 1988 to 1994. In Cook County, the ozone standard was exceeded on 4 days during 1995 (IEPA, 1996a). Although ozone levels vary considerably due to weather conditions, levels were noticeably lower during the 1990s than in previous years, and have resulted in fewer exceedances of the standard (ALAMC, 1994). It is also useful to compare ozone exceedances in this area to the number found in other major metropolitan areas. Table 2-2 presents information on major metropolitan areas nationwide (including Chicago-Gary-Lake County, Illinois-Indiana-Wisconsin) that have failed to meet the NAAQS for ozone. All of these areas have experienced ozone exceedances; however, the Chicago area compares favorably to the southern California, Philadelphia, New York, and Baltimore metropolitan areas with respect to ozone levels (U.S. Bureau of the Census, 1997).

Lake County, IN, has been designated as a nonattainment area for ozone, and the northern portion of the County has been designated as nonattainment for particulate matter and sulfur dioxide (IDEM, 1997a). The ozone standard of 0.12 ppm was exceeded in Lake County, IN, twice in 1995 and twice in 1996 (AIRS/AQS, 1997). For both years, the highest maximum was at the same

Table 2-2. Metropolitan Areas Failing to Meet National Ambient Air Quality Standards for Ozone Average Number of Days Exceeding Standards: 1991 to 1993

Metropolitan Area	1991-93, avg.	1993[1]	Metropolitan Area	1991-93 avg.	1993[1]
Albany-Schenectady-Troy, NY	--	--	Los Angeles South Coast Air, CA[6]	104.3	97.6
Allentown-Bethlehem-Easton, PA-NJ	--	--	Manchester, NH	--	--
Altoona, PA	--	--	Manitowoc Co. WI	2.0	--
Atlanta, GA	4.2	4.3	Memphis, TN-AR-MS	0.3	1.0
Atlantic City, NJ	1.0	0.0	Miami-Fort Lauderdale, FL CMSA	--	1.0
Baltimore, MD	4.8	6.2	Milwaukee-Racine, WI CMSA	3.9	2.4
Baton Rouge, LA	1.8	3.0	Monterey Bay, CA[7]	0.4	--
Beaumont-Port Arthur, TX	2.7	0.0	Muskegon, MI	2.3	1.0
Birmingham, AL	0.7	1.0	Nashville, TN	1.1	2.1
Boston-Lawrence-Salem, MA-NH CMSA[2]	3.1	4.0	New York, NY-NJ-CT CMSA[8]	6.1	6.0
Buffalo-Niagara Falls, NY CMSA	--	--	Norfolk-Virginia Beach-Newport News, VA	1.7	3.0
Canton, OH	0.3	--	Owensboro, KY	--	--
Charleston, WV	0.3	--	Paducah, KY[4]	--	--
Charlotte-Gastonia-Rock Hill, NC-SC[3]	0.7	2.1	Parkersburg-Marietta, WV-OH	--	--
Chicago-Gary-Lake County, IL-IN-WI			Philadelphia, PA-NJ-DE-MD CMSA	10.3	5.2
CMSA	4.7	2.4	Phoenix, AZ	4.0	2.0
Cincinnati-Hamilton, OH-KY-IN CMSA	1.3	1.0	Pittsburgh-Beaver Valley, PA CMSA	0.7	--
Cleveland-Akron-Lorain, OH CMSA	1.7	--	Portland-Vancouver, OR-WA CMSA	0.7	--
Columbus, OH	0.3	--	Portland, ME	11.8	3.8
Dallas-Fort Worth, TX CMSA	1.0	2.3	Portsmouth-Dover-Rochester, NH-ME	2.2	1.1
Dayton-Springfield, OH	0.0	1.0	Poughkeepsie, NY	1.4	2.0
Detroit-Ann Arbor, MI CMSA	1.0	1.0	Providence, RI[9]	4.0	1.4
Door County, WI[4]	1.6	--	Reading, PA	0.3	--
Edmonson County, KY[4]	--	--	Reno, NV	--	--
El Paso, TX	3.7	4.1	Richmond-Petersburg, VA	1.4	3.1
Erie, PA	--	--	Sacramento, CA	9.7	3.6
Essex County, NY[4]	--	--	St. Louis, MO-IL	1.7	2.1
Evansville, IN-KY	--	--	Salt Lake City-Ogden, UT	--	--
Grand Rapids, MI	3.4	1.0	San Diego, CA	11.8	4.0
Greater Connecticut, CT[5]	7.5	6.0	San Joaquin Valley, CA	18.9	27.5
Greenbrier County, WV[4]	0.4	--	San Francisco-Bay area, CA	0.7	2.0
Hancock and Waldo Counties, ME[4]	1.3	--	Santa Barbara-Santa Maria-Lompoc, CA	1.0	--
Harrisburg-Lebanon-Carlisle, PA	0.0	--	Scranton-Wilkes-Barre, PA	0.4	--

Table 2-2. Metropolitan Areas Failing to Meet National Ambient Air Quality Standards for Ozone Average Number of Days Exceeding Standards: 1991 to 1993 (Continued)

Metropolitan Area	1991-93, avg.	1993[1]	Metropolitan Area	1991-93 avg.	1993[1]
Houston-Galveston-Brazoria, TX CMSA	6.3	10.4	Seattle-Tacoma, WA	--	--
Huntington-Ashland, WV-KY-OH	1.0	1.0	Sheboygan, WI	2.6	--
Indianapolis, IN	--	--	Smyth County, VA[4]	(NA)	(NA)
Jefferson County, NY[4]	--	--	South Bend-Mishawaka, IN	--	--
Jersey Co., IL[4]	0.7	2.0	Southeast Desert Modified AQMD, CA[10]	59.3	72.6
Johnstown, PA	--	--	Springfield, MA	4.6	6.2
Kent County and Queen Anne's Co., MD[4]	2.8	2.0	Sussex County, DE[4]	1.0	--
Kewaunee County, WI[4]	0.8	0.0	Tampa-St. Petersburg-Clearwater, FL	--	--
Knox and Lincoln counties, ME[4]	2.3	1.2	Toledo, OH	0.3	1.0
Lake Charles, LA	1.3	--	Ventura County, CA	15.9	9.0
Lancaster, PA	0.3	1.0	Walworth County, WI	0.3	--
Lewiston-Auburn, ME	0.3	--	Washington, DC-MD-VA	1.4	3.1
Lexington-Fayette, KY	--	--	York, PA	--	--
Louisville, KY-IN	2.2	2.0	Youngstown-Warren, OH[11]	0.3	1.0

-- = Zero
NA = Not Available.
1 = May represent a different monitoring location than one used to calculate average
2 = Includes also both the Worcester, MA, and New Bedford, MA, MSAs.
3 = Excludes York Co., SC.
4 = Not a metropolitan area
5 = Primarily represents Hartford-New Haven area.
6 = Primarily represents Los Angeles and Orange counties.
7 = Primarily represents Monterey, Santa Cruz, and San Benito counties.
8 = Excludes the Connecticut portion.
9 = Covers entire State of Rhode Island
10 = Represents primarily San Joaquin, Turlock, Merced, Madera, Fresno, Kings, Tulare, and Kern counties.
11 = Includes Sharon, PA

Source: U S Bureau of the Census (1997)

Figure 2.5 Ground-Level Ozone

Source: U.S. EPA, 1995.

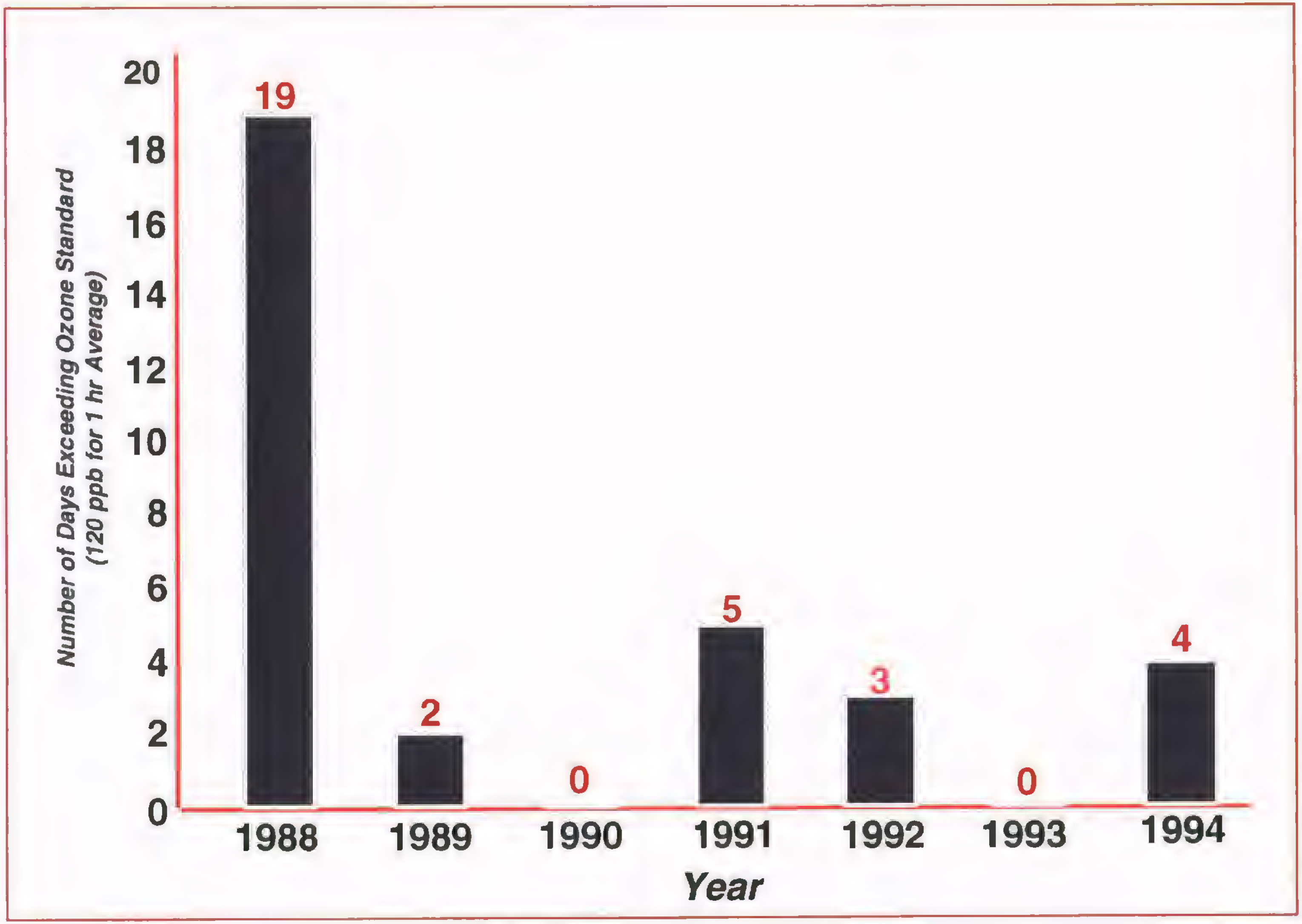


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Figure 2-6. Trends in Ozone Exceedances in Metropolitan Chicago, IL (1988 - 1994)

Source: American Lung Association of Metropolitan Chicago , 1994.

monitoring location; 1300 141st Street in Hammond (0.157 ppm in 1995 and 0.131 ppm in 1996). The second highest maximum in 1995 was 0.128 ppm at the Federal Building in Gary. The second highest maximum in 1996 was 0.122 ppm at 201 Mississippi Avenue, also in Gary. The AIRS/AQS data show that the 0.12 ppm standard was not exceeded at the Lake County, IN, monitoring stations in 1993 or 1994. Lake County, IN, recorded one exceedance in 1992 (0.131 ppm at the Hammond site).

Lake County, IN, also has the most serious particulate matter pollution in Indiana; therefore, particulate matter emissions have historically been a significant concern there. In the 1970s and 1980s, ambient levels of total suspended particulates (TSP) frequently exceeded health standards by significant margins (IDEM, 1997a). The State Implementation Plan (SIP) includes a control strategy for PM_{10} (particulate matter that is less than 10 micrometers in size) that focuses on Lake County, IN. Data indicate that PM_{10} levels have dropped significantly in recent years due to new particulate matter emissions standards and pollution prevention efforts by industry (IDEM, 1997a). The concentration of PM_{10} in ambient air in the Gary, IN, vicinity shows a downward trend from 1988 to 1995 for both parameters studied (second maximum 24-hour and weighted annual mean) in the National Air Quality and Emissions Trends Report for 1995 (U.S. EPA, 1996b). None of the data presented in this report were above the NAAQSs for PM_{10}. However, additional data (AIRS/AQS, 1997a) indicate that Lake County, IN, continues to have particulate matter air pollution problems. One monitoring station (located at 201 Mississippi Street in Gary) reported maximum 24-hour readings of 162, 157, 151, and 149 micrograms per cubic meter ($\mu g/m^3$) in 1995. The station reported 24-hour maximums below the 150 $\mu g/m^3$ standard for the other years for which data were acquired (AIRS/AQS, 1997).

2.4.1 Air Quality Rankings

NRDC's "Breath-taking" Rankings

- Chicago Metro Area Ranked #3 for Deaths and #24 for Particulate Matter Levels
- Gary-Hammond-East Chicago, IN, Ranked #66 for Deaths and #102 for Particulate Matter Levels
- Three of Top 50 "Hot Spots" for Particulate Matter Are Located in Chicago Metro Area

Air pollution, in the form of particulate matter, is of concern in the Cook County, IL, and Lake County, IN, areas as reported by the Natural Resources Defense Council (NRDC, 1996). In the report, "Breath-taking: Premature Mortality Due to Particulate Air Pollution in 239 American Cities," NRDC (1996) ranked the Chicago metropolitan area third in terms of deaths attributable to particulate matter. From NRDC's analysis, approximately 3,479 premature deaths each year by cardiopulmonary diseases could be linked to levels of particulate matter (NRDC, 1996). With respect to particulate matter levels, Chicago's average annual mean PM_{10} concentration of 33.7 $\mu g/m^3$ was ranked #24 nationwide. Within the Chicago metropolitan area, three specific monitoring stations "hot spots" were reported among the 50 highest average annual mean PM_{10} concentrations for the Nation (NRDC, 1996).

Similar data were reported by NRDC (1996) for Gary-Hamond-East Chicago, IN, with an overall ranking of #66 of the 239 metropolitan areas nationwide for number of deaths attributable to particulate matter. The ranking for this area (including Lake and Porter Counties, IN) according to average annual mean PM_{10} concentration (27.4 $\mu g/m^3$) was #102. No individual monitoring stations in the Gary-Hamond-East Chicago metropolitan area were among the top 50 "hot spots" nationwide for particulate matter (NRDC, 1996).

Table 2-3 presents air quality rankings reported by World Resources Institute (1993) for selected metropolitan areas, based on EPA's Pollutant Standard Index (PSI). EPA generates this index by taking into account daily monitoring of sulfur dioxide, nitrogen oxides, particulate matter, carbon dioxide, and ozone. PSI levels above 100 are characterized as unhealthful. The Chicago

Table 2-3. Air Quality in Select Metro Areas[a]

Metro Area	Average PSI	Metro Area	Average PSI
Honolulu	15	Tulsa	42
San Francisco-Oakland	20	Detroit	43
Kansas City	28	Grand Rapids	43
Washington, DC	32	Dallas-Ft. Worth	43
Pittsburgh	32	Milwaukee	44
Scranton	33	Las Vegas	44
Chicago	**33**	St. Louis	45
Louisville	33	Toledo	45
Albany	33	New York	46
Rochester	34	Columbus	46
Allentown	34	Jacksonville	46
Cleveland	35	Tampa-St. Petersburg	46
Harrisburg	35	Atlanta	47
Providence	35	Baton Rouge	47
Salt Lake City	36	El Paso	48
New Haven	36	Phoenix	48
Nashville	37	Memphis	49
Omaha	37	Tucson	49
Austin	38	Indianapolis	49
New Orleans	38	Bakersfield	51
Denver	39	Sacramento	51
Baltimore	39	Knoxville	52
Philadelphia	39	Charlotte	54
Worcester	39	San Diego	54
San Antonio	39	Houston	56
Cincinnati	40	Raleigh-Durham	56
Oklahoma City	41	Fresno	56
Dayton	42	Los Angeles	73
Orlando	42		

[a] EPA Aeromatic Information Retrieval System, Pollutant Standard Index (PSI) Summary, 1990.

Source World Resources Institute (1993).

metropolitan area's average PSI of 33 indicated relatively good air quality when compared to many other cities nationwide.

2.4.2 Air Pollution Impacts

One adverse effect of air pollution is its contribution to respiratory illness, especially exacerbating asthma. Children are of particular concern for air pollution's effects on asthma, partially because they spend more time outside and breathe more air relative to their size, than do adults. Also, children's lungs are still developing their defense mechanisms and may be more susceptible than adults to the effects of air pollution. Table 2-4 presents data on the number of asthmatics in Cook County, IL, and Lake County, IN, as estimated by the American Lung Association (ALA, 1996a). As a result of high levels of ozone and acidic air pollution in the summer months, about 2,000 asthma hospitalizations are believed to be associated with average summertime conditions in metropolitan Chicago. On particularly hot days (with peak pollution levels), as much as 24 to 50 percent of the respiratory hospital admissions may be linked to air pollution (ALAMC, 1994). Furthermore, a study of asthma in Chicago from 1980 to 1988 estimated that the mortality rate (16.42 deaths/million for those aged 5-34 years) was about three times greater than that for the U.S. population (Health Effects Review, 1996). A similar study found a 337 percent increase in the mortality rates for African-Americans aged 5 to 34 years in Chicago from 1968 to 1991 (Health Effects Review, 1996).

2.4.3 Sources of Air Pollution

Major air pollution sources include motor vehicles, industry, and many others. Ozone is an air pollutant that is of particular concern, and motor vehicles appear to be major contributors, both in Cook County, IL, and Lake County, IN. The Chicago Area Transportation Study (1995) concluded that mobile sources contribute more than 50 percent of the VOCs and about 70 percent of the NO_x that are precursors for ozone (Figure 2-7). Stationary "point" sources, such as power plants and other industrial facilities, are estimated to account for about 28 percent of the ozone precursor emissions, while small businesses (dry cleaners, paint shops, etc.) contribute much of the balance of VOC and NO_x emissions in the Chicago metropolitan area (CATS, 1995).

Table 2-4. Number of Asthmatics in Cook County, IL, and Lake County, IN

County	Number of Adult Asthmatics	Number of Pediatric Asthmatics
Cook County, IL	167,569	96,199
Lake County, IN	15,787	8,831

Source: American Lung Association, 1996a.

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Figure 2-7. Motor Vehicle Emissions in Chicago Metro Area

Source: CATS, 1995.

For Lake County, IN, the Indiana Department of Environmental Management (IDEM, 1994a) estimated the relative contribution of ozone precursors from various sources. For VOCs, the relative contribution from these sources was reported for 1990 as: motor vehicles (about 36 percent), non-road mobile sources (about 7 percent), industrial point sources (about 37 percent), and area sources (about 20 percent). Figure 2-8 graphically displays this information.

The high level of motor vehicle usage is one explanation for the Chicago metro area's ozone problems. It should be noted that Interstate 80/94 (the Borman Expressway) has the highest traffic volume of any road in Indiana and is the fifth most traveled truck route in the Nation, carrying more than 150,000 vehicles per day (IDOT, 1997). One indicator of the burden that automobile emissions may place on the environment is the percentage of single-occupant vehicles used in commuting to work. More than 3-million people in the Chicago metropolitan area travel to work in privately-owned vehicles (DOT, 1993). Single-occupant vehicles account for more than 67 percent of commuters, almost 12 percent carpool, and about 14 percent use mass transit (bus/subway/rail) according to the U.S. Department of Transportation's (DOT) Bureau of Transportation Statistics (DOT, 1993). Figure 2-9 compares the average number of single-occupant vehicle users in the Chicago metropolitan area to those in other major U.S. metropolitan areas. Within Cook County, IL, 61 percent are single-occupant vehicles, 13 percent carpool, and almost 20 percent take public transportation (U.S. Bureau of the Census, 1990a). However, mass transit usage in the Chicago area is among the highest in the Nation (Table 2-5) as reported by World Resources Institute (1993).

2.4.4 Trends in Air Emissions

Environmental trends reported by the Illinois Department of Energy and Natural Resources (IDENR, 1994a) for Cook County show an overall decrease in air emissions from manufacturing operations over the 1973 to 1989 timeframe (Figure 2-10). Specifically, in Cook County:

- Particulate emissions decreased 93 percent.
- Sulfur oxide emissions decreased about 75 percent.
- Nitrogen oxide emissions decreased about 75 percent.

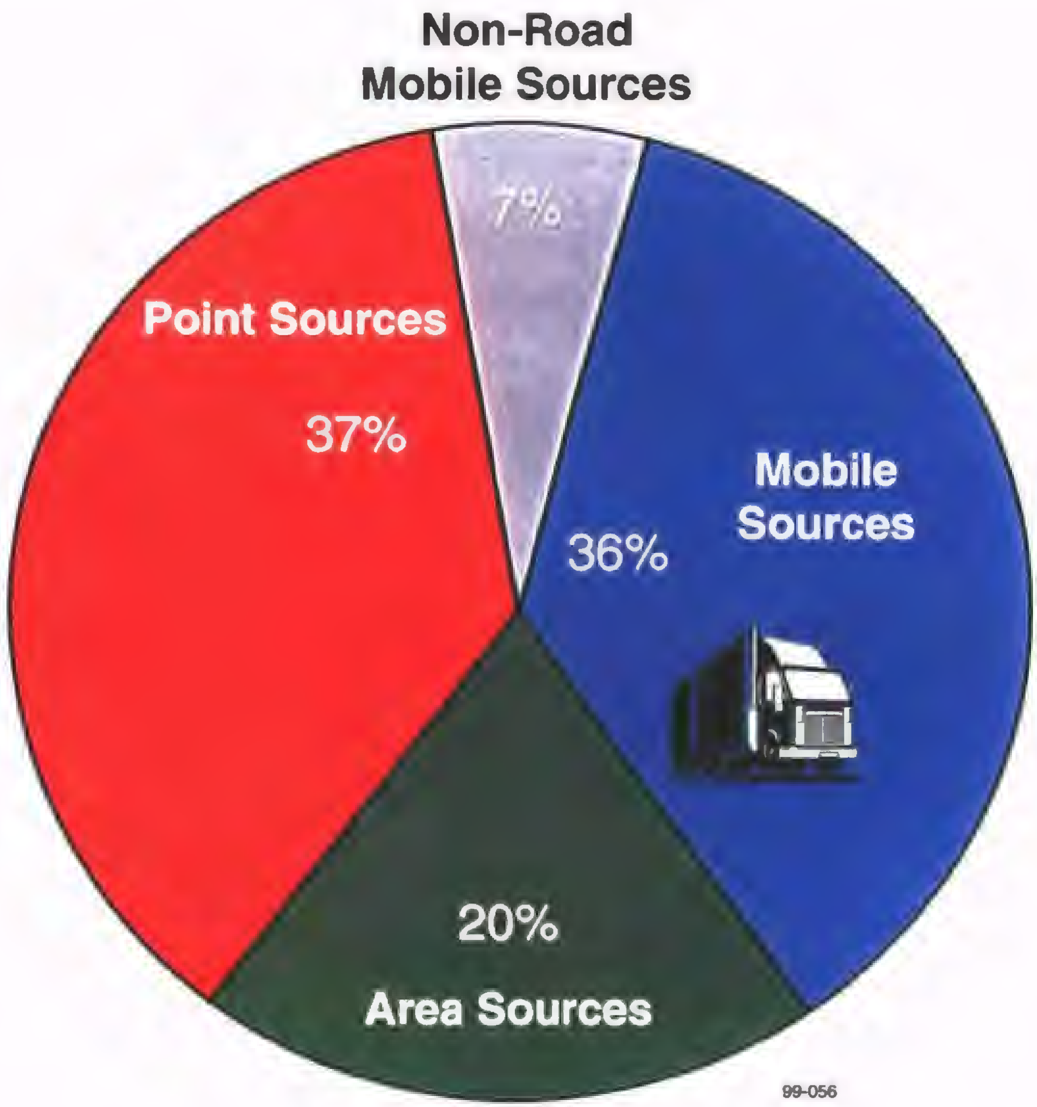

Figure 2-8. Emissions of Ozone Precursors (VOCs) in Lake County, IN

Source: IDEM, 1994a.

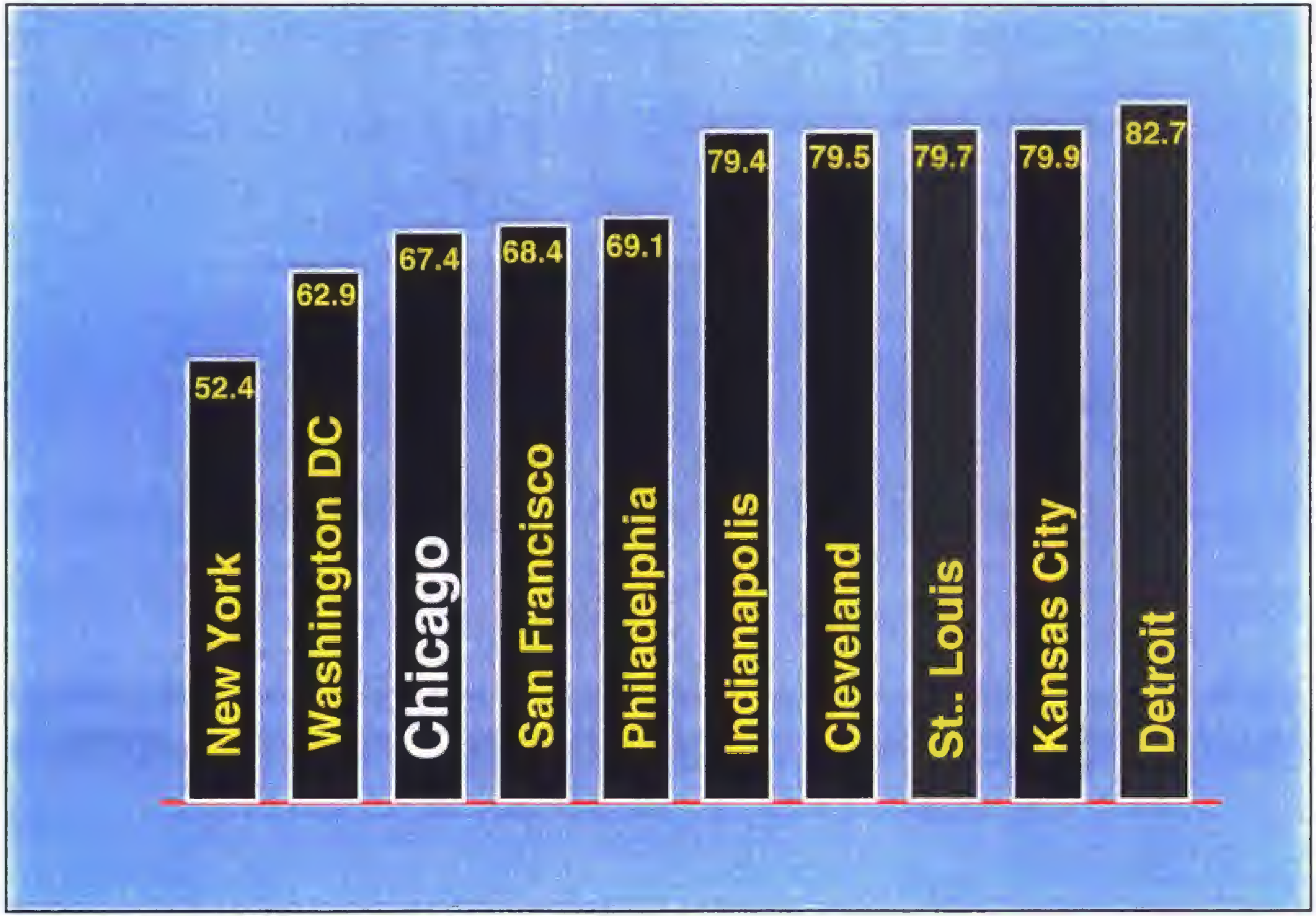

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Figure 2-9. Average Number of Single-Occupant Vehicle Users in Major Metropolitan Areas Nationwide

Source: DOT, 1993.

Table 2-5. Mass Transit Passenger Miles

Metro Area	Thousand Miles Per Year (per capita)	Qualifier
New York	1.0141	Higher Usage
Washington, DC	0.5934	(desirable)
Chicago	**0.5566**	
San Francisco-Oakland	0.4648	
Atlanta	0.3919	
Seattle-Tacoma	0.3477	
Philadelphia	0.2992	
Pittsburgh	0.2239	
Los Angeles	0.2154	
Houston	0.1986	
New Orleans	0.1898	
Miami	0.1539	
Denver	0.1520	
Minneapolis-St. Paul	0.1498	
Cleveland	0.1226	
Cincinnati	0.1128	
Dayton	0.1006	
Dallas-Ft. Worth	0.0994	
Detroit	0.0885	
Buffalo	0.0849	
Phoenix	0.0758	
Las Vegas	0.0731	
Tampa-St. Petersburg	0.0676	
Orlando	0.0664	
Norfolk	0.0588	
Harrisburg	0.0386	
Knoxville	0.0338	
Raleigh-Durham	0.0297	
Oklahoma City	0.0199	Lower Usage
Greensboro	0.0022	(less desirable)

Source: World Resources Institute (1993).

Decrease in Air Emissions in Cook County, IL from 1973 to 1989

- **Particulate Emissions Decreased 93%**
- **Sulfur Oxide Emissions Decreased 75%**
- **Nitrogen Oxide Emissions Decreased 75%**
- **Hydrocarbon Emissions Decreased 50%**

Figure 2-10. Decrease in Air Emissions in Cook County, IL from 1973 to 1989

99-056

Source: IDENR, 1994.

- Hydrocarbon emissions decreased almost 50 percent.
- Carbon monoxide emissions increased slightly.

With respect to trends in air emissions from transportation, IDENR (1994a) reported that VOC emissions in Cook County decreased about 20 percent from 1973-1981 and almost 35 percent from 1982 to 1991. Reductions of about 18 percent in NO_x and about 33 percent in carbon monoxide emissions were realized in Cook County from 1982 to 1991 (IDENR, 1994a).

2.5 TOXIC CHEMICALS AND HAZARDOUS WASTES

Other sources of pollution, including releases of toxic chemicals and hazardous wastes, can be potentially degrading to environmental conditions. Table 2-6 presents information on the amounts of toxic pollutants released in major U.S. metropolitan areas. The Chicago metropolitan area has one of the highest amounts of toxic chemicals released in the United States, based on the EPA TRI as reported by World Resources Institute (1993). TRI data for 1994 include information on emissions/releases from 573 facilities in Cook County, IL, and 50 facilities in Lake County, IN. Total emissions/releases/transfers for Cook County amount to more than 72-million pounds compared to Lake County's 55-million pounds. (More detailed information on TRI data can be found in Section 3.3 of this report.)

Toxic chemical emissions were examined by the Illinois Environmental Protection Agency (IEPA, 1995a) for the 1993 reporting year, and 9 of the top 20 ZIP Codes in the State (by total air emissions) were located in Cook County, IL. Similarly, IEPA (1995a) found that 7 of the top 20 ZIP Codes emitting to air for 1988-1993 were located in Cook County, IL. The specific ZIP Codes identified in these rankings were 60501, 60638, 60633, 60617, 60525, 60160, 60439, 60455, 60632, 60658, and 60131. IEPA's analysis of the TRI data also found that several of these ZIP Codes in Cook County, IL, ranked in the top 20 statewide for the largest air emissions of chemicals with significant human health effects (IEPA, 1995a).

Southeast Chicago contains a large number of waste sites that are potential sources of environmental contamination as determined by the Agency for Toxic Substances and Disease

Table 2-6. Toxic Chemical Releases and Transfers in Major U.S. Metropolitan Areas

Metro Area	Amount[a] (pounds per year)	Qualifier
West Palm Beach	943,459	Smaller Releases/Transfers (desirable)
Fresno	1,054,243	
Washington, DC (metro area)	1,107,218	
Tucson	1,235,512	
El Paso	1,517,720	
Little Rock	2,826,267	
Raleigh-Durham	4,034,662	
San Antonio	4,036,402	
Oklahoma City	4,269,395	
Miami	4,822,142	
San Diego	6,089,986	
Denver	6,617,837	
Tampa-St. Petersburg	7,171,038	
Hartford	7,389,714	
Phoenix	7,473,876	
Norfolk	7,634,531	
Omaha	9,564,863	
Jacksonville	9,690,225	
Portland	10,976,256	
Atlanta	12,915,673	
Kansas City	14,031,849	
Baltimore	14,997,426	
Dallas-Ft. Worth	16,669,699	
Seattle-Tacoma	17,185,029	
Boston	17,491,237	
Louisville	19,321,492	
San Francisco-Oakland	19,521,589	
Columbus	20,520,317	
Grand Rapids	21,833,254	
Charlotte	21,833,254	
Minneapolis-St. Paul	24,813,330	
Pittsburgh	30,689,769	
Richmond	34,410,782	
Cleveland	44,822,133	
Philadelphia	72,824,789	
St. Louis	83,949,520	
Detroit	85,046,048	
Los Angeles	90,368,911	
Salt Lake City	10,789,489	
New York	144,773,930	
Chicago	162,833,008	
New Orleans	186,704,887	Larger Releases/Transfers
Houston	264,880,496	(less desirable)

[a] Based on Toxic Release Inventory (TRIS) as of March 22, 1992.

Source World Resources Institute (1993)

Registry (ATSDR) and reported in Fowler (1993). ATSDR developed a hazardous substance data base (HSDB) to study relationships between exposures to hazardous substances and the occurrences of cancer, deaths, birth defects, and other health issues (Fowler et al, 1993). About 750 facilities were identified by Fowler et, al (1993), most are located in industrial areas around Lake Calumet and along the Little Calumet River. These include hazardous waste management facilities, waste transporters, and abandoned industrial sites. Several Superfund sites are located in Lake County, IN, and one NPL (Lenz Oil) and numerous hazardous waste sites exist in Cook County, IL (Table 2-7).

2.6 WATER QUALITY AND AQUATIC RESOURCES

2.6.1 Cook County, Illinois

The water resources of Cook County, IL, have shown signs of improvement after being stressed by more than a century of industrial and urban development. This area has been subjected to some of the most intense industrial activities in the United States (Bhowmik and Fitzpatrick, 1988). The flow patterns in the Chicago area have been altered, and about 20 percent of the original Lake Calumet have been filled for use as a municipal waste disposal site for the City of Chicago. Water quality in streams and lakes of the Great Lakes/Calumet watersheds of Illinois (an area larger than Cook County) have been stressed by nutrients, metals, and low dissolved oxygen attributed to municipal point source pollution, urban runoff, and other causes (IEPA, 1997a). As part of the Illinois 305(b) water quality assessment, IEPA (1997a) rated these water resources as "good" on only 9 percent, "fair" on 81 percent, and "poor" on 10 percent of the stream miles.

Following the dredging of the mouth of the Calumet River in the 1870s, the potential development of a harbor and the existence of open lands attracted many industries to the region. Hundreds of acres of land were built up by dumping steel mill slag, dredge spoil, and other solid wastes in order to improve industrial sites. During this time period, liquid wastes were discharged directly into nearby bodies of water. Early concerns over sewage and waste disposal centered on biological waste and the known link between diseases and contaminated water supplies (Bhowmik and Fitzpatrick, 1988). In the 1920s, efforts were made to divert the polluted Calumet and Chicago

Table 2-7. Superfund and Major Hazardous Waste Sites in Lake County, IN, and Cook County, IL*

Lake County, IN

Site	Nature of Contamination/Pollutants
Ninth Avenue Dump (NPL Site)	Liquid hazardous waste (VOCs, benzene, toluene, xylenes, PAHs, metals, PCBs).
Midwest Industrial Waste Disposal Company (MIDCO) II (NPL Site)	Bulk liquid and drum storage of waste (estimated 50,000 to 60,000 drums).
Midwest Solvent Recovery Company (MIDCO) I (NPL Site)	Estimated 14,000 drums of solvent, pesticide, and PCB wastes.
Lake Sandy Jo (M&M Landfill) (CERCLIS Site)	Landfill for construction, municipal, and industrial wastes, and drums. Contamination included heavy metals, solvents, PCBs, and pesticides.
American Chemical Service Inc. (NPL Site)	Solvent - reclamation and chemical manufacturing facility. Groundwater contaminated with VOCs, PCBs, and phthalates, and 35,000 buried drums of sludges and underground wastes.
U.S. Smelter and Lead Refinery, Inc. (CERCLIS Site)	Proposed for NPL. Blast furnace slag. Lead containing dust and various metals.

Cook County, IL

Site	Nature of Contamination/Pollutants
Album Inc. (CERCLIS Site)	Incinerator drums, lagoon.
Pullman Sewage Farm (CERCLIS Site)	Landfarming of industrial and municipal sewage.
Estech General Chemical (AKA G&M Wrecking) (CERCLIS Site)	Sulfuric acid, fertilizer, and pesticides production.
US Drum Disposal Corporation (AKA US Drum II)(CERCLIS Site)	Municipal and industrial waste, drums, assorted sludge, and liquid hazardous waste.
Land & Lakes #3 (CERCLIS Site)	Solid, liquid, and industrial wastewater treatment sludge wastes.

Table 2-7. Superfund and Major Hazardous Waste Sites in Lake County, IN, and Cook County, IL* (continued)

Site	Nature of Contamination/Pollutants
Land & Lakes #2 previously (AKA Cottage Grove Landfill) (CERCLIS Site)	Solid, sludges, and liquid from municipal, industrial, and commercial sources, including sludge from Metropolitan Sanitation District of Greater Chicago (MSDGC) and river bottom dredging from the Indiana Harbor Canal.
Cosden Oil & Chemical Company (CERCLIS Site)	Facility manufactured chemicals and plastics.
Cottage Grove Landfill (CERCLIS Site)	Hazardous waste, sludge from unlinded lagoon.
MSD #4 Sludge and Barrel Dump (CERCLIS Site)	Facility is active and operates under permit. Receives municipal sludge generated by MWRDGC, dries the sludge, and transports it to CID Landfill.
Paxton Landfill/LHL #2 (CERCLIS Site)	Several landfills. Accepted general refuse industrial wastes.
Lenz Oil Service, Inc. (NPL Site)	Solvent storage and transfer facility. Groundwater and soils contaminated with various VOCs, PAHs, PCBs, and inorganics.

* Only one NPL site exists in Cook County, IL, the other sites are significant hazardous waste sites that have received more extensive investigation and/or remediation.
AKA = Also Known As

Source: U.S. EPA, 1995a,b.

Rivers away from Lake Michigan (Colten, 1985). Little attention was given toward health effects of industrial chemicals discharged into the rivers and lakes of the region until years later when the passage of the Clean Water Act and court cases "forced industries to halt untreated discharges in the late 70s" (Colten, 1985).

Sediments in most of the waterbodies in the area, including Lake Calumet and the Calumet River, are known to have elevated levels of metals and organic chemicals. A recent study of Lake Calumet sediments found toxic concentrations of lead, cadmium, chromium, and mercury (Ross et al, 1988). The streams of the Calumet area are believed to be "grossly polluted with fecal contamination," oily waste, pickle liquors, ammonia, cyanide, and phenolic materials (Bhowmik and Fitzpatrick, 1988). Bottom sediments of the Little Calumet and Calumet Rivers are "composed of ooze and organic debris, with strong sewage and petroleum odors" (Bhowmik and Fitzpatrick, 1988).

Recent data on the water quality of the rivers of the region show an improvement over the past 30 years. Industrial discharges from point sources are being regulated. Much of the commercial and industrial wastewaters are being treated by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). In past decades, sewer overflows occurred approximately 100 times a year (City of Chicago), and accounted for 45 percent of the total pollutants delivered to the rivers of the area (Bhowmik and Fitzpatrick, 1988). During storm events, the combined sewer system (which handles both sanitary and stormwaters) were overloaded; in order to prevent sewage backup into homes and businesses, raw sewage flowed into the Calumet and Grand Calumet Rivers. Sewer overflows combined with stormwater during rain events. These used to cause overflows into waterbodies, and the Calumet River would "back up" and discharge pollutants directly into Lake Michigan on a fairly regular basis. During very intense rainfall, the controlling locks at the O'Brien Lock and Dam on the Calumet River were opened to prevent flooding in the Little Calumet and Grand Calumet areas, causing these rivers to reverse flow and discharge their untreated sewage into the Calumet River and then into Lake Michigan (Bhowmik and Fitzpatrick, 1988). The efforts under the Tunnel and Reservoir Plan (TARP) have succeeded in reducing this problem. More discussion of the TARP is included in Sections 3 and 4.

2.6.2 Lake County, Indiana

Water Quality in Lake County, IN

- Grand Calumet River and Indiana Harbor Ship Canal are Areas of Concern
- Major Municipal and Industrial Point Source Discharges
- Contaminated Sediments

Water quality and aquatic resources in Lake County, IN, also have persistent problems, many of which can be attributed to municipal and industrial wastewater discharges, combined sewer overflows, and spills, as well as nonpoint source runoff. The Grand Calumet River and Indiana Harbor Ship Canal (GCR/IHSC) were designated as one of the 43 Areas of Concern (AOC) in the Great Lakes, but it was the only one with all 14 beneficial uses impaired (IDEM, 1997a).

The majority of the Grand Calumet River's flow is formed by the effluents from industrial and municipal sources including sewage treatment plants in Gary, Hammond, East Chicago, and Whiting, as well as industrial sources such as USX Gary Works, Inland Steel, and LTV Steel (U.S. EPA, 1994a). Flow in the East Branch of the river is dominated by USX Gary Works and in the West Branch by the Hammond Sewage Treatment Plant and the East Chicago Sanitary District (HydroQual, 1985). The West Branch, from the East Chicago and Hammond areas, flows to the west depending on wind speed, inputs from other sources, and Lake Michigan's conditions (HydroQual, 1985). The remainder of the West Branch flows east to the Indiana Harbor Ship Canal and to Lake Michigan. The Indiana Harbor Ship Canal was created in 1901 when Inland Steel financed its construction to improve shipping capacity to Lake Michigan (Ketcham and Kunchakarra, 1992). The Harbor Canal connects the Grand Calumet River to Lake Michigan, but it has not been dredged since 1972 because of the highly-contaminated sediments. Previously, dredged spoils were disposed in open waters of Lake Michigan, but this practice was halted (U.S. EPA, 1994a). Efforts have been underway to find a solution to the disposal problem so the harbor can be dredged.

Recent monitoring of the GCR/IHSC found water quality violations for cyanide, as well as for E. coli bacteria, where the criterion was exceeded about 86 percent of the time at all seven monitoring stations (IDEM, 1997a). Combined sewer overflows are of concern, and, for example, 95 percent of the storm sewers in Gary, IN, are believed to be combined sewers (Ketcham and Kunchakarra, 1992). Overall, both the East and West Branches of the Grand Calumet River, as well as the Indiana Harbor Ship Canal, have been designated as nonsupporting for aquatic life and recreational use (IDEM, 1994b). The presence of metals, polychlorinated biphenyls (PCBs), pesticides, ammonia, and other contaminants are probable causes.

Sediments in the GCR/IHSC are similarly impacted from years of contamination with concentrations several orders of magnitude higher than in the water column. Sediment monitoring data have identified a variety of contaminants including metals, polycyclic aromatic hydrocarbons (PAHs), PCBs, DDT, and others (IDEM, 1997a). Similarly, fish tissue from these waters contain PCBs, mercury, pesticides, and other contaminants at levels of concern. The most stringent fish consumption advisories ("Do Not Eat") have been issued by the Indiana State Department of Health for all species in the GCR/IHSC because of the presence of these contaminants.

2.7 LAKE MICHIGAN

Lake Michigan is part of the largest body of freshwater in the world, the Great Lakes. The Great Lakes also support the largest freshwater fishery in the world, despite their degradation from more than a century of overfishing, dumping of sewage, and contamination with synthetic chemicals (Environment Canada, 1991a,b). As early as the 1960s, the impacts of contamination of the Great Lakes were manifested as fish consumption advisories, reproductive effects in waterfowl, and other degradation. Much of the early focus of States, Provinces, and Federal governments was on the more toxic, persistent chemicals such as PCBs, organochlorine pesticides (such as DDT), and heavy metals (such as mercury). Some of these chlorinated compounds (e.g., DDT and chlordane) were used extensively in the Great Lakes region for decades; their use peaked in the 1960s, and several were subsequently banned in the 1970s and 1980s due to their effects on human health and the environment. Levels of these chemicals in the Great Lakes have declined dramatically in the water, sediments, and biota since the early 1970s, some by more than 90 percent. However, some of the more persistent contaminants (PCBs, dioxins, mercury) are still present at unacceptably high concentrations in certain fish species (Tremblay and Gilman, 1995). There is renewed interest in many of these chemicals because they are believed to be endocrine disruptors, and may produce toxic effects even at extremely low concentrations (IEPA, 1997b). By the 1980s, scientists had identified the presence of more than 800 chemicals in the Great Lakes basin (Tremblay and Gilman, 1995).

2.7.1 Sources of Exposure Related to Lake Michigan

The Lake is an important resource to the citizens of the Chicago area, providing transportation, recreation, aesthetic, and other benefits. It is the source of drinking water for more than 95 percent of the population in the two counties. In general, the water quality of Lake Michigan in the study area is good; having been the recipient of more than 20 years of effort to improve its condition. However, the lake still has problems from over a century of environmental stresses from fishing, dumping of sewage, and contamination with chemicals.

Residents of Cook County, IL, and Lake County, IN, can be potentially exposed to these toxic chemicals that are present in the water column, sediments, and biota of Lake Michigan. Such exposures could occur from swimming/wading, or consuming fish and drinking water taken from the Lake. For the Great Lakes area, food chain exposure is estimated to account for about 80-90 percent of exposure to organochlorine compounds; some exposure comes from air, and less than 1 percent comes from water (Hicks, 1996). Actual exposures depend on behavior/activity patterns, location, etc., but in general, subpopulations at greatest risk include:

- Pregnant Women;
- Nursing Mothers;
- Fetuses and Nursing Infants;
- The Elderly;
- Infants and Children;
- The Chronically Ill;
- Native Americans;
- Sport Fishermen; and
- Urban Poor.

Several studies conducted specifically on sport anglers found higher levels of PCBs in sport fishermen than in the general population. Health effects have also been observed in children of mothers who consumed fish from the Great Lakes. Some of the effects on newborn infants include lower birthweight and head circumference (Hicks, 1996).

2.7.2 PCBs and Lake Michigan

One concern about Lake Michigan (and the Great Lakes as a whole) has been the presence of PCBs in the water column, sediments, and biota and its resulting impacts to ecological and human health. Despite the fact that manufacture was banned, and use of PCBs has declined substantially since the TSCA was passed in 1976, levels of PCBs persist in Lake Michigan (U.S. EPA, 1994b). While local and regional efforts in the 1970s successfully reduced dumping into the Lakes, these contaminants are still present because of their persistence. In fact, PCBs levels frequently exceed water quality standards in the Great Lakes. Long-range atmospheric transport and deposition of PCBs continue to provide about 58 percent of loadings of PCBs to Lake Michigan (Environment Canada, 1991a,b). Such atmospheric deposition comes from sources on national and global scales. Specifically, the inputs of selected toxic chemicals to Lake Michigan from atmospheric deposition are presented in Table 2-8. Surprising, however, is the fact that Lake Michigan is a "net source" of PCBs due to volatilization of PCBs from the water column to the air. The rate and magnitude of volatilization from Lake Michigan to the atmosphere often exceeds the rate of deposition, depending on season and location (temperature/wind direction) (U.S. EPA, 1994b; Baker et al, 1993).

2.8 LEAD

Lead is of particular concern in the Chicago area. In 1996, more than 12,800 children were found to suffer from elevated blood-lead levels (≥ 15 micrograms per deciliter (μg/dL)) (IDPH, 1997). Chicago accounts for 72 percent of the children State-wide with dangerous levels of lead. In

Blood-Lead Levels in Children

- 13,500 Children in Cook County, IL, Have Elevated Blood-Lead Levels (above 15 μg/dL)
- 2,100 Children in Lake County, IN, Have Blood-Lead Levels Above CDC's Level of Concern (10 μg/dL)

Table 2-8. Chemical Loadings to Lake Michigan and Percentage Attributable to Atmospheric Sources

Chemical	Total Loading (kg/yr)	% Attributable to Atmospheric Deposition
PCBs	685	58
DDT	65	98
Benzo(a)pyrene	208	86
Lead	543	99

kg/yr - kilograms per year

Source: Environment Canada, 1991a, b.

Cook County, IL, almost 13,500 children have blood-lead levels above 15 $\mu g/dL$. Babies and children show a greater sensitivity to lead's effects than adults. Studies have shown that even small amounts of lead can slow mental development, lower intelligence, and cause behavioral disorders in young children. Evidence also suggests that the potential for multimedia exposure to lead from emissions and discharges is higher in Chicago than anywhere else in the Nation (SAIC, 1995a). In 1995, every ZIP Code in Chicago was designated a high risk ZIP Code for lead poisoning (Fornoff, 1997b). Most lead-poisoned children are exposed to lead in their homes, primarily because of the presence of lead paint dust. Chicago has some of the oldest housing stock in the Nation; the average house in Chicago was built between 1943 and 1955.

The Indiana Childhood Lead Poisoning Prevention Program has a voluntary blood-lead monitoring program in Lake County, IN, to screen for lead poisoning in children. Specifically, of the 12,604 children screened in Lake County during fiscal years 1994-96, about 17 percent had blood lead levels that exceeded the CDC's level of concern ($\geq 10\mu g/dL$) (Nordholm, 1997). About 1,350 black children (11 percent) and about 275 white children (1 percent) had blood-lead levels above this concentration (Nordholm, 1997).

The primary sources of exposure are leaded paint, soil, and drinking water (Figure 2-11). Although inhalation of lead from gasoline is no longer considered a public health problem, the lead from dust in automobiles emissions has been deposited in the soil. Children playing near highways may come in contact with contaminated soil. Children are vulnerable to exposure because they may place objects coated with lead dust in their mouths or eat lead paint chips. Nationally, blood-lead levels for both children and adults have been dropping since the 1970s largely due to the reduction of lead levels in gasoline. While this can be considered a major achievement in the field of environmental health, U.S. Department of Health and Human Services Secretary, Donna E. Shalala states that "a significant number of children are still at risk for high lead exposure, and we have to finish the job on their behalf" (DHHS, 1997).

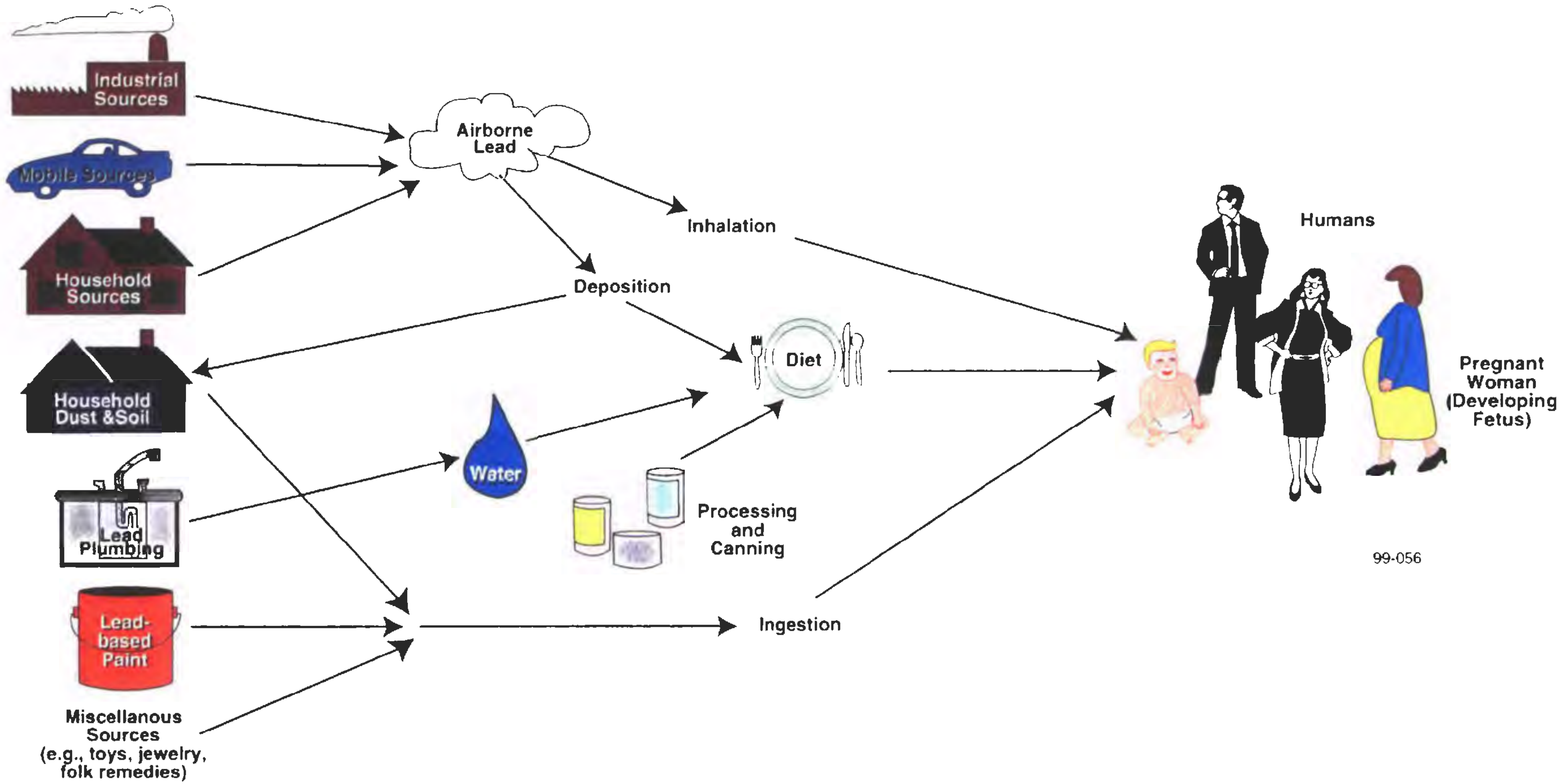

Figure 2-11. Example of How One May Be Exposed to Lead

2-13 lead exposure

2.9 ACCESS TO PARKS

A desirable quality of the environment is access to nature and parks. While Chicago is a predominately urban area, more than 10 percent of its land area are parkland, among the highest in the Nation for cities of its size (World Resources Institute, 1993). Table 2-9 presents data on urban parkland in various U.S. cities. These parklands support wildlife, as well as recreational use by residents. About 14 percent of the area of Cook County, IL, are devoted to parklands/open space (NIPC, 1990).

2.10 GREEN METRO INDEX

Green Metro Index

Chicago Ranks #25 in the United States
(1=best, 75=worst)

Average Air Quality:	5
Acute Air Quality:	1
Water Quality Violations:	1
Toxic Releases:	72
Superfund Sites:	19
Mass Transit Use:	4
Residential Energy Use:	41
Gasoline Price:	3
Electricity Price:	7
SCORE	17.00

One overall indicator of environmental health is available. The Green Metro Index is an environmental ranking system for 75 major metro areas compiled by World Resources Institute (1993). This index combines eight measures of environmental quality such as the average air quality, acute air quality, water quality violations, toxic releases, Superfund sites, mass transit use, residential energy use, and gasoline and electricity prices. Chicago's position (#25) in the top third of this list (Table 2-10) suggests that its environmental-related conditions are somewhat better than major cities/metropolitan areas in the United States with respect to this particular indicator (World Resources Institute, 1993). According to the Green Metro Index, environmental conditions are moderate; however, this equally weights all eight measures. Because Cook County, IL, only has one Superfund site, the Green Metro index may overestimate the environmental quality of this area.

Table 2-9. Access to Nature (Urban Parkland) in U.S. Cities

City	Parkland (percent of area)	Qualifier
Honolulu	40.68	More Parkland
Washington, DC	20.60	(desirable)
Minneapolis	17.30	
Tulsa	14.00	
St. Paul	12.00	
El Paso	11.70	
Buffalo	11.50	
Portland	11.00	
Chicago	**10.50**	
Seattle	10.00	
Omaha	9.80	
Dallas	9.00	
Cincinnati	9.00	
Pittsburgh	7.30	
Virginia Beach	7.10	
Oakland	7.00	
Austin	6.80	
Wichita	5.99	
Columbus	5.80	
Los Angeles	5.30	
Toledo	5.30	
Miami	5.10	
Indianapolis	5.00	
Newark	5.00	
Ft. Worth	4.70	
Denver	4.00	
Oklahoma City	4.00	
New Orleans	3.60	
Birmingham	3.00	
Tucson	2.91	
Fresno	1.56	
Milwaukee	1.00	
Kansas City	0.05	Less Parkland
Jacksonville	0.01	(less desirable)

Source· World Resources Institute (1993).

Table 2-10. Green Metro Index for 75 Metro Areas

Metro Area	Rank[a]	Rank Score	Metro Area	Rank	Rank Score
Honolulu	1	4.75	New York	39	18.88
San Diego	2	9.78	Dayton	40	19.00
San Francisco-Oakland	3	10.78	Allentown	41	19.29
El Paso	3	10.78	Los Angeles	42	19.56
Washington	5	11.44	Salt Lake City	43	19.63
Austin	6	12.14	Cincinnati	44	19.67
Fresno	7	12.75	Portland	45	19.86
New Bedford	8	13.00	Charlotte	46	10.00
Tuscon	9	13.29	Raleigh-Durham	47	20.14
New Haven	10	13.57	Syracuse	48	20.20
Rochester	11	13.71	Louisville	49	20.56
San Antonio	12	13.88	West Palm Beach	50	20.60
Bakersfield	13	14.29	Dallas-Ft. Worth	51	21.00
Pittsburgh	14	14.44	Houston	52	21.22
Miami	15	14.86	Oklahoma City	53	21.33
Atlanta	16	15.11	Nashville	54	22.44
Boston	17	15.13	Omaha	54	22.44
Albany	18	15.25	Knoxville	56	23.00
Toledo	19	15.88	Norfolk	57	23.00
Baltimore	20	16.11	Milwaukee	58	23.22
Sacramento	21	16.22	Seattle-Tacoma	59	23.29
Denver	22	16.33	Richmond	60	23.57
Orlando	23	16.50	Columbus	61	23.89
Harrisburg	24	16.57	St. Louis	61	23.89
Chicago	**25**	**17.00**	Detroit	63	24.11
Providence	25	17.00	Memphis	64	25.00
Philadelphia	27	17.11	Buffalo	65	25.14
Phoenix	28	17.22	Kansas City	66	25.38
Worcester	29	17.29	Indianapolis	67	27.44
Scranton	30	17.33	Tulsa	68	27.71
New Orleans	31	17.44	Birmingham	69	27.83
Springfield	32	17.60	Grand Rapids	70	28.57
Las Vegas	33	17.63	Baton Rouge	71	28.86
Cleveland	34	17.89	Charleston	72	30.40
Hartford	35	18.33	Minneapolis-St. Paul	73	30.71
Jacksonville	36	18.33	Greenville	74	31.40
Little Rock	37	18.43	Greensboro	75	33.20

NOTE: Except where indicated by equal rank, apparent ties are the result of rounding.
[a] (1 = best, 75 = worst)

Source: World Resources Institute (1993)

2.11 SUMMARY

This section introduced some of the general issues related to environmental quality in Cook County, IL, and Lake County, IN. Included were general indicators of environmental condition, which were intended to introduce the types of issues that will be addressed later in the report. Air and water quality have been problems of historical significance; however, some of the measures (such as the lower number of ozone exceedances in recent years) may indicate that environmental conditions are improving. Pollution control efforts with respect to air and water resources and other environmental media are showing improvements in environmental quality. The following sections provide additional information that characterize sources of pollution and the types of contaminants present in environmental media that can pose risks to human health in the area.

3.0 Sources and Loadings

3.0 SOURCES AND LOADINGS TO THE ENVIRONMENT

Sources and Loadings

- Emissions to Air
- Discharges to Surface Waters
- Toxic Chemical Releases
- Chemical Spills/Accidents
- Hazardous Waste Generation and Management
- CERCLIS Sites

This section describes known sources of pollution within Cook County, IL, and Lake County, IN, and characterizes the magnitude of emissions/releases from point sources and nonpoint sources. Organized by media (air, water, toxic releases, hazardous wastes, etc.), each following subsection contains tables and graphs that summarize the magnitude of loadings from known sources. Because of the abundance of data, summaries of the major sources, pollutants, industries, etc. are presented (e.g., a source characterization for each ZIP Code, chemical, or facility might be burdensome). More complete data for sources and pollutants/parameters are presented in the accompanying database. The ACCESS data base allows for custom analyses for particular pollutants, facilities, or geographic areas. Figure 3-1 summarizes the hierarchy of data from ACCESS that were primarily used in preparing in this section.

Information is presented on point (regulated) and nonpoint sources of environmental pollution within the study area. Organized by media (developed from various data bases), these descriptions include lists accompanied by maps/tables/summaries of the type and geographic location of sources. Estimates of loadings are based on the EPA mainframe data bases (TRI, PCS, AIRS/AFS, etc.) and are augmented by other data sources (literature) and data bases on emissions from "small" facilities and small quantity generators of hazardous waste. This is particularly true for air emitters where emissions information is presented for the smaller "area" sources. Rankings of the largest facilities for each medium generally include those that collectively contribute at least 80 percent of the total loadings (on certain tables, the cumulative percentage column reflects this quantity). Numerous tables and figures are included that present the data on these sources, chemicals

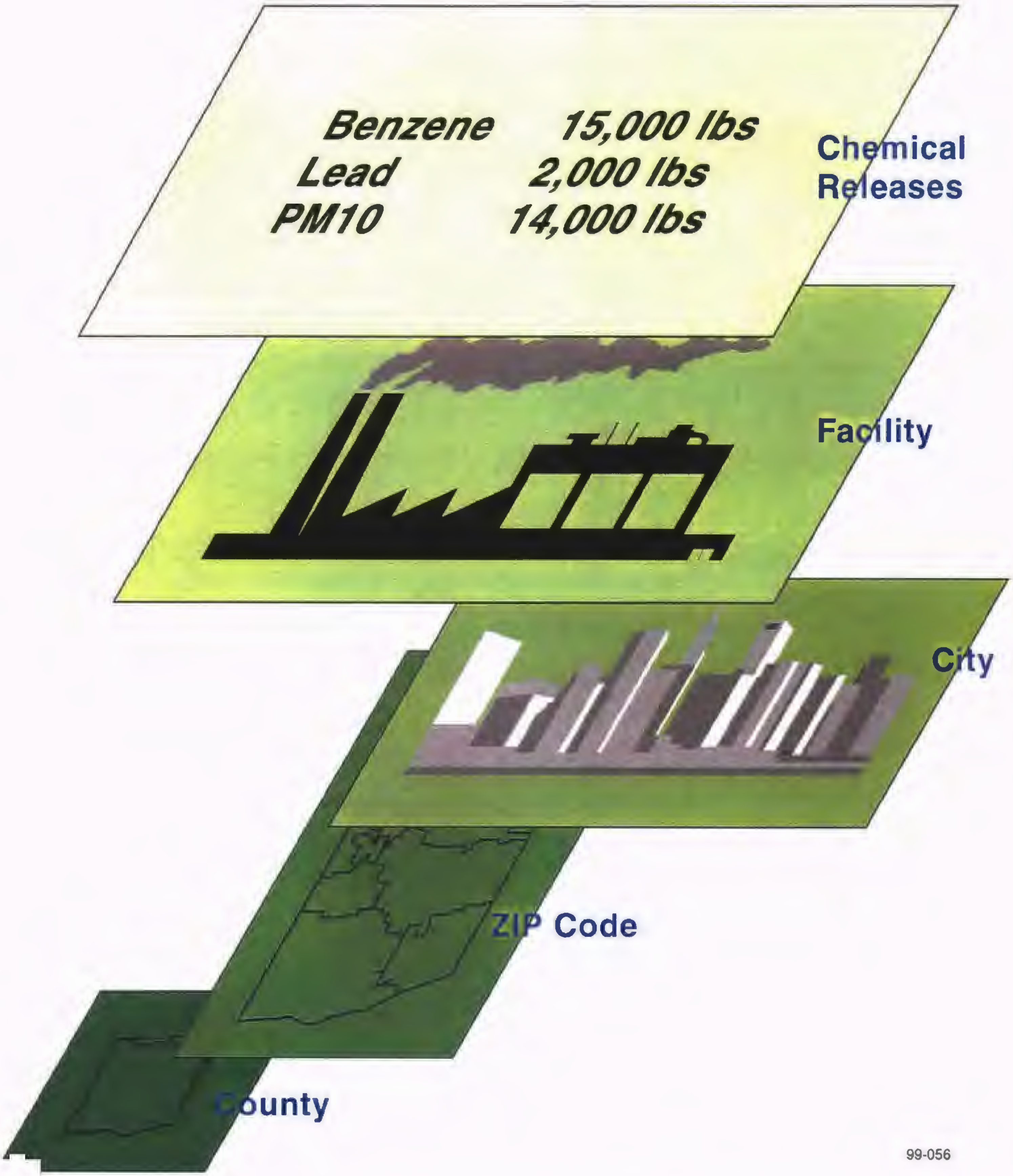

Figure 3-1. Hierarchy of Data from the ACCESS Data Base

and geographic areas with the largest loadings. Section 5 contains additional analyses of sources in Southeast Chicago, Southwest Chicago, and Northern Lake County, IN. That discussion provides more of an integrated, multimedia perspective of all types of pollution sources in these particular areas.

Pollutants and other forms of environmental degradation come from a variety of sources. Point sources are stationary facilities that discharge pollutants from smoke stacks, pipes, etc. under permits issued by the Federal and/or local governments. As such, regulations governing these facilities establish limits on the amount and type of emissions releases. Furthermore, the permits for these point sources specify monitoring requirements for tracking the emissions. Under the authority of Federal laws such as the Clean Water Act (CWA), the Clean Air Act (CAA), and the Resource Conservation and Recovery Act (RCRA), these facilities obtain permits that specify the conditions for the releases (specific type, amount, and limits for the discharges). Although people often associate pollution only with point sources (smokestacks reaching into the sky or pipes discharging wastewaters into rivers), other sources may contribute significantly to the overall environmental picture. While these less obvious sources of pollution often go unnoticed, they can be major causes of degradation of the local environment. For example, the subsection on surface waters includes estimates of loadings from nonpoint source runoff.

Releases of pollutants from point sources to water, air, and other media are regularly measured or estimated to track the emissions/releases from each facility. Data from these monitoring programs are used by EPA, State, and local agencies for compliance and enforcement purposes. This information is entered into EPA's computer data bases, which are available for analysis of potential impacts to human health and the environment. The primary computer data bases used to inventory, characterize, and rank sources within each environmental medium were:

- Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS) - Emissions to Air From Point Sources;
- Regional Air Pollutant Inventory Development System (RAPIDS) - Air Emissions from Point and Area Sources;

- Permit Compliance System (PCS) - Discharges to Surface Waters;
- Toxic Release Inventory System (TRIS) - Multimedia Releases of Toxic Substances;
- Biennial Reporting System (BRS) - Hazardous Waste Generation/Management;
- Resource Conservation and Recovery Information System (RCRIS) - Hazardous Waste Generation/Management;
- Emergency Response Notification System (ENRS) - Accidents and Spills;
- Accidental Release Information Program (ARIP) - Accidents and Spills; and
- Comprehensive Environmental, Response, Compensation and Liability Information System (CERCLIS) - Contaminated Sites

In several instances (e.g , point sources to air and water), multiple point sources within a facility are aggregated to the facility level For example, some larger facilities may have dozens of individual stacks or outfalls. Estimates of releases/discharges from these individual sources are summed for a facility as a whole to facilitate analyses and reporting. In general, data from the most current reporting year(s) available at the time this report was written are used in this document. For instance, data from 1995 are used for AIRS/AFS, PCS, and TRI, while hazardous waste generation/management data are from 1993. RAPIDS data were generated in 1997 but reflect air emissions inventory estimates as of 1993.

In some cases, multiple data sources exist that might be used to estimate loadings for a particular type of source or for a certain medium This is true for estimating air emissions, where AIRS/AFS, portions of TRI, and RAPIDS describe emissions from facilities in this area. Estimates from these three data sources may overlap to some degree It is important to note the similarities and differences among these three data sources with respect to the number of facilities covered, the number of chemicals reported, and the age of the data. In general, AIRS/AFS contains data for a large number of facilities, but for relatively few pollutants Inventories are not usually conducted yearly, so AFS data may be a few years old. RAPIDS data represent about as many facilities and up to 49 chemicals The RAPIDS emissions estimates are from 1993 data TRI stack and fugitive air emissions data represent fewer facilities, but potentially several hundred chemicals. TRI data are reported by the facilities annually, and 1995 data are used in this report. Air emissions data from each of the three data bases have utility for this report, but some overlap may occur even though they address different types of facilities and different chemicals. The degree of overlap may vary from facility to facility. No attempt has been made to compare or combine the data sets. Therefore, these rankings are best taken within the context of the same systems

It should be noted, there are limitations to the information contained in these data bases. Although some of the limitations (and caveats) are specifically discussed in the following subsections (and Section 1 4), several general limitations are worth noting. These data bases do not contain information on all sources, only those facilities that either have permits, are regulated, or are required to report releases or emissions of pollutants. Furthermore, monitoring data are often only provided for larger facilities. This is particularly true for the PCS, as well as the AFS and TRI data, which have reporting thresholds Also, monitoring data in these data bases only cover those pollutants that are specified in permits (or are required to be reported), therefore, other contaminants may be released that are not addressed in the permits and are not monitored. Furthermore, some information in these data bases pertain to past incidents and may no longer be an indication of current conditions. This is the case in AFS because air emissions inventories are not conducted every year and actual emissions may change over time depending on the processes, production schedules, and other factors that influence emission levels. This is also evident in CERCLIS, because sites can remain in the data base even after actions have been taken to remedy the situation or after it has been determined that no further action is needed.

It should also be noted that the risks or hazards of the chemical constituents/parameters released were not considered in the ranking of facilities in this section. As introduced in Section 1, the Environmental Loadings Profile focuses on the magnitude of the release. The chemicals described and the facilities ranked are examined solely on the total mass of the emission/release, not on a risk basis. That means that no attempt has been made to account for fate and transport of contaminants, or their toxicity, or other issues that are part of the risk assessment process

Six subsections follow, describing sources and loadings to the environment in Cook County, IL, and Lake County, IN

- 3.1 - Emissions to Air;
- 3 2 - Discharges to Surface Waters;
- 3.3 - Toxic Chemical Releases;
- 3 4 - Chemical Spills/Accidents;
- 3.5 - Hazardous Waste Generation and Management, and
- 3.6 - CERCLIS Sites.

3.1 EMISSIONS TO AIR

This subsection characterizes known sources of air pollution in Cook County, IL, and Lake County, IN. In general, quantification of the loadings of pollutants emitted is presented from data contained in AIRS/AFS for point sources and from several literature sources/data bases for area sources and for mobile sources. As such, focus is placed on the air pollutants emitted in the largest quantities Descriptions are included on the loadings of these pollutants from point sources Also, information is provided on the location of major emitters (by facility, city, ZIP Code) and the types of industries that emit the largest quantities of air pollutants. Section 5 of this report provides

Emissions to Air

- Total Loadings From Point Sources (AIRS/AFS Data)
- Chemicals Emitted
- Major Point Sources and Their Geographic Locations
- RAPIDS Emissions Estimates
- Area Sources
- Mobile Sources

additional analyses of air emissions data, focusing on AIRS/AFS, RAPIDS, and TRI data in Southeast Chicago, Southwest Chicago, and North Lake County, IN

Table 3-1 displays the estimated total emissions of air pollutants from point sources (large facilities) in Cook County, IL, and Lake County, IN. These data were compiled from the AIRS/AFS data base and represent emissions as of 1995, although the most recent inventories may not have been conducted during this year (AIRS/AFS, 1997) More than 2,000 facilities reported emissions to air, and more than 1,179,000 tons of air pollutants were emitted from these point sources. As shown in Figure 3-2, more than 50 percent of the emissions were carbon monoxide (CO) Other criteria air pollutants, such as sulfur dioxide (SO_2), nitrogen dioxide (NO_2), volatile organic compounds (VOCs), and particulate matter, composed most (99 percent) of the remainder of the total mass. Other hazardous air pollutants (HAPs) with emissions reported in AIRS/AFS included chlorofluorocarbons (CFCs), lead, methylene chloride, and several others. For the criteria pollutants, analyses of their emissions, major sources, and the geographic locations of point source emitters are presented below Following these subsections are data on area sources, mobile sources, and other analyses of air pollution loadings in Cook County, IL, and Lake County, IN.

3.1.1 Major Point Sources Emitting to Air

This subsection reports air emissions data from AIRS/AFS on the largest sources and the pollutants emitted in the largest quantities. A total of 87,466 tons of VOCs, primary in the formation of ozone, were emitted (AIRS/AFS, 1997). Almost 70 percent of the VOC emissions (60,252 tons) were emitted from facilities in Cook County, IL, while Lake County, IN, point sources contributed about 27,214 tons (Figure 3-3). Conversely, point sources in Lake County, IN, emitted more than 75 percent of the CO emissions for point sources in the entire study area Lake County, IN, also emitted about 63 percent (74,064 tons) of the total NO_2 emissions from point sources About 93,396 tons of particulate matter were emitted from point sources during 1995 Cook County, IL, contributed more than 89 percent (82,884 tons) of the total for the two counties. Point sources in Lake County, IN, emitted more than 75 percent of the particulate matter less than 10 microns (PM_{10}) emissions (67,629 tons), while Cook County's point sources emitted 16,984 tons (Figure 3-4) Lake

Table 3-1. Air Pollutants Emitted in 1995 by Point Sources in Cook County, IL, and Lake County, IN

Chemical	Emissions in Pounds	Emissions in Tons
Carbon Monoxide	1,259,187,565	629,594
Sulfur Dioxide	322,096,981	161,048
Nitrogen Dioxide	236,841,450	118,421
Particulate Matter (total)	186,792,430	93,396
Volatile Organic Compounds	174,932,862	87,466
Particulate Matter < 10μm	169,226,223	84,613
Chlorofluorocarbons	6,176,693	3,088
Lead	2,335,812	1,168
Methylene Chloride	860,706	430
1,1,1-Trichloroethane	191,662	96
Formaldehyde*	16,521	8
Hydrochloric Acid	6,231	3
Cadmium	895	<1
Nickel Compounds	196	<1
Chloride	84	<1
Manganese Compounds	58	<1
Chromium Compounds	3	<1
Mercury	35	<1
	2,358,666,405	1,179,333

* The validity of this data point is suspect and has not been verified.

Source: AIRS/AFS, 1997.

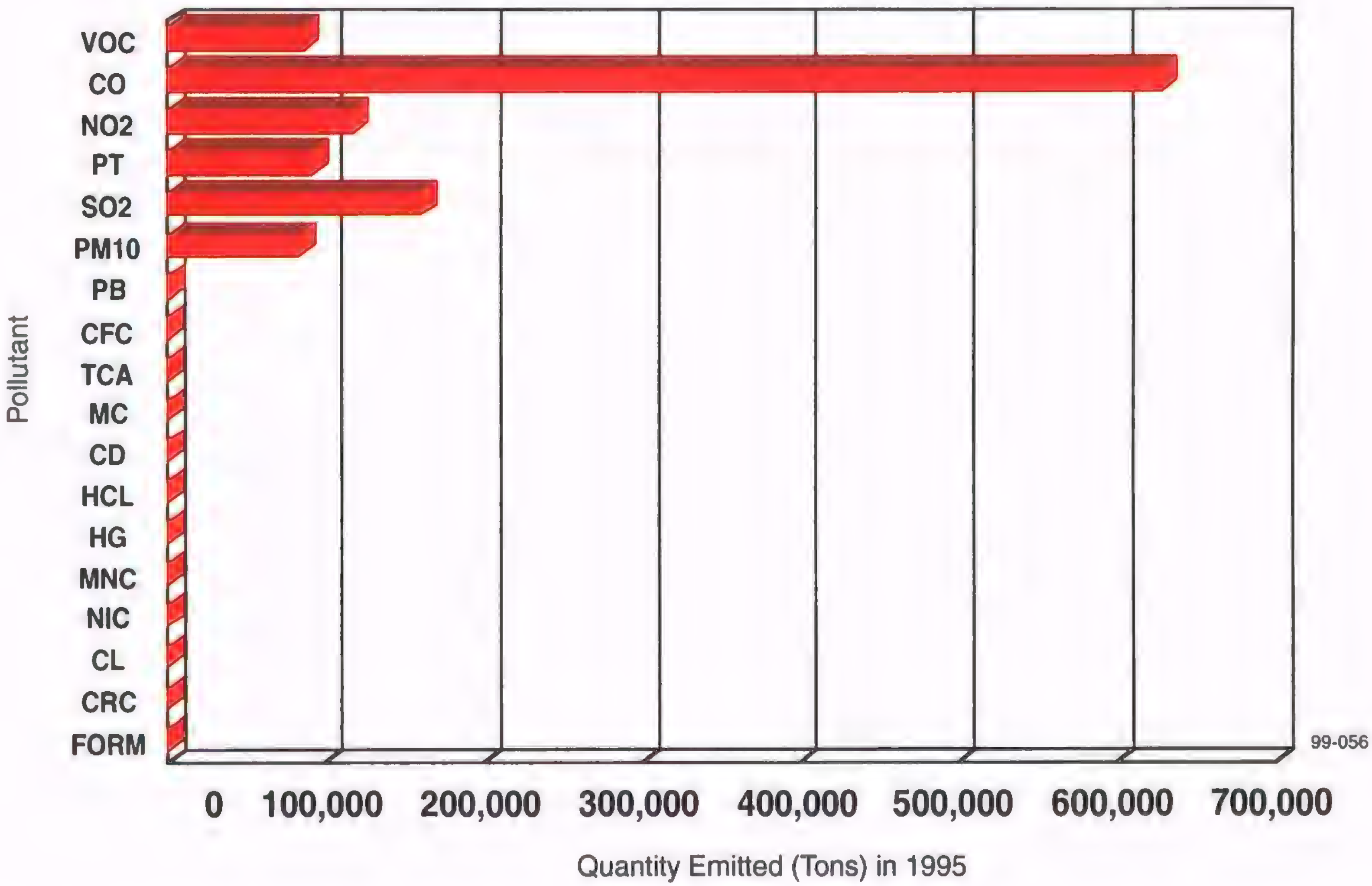

Figure 3-2. Emissions of Air Pollutants from Point Sources in 1995 in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

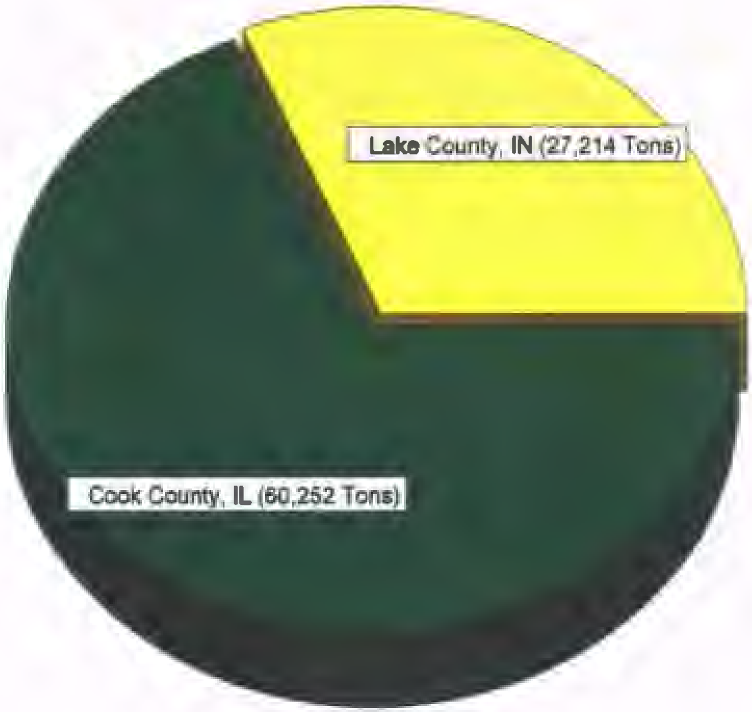

Figure 3-3. Emissions of VOCs from Point Sources in 1995 by County

Source: AIRS/AFS, 1997.

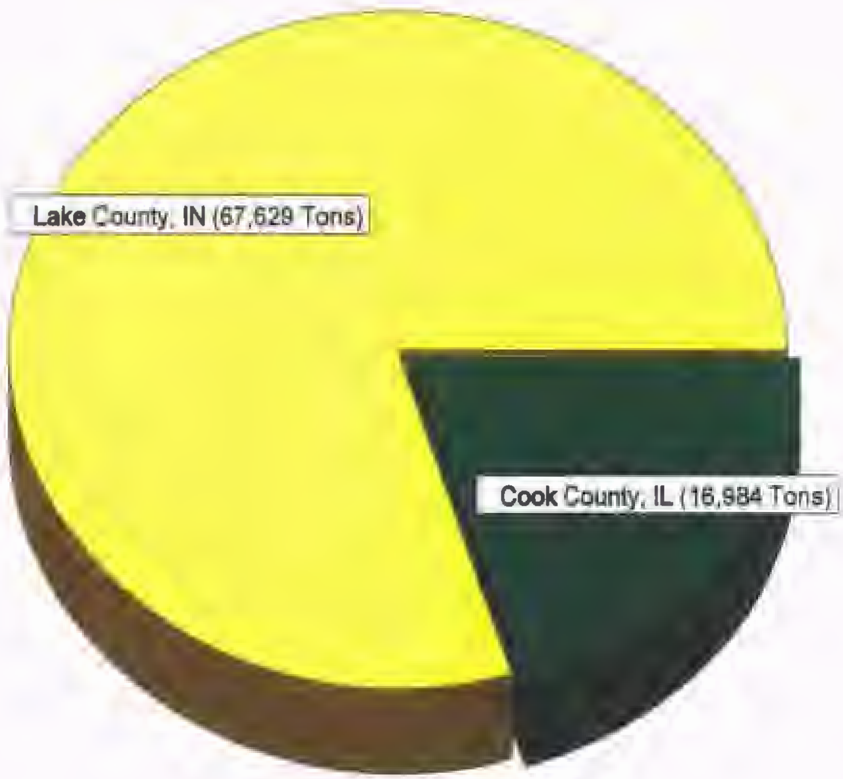

Figure 3-4. Emissions of PM10 from Point Sources in 1995 by County

Source: AIRS/AFS, 1997.

> **Point Source Emissions**
>
> - Annual Loadings of Air Pollutants from AIRS/AFS
> - Largest Sources of VOCs, Particulate Matter, PM_{10}, CO, NO_2, SO_2, and Lead
> - Geographic Areas (Cities and ZIP Codes) with Largest Emissions from Point Sources

County, IN, point sources also emitted a larger quantity of SO_2 (106,047 tons) compared to Cook County's 55,002 tons.

VOC emissions were reported by 1,617 point sources in the study area, totaling 87,466 tons (AIRS/AFS, 1997) The 79 largest point source emitters of VOCs, contributing 80 percent of the total for the two counties, are presented in Table 3-2. Figure 3-5 shows locations of the 1,617 facilities reporting VOC emissions, while Figure 3-6 identifies the locations of the 50 largest point source emitters of VOCs in the study area. U.S Steel-Gary Works is the largest emitter of VOCs, with 15,845 tons or 18 percent of the total Analyses of the locations of the VOC emitters reveal that 20 percent (17,811 tons) of the total were from facilities located in ZIP Code 46402 Similarly, point sources located in ZIP Code 60617 accounted for more than 14 percent (12,575 tons) of the total VOC emissions for the entire study area. ZIP Codes 60131 and 60501 each emitted about 6 percent of the total VOCs. The remainder of the ZIP Codes accounted for less than 5 percent of the total VOC emissions in Cook County, IL, and Lake County, IN Point sources in the City of Chicago accounted for more than 30 percent (26,882 tons) of the total, while Gary contributed about 20 percent (17,849 tons). Table 3-3 presents the VOC emissions for the 11 cities that compose 80 percent of the total

Particulate matter emissions were reported by 1,971 point sources in the study area, as presented in AIRS/AFS (1997) These point sources emitted 93,396 tons of particulate matter during 1995. The 25 largest point source emitters of particulate matter, contributing 90 percent of the total emissions for the two counties, are presented in Table 3-4. One facility, Bradshaw-Praeger & Co , a paint and allied products manufacturer in Chicago, accounted for 43,687 tons of particulate emissions, which were almost 47 percent of the total particulate matter emissions from point sources in the study area Figure 3-7 displays the locations of the 1,971 point source emitters of particulate matter and identities, the 50 largest emitters in the study area Analyses of the locations of the point

Table 3-2. Major Point Source Emitters of VOCs in 1995 in Cook County, IL, and Lake County, IN

Rank	Emissions in tons/year	Cumulative Percent of Total Emissions	Facility Name
1	15,845	18.10%	U.S. STEEL CO GARY WORKS
2	8,386	27.70%	ACME STEEL COMPANY-CHICAGO COKE PLANT
3	4,181	32.50%	SALKOVER METAL PROC.
4	4,053	37.10%	LTV STEEL COMPANY, INC. (REPUBLIC)
5	3,395	41.00%	3M INDUSTRIAL TAPE
6	3,150	44.60%	AMOCO OIL COMPANY, WHITING REFINERY
7	3,002	48.00%	INLAND STEEL COMPANY
8	1,963	50.30%	U S STEEL CO GARY WORKS PART 2
9	1,662	52.20%	FLEISCHMANN VINEGAR COMPANY
10	1,296	53.70%	R R DONNELLEY & SONS CO.
11	1,140	55.00%	CLARK OIL & REFINING CORPORATION
12	853	55.90%	GENERAL MOTORS - ELECTRO-MOTIVE DIV PL
13	835	56.90%	PACKAGING CORPORATION OF AMERICA
14	831	57.80%	VAN LEER CONTAINERS INC.
15	816	58.80%	SEALED AIR CORP-PACKAGING DIV.
16	784	59.70%	VISKASE CORPORATION
17	776	60.60%	LTV STEEL COMPANY
18	760	61.40%	CPC INTERNATIONAL INC.
19	721	62.30%	GATX TERMINALS CORP.
20	593	62.90%	RIETH-RILEY ASPH PLT #671 / ATLAS
21	548	63.60%	INDUSTRIAL COATINGS GROUP INC.
22	543	64.20%	AMERICAN NATIONAL CAN CO-ENGLEWOOD PLT.
23	543	64.80%	ACME BARREL CO.
24	483	65.30%	BALL METAL DECORATING
25	482	65.90%	KEIL CHEM -FERRO CO.
26	462	66.40%	GENERAL FOAM CORP(DIV OF PMC, INC.)
27	434	66.90%	MARATHON OIL CO-MANNHEIM TERMINAL
28	411	67.40%	ALLIED TUBE & CONDUIT CORP.

Table 3-2. Major Point Source Emitters of VOCs in 1995 in Cook County, IL, and Lake County, IN (Continued)

Rank	Emissions in tons/year	Cumulative Percent of Total Emissions	Facility Name
29	401	67.90%	FORD MOTOR COMPANY
30	389	68.30%	LASALLE CLEANERS & DYERS INC.
31	386	68.70%	MOBIL OIL CORP./STATION 05-EW9
32	321	69.10%	SUN CHEMICAL (GENERAL PRINTING INK
33	314	69.50%	POWELL DUFFRYN TERMINALS
34	305	69.80%	JLM CHEMICALS, INC.
35	296	70.20%	PHILLIPS PIPELINE
36	294	70.50%	ASHLAND CHEMICAL CO.
37	292	70.80%	FORD MOTOR CO. CHICAGO STAMPING PLANT
38	280	71.10%	BAGCRAFT CORP. OF AMERICA
39	276	71.50%	LAWSON MARDON FLEXIBLE, INC.
40	275	71.80%	CHICAGO HEIGHTS STEEL
41	269	72.10%	ACME STEEL COMPANY
42	269	72.40%	JERNBERG FORGINGS CO.
43	266	72.70%	PRE FINISH METALS-PLT#2 LINES 2&4
44	266	73.00%	SHELL OIL COMPANY
45	259	73.30%	NORTHWEST WASTE TO ENERGY
46	251	73.60%	SHELL OIL COMPANY, ARGO PLANT
47	247	73.90%	KOPPERS INDUSTRIES, INC.
48	246	74.10%	ARMSTRONG CONTAINERS, INC.
49	234	74.40%	TRILLA STEEL DRUM CORPORATION
50	232	74.70%	CENTRAL CAN COMPANY - KILBOURN PLANT
51	211	74.90%	KERR GROUP, INC.
52	211	75.20%	CROWN CORK AND SEAL
53	196	75.40%	OWENS-CORNING FIBERGLAS CORP.
54	195	75.60%	DUO FAST CORPORATION
55	183	75.80%	BORG-WARNER CORP. - SPRING DIVISION
56	182	76.00%	WALDORF CORPORATION
57	182	76.20%	MOTOROLA INC.
58	181	76.40%	BENJAMIN MOORE & CO.

Table 3-2. Major Point Source Emitters of VOCs in 1995 in Cook County, IL, and Lake County, IN (Continued)

Rank	Emissions in tons/year	Cumulative Percent of Total Emissions	Facility Name
59	178	76.60%	SLEEPECK PRINTING CO.
60	169	76.80%	MORTON INTERNATIONAL
61	166	77.00%	HARGRO HEALTH CARE PACKAGING
62	164	77.20%	EDSAL MFG. CO., INC.
63	162	77.40%	AMERICAN NATIONAL CAN COMPANY
64	162	77.60%	THRALL CAR MFG CO PLANT #2
65	159	77.80%	LAKE-RIVER TERMINALS INC.
66	158	77.90%	CCL CUSTOM MFG., INC.
67	157	78.10%	MEAD PACKAGING-CHICAGO FACILITY
68	150	78.30%	MICROCOSM, INC.
69	146	78.50%	WRICO PACKAGING
70	145	78.60%	ACME PACKAGING CORPORATION
71	141	78.80%	CONTINENTAL GROUP INC - WHITE CAP DIV.
72	140	78.90%	HEEKIN CAN CORP.
73	140	79.10%	AG COMMUNICATION SYSTEMS CORP.
74	135	79.30%	MEYER STEEL DRUM INC.
75	130	79.40%	COM ED - CRAWFORD STATION
76	130	79.60%	RELEASE INTERNATIONAL, INC.
77	127	79.70%	WHEATLAND TUBE COMPANY,CHICAGO DIV.
78	125	79.80%	UNION TANK CAR COMPANY - PLANT #1
79	124	80.00%	AMERICAN DECAL AND MFG. CO.

Source: AIRS/AFS, 1997.

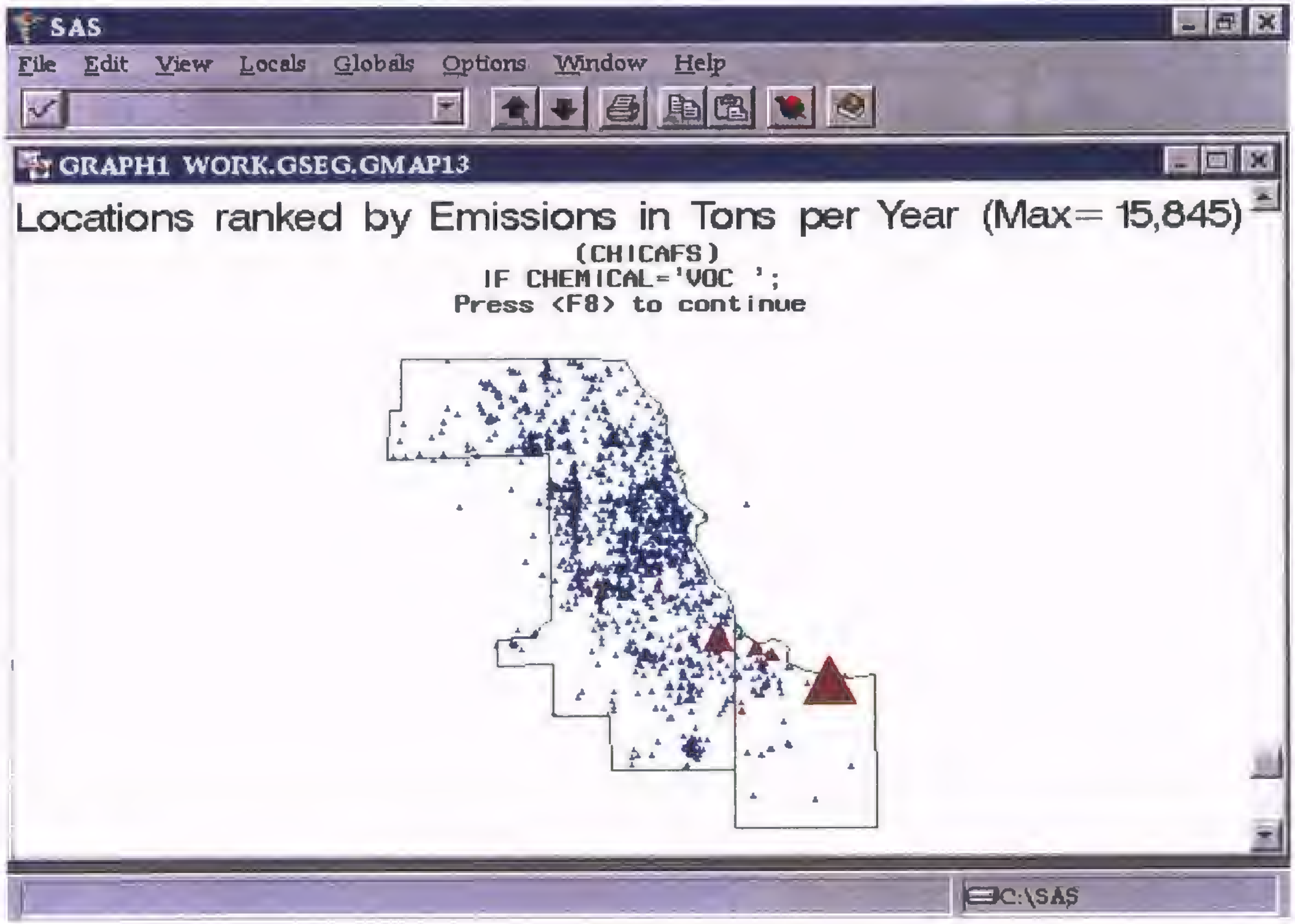

Figure 3-5. Locations of Point Source Emitters of VOCs in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

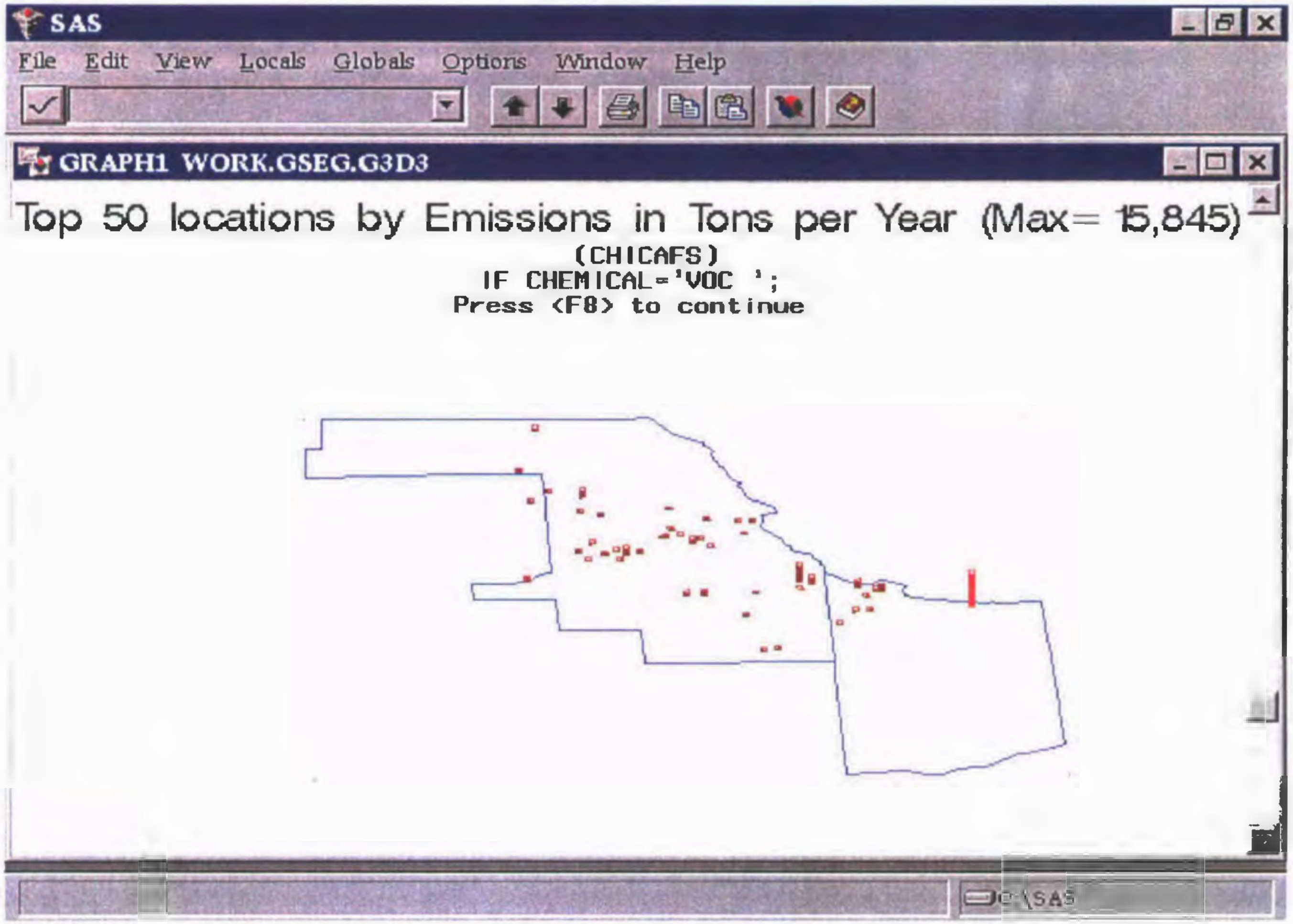

Figure 3-6. Locations of Top 50 Point Source Emitters of VOCs in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

Table 3-3. Cities with Largest Point Source Emissions of VOCs in 1995

City	Emissions in Pounds/year	Emissions in Tons/year
CHICAGO	53,764,101	26,882
GARY	35,697,565	17,849
BEDFORD PARK	13,845,140	6,923
FRANKLIN PARK	10,955,638	5,478
EAST CHICAGO	8,740,312	4,370
WHITING	6,300,164	3,150
HAMMOND	3,423,644	1,712
ALSIP	2,734,408	1,367
BLUE ISLAND	2,656,756	1,328
WHEELING	2,198,424	1,099
CHICAGO HEIGHTS	2,111,371	1,056

Source: AIRS/AFS, 1997.

Table 3-4. Major Point Source Emitters of Particulate Matter in 1995 in Cook County, IL, and Lake County, IN

Rank	Emissions in Pounds per Year	Cumulative Percentage	Facility Name
1	87,373,739	46 80%	BRADSHAW-PRAEGER & CO.
2	9,732,708	52.00%	ACME STEEL COMPANY
3	8,846,158	56.70%	CONTINENTAL GRAIN CO-ELEVATOR CO.
4	8,362,463	61.20%	U S STEEL CO GARY WORKS PART 2
5	7,300,240	65.10%	MATERIAL SERVICE CORP. - YARD 41
6	7,252,370	69 00%	CARGILL INC - COMMODITY MARKETING DIV.
7	7,018,517	72 70%	CARGILL, INC.- OILSEEDS DIVISION
8	5,295,323	75 60%	LTV STEEL COMPANY, INC. (REPUBLIC)
9	4,703,260	78 10%	INLAND STEEL COMPANY
10	4,094,776	80.30%	REYNOLDS METALS CO
11	2,780,197	81.80%	ACME STEEL COMPANY-CHICAGO COKE PLANT
12	1,894,188	82.80%	LTV STEEL COMPANY
13	1,720,737	83.70%	NIPSCO-DEAN H. MITCHELL STATION - GARY
14	1,392,819	84 50%	CPC INTERNATIONAL INC.
15	1,267,372	85.10%	U.S. STEEL CO. GARY WORKS
16	1,262,542	85.80%	AMOCO OIL COMPANY, WHITING REFINERY
17	1,232,470	86.50%	COM ED - CRAWFORD STATION
18	1,223,658	87.10%	HORSEHEAD RESOURCE DEVELOPMENT CO., INC.
19	1,174,483	87 80%	COM ED - FISK STATION
20	882,394	88.20%	OWENS-CORNING FIBERGLAS CORP.
21	742,681	88.60%	RHONE-POULENC BASIC CHEMICALS CO.
22	707,176	89 00%	CLARK OIL & REFINING CORPORATION
23	682,811	89 40%	NORTHWEST WASTE TO ENERGY
24	585,304	89.70%	MARBLEHEAD LIME CO.
25	581.036	90 00%	VULCAN MATERIALS - MCCOOK QUARRY #378

Source AIRS/AFS. 1997

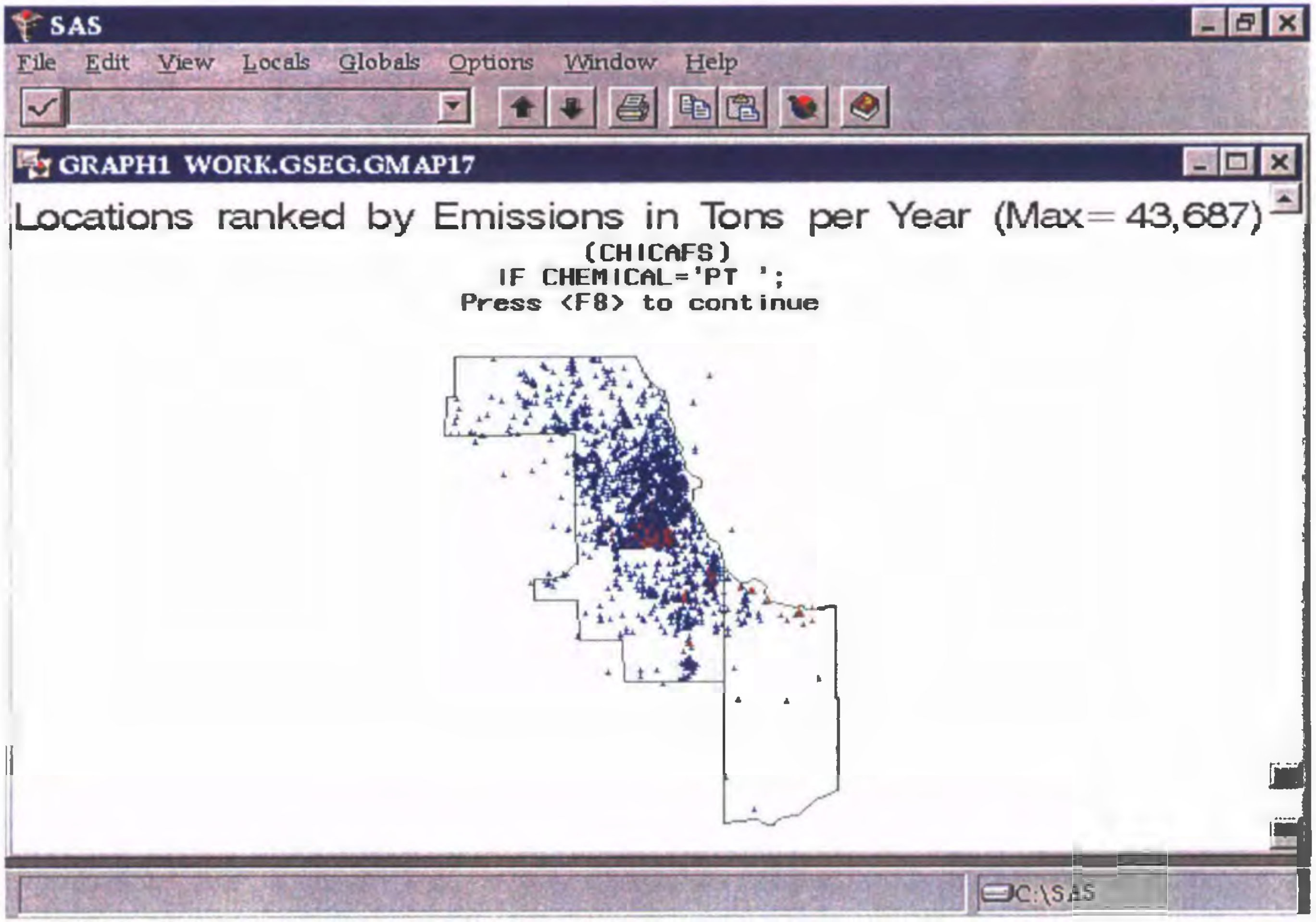

Figure 3-7. Locations of Point Source Emitters of Particulate Matter in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

source emitters of particulate matter indicate that Chicago accounts for about 70 percent (66,020 tons) of the total emissions Other cities with major contributions of particulate matter from point sources included Gary (6,181 tons or about 7 percent), Riverdale (4,375 tons or 5 percent), Thornton (3,840 or 4 percent), East Chicago (3,359 tons or 3.5 percent), McCook (2,759 tons or 3 percent), and Bedford Park (1,047 tons or 1 percent).

PM_{10} (particulate matter less than or equal to 10 micrometers in size) emissions were reported by 321 facilities in the study area, emitting to total of 84,613 tons of PM_{10} (AIRS/AFS, 1997). However, one facility (U.S. Steel - Gary Works, Part 1) accounted for 59,496 tons, more than 70 percent of the total PM_{10} emissions for all point sources in the study area Collectively, only 10 point sources provided more than 90 percent of the total PM_{10} emissions Table 3-5 presents the largest point source emitters of PM_{10} in Cook County, IL, and Lake County, IN Figure 3-8 displays the locations of the largest 50 point source emitters of PM_{10}. The geographic location of these facilities emitting PM_{10} included more than 61,805 tons (73 percent) from point sources in Gary, IN. Table 3-6 presents the 12 cities with PM_{10} emissions greater than 100 tons per year These cities contributed more than 95 percent of the total PM_{10} emissions from point sources in the study area.

Emissions of CO from 1,583 point sources in Cook County, IL, and Lake County, IN, totaled 629,594 tons Only three facilities (Amoco, U.S Steel-Part 2, and Acme Steel) comprised more than 80 percent of the total CO emissions in the study area. Table 3-7 presents the largest 31 facilities; all emitted more than 100 tons per year of CO. Cities with the largest CO emissions include Whiting (228,503 tons or 36 percent), Gary (198,069 tons or 31 percent), Riverdale (100,514 tons or 6 percent), East Chicago (72,022 tons or 11 percent), Stickney (15,689 tons or 2 percent), Chicago (7,291 tons or 1 percent), and Hammond (3,529 tons or 0 5 percent). The remainder of the cities each contributed less than 1,000 tons per year of CO emissions from point sources

NO_2 emissions during 1995 totaled 118,421 tons in the study area Facilities in Hammond (26,443 tons), Chicago (21,960 tons), Gary (21,420 tons), East Chicago (16,836 tons), Whiting (8,598 tons), Riverdale (5,365 tons), and Bedford Park (5,056 tons) provided about 90 percent of the total emissions Similarly, more than 95 percent of the 161,048 tons per year of SO_2 emissions were from point sources located in just 10 cities (Table 3-8)

Table 3-5. Major Point Source Emitters of PM_{10} in 1995 in Cook County, IL, and Lake County, IN

Rank	Emissions (Pounds per Year)	Cumulative Percentage	Facility Name
1	118,992,314	70.30%	U.S. STEEL CO GARY WORKS
2	6,303,247	74.00%	AMOCO OIL COMPANY, WHITING REFINERY
3	5,107,036	77.10%	ACME STEEL COMPANY
4	3,778,410	79.30%	CARGILL INC - COMMODITY MARKETING DIV
5	3,662,071	81.50%	CARGILL, INC.- OILSEEDS DIVISION
6	3,652,391	83.60%	U S STEEL CO GARY WORKS PART 2
7	3,305,695	85.60%	LTV STEEL COMPANY, INC. (REPUBLIC)
8	3,169,143	87.40%	INLAND STEEL COMPANY
9	2,396,613	88.90%	CONTINENTAL GRAIN CO-ELEVATOR C
10	2,197,616	90.20%	REYNOLDS METALS CO.
11	1,731,005	91.20%	LTV STEEL COMPANY
12	1,300,340	91.90%	REPUBLIC ENGINEERED STEELS, INC.
13	1,167,934	92.60%	HORSEHEAD RESOURCE DEVELOPMENT CO., INC.
14	1,047,002	93.30%	MATERIAL SERVICE CORP. - YARD 41
15	1,046,814	93.90%	ACME STEEL COMPANY-CHICAGO COKE PLANT
16	883,310	94.40%	RHONE-POULENC BASIC CHEMICALS CO.
17	740,000	94.80%	NALCO CHEMICAL CO.- CLEARING PLANT
18	683,089	95.20%	CPC INTERNATIONAL INC.

Source AIRS/AFS, 1997

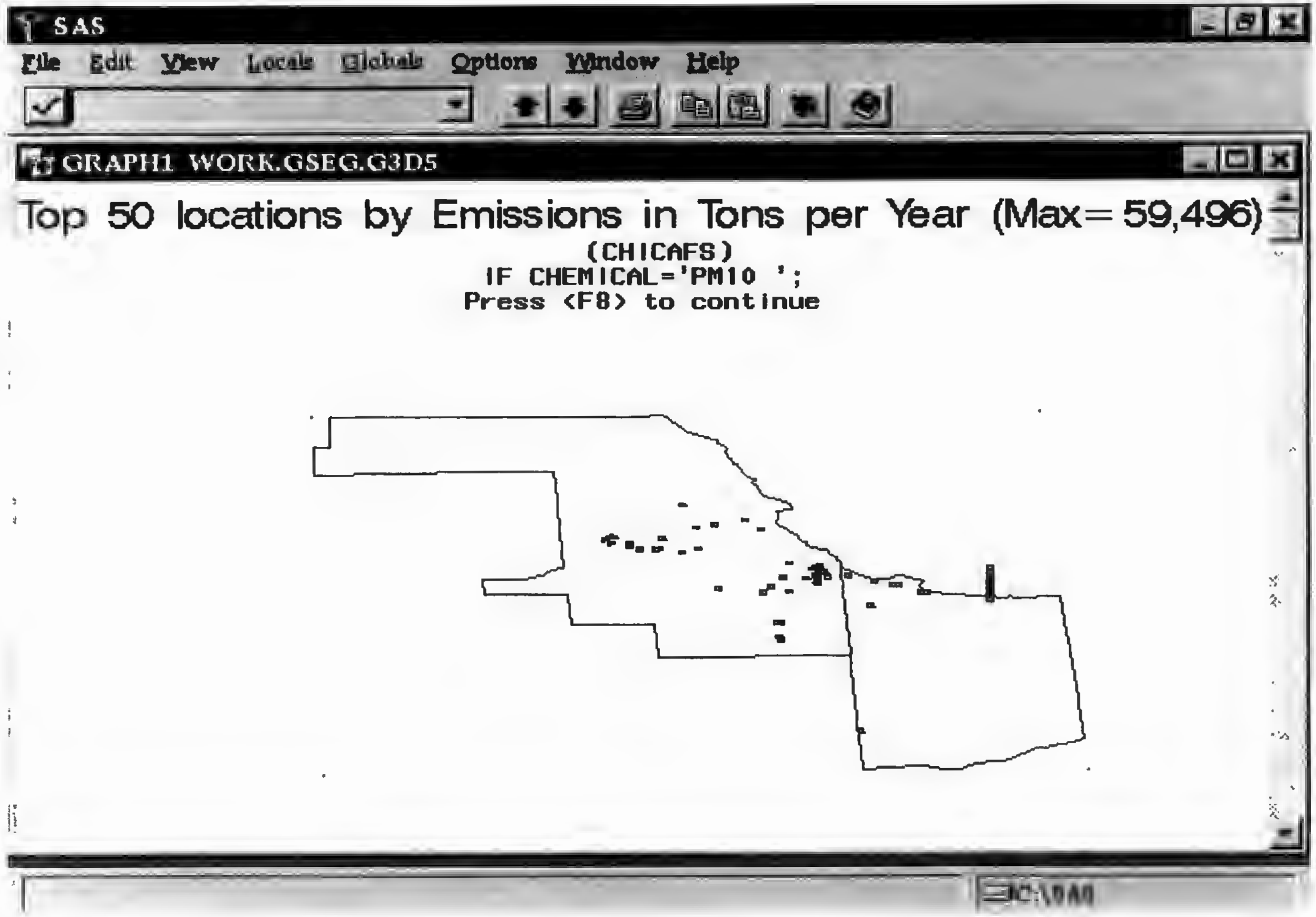

Figure 3-8. Locations of the Top 50 Point Source Emitters of PM10 in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

Table 3-6. Cities with Largest Point Source PM_{10} Emissions in 1995

City	Emissions in Pounds/Year	Emissions in Tons/Year
GARY	123,609,550	61,805
CHICAGO	21,025,560	10,513
WHITING	6,303,247	3,152
EAST CHICAGO	4,974,161	2,487
RIVERDALE	4,757,580	2,379
MC COOK	2,635,777	1,318
BEDFORD PARK	1,839,639	920
THORNTON	1,217,855	609
CHICAGO HEIGHTS	1,071,815	536
SUMMIT	573,485	287
HAMMOND	354,263	177
DOLTON	199,124	100

Source: AIRS/AFS, 1997.

Table 3-7. Major Facilities Emitting CO in 1995 in Cook County, IL, and Lake County, IN

Name	Emissions in Pounds	Emissions in Tons
AMOCO OIL COMPANY, WHITING	457,003,299	228,502
U.S. STEEL CO GARY WORKS PART 2	350,863,882	175,432
ACME STEEL COMPANY	202,528,597	101,264
INLAND STEEL COMPANY	82,436,316	41,218
LTV STEEL COMPANY	61,215,861	30,608
U S STEEL CO GARY WORKS	44,594,514	22,297
KOPPERS INDUSTRIES, INC.	31,322,153	15,661
RIETH-RILEY ASPH PLT #671 / AT	4,473,800	2,237
ACME STEEL COMPANY-CHICAGO	2,414,281	1,207
AMERICAN MAIZE PRODUCTS COMPANY	1,625,648	813
LTV STEEL COMPANY, INC.	1,454,247	727
CALUMET STEEL COMPANY	1,333,756	667
MARBLEHEAD LIME CO.	1,211,246	606
A FINKL & SONS CO.	1,102,532	551
COM ED - CRAWFORD STATION	856,464	428
COM ED - FISK STATION	733,579	367
SWEETHEART CUP CORP.	630,168	315
NIPSCO-DEAN H MITCHELL STATION	599,031	300
VULCAN MATLS-LIME PLANT #540	562,162	281
CPC INTERNATIONAL INC.	481,420	241
COMMONWEALTH EDISON	480,116	240
LAKE LANDFILL	436,800	218
AMERICAN STEEL FOUNDRIES	369,256	185
CLARK OIL & REFINING CORPORATION	361,591	181
JUPITER ALUMINUM CORPORATION	312,279	156
J-PITT STEEL MELT SHOP, INC.	311,040	156
NORTHWEST WASTE TO ENERGY	286,452	143
U.S. STEEL - SOUTH WORKS	268,470	134
NATIONAL CASTINGS, INC.	266,025	133
UNIVERSITY OF CHICAGO	250,946	125
REYNOLDS METALS CO.	229,962	115

Source AIRS/AFS. 1997

Table 3-8. Cities with Largest Point Source Emissions of SO_2 in 1995

CITY	Emissions in Pounds/Year	Emissions in Tons/Year
GARY	91,223,774	45,612
CHICAGO	54,516,773	27,258
WHITING	53,280,290	26,640
EAST CHICAGO	39,241,244	19,621
BLUE ISLAND	29,592,748	14,796
HAMMOND	28,348,162	14,174
THORNTON	11,710,112	5,855
BEDFORD PARK	6,946,539	3,473
MC COOK	2,468,558	1,234
RIVERDALE	2,437,715	1,219

Source: AIRS/AFS, 1997.

Lead emissions from 54 point sources totaled 1,168 tons for the entire study area (AIRS/AFS, 1997). Lake County, IN, contributed 789 tons (68 percent); Cook County emitted 379 tons (32 percent) from facilities (Figure 3-9). The single largest emitter of lead was U S. Steel Gary Works (Part 1), which released 786 tons (67 percent). Another significant lead emitter was Horsehead Resource Development (303 tons or 26 percent). Overall, primary metals industries contributed 1,144 tons, or 98 percent, of the total lead emissions for point sources in the study area

In general, the air emissions data collected from point sources (and presented in AIRS/AFS) focus on criteria air pollutants. Some emissions data are available from 1995 for a limited number of hazardous air pollutants (HAPs) such as solvents, metals, and other compounds. The magnitude of the emissions of HAPs is typically smaller than those of the criteria pollutants; however, there is interest in characterizing the mass of these emissions and major emitting facilities. Table 3-9 summarizes these emissions from AIRS/AFS (1997) and the largest facilities.

As shown in Table 3-10, however, IEPA in the *1995 Illinois Annual Air Quality Report* (IEPA, 1996a), reported somewhat different point source emissions for Cook County, IL. These emissions data are from the Emissions Inventory System (EIS), an on-line system maintained by the IEPA. Sweet and Vermette (1991) inventoried sources in a 64 square kilometer area in Southeast Chicago. Table 3-11 presents the point source emissions estimated for facilities included in this study.

3.1.2 Area Sources of Air Pollution

Area sources are smaller sources of air pollution that individually emit below certain threshold quantities for criteria pollutants (CO, NO_2, SO_2, etc) Emissions data for area sources are determined as emissions from a collection of sources with similar emissions within a geographic area, such as gas stations and dry cleaners Emissions data for many/most area sources are not usually

Area Source Emissions

- "Smaller" Air Pollution Sources
- IEPA Inventory of Smaller Point Sources and Area Sources
- Comparison of Area Sources, Mobile Sources, and Point Sources in Chicago Area

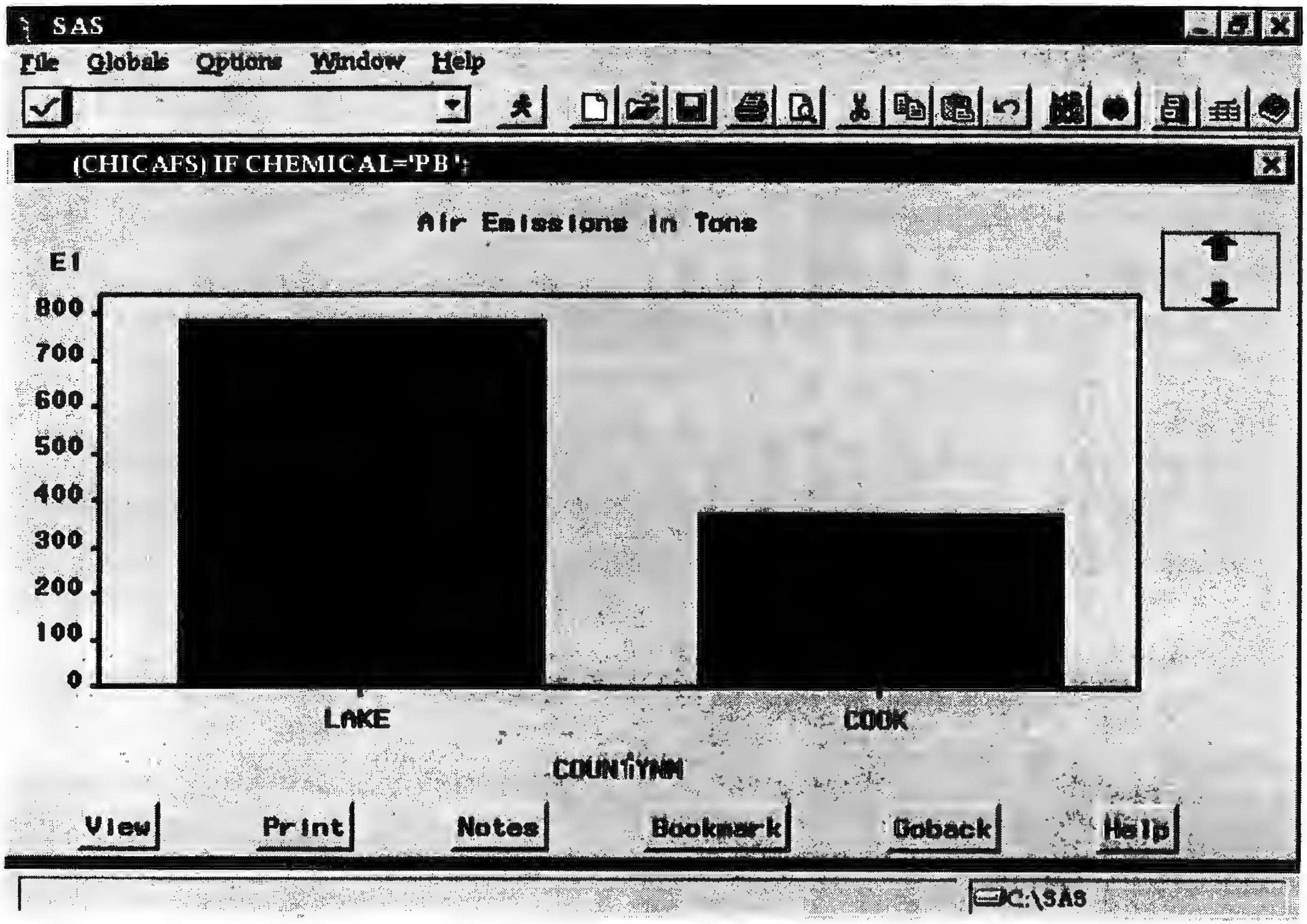

Figure 3-9. Lead Air Emission from Point Sources in Cook County, IL, and Lake County, IN

Source: AIRS/AFS, 1997.

Table 3-9. Emissions of Hazardous Air Pollutants from Point Sources as Reported in AIRS/AFS for 1995

Pollutant/Total Emissions (Pounds/Year)	5 Largest Facilities	Emissions (Pounds/Year)
Chlorofluorocarbons (6,176,693 lbs. from 99 facilities)	Oakley Tube Corp. Motorola Inc. Reynolds Metals Co. Free-Flow Packaging Co. Matsushita Electric	4,000,000 310,223 285,400 149,745 104,082
Methylene Chloride (860,706 lbs. from 10 facilities)	General Foam Corp. (Div. Of PMC Inc.) Amerail (Morrison-Knudsen Transit) Kalmus and Associates	709,909 88,528 23,296
1,1,1-Trichloroethane (191,662 lbs. from 22 facilities)	Vapor Mark IV Beeco Manufacturing Co. Chicago Faucet Co. Stiffel Co. Senior Flexonics, Inc.	40,000 38,372 23,210 22,932 13,229
Formaldehyde (16,521 lbs.)	The validity of this data point has not been determined and may be suspect.	16,521
Hydrochloric Acid (6,231 lbs. from 2 facilities)	Inland Steel Co. U.S. Reduction	6,106 125
Cadmium (895 lbs. from 4 facilities)	NIPSCO-Dean H. Mitchell Station Inland Steel Co. Commonwealth Edison U.S. Reduction	757 108 28 1
Nickel Compounds (196 lbs. from 1 facility)	Francis and Nygren Foundry	196
Chloride (84 lbs. from 1 facility)	U.S. Reduction	84
Manganese Compounds (58 lbs. from 1 facility)	Francis and Nygren Foundry	58
Mercury (35 lbs. from 3 facilities)	NIPSCO-Dean H. Mitchell Station Inland Steel Commonwealth Edison	30 4 1
Chromium Compounds (3 lbs. from 1 facility)	U.S. Reduction	3

Source. AIRS/AFS, 1997

Table 3-10. Estimated Cook County, IL, Stationary Point Source Emissions (tons/year)

	Particulate Matter	Sulfur Dioxide	Nitrogen Oxides	Volatile Organic Material	Carbon Monoxide
Cook County Emissions (tons/year)	29,154.9	49,921.4	38,447.0	43,062.1	68,415.8

Source: IEPA, 1996a.

Table 3-11. Southeast Chicago Point Source Inventory (tons/year)

Point Source	SIC Code	Particulate Matter	SO_2	Significant Other Pollutants
Interlake-Riverdale	3312 - Steel manufacturing	373.6	639.8	695.1 (NOx)
U.S. Steel- Southworks	3312 - Steel manufacturing	110.0	0.1	37.5 (NOx)
Chicago Blast Furnace	3312 - Steel manufacturing	324.2	818.9	2,170.0 (NOx)
LTV Steel	3312 - Steel manufacturing	515.0	680.3	420.0 (NOx) 1,713.0 (CO)
Chicago Coke Plant	3312 - Steel manufacturing	151.6	437.4	401.6 (HC)
Heckett - Plant 27	3295 - Slag processing	36.5	0	_
Heckett Eng.	3295 - Slag processing	76.8	0	_
Heckett Eng. Harsco	3295 - Slag processing	110.9	0	_
Cinders	3295 - Slag processing	142.5	0	_
Inland Metals	3341 - Refining nonferrous	1.2	0	_
Marblehead Lime	3274 Lime manufacturing	129.7	532.8	_
Domtar Ind.	2899 - Refining Na Cl	12.9	0	_
Great Lakes Carbon	2999 - Petro & coal prod.	6.9	376.8	_
PVS Chemicals	2819 - Inorganic chemicals	129.7	532.8	26.5 (NOx)
SCA Chemical	4953 - Refuse disposal	16.3	0	17.3 (NOx)
Ford Motor Co.	3711 - Auto manufacturing	9.0	1.9	869.0 (HC)
Mississippi Line	4463 - Marine cargo hand.	12.4	0	_

Table 3-11. Southeast Chicago Point Source Inventory (tons/year) (Continued)

Point Source	SIC Code	Particulate Matter	SO_2	Significant Other Pollutants
Rail-to-water	4463 - Marine cargo hand.	11.7	0	-
Int. Minerals	4463 - Marine cargo hand.	16.9	0	-
Stolt Terminals	4226 - Warehouse & storage	7	0.9	9.8 (NOx) 89.4 (HC)
Sherwin-Williams	2851 Paint manufacturing	2.4	0	-
Stauffer Chemical	2874 - Fertilizer mfg.	20.6	0	-
Continental -Elv B	5153 - Marketing grain	121.3	1.6	-
Cargill, Inc.	5153 - Marketing grain	54.0	0	-
General Mills, Inc.	2041 - Milling grain	154.0	0	-
Jay's Foods	2099 - Food preparation	11.6	0	-
CID Landfill	Landfill site	4.4	0	-
Com-ED Peaking Units	4912 - Electric power	6.5	69.5	121.1 (NOx)
Riverdale Plating	3471 - Plating	19.4	0	-

Source Sweet and Vermette, 1991

presented in AIRS/AFS, rather, they are tracked by State regulatory agencies and have been studied by several investigators

3.1.2.1 *Cook County, IL*

Illinois Environmental Protection Agency (IEPA) has inventoried smaller point source and area source emitters in Cook County, IL, (Higgins, 1997). This data base contains information on air emissions from many sources that are smaller and are not contained in AIRS/AFS, although there is some degree of overlap with the facilities inventoried in AIRS/AFS Tables 3-12 to 3-14 summarize the air emissions inventoried by IEPA from small facilities in Cook County, IL, in 1995. In all, 1,067 facilities were in the data base, emitting 12,589,069 pounds of pollutants in 1995 (Higgins, 1997) Table 3-12 shows emission rates by small emitters from various cities in Cook County Chicago contains over one-third of all small-emitting facilities in Cook County. Out of all cities in the county, Chicago produces the greatest amount of small emitter emissions--about one-third by weight. Small emission sources are spread relatively evenly throughout the ZIP Code areas of Cook County, with somewhat larger emissions in the central/west portion, and somewhat smaller emissions in the northwest. Table 3-13 shows the types of pollutants being emitted from these sources The pollutants emitted in the largest amounts by small emitters in 1995 were:

- Volatile Organic Matter (4,385,578 pounds),
- NO_x (3,783,117 pounds),
- Particulate Matter (2,181,919 pounds), and
- CO (1,024,341 pounds).

These pollutants comprised 90 percent of the emissions from small emitters in Cook County in 1995 (Higgins, 1997) Other pollutants emitted included 1,1,1-trichloroethane (87,840 pounds), which was emitted more than twice as much as the next most emitted compound, and trichloroethylene (38,218 pounds). Table 3-14 shows emissions from different industries, based on SIC Codes. The industries with largest emissions are the chemical industry, with 1,212,209 pounds of pollutants in 1995 (17,000 pounds per facility, on average), and the food industry, with 909,451 pounds emitted (17,000 pounds per facility) Other industries with emissions include metal fabrication, machinery, and electrical

Table 3-12. Emissions from Small Facilities in Cook County, IL, in 1995, Sorted by City

Rank	City	Number of Facilities	Pounds Emitted	Percent	Cumulative Percent
1	Chicago	362	4,686,384	37.23%	37.23%
2	Bedford Park	21	642,257	5.10%	42.33%
3	Franklin Park	36	460,663	3.66%	45.99%
4	Des Plaines	34	451,571	3.59%	49.57%
5	Skokie	16	264,212	2.10%	51.67%
6	Cicero	25	240,443	1.91%	53.58%
7	Bellwood	12	238,633	1.90%	55.48%
8	Melrose Park	17	238,195	1.89%	57.37%
9	Elk Grove Village	31	226,025	1.80%	59.17%
10	Wheeling	17	217,978	1.73%	60.90%
11	Niles	12	186,350	1.48%	62.38%
12	Schiller Park	19	172,746	1.37%	63.75%
13	Lansing	9	162,097	1.29%	65.04%
14	Alsip	21	140,280	1.11%	66.15%
15	Waukegan	13	119,697	0.95%	67.10%
16	South Holland	19	117,830	0.94%	68.04%
17	Northbrook	11	116,687	0.93%	68.96%
18	Wilmette	10	115,183	0.91%	69.88%
19	McCook	4	111,735	0.89%	70.77%
20	Broadview	11	98,785	0.78%	71.55%
21	Bridgeview	9	97,687	0.78%	72.33%
22	Arlington Heights	11	96,485	0.77%	73.09%
23	Riverdale	9	94,658	0.75%	73.85%
24	Chicago Heights	12	92,953	0.74%	74.58%
25	Glenview	6	92,216	0.73%	75.32%
26	North Chicago	6	91,570	0.73%	76.04%
27	Morton Grove	7	90,517	0.72%	76.76%
28	Lake Zurich	7	89,087	0.71%	77.47%
29	Summit	5	87,395	0.69%	78.17%
30	Forest View	5	85,336	0.68%	78.84%
31	Evanston	10	83,865	0.67%	79.51%
32	South Chicago Heights	1	83,128	0.66%	80.17%

Source Higgins, 1997

Table 3-13. Emissions from Small Facilities in Cook County, IL, in 1995, Sorted by Pollutant

Rank	Pollutant	Number of Facilities	Pounds Emitted	Percent	Cumulative Percent
1	Volatile Organic Matter	598	4,385,578	34.84%	34.84%
2	NO_x	566	3,783,117	30.05%	64.89%
3	Particulates	666	2,181,919	17.33%	82.22%
4	CO	506	1,024,341	8.14%	90.36%
5	SO_2	182	488,079	3.88%	94.23%
6	PM_{10}	148	402,192	3.19%	97.43%
7	1,1,1-Trichloroethane	9	87,840	0.70%	98.13%
8	Nonvolatile Organic Matter	27	69,885	0.56%	98.68%
9	Trichloroethylene	7	38,218	0.30%	98.98%
10	Methylene Chloride	9	35,767	0.28%	99.27%
11	Perchloroethylene	4	18,245	0.14%	99.41%
12	Ethylene	7	18,077	0.14%	99.56%
13	Methanol	12	12,834	0.10%	99.66%
14	Methyl Ethyl Ketone	9	12,078	0.10%	99.75%
15	Xylene	12	10,405	0.08%	99.84%
16	Styrene	2	6,016	0.05%	99.88%
17	Formaldehyde	6	2,596	0.02%	99.91%
18	Glycol Ethers	8	2,465	0.02%	99.93%
19	Ethylbenzene	5	1,546	0.01%	99.94%
20	Hydrochloric Acid	2	1,440	0.01%	99.95%
21	Methyl Isobutyl Ketone	4	1,046	0.01%	99.96%
22	Diethanol	2	1,000	0.01%	99.97%
23	Lead	14	951	0.01%	99.97%
24	Chromium (Hexavalent)	4	937	0.01%	99.98%
25	Phenol	3	828	0.01%	99.99%
26	Propionaldehyde	1	661	0.01%	99.99%
27	Chloromethane	1	363	0.00%	99.99%
28	Benzene	3	341	0.00%	100.00%
29	Ethylene Oxide	1	194	0.00%	100.00%
30	Hydroquinoline	2	38	0.00%	100.00%
31	Acrylamide	1	34	0.00%	100.00%
32	Naphthalene	1	20	0.00%	100.00%
33	2,4-D	1	10	0.00%	100.00%
34	Isophorone	2	5	0.00%	100.00%
35	4,4'-Methyledianiline	1	2	0.00%	100.00%
36	Cumene	1	1	0.00%	100.00%
37	Vinyl Chloride	2	<1	0.00%	100.00%
38	Ethyl Acrylate	1	<1	0.00%	100.00%

Source Higgins, 1997

Table 3-14. Emissions from Small Facilities in Cook County, IL, in 1995, Sorted by SIC

Rank	SIC Code	SIC Description	Number of Facilities	Pounds Emitted	Percent	Cumulative Percent
1	28	Chemical	71	1,212,209	9.63%	9.63%
2	20	Food	54	909,451	7.22%	16.85%
3	--	Unknown	110	883,682	7.02%	23.87%
4	27	Printing	34	826,497	6.57%	30.44%
5	34	Fabr. Metal	116	815,006	6.47%	36.91%
6	35	Machinery	69	723,753	5.75%	42.66%
7	36	Electrical	49	710,111	5.64%	48.30%
8	33	Primary Metal	52	682,366	5.42%	53.72%
9	38	Measure/Photo	26	597,946	4.75%	58.47%
10	30	Plastics	33	493,494	3.92%	62.39%
11	72	Personal SVCs	35	435,428	3.46%	65.85%
12	26	Paper	17	355,174	2.82%	68.67%
13	65	Real Estate	17	349,427	2.78%	71.45%
14	82	Educational	41	332,635	2.64%	74.09%
15	49	Utilities	65	301,693	2.40%	76.49%
16	51	Nondur. Wholesale	31	289,021	2.30%	78.78%
17	32	Stone/Clay	26	288,862	2.29%	81.08%

Source. Higgins, 1997.

An IEPA (1993a) study *1990 Ozone Precursors Emissions Inventory for the Chicago Area, Illinois Ozone State Implementation Plan* found that in 1990, area sources accounted for 23.1 percent of the total Cook County, IL, volatile organic matter (VOM) emissions (point, area, and mobile sources combined), 3.2 percent of the total Cook County NO_x emissions, and 0.5 percent of the total Cook County CO emissions Specifically, IEPA (1993a) reported Cook County, IL, 1990 total emissions from area sources as 173.72 tons/ozone season weekday for VOM, 17.38 tons/ozone season weekday for NO_x, and 15.0 tons/ozone season weekday for CO In the study, area sources included: volatile organic liquid transfer (ship and barge); gasoline distribution (tank truck unloading, vehicle fueling, underground storage tank [UST] breathing, etc); stationary source solvent usage (architectural surface coating, dry cleaning, solvent degreasing, etc.); biogenics; municipal waste incineration, industrial, commercial, and residential fuel combustion (natural gas, distillate, and residual oil); and open burning (structural and forest fires).

Figures 3-10, 3-11, and 3-12 summarize the relative contributions of Cook County, IL, area source types to total VOM, NO_x, and CO area source emissions, respectively. Detailed analysis of the IEPA (1993a) study reveals that the largest area sources of VOM emissions were commercial/consumer solvent use (25.4 percent of VOM area source emissions), architectural surface coating (about 21 percent of VOM area source emissions), and vehicle refueling and solvent degreasing (each about 13 percent of VOM area source emissions). For NO_x, the largest area sources were residential fuel combustion (59 4 percent of NO_x area source emissions) and commercial fuel combustion (24.2 percent of NO_x area source emissions). For CO, the largest area sources were structural fires (44.3 percent of CO area source emissions), commercial municipal incinerators (32 9 percent of CO area source emissions), and residential fuel combustion (14.7 percent of CO area source emissions) (IEPA, 1993a)

3.1.2.2 *Lake County, IN*

Area-source analysis of the most recent, comprehensive inventory for Lake County, IN, identified area source emissions of 9,084 tons/year for VOCs, 2,279 tons/year for NO_x, and 1,298 tons/year for CO (Koch, 1997a) Figures 3-13, 3-14, and 3-15 present the relative contribution to Lake County, IN, area source emissions from various source categories for VOCs, NO_x, and CO, respectively. As shown in Figure 3-13, the stationary source solvents category was the largest VOC

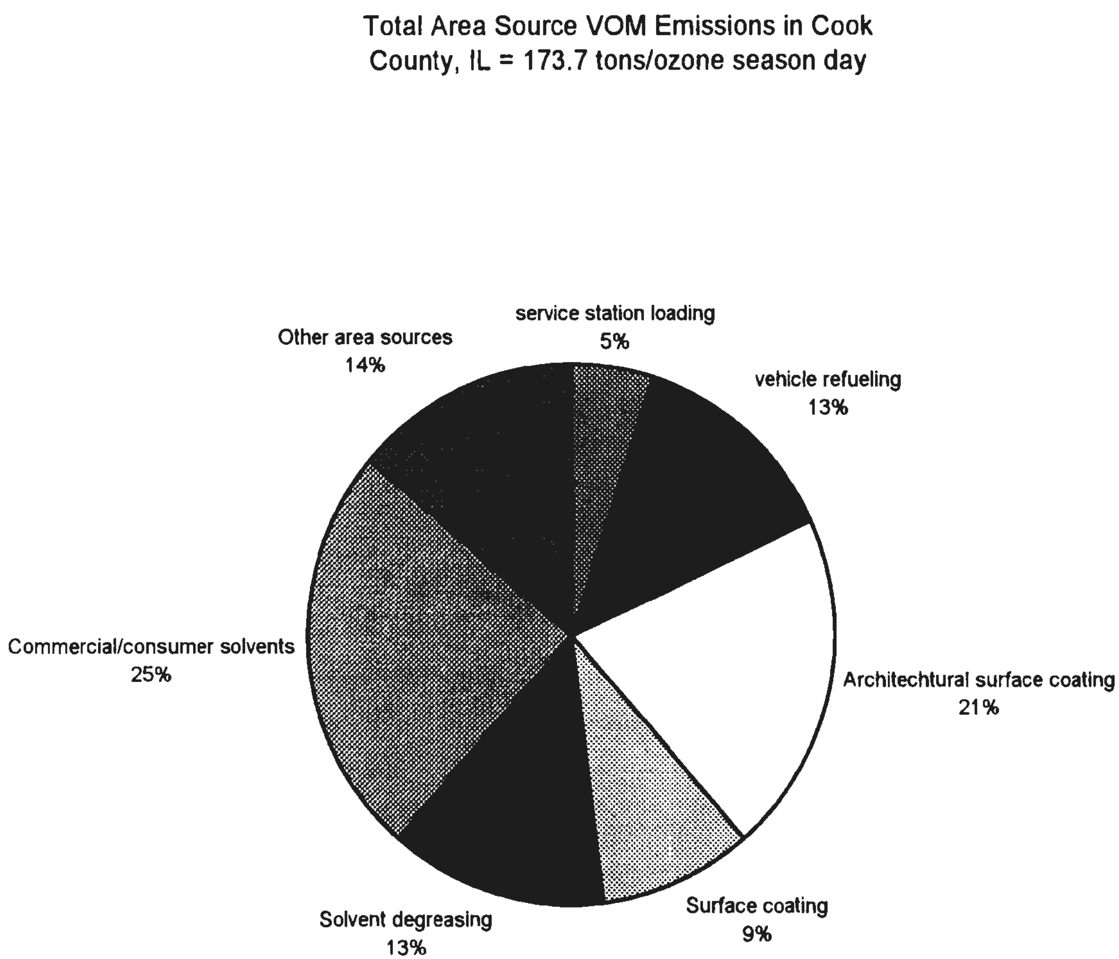

Figure 3-10. Relative Contribution to VOM Emissions by Cook County Area Sources

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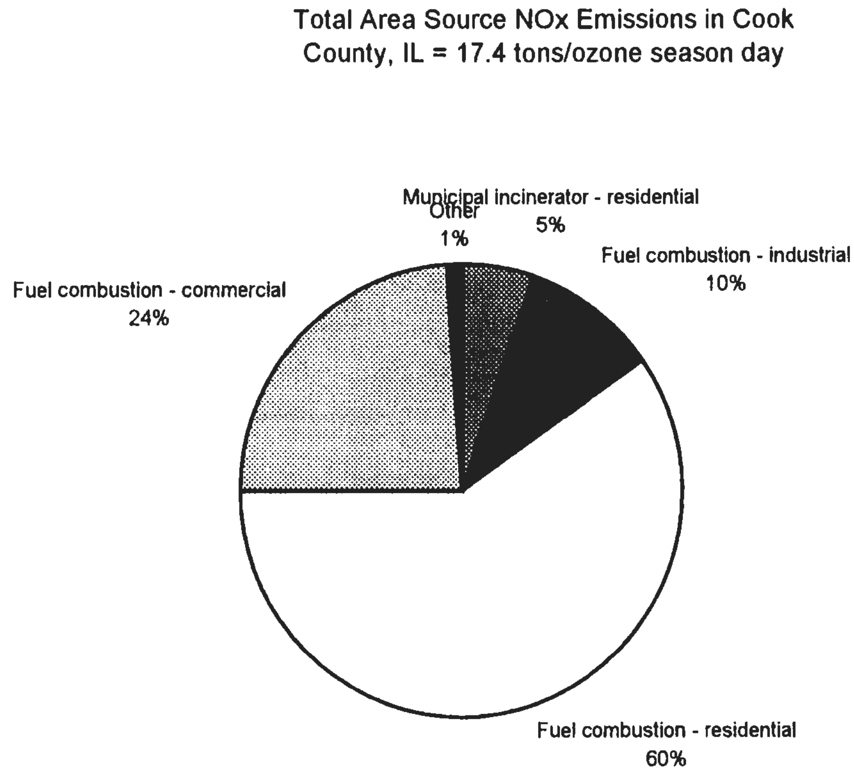

Figure 3-11. Relative Contribution to NOx Emissions by Cook County Area Sources (IEPA, 1993)

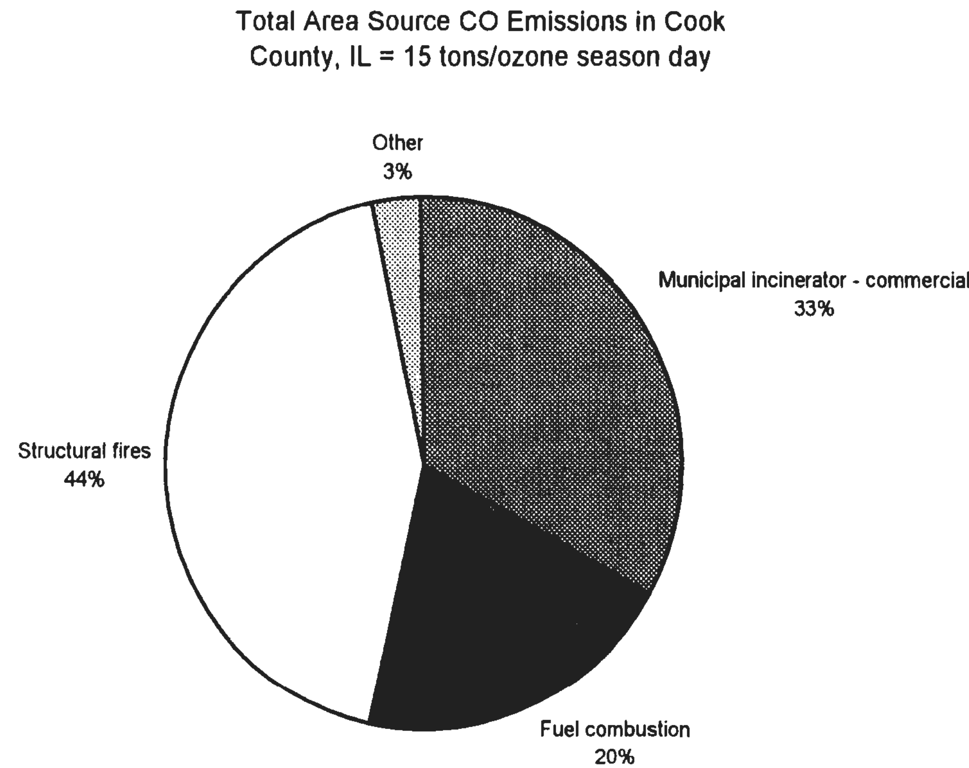

Figure 3-12. Relative Contribution to CO Emissions by Cook County Area Sources (IEPA, 1993)

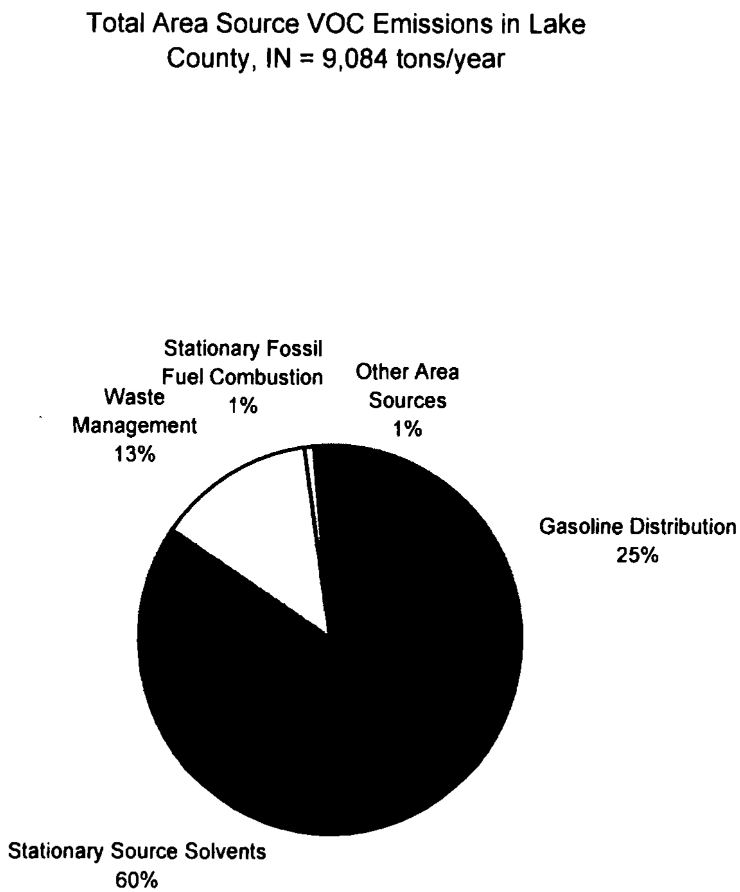

Figure 3-13. Relative Contribution to VOC Emissions by Lake County, IN Area Sources (Koch, 1997a)

area source in Lake County, IN. Major emission sources in this source category included architectural surface coating (1,094 tons/year), cold cleaning (856 tons/year), and automobile surface coating (684 tons/year) However, the largest single Lake County, IN, VOC area source was in the gasoline distribution category (vehicle fueling, 1,624 tons/year).

According to IDEM, and as shown on Figure 3-14, fossil fuel combustion was the most significant area source of NO_x emissions in Lake County, IN, accounting for nearly 96 percent of the County's area source emissions (Koch, 1997a). In fact, the largest NO_x area source was natural gas combustion, which accounted for almost 72 percent (1,638 tons/year) of the Lake County, IN, area source NO_x emissions Sources of NO_x in the waste management category included waste incinerators and open burning of wastes, and contributed about 4 percent of the total NOx emissions from area sources in Lake County, IN

Figure 3-15 summarizes the contribution to CO emissions from Lake County, IN, area sources (Koch, 1997a). The largest sources were natural gas combustion (stationary fossil fuel combustion category) at 350 tons/year (27 percent of Lake County, IN, CO area source emissions), structural fires (other area source category) at 287 tons/year (22 percent of Lake County, IN, CO area source emissions), residential open burning (waste management category) at 249 tons/year (19 percent of Lake County, IN, CO area source emissions), and coal combustion (stationary fossil fuel combustion category) at 181 tons/year (14 percent of Lake County, IN, CO area source emissions)

3.1.2.3 *Southwest Lake Michigan Pilot Study*

The States of Illinois, Indiana, and Wisconsin, working through the Great Lakes Commission (GLC), recently conducted a pilot study, which was funded by EPA, to inventory small-point and area sources of toxic air emissions in the Southwest Lake Michigan (SWLM) area, including Cook County, IL, and Lake County, IN, (U.S EPA, 1995c) For Cook County, the study contains estimated 1993 area source emissions data for a comprehensive list of source categories for 27 pollutants. The study also presents SIC Code specific emissions estimates for 25 pollutants from area sources (i e., sources with emissions of criteria pollutants of less than 25 tons per year) For Lake County, IN, the study presents estimated 1993 emissions data by SIC Code for 22 pollutants from area sources (annual emissions of less than 25 tons per year of criteria pollutants) Table 3-15

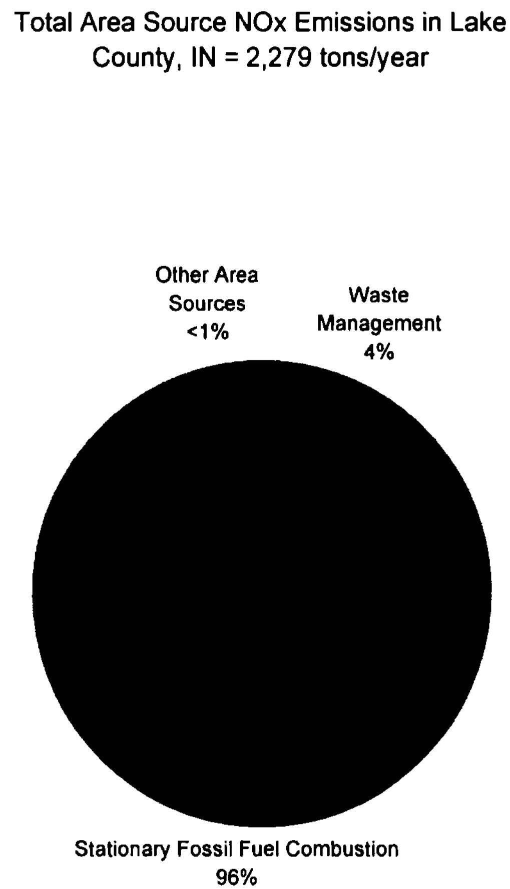

Figure 3-14. Relative Contribution to NOx Emissions by Lake County, IN Area Sources (Koch, 1997a)

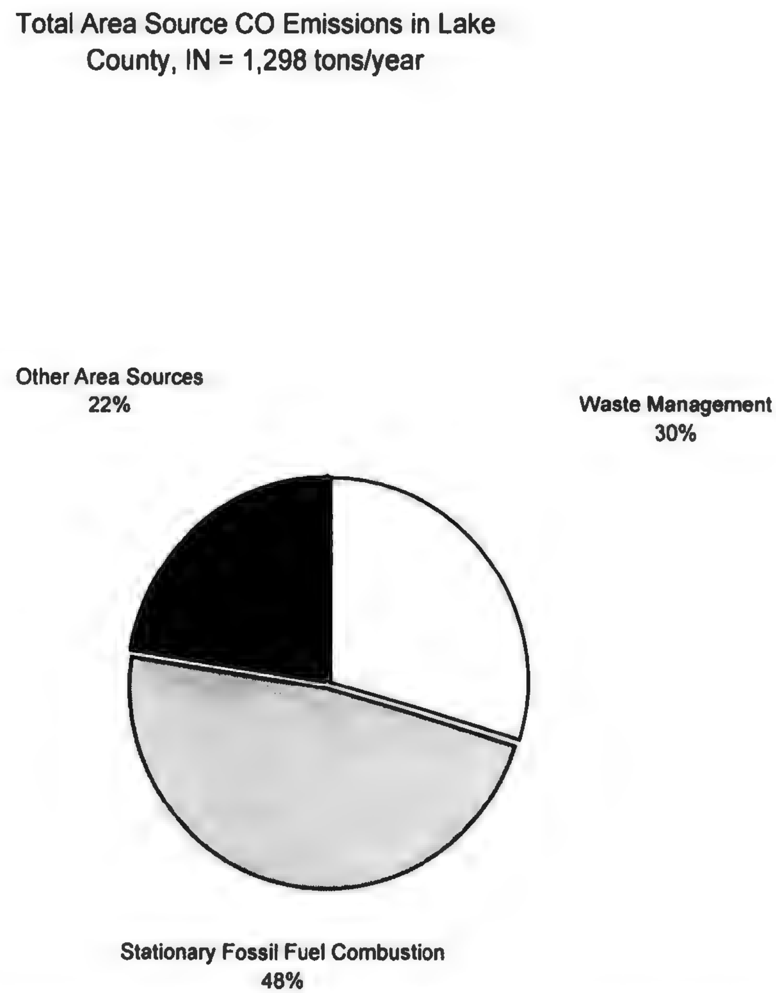

Figure 3-15. Relative Contribution to CO Emissions by Lake County, IN Area Sources (Koch, 1997a)

Table 3-15. Total Emissions for Cook and Lake County Area Sources (Total Emissions of Criteria Pollutants Below 25 tons/year).

Pollutant	Total Emissions (lb/yr)	Cook County Emissions (lb/yr)	Percent of Total Emissions from Cook County	Lake County Emissions (lb/yr)	Percent of Total Emissions from Lake County
Perchloroethylene	2711172 83	2711172 83	100 00%	NC	0 00%
Polycyclic Organic Matter	445308 39	445218 67	99 98%	89 72	0 02%
Trichloroethylene	299534 28	299534 28	100 00%	NC	0 00%
Methylene Chloride	51812 22	51812 22	100 00%	NC	0 00%
Lead	14220 79	13587 89	95 55%	632 90	4 45%
Cadmium	10333 42	10326 69	99 93%	6 73	0 07%
1,1,1-Trichloroethane	8745 62	8745 62	100 00%	NC	0 00%
Polycyclic aromatic hydrocarbons	2845 02	NC	0 00%	2845 02	100 00%
Mercury	1242 37	1241 19	99 91%	1 18	0 09%
Naphthalene	841 86	NC	0 00%	841 86	100.00%
Nickel	834 70	748 83	89 71%	85 87	10 29%
Copper	685 26	683 92	99 80%	1 34	0 20%
Chromium, total	298 79	285 40	95 52%	13 39	4 48%
Manganese	197 65	159 37	80 63%	38 28	19 37%
Cobalt	107 17	106 41	99 29%	0 76	0 71%
Arsenic	86 61	84 91	98 04%	1 70	1 96%
Chrysene	57 19	0 32	0 56%	56 87	99 44%
Fluoranthene	48 93	2 82	5 76%	46 11	94 24%
Phenol	46 04	0 56	1 21%	45 48	98 79%
Benzo(a)pyrene	34 14	NC	0 00%	34 14	100 00%
Ethylbenzene	32 23	32 23	100 00%	NC	0 00%
Chromium, Hexavalent	25 91	25 47	98 30%	0 44	1 70%
Benz(a)anthracene	5 87	NC	0 00%	5 87	100 00%
1,2-Dichloroethane	5 68	5 68	100 00%	NC	0 00%
Total polychlorinated dibenzofurans	0 53	0 44	83 14%	0 09	16 86%
Carbon tetrachloride	0 21	0 21	100 00%	NC	0 00%
Total polychlorinated dibenzodioxins	0 15	0 13	86 86%	0 02	13 14%
2,3,7,8-Tetrachlorodibenzofuran	2 60E-003	1 04E-004	3 98%	2 50E-003	96 02%
2,3,7,8-Tetrachlorodibenzo-p-dioxin	3 81E-004	3 39E-004	88 99%	4 20E-005	11 01%

NC = Not Calculated

Source U S EPA, 1995c

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presents the estimated emissions for the pollutants included in the study for area sources in Cook County, IL, and Lake County, IN.

As shown in Table 3-15, perchloroethylene had the highest area source emission rates in Cook County, IL, (2,711,172.83 pounds/year). A closer look at SIC Code data indicates that 95 percent of the perchloroethylene emissions in Cook County, IL, were from the laundry and dry cleaning industry (SIC Codes 7211 and 7216), with small contributions from the metal stamping industry (1.7 percent from SIC Code 3469), electroplating (1 1 percent from SIC Code 3471), and electrical transmission and distribution equipment (1 percent from SIC Code 3599) (U.S. EPA, 1995c). Perchloroethylene emissions were not presented for Lake County, IN, so comparison between counties is not possible (U.S. EPA, 1995c).

The SWLM Pilot Study estimated that significant sources of trichloroethylene in Cook County, IL, included: electroplating, polishing, anodizing, and coloring (SIC Code 3471) at 40 percent of the County's emissions; industrial furnaces and ovens (SIC Code 3567) at 13 percent of emissions; and, metal heat treating (SIC Code 3398) at 9 percent of emissions. Trichloroethylene emissions were not presented for Lake County, IN, (U S. EPA, 1995c).

Cook County, IL, also had relatively high area source emission rates for methylene chloride, lead, and cadmium (U.S EPA, 1995c) For methylene chloride, emissions were concentrated in the electronic components industry (SIC Code 3679, at 45 percent of the County's emissions) and office machines (SIC Code 3579, at 31 percent of the County's emissions) For lead, emissions are concentrated in the storage batteries industry (SIC Code 3691, at 58 percent of the County's emissions) and secondary nonferrous metals (SIC Code 3341, at 18 percent of the County's emissions) The largest sources of cadmium emissions in Cook County, IL, were the secondary nonferrous metals (SIC Code 3341, at 67 percent of the County's emissions) and the steel wire and related products industry (SIC Code 3315, at 24 percent of the County's emissions) (U.S. EPA, 1995c)

Table 3-15 also shows that both counties had *relatively* significant area source emission rates for polycyclic organic matter (POM) In Cook County, significant POM emissions sources included· lubricating oils and greases (SIC Code 2992, at 19 percent of the County's emissions), industrial inorganic chemicals (SIC Code 2819, at 8 percent), and sheet metal work (SIC Code 3444, at 7 percent of the POM emissions). In Lake County, IN, significant POM sources included: paving mixtures and blocks (SIC Code 2951, at 94 percent of the County's emissions), and lubricating oils and greases (SIC Code 2992, at about 6 percent) (U.S. EPA, 1995c).

For Lake County, IN, in addition to POM, the pollutants with the highest area source emission rates were polycyclic aromatic hydrocarbons (PAHs), naphthalene, lead, and nickel (U.S. EPA, 1995c). The SWLM Pilot Study also found that much of the area source emissions in Lake County, IN, were from nonclassifiable establishments (SIC Code 9999). For emissions that could be classified, industrial inorganic chemicals (SIC Code 2819) accounted for 99 percent of the County's lead emissions, and paving mixtures and blocks (SIC Code 2951) accounted for 95 percent of the nickel emissions, 3 percent of naphthalene emissions, and 41 percent of cadmium emissions. Lubricating oils and greases (SIC Code 2992) account for 38 percent of cadmium emissions and 84 percent of chromium emissions

Analysis of Table 3-15 also shows that, in most cases where data were presented for both counties, area source emission rates in Cook County, IL, were dramatically higher than in Lake County, IN, (U.S. EPA, 1995c). In fact, of the pollutants for which emission rates were calculated for both counties, chrysene, fluoranthene, and 2,3,7,8-tetrachlorodibenzofurans are the only pollutants that showed higher emissions rates in Lake County, IN, (U S. EPA, 1995c).

3.1.3 RAPIDS Air Emissions Estimates

RAPIDS Emissions

- Characterization of Point and Area Source Emissions
- 49 Toxic Chemicals
- Rankings of Emissions by Source, Chemical, SIC Code and ZIP Code

The Regional Air Pollutant Inventory Development System (RAPIDS) is a multistate pollutant emissions inventory data base It is a regional inventory of point and area sources of toxic air contaminants and has targeted 49 selected pollutants (RAPIDS, 1998) This effort is a followup to the SWLM Pilot Study, which was expanded to include additional pollutants/industries/sources using updated emission factors by U.S. EPA Office of Air Quality Planning and Standards (OAQPS) in cooperation with the States. Estimates of chemical loadings in RAPIDS are based on 1993 emissions inventory data The RAPIDS data repository is located at the U.S. EPA's Great Lakes National Program Office. There are similarities among the emissions information contained in RAPIDS, AFS, and TRI. As a result, there could be a degree of overlap among these data sets with respect to facilities and chemicals. The distinguishing features among these three data bases is their origin and the different reporting procedures required by State and Federal regulatory agencies in tracking compliance under numerous statutes Emission data for Cook County, IL, and Lake County, IN, from the RAPIDS data base were provided by EPA Region 5 for inclusion in this report (RAPIDS, 1998). This subsection identifies the known sources of air pollution in Cook County, IL, and Lake County, IN, using RAPIDS data. The total pollutant loadings for the two counties, for the ZIP Codes with the largest emissions, most prevalent pollutants, and the responsible industries have been identified for Cook County, IL, and Lake County, IN using data from the RAPIDS data base.

The total RAPIDS air emissions estimate in Cook County, IL, is 11,870,015 pounds, 7,213,179 pounds from point sources, and 4,656,836 pounds from area sources The RAPIDS data base includes 1,474 facilities in Cook County, IL. As shown in Table 3-16, the facilities with the largest emissions include General Foam Corp (Division of PMC, Inc.) (663,900 pounds or about 9.2 percent of the total RAPIDS point source emission in Cook County), U.S Steel - South Works (484,798 pounds), Senior Flexonics (372,507), Zenith Electronics (314,711), and LTV Steel Company Inc. (286,726 pounds) The chemicals emitted in the largest quantities from these point sources included trichloroethylene (2,085,998 pounds), methylene chloride (1,371,638 pounds), polycyclic organic matter (1,215,712 pounds), and 1,1,1-trichloroethane (979,804 pounds). These four pollutants make up 80 percent of total emissions from facilities in Cook County, IL The largest emissions from area sources in Cook County, IL, include consumer solvent use of 1,1,1-trichloroethane (2,051,504 pounds), perchloroethylene emissions from dry cleaners (1,980,718 pounds) and consumer use of naphthalene (317,063 pounds). In Cook County, IL, 1,1,1-trichloroethane and perchloroethylene emissions constitute 87 percent of total area emissions. Table 3-17 lists the toxic chemicals emitted from point and area sources in Cook County, IL

Table 3-16. Largest Emitters in Cook County, IL, from RAPIDS Data Base

RAPIDS Source	Emissions (Pounds/year)
County-wide Consumer Solvent Emissions	2,651,904
County-wide Dry Cleaning (Perchloroethylene) Emissions	1,980,718
General Foam Corp. (Div. of PMC, Inc.)	663,899
U.S. Steel - South Works	484,798
Senior Flexonics, Inc.	372,507
Zenith Electronics	314,711
LTV Steel Company, Inc.	286,726
Wheatland Tube Company, Chicago Div.	230,400
Duo Fast Corporation	224,619
Ingersoll Products	186,800
Reliable Power Products Inc.	138,698
Reynolds Metals Co.	130,176
Bagcraft Corp. of America	111,878
FPM Heat Treating, Inc.	110,000
G W Electric Specialty	99,700
Horsehead Resource Development Co., Inc.	93,712
Arlington Plating Co., Inc	93,325
Parkview Metal Products	91,635
General Fire Extinguisher Corp	89,416
Mobil Oil Corp-Lube Plant	84,615
Chicago Union Station Co., Power Plant	75,566
Tapecoat Co. Inc.	74,400
County-Wide Architectural Coating Emissions	69,183
Acme Steel Company-Chicago Coke Plant	67,220
County-Wide Autobody Refinishing Emissions	65,012
Now Products Corporation	64,698
John Crane, Inc.	61,101
Hysan Corp.	59,525
Lightning Metal Specialty	58,567
Ford Motor Company	58,308
Greif Bros. Corp., Seymour & Peck Div.	55,750

Table 3-16. Largest Emitters in Cook County, IL, from RAPIDS Data Base (Continued)

RAPIDS Source	Emissions (Pounds/year)
University of Illinois Chicago-Med Center	47,775
Celco Industries, Inc.	47,440
Accurate Anodizing Corporation	45,760
Zenith Radio Corporation	42,826
ITT Bell & Gossett	42,252
Ecolab, Inc.	40,951
Vapor Mark IV	40,722
Peace Industries, LTD.	38,970
Douglas Cleaners	38,938
Beeco Manufacturing Company	38,373
American Clybourn Finishing	37,800
Resinoid Engineering Corporation	37,064
Enamelers & Japanners, Inc. - Plants 1-5	35,150
Koppers Industries, Inc.	34,855
Scot Forge Company	34,101
1,428 Other Facilities	2,117,470
Total RAPIDS Emissions	11,870,016

Source: RAPIDS, 1998.

Table 3-17. Toxic Chemicals Emitted From Point and Area Sources in Cook County, IL, from RAPIDS Data Base

RAPIDS Chemical	Emissions (pounds/year)
1,1,1-Trichloroethane	3,031,308
Perchloroethylene	2,433,568
Trichlorethylene	2,088,575
Methylene chloride	1,564,596
Polycyclic Organic Matter	1,215,768
Manganese	484,315
Naphthalene	318,470
Coke Oven Gas	254,876
Ethylbenzene	222,402
Cadmium	109,613
Phenol	89,133
Polycyclic Aromatic Hydrocarbons	19,298
Lead	7,783
Benzo(a)pyrene	7,025
Nickel	6,160
Chromium	3,989
Dibutyl Phthalate	3,970
Copper	3,110
Mercury	2,913
Arsenic	887
Chlordane	816
Cobalt	593
Chrysene	355
Fluoranthene	313
1,2-Dichlorethane	80
Chromium VI	60
Benz(A)anthracene	36
Dioctyl Phthalate	1.41
PCBs	0.69
PCDF	0.58
Carbon Tetrachloride	0.31
PCDD	0.1058
2,3,7,8-TCDD (EQ)	0.0799
2,3,7,8-TCDF	0.0164
2,4,6-Trichlorophenol	0.0084
Total RAPIDS Emissions	11,870,015

Source: RAPIDS, 1998.

The total RAPIDS air emissions estimate for Lake County, IN, is 3,370,665 pounds for point and area sources, 3,192,805 pounds for point sources, and 177,860 pounds for area sources. The RAPIDS data base includes 51 facilities in Lake County, IN, with total estimated annual loadings of 3,192,805 pounds (Table 3-18). The facilities with the largest emissions include U.S. Steel Co. Gary Works (1,498,867 pounds or about 47 percent of the total RAPIDS point source emission in Lake County), Keil Chem-Ferro Co. (965,100 pounds), and Inland Steel (309,702 pounds). The chemicals emitted in the largest quantities from these point sources included 1,2-dichlorethane (964,600 pounds), coke oven gas (798,774 pounds), polycyclic organic matter (496,632 pounds), manganese compounds (228,246 pounds), and perchloroethylene (187,077). These five pollutants make up 75 percent of total emissions from facilities in Lake County, IN. The largest emissions from area sources in Lake County, IN include perchloroethylene (121,381 pounds), naphthalene (33,201 pounds) and ethyl benzene (12,228 pounds). Perchloroethylene and naphthalene emissions constitute 87 percent of total area emissions in Lake County, IN. Table 3-19 lists the toxic chemicals emitted from point and area sources in Lake County, IN.

Evaluating the RAPIDS data by industry type (SIC Code) indicates that of the reported 58 SIC Code categories found in Cook County, IL, and Lake County, IN, primary metal facilities (SIC Code 33) represent the highest combined level of emissions (21 percent or 3,191,947 pounds). The "non-classified/other" category constitutes 19 percent (2,826,573 pounds), personal services (SIC Code 72) (e.g., laundry, dry cleaning, photograph studios, barber shops and beauty salons) constitute 14 percent (2,201,710 pounds), and the chemical industry (SIC Code 28) constitutes 10 percent (1,556,221 pounds) of emissions in both counties. Of the combined area source emissions in Cook County, IL, and Lake County, IN, 58 percent fall into the "non-classified/other" category Table 3-20 displays the SIC codes that contribute 80 percent of total emissions in Cook County, IL, and Lake County, IN.

In Cook County, IL, five industrial categories constitute 64 percent of total emissions. 23 percent (2,774,400 pounds) are non classified, SIC Code 72, personal services, constitutes 15 percent (1,831,229 pounds), SIC Code 35, industrial and commercial machinery and computer equipment, constitutes 10 percent (1,205,987 pounds), SIC Code 34, fabrication/metals, constitutes 9 percent (1,060,702 pounds), and SIC Code 30, plastics, constitutes 7 percent (802,168 pounds). In Lake County, IN, two industrial-type categories constitute 90 percent of total emissions The primary

Table 3-18. Largest Emitters in Lake County, IN, from RAPIDS Data Base

RAPIDS Facility	Emissions (pounds/year)
U.S. Steel Co Gary Works	1,498,867
Keil Chem-Ferro Co.	965,100
Inland Steel Flat Products Part 1	309,702
Rhone-Poulenc Basic Chemicals co	184,510
Union Tank Car Co.	30,103
Globe Industries Inc	29,500
American Steel Foundries	25,724
Harbison-Walker Refractories	21,500
American National Can Co.	19,512
LTV Steel Company	18,862
48 Other Facilities	267,284
Total RAPIDS Emissions	3,370,665

Source: RAPIDS, 1998.

Table 3-19. Toxic Chemicals Emitted From Point and Area Sources in Lake County, IN, From RAPIDS Data Base

RAPIDS Chemical	Emissions (pounds/year)
1,2-Dichlorethane	964,600
Coke Oven Gas	798,774
Polycyclic Organic Matter	496,632
Perchloroethylene	308,458
Manganese Compounds	228,246
Methylene Chloride	141,575
Lead	134,477
Ethylbenzene	82,193
Phenol	61,376
Naphthalene	48,385
Trichlorethylene	25,976
1,1,1-Trichloroethane	19,098
Chromium	17,331
Copper	13,803
Dibutyl Phthalate	8,213
Cadmium	6,199
Nickel Compounds	4,905
Benzo(a)pyrene	2,582
Polycyclic Aromatic Hydrocarbon	2,570
Carbon Tetrachloride	2,000
Mercury	1,328
Arsenic	672
Cobalt	601
Diethylhexyl Phthalate	255
PCDF	250
Fluoranthene	78
Chrysene	63
Dioctyl Phthalate	21
Benz(a)anthracene	2.47
Chromium VI	1.43
PCDD	0.007
1,2,7,8-TCDF	0.0005
Total RAPIDS Emissions	3,370,665

Source: RAPIDS, 1998.

Table 3-20. Industrial Category Groups Contributing to 80 Percent of Total Emissions in Cook County, IL, and Lake County, IN

SIC Code	Industry	Emissions (pounds/year)
33	Primary Metal	3,191,947
Non classified/other	----	2,826,573
72	Personal Services	2,201,710
28	Chemical	1,556,221
35	Industrial and Commercial Machinery	1,223,963
34	Fabrication/Metals	1,082,920
	53 Other SIC Codes	3,157,346
Total RAPIDS Emissions		15,240,680

Source: RAPIDS, 1998.

metal industry (SIC Code 33) constitutes 56 percent of emissions (1,871,513 pounds) and the chemical industry (SIC Code 28) constitutes 34 percent (1,153,023 pounds) of emissions.

The RAPIDS data base reports 173 ZIP Code areas in Cook County, IL and Lake County, IN, combined: 155 ZIP Code areas in Cook County, IL, (7,213,179 pounds) and 18 ZIP Code areas in Lake County, IN, (3,192,805 pounds). Combined RAPIDS data for the two counties indicate that two ZIP Codes in Lake County, 46402 (1,498,875 pounds) and 46320 (1,177,349 pounds) have the highest emissions. ZIP Code areas 60617 (982,615 pounds) and 60455 (675,626 pounds) rank third and fourth. Table 3-21 lists the ZIP Code areas that release 80 percent of total emissions in Cook County, IL, and Lake County, IN. Figure 3-16 displays ZIP Code areas in Lake County, IN, that constitute 90 percent of point source emissions Figure 3-17 displays ZIP Code areas in Cook County, IL, that constitute approximately 75 percent of point source emissions.

3.1.4 Air Emissions by Industry Type

It is possible to identify the types of industries that emit air pollutants from SIC Codes. Presented below, first for point sources from AIRS/AFS and secondly for area sources, are summaries of the major industries emitting air pollutants in Cook County, IL, and Lake County, IN.

3.1.4.1 *Point Source Emissions by Industry Type*

Point source emissions of criteria air pollutants reported in AIRS/AFS (1997) come from a variety of industry types in the Cook County, IL, and Lake County, IN, area VOC emissions, totaling 87,466 tons per year from point sources, were attributed to the primary metal industries (40,926 tons or 47 percent), as well as other industries. Table 3-22 presents VOC emissions by two-digit SIC Code

CO emissions (totaling 629,591 tons per year) in the study area primarily came from: primary metals (60 percent) and petroleum (37 percent). NO_2 emissions, which total 118,411 tons per year, were emitted by the primary metals (42,205 tons or 36 percent), utilities (26,470 tons or 22 percent), petroleum (21,654 tons or 18 percent), and food (9,742 tons or 7 percent) industries

Table 3-21. ZIP Code Areas That Release 80 Percent of Total RAPIDS Emissions in Cook County, IL, and Lake County, IN

ZIP Code	Emissions (pounds/year)
46402	1,498,875
46320	1,177,349
60617	982,615
60455	675,627
60131	467,859
60609	374,453
60103	372,507
46312	359,072
60160	316,930
60650	275,679
60007	250,300
60406	213,064
60643	186,843
60632	156,248
60525	156,078
60053	143,358
60607	142,265
60639	135,982
60067	120,945
60076	109,741
60618	104,646
60062	102,300
60628	98,246
150 Other ZIP Code Areas	1,985,003
Area Sources	4,834,696
Total RAPIDS Emissions in Cook County, IL, and Lake County, IN	15,240,680

Source: RAPIDS, 1998

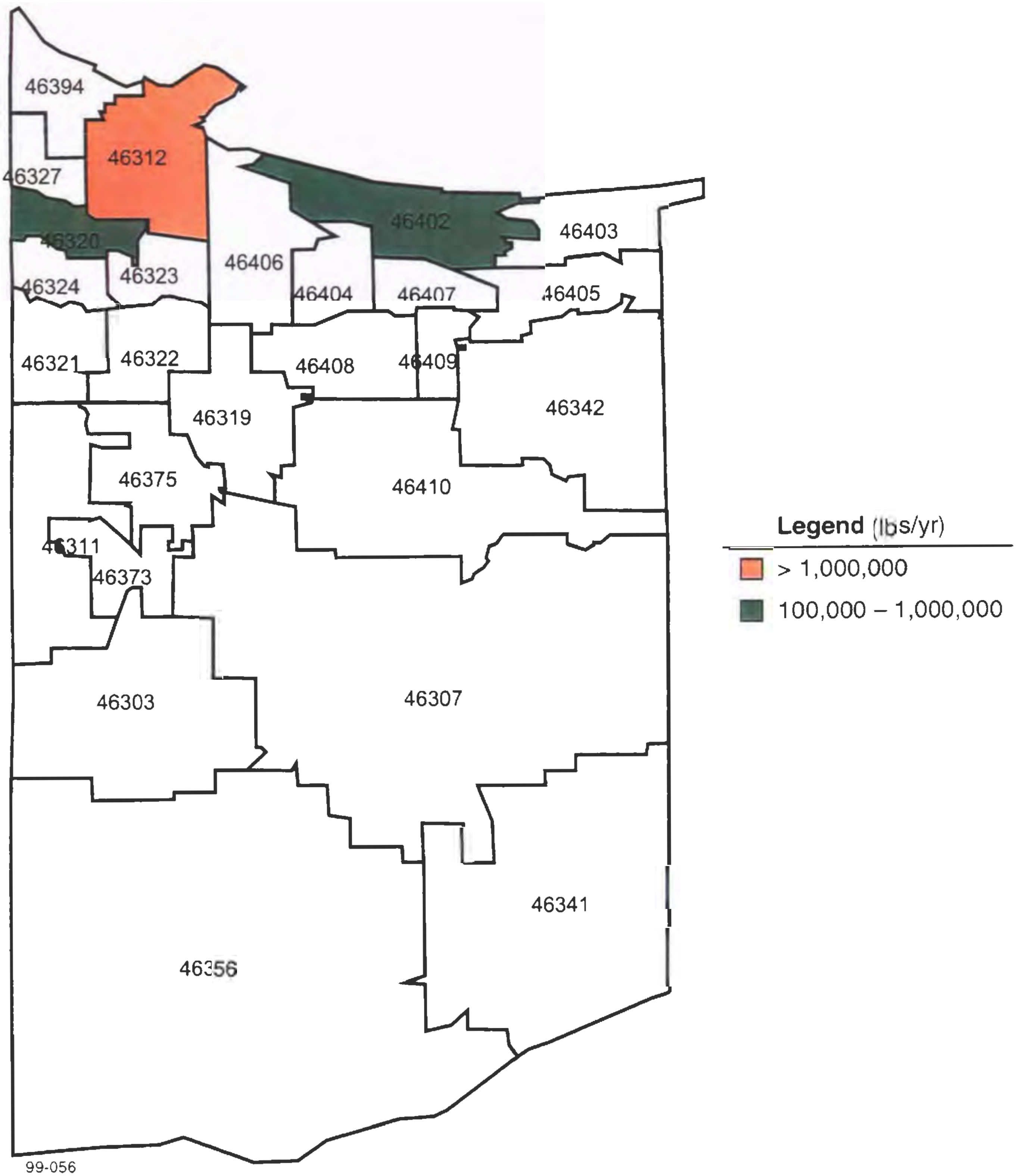

Figure 3-16. RAPIDS Air Emission Estimate for Lake County, IN

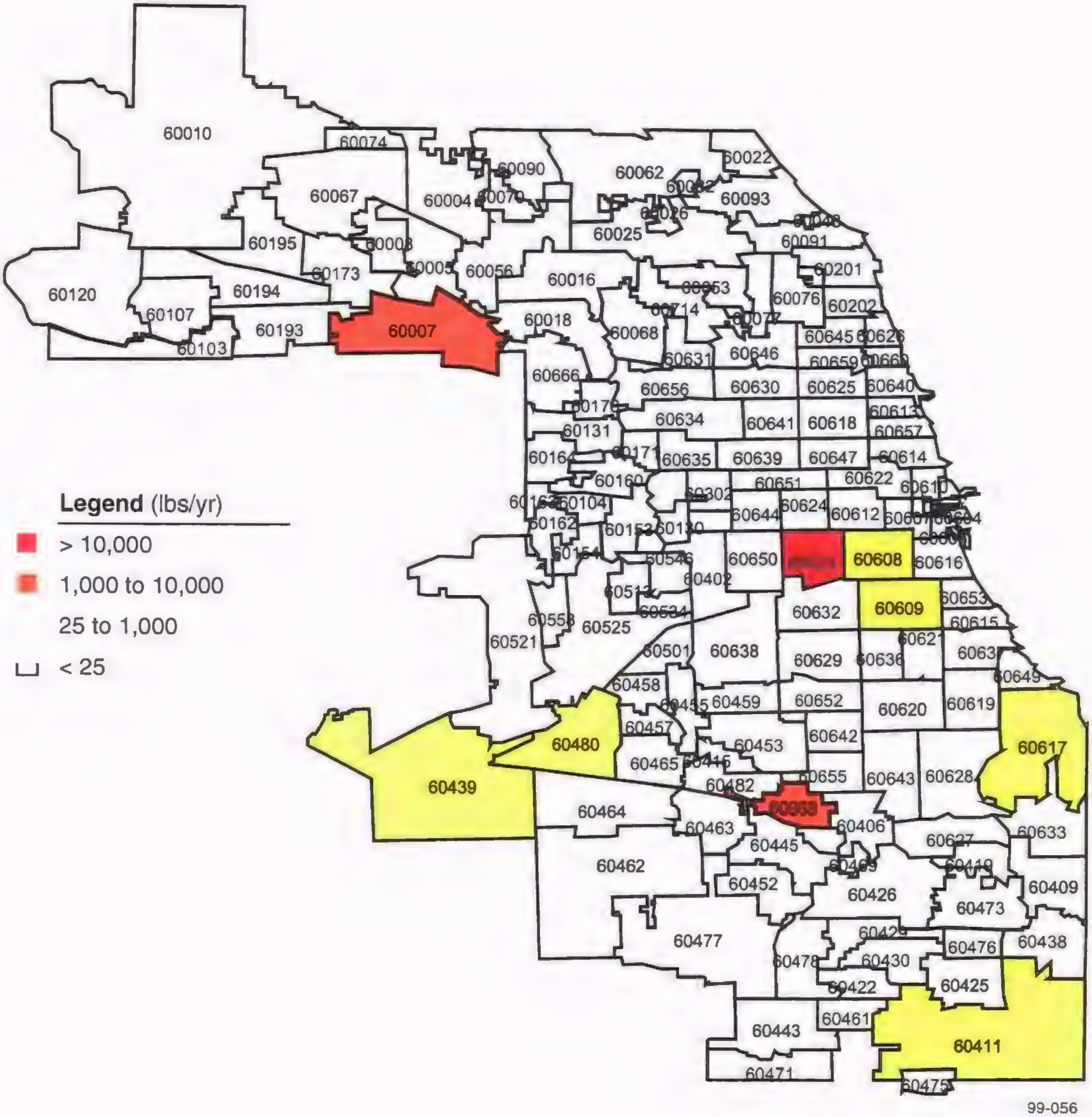

Figure 3-17. RAPIDS Air Emissions Estimates for Cook County, IL

Table 3-22. VOC Emissions from Point Sources in 1995 by Industry Type

Two-Digit SIC	Type of Industry	Emissions in Pounds/Year	Emissions in Tons/Year
8	FORESTRY	1,747	1
14	MINERALS	23,853	12
16	HEAVY CONSTRUCTION	109	<1
20	FOOD	6,082,522	3,041
21	TOBACCO	131,313	66
22	TEXTILES	1,258,553	629
23	APPAREL	95,731	48
24	LUMBER + WOOD	538,483	269
25	FURNITURE	1,619,037	810
26	PAPER	10,763,299	5,382
27	PRINTING	8,359,133	4,180
28	CHEMICAL	8,734,246	4,367
29	PETROLEUM	10,624,976	5,312
30	PLASTICS	3,850,469	1,925
31	LEATHER	106,482	53
32	STONE/CLAY	443,044	222
33	PRIMARY METAL	81,852,907	40,926
34	FABR. METAL	11,783,949	5,892
35	MACHINERY	2,577,862	1,289
36	ELECTRICAL	2,418,237	1,209
37	TRANSPORTATION	4,329,962	2,165
38	MEASURE/PHOTO	536,676	268
39	MISCELLANEOUS	874,766	437
40	RAIL TRANSPT	42,876	21
42	TRUCK TRANSPORT	129,498	65
44	WATER TRANSPORT	627,525	314
45	AIR TRANSPORT	13,453	7
46	PIPELINES	198,189	99
47	TRANSPT SVCS	133,028	67

Table 3-22. VOC Emissions from Point Sources in 1995 by Industry Type (continued)

Two-Digit SIC	Type of Industry	Emissions in Pounds/Year	Emissions in Tons/Year
49	UTILITIES	1,497,053	749
50	DURABLE WHSL	312,701	156
51	NONDUR WHSL	6,609,424	3,305
53	GENERAL RETAIL	6,396	3
54	FOOD STORES	656	1
55	GAS STATIONS	24,724	12
59	OTHER RETAIL	1,877	1
60	BANKING	1,834	1
65	REAL ESTATE	85,979	43
70	HOTELS	2,731	1
72	PERSONAL SVCS	1,922,713	961
73	BUSINESS SVCS	15,345	8
75	AUTO REPAIR	64,022	32
76	OTHER REPAIR	26,385	13
80	HEALTH	96,928	48
82	EDUCATIONAL	50,515	25
83	SOCIAL	374	<1
86	ORGANIZATIONS	1,240	1
87	ENG.+MGMT. SVCS	9,737	5
89	OTHER SVCS	1,109	1
91	EXEC.+LEGIS.	3,557	2
92	JUSTICE	1,783	1
95	ENVIR.+HOUSING	6,605	3
96	ADMINISTRATVE	79,061	40
97	NATIONAL SECURITY	79,433	40
99	NONCLASSIFIED	5,749,522	2,875
	Total Emissions	**174,803,629**	**87,466**

Source AIRS/AFS. 1997

Analyses of particulate matter emissions from point sources by industry type reveal that of the total emissions (93,396 tons per year), almost 50 percent (45,088 tons) were from the chemical industry. Table 3-23 presents the emissions of particulate matter by SIC Code for the largest industry types PM_{10} emissions totaled 84,613 tons per year from point sources in the study area. More than 83 percent of these emissions were from primary metal industries. Table 3-24 presents PM_{10} emissions by SIC Code.

SO_2 emissions totaled 161,048 tons per year from point sources in Cook County, IL, and Lake County, IN. The primary metal industry attributed for about 42 percent of the total, petroleum-related industries contributed about 26 percent; and utilities emitted about 22 percent of the total SO_2 emissions from point sources.

3.1.4.2 *Area Source Emissions by Industry Type*

Summerhays generated emissions estimates by source category for area sources in the Southeast Chicago area (U.S EPA, 1989a). The study included focused on 32 carcinogens including chlorinated VOCs, nonchlorinated VOCs, and inorganics. The study reported the highest carcinogenic pollutant emission rates for gasoline vapors, benzene, methylene chloride, perchloroethylene, and formaldehyde. For noncarcinogens, the highest emission rates were for toluene, xylene, ethylene, and acetone (U S. EPA, 1989a). Source categories included in the study were steel mills, consumer sources (home heating and cooling, gas stations/marketing), waste facilities, sewage treatment plants, other industrial sources, and mobile sources. The following summarizes major emission rates by compound and source category from the Summerhays study (U S. EPA, 1989a).

Table 3-23. Particulate Matter Emissions from Point Sources in 1995 by Industry Type

Two-Digit SIC	Type of Industry	Emissions in Pounds/Year	Emissions in Tons/Year
7	AG SERVICES	834	0
14	MINERALS	9,026,018	4,513
16	HEAVY CONSTRUCTION	4,320	2
20	FOOD	2,812,958	1,406
21	TOBACCO	6,983	3
22	TEXTILES	15,553	8
23	APPAREL	22,691	11
24	LUMBER + WOOD	195,819	98
25	FURNITURE	145,672	73
26	PAPER	609,919	305
27	PRINTING	356,251	178
28	CHEMICAL	90,176,516	45,088
29	PETROLEUM	3,951,127	1,976
30	PLASTICS	176,357	88
31	LEATHER	63,765	32
32	STONE/CLAY	3,472,747	1,736
33	PRIMARY METAL	42,104,906	21,052
34	FABR. METAL	1,297,224	649
35	MACHINERY	453,677	227
36	ELECTRICAL	306,922	153
37	TRANSPORTATION	505,047	253
38	MEASURE/PHOTO	27,076	14
39	MISCELLANEOUS	45,944	23
40	RAIL TRANSPORT	21,274	11
42	TRUCK TRANSPORT	14,707	7
44	WATER TRANSPORT	85,009	43
47	TRANSPORT SERVICES	289	<1
49	UTILITIES	5,150,492	2,575
50	DURABLE WHOLESALE	195,935	98
51	NONDUR WHOLESALE	16,432,586	8,216
52	BLDG MATERIAL	1,986	1
53	GENL. RETAIL	33,985	17
54	FOOD STORES	25,266	13

Source: AIRS/AFS, 1997

Table 3-24. PM_{10} Emissions from Point Sources in 1995 by Industry Type

Two-Digit SIC	Type of Industry	Emissions in Pounds/Year	Emissions in Tons/Year
14	MINERALS	1,268,512	634
20	FOOD	1,155,365	578
22	TEXTILES	29	<1
24	LUMBER + WOOD	22,962	11
25	FURNITURE	47,370	24
26	PAPER	280,155	140
27	PRINTING	21,578	11
28	CHEMICAL	3,059,022	1,530
29	PETROLEUM	7,056,832	3,528
30	PLASTICS	9,994	5
31	LEATHER	1,128	1
32	STONE/CLAY	1,201,424	601
33	PRIMARY METAL	142,505,259	71,253
34	FABR. METAL	245,867	123
35	MACHINERY	5,095	3
36	ELECTRICAL	60,241	30
37	TRANSPORTATION	262,498	131
38	MEASURE/PHOTO	1,310	1
40	RAIL TRANSPORT	1,110	1
42	TRUCK TRANSPORT	4,915	2
44	WATER TRANSPORT	30,344	15
47	TRANSPORT SERVICES	289	<1
49	UTILITIES	1,742,161	871
50	DURABLE WHOLESALE	98,564	49
51	NONDUR WHOLESALE	6,247,211	3,124
60	BANKING	4,197	2
65	REAL ESTATE	6,290	3
80	HEALTH	108	<1
82	EDUCATIONAL	11,529	6
86	ORGANIZATIONS	25	<1
99	NONCLASSIFIED	3,874,836	1,937
	Total Emissions	**169,226,223**	**84,613**

Source: AIRS/AFS, 1997

Steel Mills

The Summerhays study found that steel mills, specifically the coking ovens, were a significant source of air toxics in the study area (U.S. EPA, 1989a) The pollutants with the highest emission rates from steel mills were benzene (3,356.2 tons/year[1]), toluene (548.4 tons/year), coke oven emissions[2] (427.8 tons/year), ethylene (215.8 tons/year), and xylene (194.3 tons/year) In terms of emission rates, the largest steel mills included in the Summerhays inventory were Inland Steel, U.S Steel, LTV Steel (Chicago), and Acme Steel (U.S. EPA, 1989a)

Waste Facilities

Summerhays found that the primary pollutants emitted from waste facilities included: methylene chloride (68.2 tons/year), toluene (40 9 tons/year), ethyl acrylate (39 1 tons/year), trichloroethylene (30.6 tons/year), and acetone (14.9 tons/year) (U.S. EPA, 1989a). Using data generated by MRI (1987), Summerhays reported that hazardous waste treatment, storage, and disposal facilities (TSDFs) had the greatest total emissions, municipal landfill emissions are somewhat lower, and abandoned waste site emissions were substantially lower (U.S EPA, 1989a). In terms of emission rates, some of the largest TSDF facilities in the study included: the CID facility, Allied Tube and Conduit Corporation, Chem-Clear, American Chemical Services, McKesson Envirosystems, Metal Finishing Research, and the SCA incinerator The municipal landfills included in the study were, in descending order of emissions rate· the Land & Lakes Landfill, the Lansing/Sexton Landfill, and the Paxton Landfill The estimates for abandoned waste sites were based on information for 42 sites from CERCLIS (U.S. EPA, 1989a)

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[1]Emissions data in the Summerhays report (U S EPA, 1989a) were reported in metric tons per year. For consistency within this document, metric tons were converted to English tons using a conversion factor of 1.1025 tons/metric ton

[2]The Summerhays (U S. EPA, 1989a) study describes coke oven emissions as total emissions of benzene-soluble organics that are emitted from charging and leaks from coke ovens

For Lake County, IN, sources, IDEM (1997a) estimated emissions from solid waste incineration at 47 tons/year for VOC, 71 tons/year for NO_x, and 139 tons/year for CO For landfills, IDEM also estimated VOC emissions at 275 tons/year.

Sewage Treatment Plants

Emissions estimates by Summerhays for this category were based on the Calumet and West-Southwest wastewater treatment plants (U.S. EPA, 1989a) Estimated emissions included: acetone (203 tons/year), xylene (17.3 tons/year), methylene chloride (9.5 tons/year), toluene (7.6 tons/year), and perchloroethylene (6.6 tons/year).

A separate study conducted by the Illinois Department of Energy and Natural Resources (IDENR), entitled *A Study Estimating VOC Emissions from the Calumet Sewage Treatment Plant in the Chicago Area* (IDENR, 1986), developed emissions estimates for the Calumet sewage treatment plant that are somewhat different from those presented in the Summerhays study (U.S. EPA, 1989a) IDENR used three different models to develop emissions estimates for VOCs Pollutant emission rates using the model that generally produced the highest emissions rates in the IDENR study (i.e , the Input/Output model) included· toluene (24 98 tons/year), benzene (7.36 tons/year), ethylbenzene (5 44 tons/year), tetrachloroethylene (4 43 tons/year), 1,1,1-trichloroethane (3 13 tons/year), and trichloroethylene (2 91 tons/year).

A similar study conducted by Noll, entitled *Calculation of VOC U.S. EPA-listed Emissions from the Calumet Sewage Treatment Works of the Metropolitan Sanitary District of Greater Chicago* (Noll, 1987), found similar emission rates using the same input/output model Specifically, the pollutants with the highest emission rates included: toluene (11 84 tons/year), 1,1,1-trichloroethane (8 61 tons/year), dichloromethane (3 68 tons/year), ethylbenzene (2.08 tons/year), benzene (1.71 tons/year), and tetrachloroethene (1.11 tons/year)

Namkung and Rittmann (1987) used a mass balance approach to estimate VOC emissions from the Calumet and West-Southwest treatment plants Specifically, the study used VOC influent and effluent concentrations and then calculated removal efficiencies for the three VOC removal mechanisms operating at each plant· volatilization, biodegradation, and adsorption Namkung and

Rittmann's study-estimated VOC emissions for the Calumet and West-Southwest treatment plants are shown in Table 3-25. Table 3-26 compares the results for the Namkung and Rittmann (1987) study with the results from the IDENR and Noll studies for the Calumet plant, and Table 3-27 compares the combined Calumet and West-Southwest treatment plant emissions as estimated by the Namkung and Rittmann (1987) and Summerhays (U.S. EPA, 1989a) studies.

For Lake County, IN, IDEM (1997a) estimated VOC emissions from wastewater treatment (publicly-owned treatment works [POTWs] and industrial wastewater treatment plants, combined) to be 749 tons/year

Consumer Sources

Consumer sources in the Summerhays study included home heating and cooling and gasoline marketing (gas stations, distribution, etc.) (U.S. EPA, 1989a) The highest emission rates of carcinogens from this source category included· gasoline vapors (5,222 8 tons/year), methylene chloride (1,195.1 tons/year), perchloroethylene (884.2 tons/year), and formaldehyde (121.3 tons/year) For noncarcinogens, the highest emissions rates included· toluene (371.5 tons/year), xylene (70.9 tons/year), and nickel (16.3 tons/year). Summerhays estimated POM emissions from wood burning at 2.1 tons/year for Cook County, IL, and 0.6 tons/year for Lake County, IN, (U.S. EPA, 1989a).

Other Industrial Sources

Emissions from this source category were obtained, primarily, from data for nearly 200 facilities submitted in response to Section 313 of the Superfund Amendments and Reauthorization Act (SARA), as updated by a questionnaire submitted by some facilities to EPA Region 5 (U S EPA, 1989a). Based on these data, the highest estimated emission rates for carcinogens included· perchloroethylene (383.7 metric tons/year), trichloroethylene (374 7 metric tons/year), methylene chloride (287 3 tons/year), and gasoline vapors (216 2 metric tons/year) (U.S EPA, 1989a) For noncarcinogens, the highest emission rates were for toluene (2,450 6 metric tons/year), xylene (960 4 metric tons/year), acetone (466 5 metric tons/year), and ethylene (140 1 metric tons/year)

Table 3-25. VOC Emissions Estimates for Calumet and West-Southwest Wastewater Treatment Plants

Pollutant	Calumet Estimated Emissions (Tons/year)	West-Southwest Estimated Emissions (Tons/year)
Benzene	0.21	0.01
Chlorobenzene	0.004	<0.01
Chloroform	0.61	2.39
1,2-Dichloroethane	0.07	0.16
Ethylbenzene	0.2	0.34
Methylene chloride	0.05	0.8
Tetrachloroethylene	4.7	12.91
Toluene	0.95	0.81
1,2-Trans-Dichloroethane	0.28	1.25
1,1,1-Trichloroethane	2.0	8.24
Trichloroethylene	2.35	19.45
Total VOCs	11.43	46.39

Source: Namkung and Rittmann, 1987.

Table 3-26. Comparison of Emissions Estimates for the Calumet Wastewater Treatment Plant

Pollutant	Estimated Emissions (Tons/year)		
	Namkung and Rittmann Study (1987)	IDENR Study (1986)	Noll Study (1987)
Benzene	0.21	7.36	1.71
Ethylbenzene	0.2	5.44	2.08
1,1,1-Trichloroethane	2.0	3.13	8.61
Tetrachloroethylene	4.7	4.43	1.11
Trichloroethylene	2.35	2.91	0.77
Toluene	0.95	24.98	11.84
Chlorobenzene	0.004	0.15	0.12
Chloroform	0.61	0.34	0.81
1,2-Dichloroethane	0.07	0.34	0.08
Methylene Chloride	0.05	0.15	0
Total VOCs	11.43	49.7	31.99

Sources: Namkung and Rittmann, 1987.
IDENR, 1986
Noll, 1987

Table 3-27. Comparison of Combined Emission Estimates for Calumet and West-Southwest Treatment Plant

Pollutants	Estimated Emissions	
	Summerhays Study (EPA, 1989a) (Metric Tons/year)	Namkung and Rittmann Study (1987) (Tons/year)
Benzene	0.7	0.2
Chlorobenzene	NC	0.004
Chloroform	0.7	3.0
1,2-Dichloroethane	NC	0.2
Ethylbenzene	NC	0.6
Methylene Chloride	8.6	0.9
Tetrachloroethylene	NC	17.6
Toluene	6.9	1.8
1,2-Trans Dichloroethane	NC	1.5
1,1,1-Trichloroethane	NC	10.2
Trichloroethylene	1.9	21.8

NC = Not Calculated

Sources: U.S. EPA, 1989a.
Namkung and Rittmann, 1987.

Hexavalent chromium emissions from chrome electroplating operations were estimated at 2.1 tons/year from the 41 electroplating facilities in the Cook County, IL, portion of the study area and 0 7 tons/year in the Lake County, IN, portion of the study area (U S. EPA, 1989b). For Cook County, emissions were based on the number of chrome plating facilities; however, information on the number of chrome plating facilities in Lake County, IN, was not available. Emission rates for Lake County, IN, were based, therefore, on the number of manufacturing employees in the County.

This source category also included emissions from a municipal incinerator in East Chicago, IN. Emissions estimates from this incinerator included mercury (0.6 tons/year), formaldehyde (0.4 tons/year), nickel (0.2 tons/year), cadmium (0.1 tons/year), and dioxin[3] (0.0002 tons/year) (EPA, 1989b).

Midway Airport Emissions

Ricondo & Associates (1996) performed an emissions inventory at Midway Airport in Cook County, IL Table 3-28 presents the results of the Midway Airport emissions inventory for 1995.

Contribution to Air Pollution-Related Cancer Cases

The emissions estimates included in the Summerhays report were used to estimate contributions by source category to estimated air pollution related cancer cases in the Southeast Chicago area (U.S EPA, 1989a). While this environmental loadings profile does not address risks, the information from the Summerhays report is useful in assessing the relative contributions of loadings from different pollutants and types of sources. The results of this analysis are presented in Figure 3-18

Vigyan (1993) used emissions estimates from a 16 square mile study area, which included Midway Airport, in Cook County, IL, to develop estimated source category contributions to air pollution related cancer cases The study estimated that over a 70-year period about 20 cancer cases

[3]Dioxin emissions using a toxicity equivalence factor approach such that dioxin emissions are expressed as if all the dioxins and furans were emitted as 2,3,7,8-tetrachlorodibenzo-p-dioxin.

Table 3-28. 1995 Emissions Inventory for Midway Airport

Source	Pollutant Emission (tons/year)				
	CO	VOC	NOx	SOx	PM10
Motor vehicles - roadways	66.7	5.27	5.54	0	0.34
Motor vehicles - parking lots	43.36	3.53	1.33	0	0
Power plants	0.15	0.06	0.75	0.08	0.02
Heating plants	0.18	0.07	0.88	0.01	0.03
Fuel tanks	0	10.39	0	0	0
Ground support equipment	335.57	74.37	62.4	1.39	3.9
Aircraft	3,138.77	440.31	635.57	53.43	22.37
Total Emissions	3,584.72	534.0	706.47	54.9	26.66

Source Ricondo, 1996

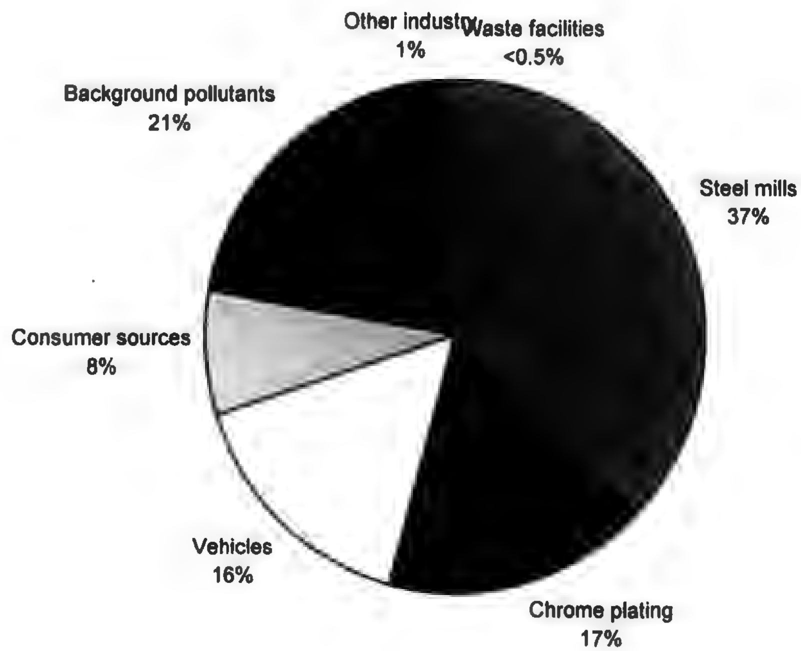

Figure 3-18. Relative Contribution of Emission Source Categories to Air Pollution-Related Cancer Cases in the Southeast Chicago Area (EPA, 1989a)

in the study area would be attributable to air pollution, therefore, the average cancer risk across the study area due to air pollution was approximately 2.1 x 10^{-4} As shown in Figure 3-19, the major contributors to air pollution related cancer cases in the study area were road vehicles, background concentrations,[4] chrome platers, nonroad engines, aircraft engines, and steel mills. The study (Vigyan, 1993) also estimated the percent of cancer cases in the study area associated with specific pollutants. The results of this analysis are presented in Figure 3-20.

3.1.5 Mobile Sources

> **Mobile Sources**
>
> - Characterization of Emissions of VOCs, CO, and NO_x
> - Comparison of Mobile Source Types
> - Mobile Source Estimates for Cook County, IL, and Lake County, IN

Mobile sources are a significant contributor to total loadings of CO, VOCs, and NO_x in the Chicago area Cook County, IL, and Lake County, IN, estimates of mobile source emissions from 1990 are presented in Table 3-29 For Cook County, IL, as part of the development of its State Implementation Plan (SIP), IEPA reported 1990 emissions from mobile sources as 379.40 tons/day for VOM, 420 51 tons/day for NO_x, and 2,339.67 tons/day for CO (IEPA, 1993a). The study found that mobile sources in 1990 accounted for 50 5 percent of the total Cook County, IL, VOM emissions (point, area, and mobile sources combined), 78 percent of the total Cook County NO_x emissions, and 78 8 percent of the total Cook County CO emissions The largest mobile source emissions for VOM, NO_x, and CO were highway vehicles (79.7 percent of VOM mobile source emissions, 74.4 percent of NO_x mobile source emissions, and 74 1 percent of CO mobile source emissions) Lawn and garden equipment were the next largest source of mobile sources emissions for both VOM and CO (7 2 percent of VOM mobile source emissions and 9.9 percent of CO mobile source emissions). For NO_x, construction equipment was the next largest source of emissions from mobile sources (12 2 percent of NO_x mobile source emissions) Figures 3-21, 3-22, and 3-23 summarize the relative

[4]In the Vigyan (1993) study, background concentrations are defined as ambient concentrations of formaldehyde and carbon tetrachloride that may be attributed to origins other than current emissions

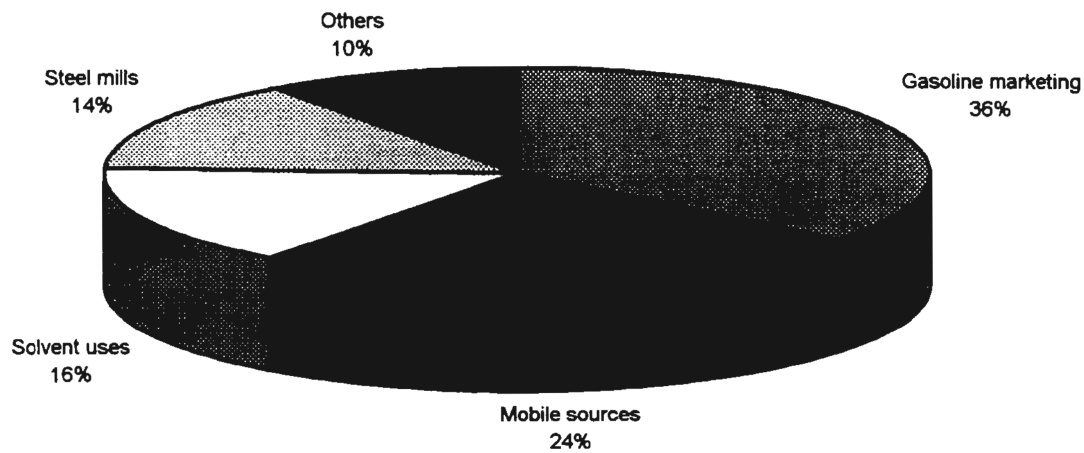

Figure 3-19. Relative Contribution to Carcinogenic Emissions by Sources in Southwest Chicago, Cook County, IL (Vigyan, 1993).

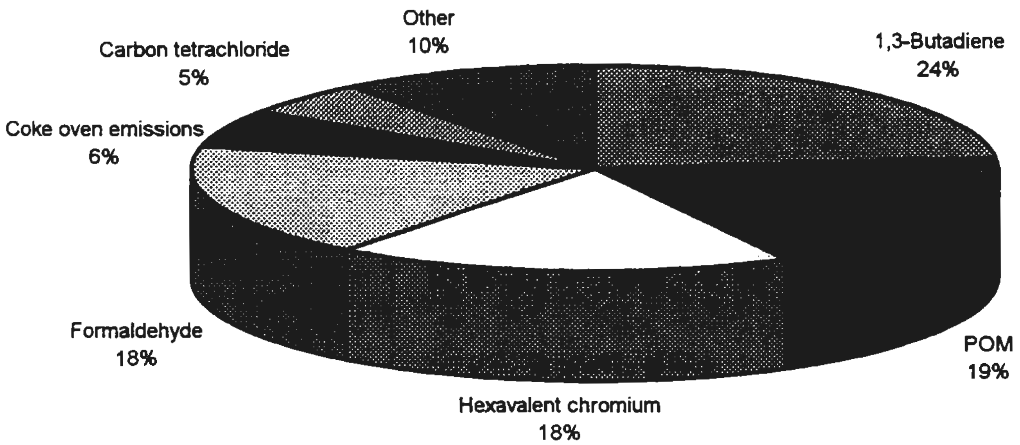

Figure 3-20. Relative Contribution to Air Pollution Related Cancer Cases by Pollutants in the Vigyan Study Area in Cook County, IL (Vigyan, 1993).

Table 3-29. 1990 Mobile Source Emissions for Cook and Lake Counties

	VOC Emissions (Tons/day*)	NOx Emissions (Tons/day*)	CO Emissions (Tons/day*)
Cook County, IL	379.4	420.5	2,339.7
Lake County, IN	52.8	52.7	318

*For Lake County, IN, non-road mobile source emissions were presented in pounds/summer day. These emissions were converted to tons/day by dividing by 2,000 pound/ton.

Sources: IEPA, 1993a, Koch, 1997b and 1997e.

Total Mobile Source Emissions in Cook County, IL = 379.4 tons/year

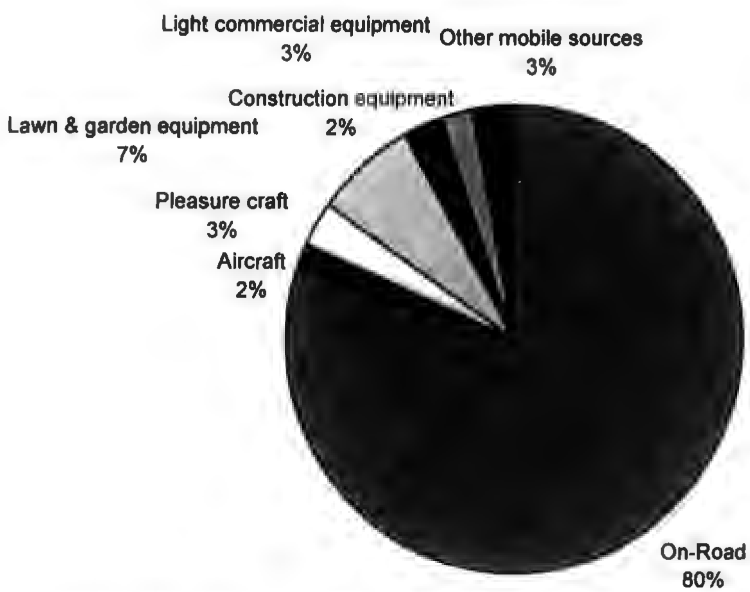

Table 3-21. Relative Contribution of Cook County Mobile Sources to VOC Emissions (IEPA, 1993)

Total Mobile Source NOx Emissions in Cook County, IL = 420.5 tons/day

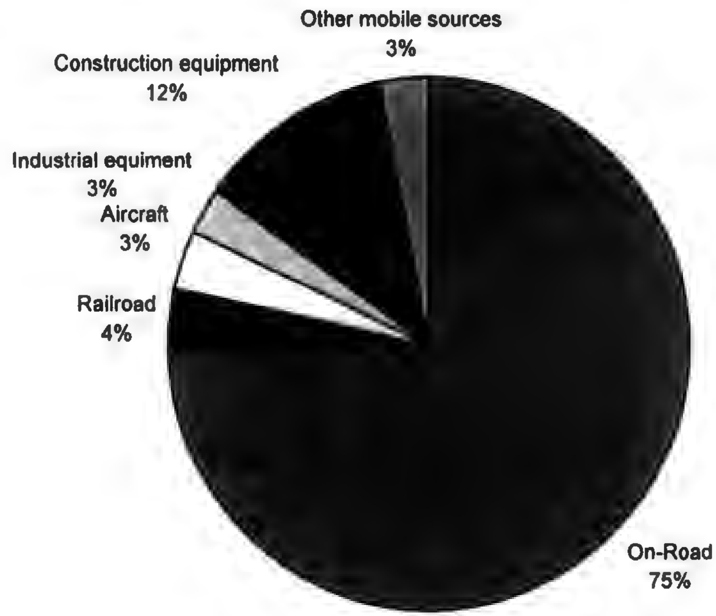

Figure 3-22. Relative Contribution of Cook County Mobile Sources to NOx Emissions (IEPA, 1993)

Total Mobile Source CO Emissions in Cook County, IL = 2,339.7

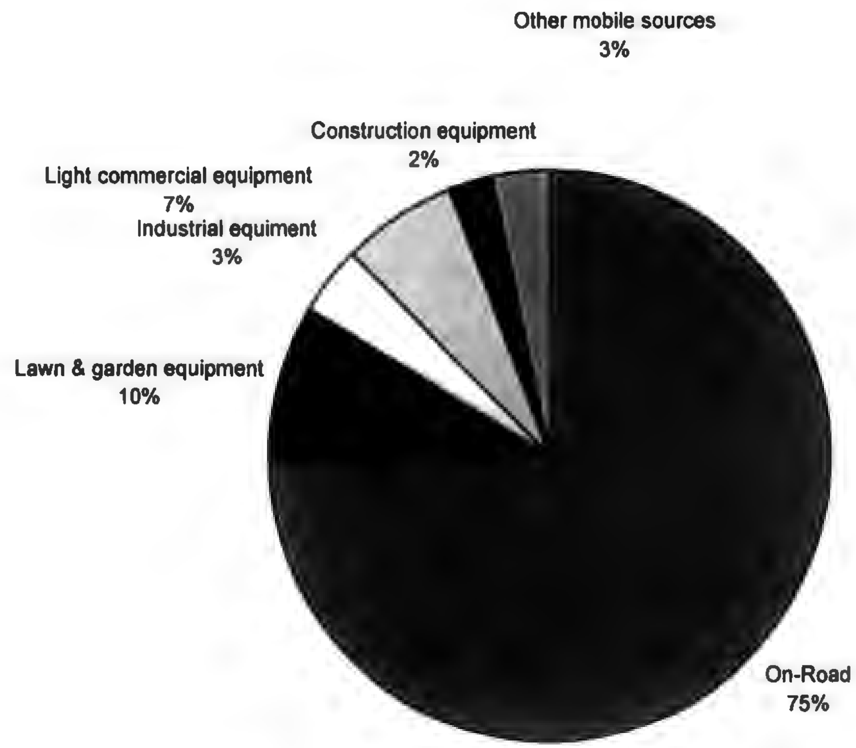

Figure 3-23. Relative Contribution of Cook County Mobile Sources to CO Emissions (IEPA, 1993)

contribution of various sources to Cook County, IL, mobile source emissions for VOC, NO_x, and CO, respectively. Table 3-30, presents the 1990 Cook County, IL, mobile source emissions as reported by Vigyan (Vigyan, 1993).

Total Lake County, IN, mobile source emissions were calculated[5] using the 1990 Lake County, IN, on-road mobile source inventory (Koch, 1997b) and 1990 Lake County non-road mobile sources inventory (Koch, 1997e). The total calculated mobile source emissions for Lake County, IN, were 52.8 tons/day for VOC, 52.7 tons/day for NO_x, and 318 tons/day for CO. Figures 3-24, 3-25, and 3-26 summarize the relative contribution of various sources to Lake County, IL, mobile source emissions for VOC, NO_x, and CO, respectively.

The 1990 Lake County, IN, on-road mobile source inventory estimated combined mobile source emissions from rural, suburban, and urban roads at 44.7 tons/day for VOCs, 258.6 tons/day for CO, and 37.2 tons/day for NO_x (Koch, 1997b).

The 1990 Lake County, IN, non-road mobile sources inventory estimated emissions at 16,243 pounds/summer day, 118,733 pounds/summer day for CO, and 31,000 pounds/summer day for NO_x (Koch, 1997e). For both VOC and CO, non-road mobile source emissions, lawn and garden equipment were the largest sources (45.3 percent of non-road mobile source VOC emissions and 49.8 percent of non-road mobile source CO emissions) (Koch, 1997e). Other large sources of VOC emissions included recreational marine vessels (13.7 percent of VOC non-road mobile source emissions) and construction equipment (10.7 percent of VOC non-road mobile source emissions). Other large non-road mobile sources of CO emissions included light commercial equipment (12.5 percent of CO non-road mobile source emissions) and industrial equipment (11.9 percent of CO non-road mobile source emissions). The largest sources on non-road NO_x emissions were railroads (39.3 percent of NO_x non-road mobile source emissions) and construction equipment (35.7 percent of NO_x non-road mobile source emissions) (Koch, 1997e).

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[5]Emissions data for in the on-road inventory data were presented as tons/day (Koch, 1997b), but in pounds/summer day in the non-road inventory (Koch, 1997e) To generate a combined "total" for mobile source emissions, non-road emissions data were divided by 2,000 pounds/ton to generate emissions estimates in tons/day.

Table 3-30. 1990 Cook County, IL, Mobile Source Emissions (tons/year)

Pollutant	1990 Cook County, IL Mobile Source Emissions (tons/year)
Total organic gases	26,718.19
Gasoline particulate	116.35
Diesel particulate	1,337.7
Benzene	658.58
1,3-Butadiene	106.47
Formaldehyde	220.61
Asbestos	0.045
Cadmium	0.019

Source: Vigyan, 1993.

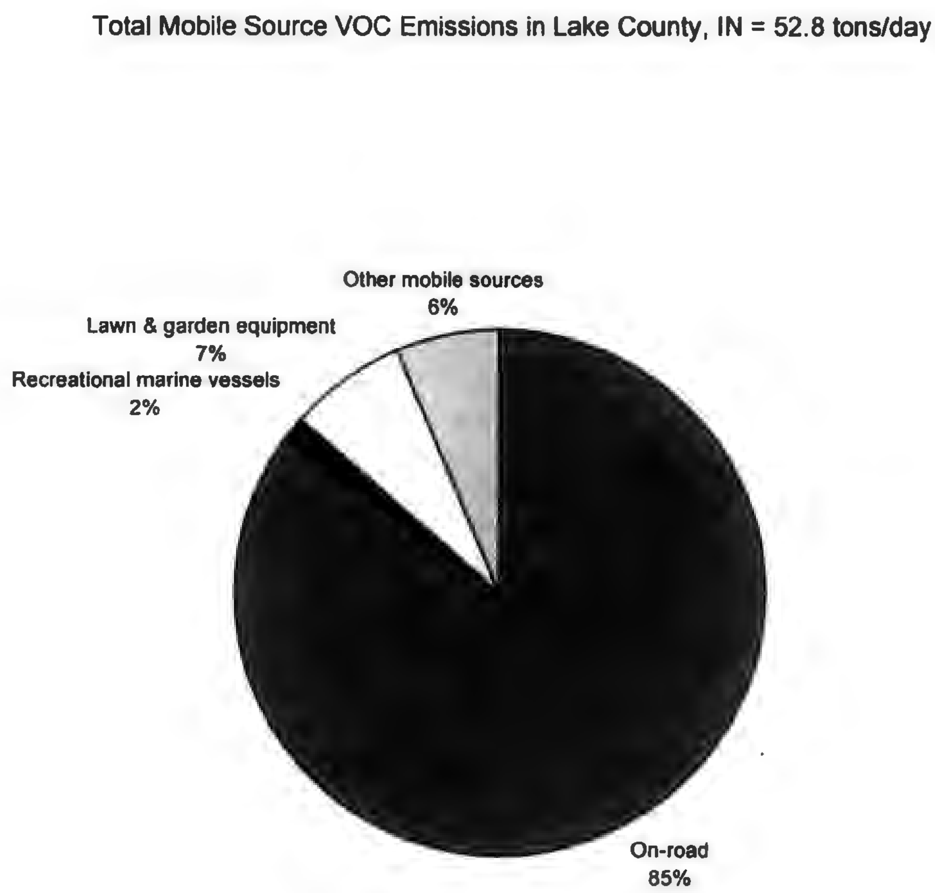


Figure 3-24. Relative Contributions of Lake County Mobile Sources to VOC Emissions (Koch, 1997b and e)

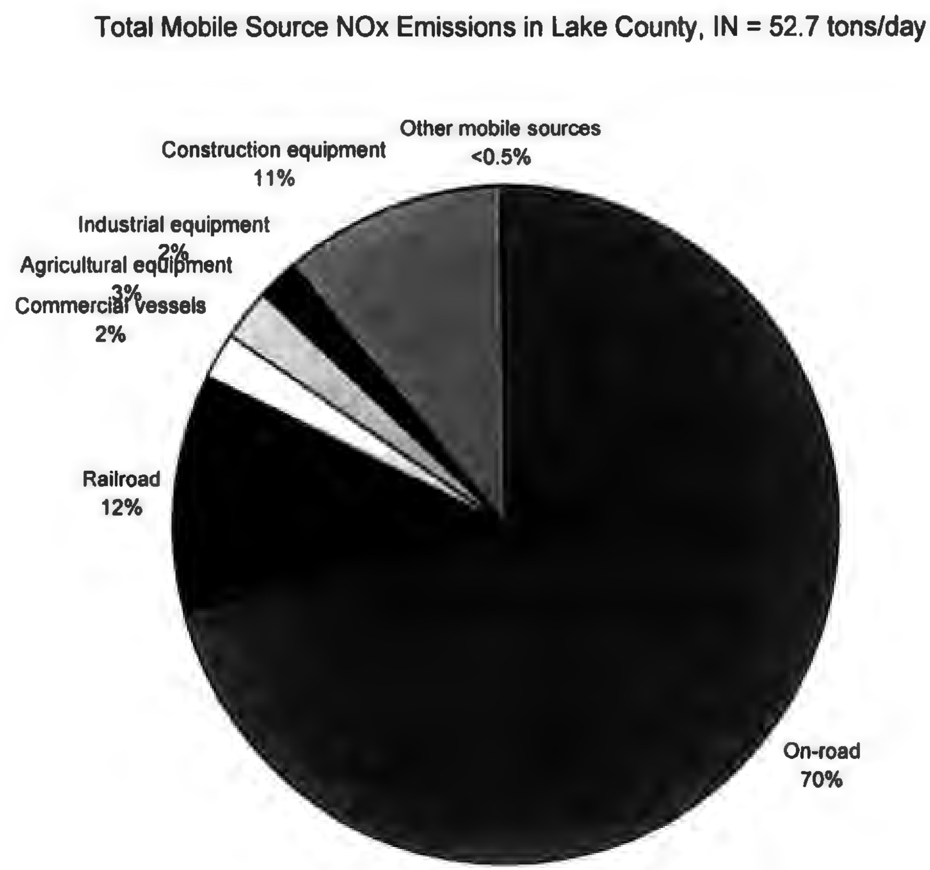


Figure 3-25. Relative Contributions of Lake County Mobile Sources to NOx Emissions (Koch, 1997b and e)

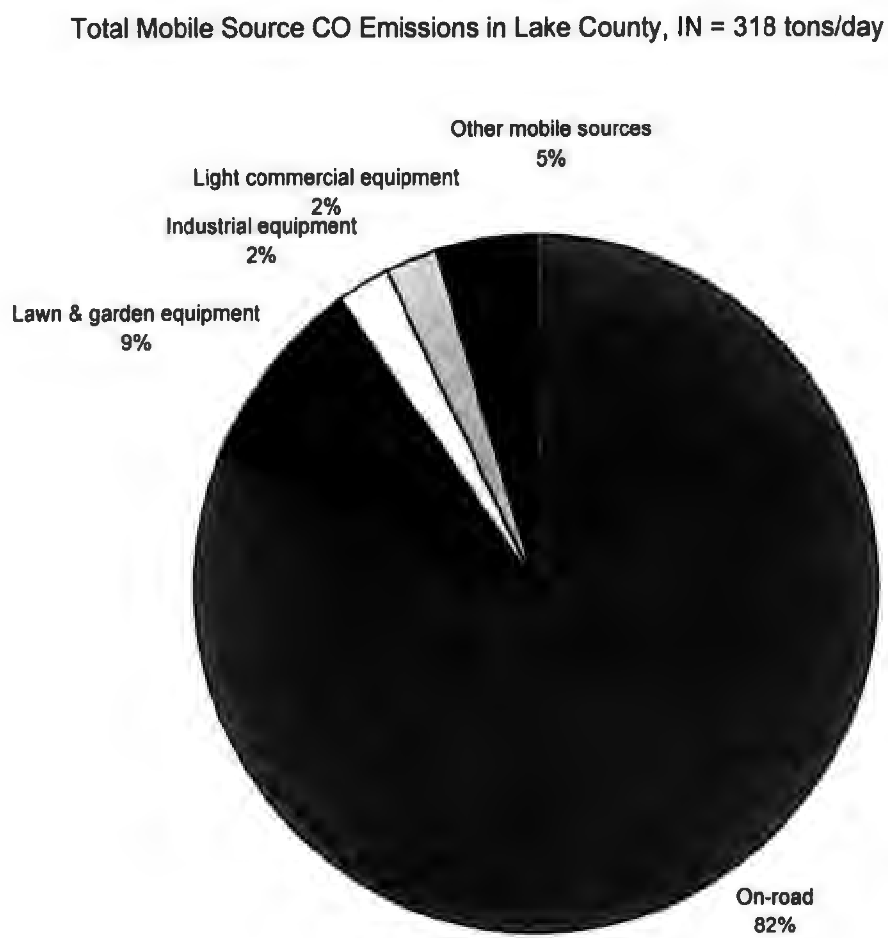


Figure 3-26. Relative Contributions of Lake County Mobile Sources to CO Emissions (Koch, 1997b and e)

Vigyan (1993) estimated non-road mobile source emissions for both Cook County, IL, and Lake County, IN. Table 3-31 presents the estimated non-road mobile source emissions for Cook and Lake Counties contained in this study (Vigyan, 1993).

Summerhays used data in the Southeast Chicago area 1980 and 1987 ozone State Implementation Plans to estimate emissions from mobile sources (U.S. EPA, 1989a). Although County-specific data were not presented, the study presented emissions data for freeway exhaust, non-freeway exhaust, and evaporative losses. With the exception of dioxins and gasoline vapors, the highest emission rates were from non-freeway exhausts. The study found that the highest emission rates from mobile sources in Southeast Chicago included: gasoline vapors (15,849.5 tons/year), toluene (2,518.7 tons/year), ethylene (2,251.3 tons/year), xylene (1,947.2 tons/year), and benzene (896.1 tons/year) (U.S. EPA, 1989a).

Midway Airport Mobile Source Emissions

Midway Airport emissions estimates were developed for both aircraft and automobiles (Vigyan, 1993). Table 3-32 presents the total emissions estimates from aircraft and automobiles at Midway Airport.

3.1.6 Air Emissions Summary

Estimated total 1990 VOC emissions for all sources (point, area, and mobile) for Lake County, IN, were conservatively[6] calculated by IDEM at 44,800.8 tons/year (calculated using Koch, 1997a; Koch, 1997b; Koch, 1997c; and Koch, 1997e). Figure 3-27 presents the relative contribution to VOC emissions from point sources, mobile source, non-road mobile sources, and area sources for

[6]Total Lake County, IN, VOC emissions were calculated using the results of the various 1990 Lake County emissions inventory results (Koch, 1997 a-c and e) However, the data for mobile sources (both road and non-road) were only presented on a per day or per summer day basis and, therefore, for the purposes of this document, were converted to a per year basis. Because no source specific seasonal adjustment factors were presented, a conservative factor of 365 days per year was used to convert per day and per summer day emissions to annual emissions. This probably results in an overstatement of the actual emissions, especially for non-road mobile sources, which include sources such as lawn and garden equipment and recreational marine vessels.

Table 3-31. Non-road Mobile Source Emissions

Pollutant (tons/yr)	Cook County, IL	Lake County, IN
Benzene	157.67	29.43
1,3-Butadiene	66.18	12.48
Formaldehyde	56.0	10.56
Gasoline Particulate	82.61	17.15
Diesel Particulate	668.98	82.24

Source: Vigyan, 1993.

Table 3-32. Emissions Estimates Associated with Midway Airport

Pollutant (tons/year)	Aircraft Emissions	Automobile Emissions
Particulate	50.87	0.258
VOC	401.47	Not presented
Total Organic Gases	444.87	11.815
Benzene	8.98	0.332
Formaldehyde	62.8	0.118
1,3-Butadiene	7.55	0.055

Source: Vigyan, 1993.

Total 1990 VOC Emissions in Lake County, IN = 44,800.8 tons/year

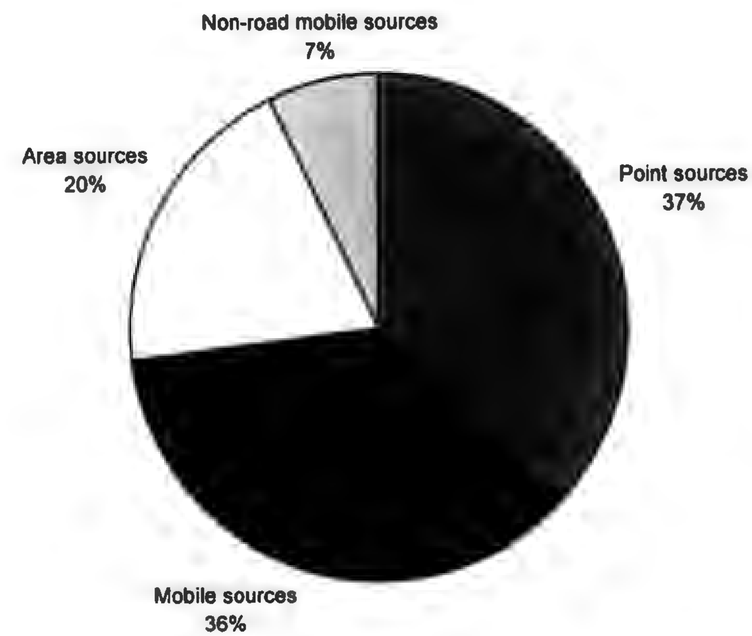


Figure 3-27. Relative Contributions of Different Source Types to Total VOC Emissions in Lake County, IN, 1990 (Koch, 1997a-c and e)

Lake County, IN. As shown in the Figure, in 1990, Lake County, IN, VOC emissions from point sources and mobile sources were about the same (37 percent of VOC emissions from point sources and 36 percent of the total from mobile sources). Area sources accounted for about 20 percent of VOC emissions in Lake County, while non-road mobile sources accounted for over 6 percent of the county's VOC emissions. Comparison of 1990 data with the 1994 Lake County point source data from AIRS/AFS reveals a very significant difference (16,437 tons/year in 1990 vs. 27,214 tons/year in 1994). Detailed analysis reveals that the difference is primarily due to increased emissions at the U.S. Steel Gary Works facility resulting from changes in the emission factors used to estimate emissions from coke ovens (Koch, 1997d). Comparison of the revised 1994 point source emissions against the 1990 data for mobile source, non-road mobile sources, and area sources (which were not expected to have changed significantly between 1990 and 1994) to estimate relative contributions to total VOC emissions paints a different picture, as shown in Figure 3-28. It is important to note that the 1994 data from these estimates by IDEM have not been carefully quality assurance/quality checked (QA/QCed) and should be used with caution.

For the ozone precursors VOC and NO_x, evaluation of nonpoint source 1990 Lake County emissions data (Koch, 1997a, Koch, 1997b, and Koch, 1997e) reveals that mobile sources accounted for the majority of 1990 Lake County CO and NO_x nonpoint source emissions (over 80 percent of CO emissions and over 63 percent of NO_x emissions). Non-road mobile sources accounted for over 18 percent of CO nonpoint source emissions and more than 26 percent of NO_x nonpoint source emissions.

For Cook County, 1990 total VOC emissions for all sources (point, area, and mobile) were 751.9 tons/day, total NO_x emissions for all sources (point, area, and mobile) were 538.9 tons/day, and total CO emissions for all sources (point, area, and mobile) were 2,970.3 tons/day (IEPA, 1993a). Figures 3-29, 3-30, and 3-31 present the relative contributions to total emissions from point sources, mobile sources, non-road mobile sources, and area sources for VOC, NO_x, and CO, respectively.

Table 3-33 presents the total estimated 1993 emission rates in pounds per year for all Cook County, IL, point and area sources included in the SWLM pilot study (U.S. EPA, 1995c).

Total VOC Emissions Using 1994 Point Source Data and 1990 Data for Other Sources in Lake County, IN = 55,577.8 tons/year

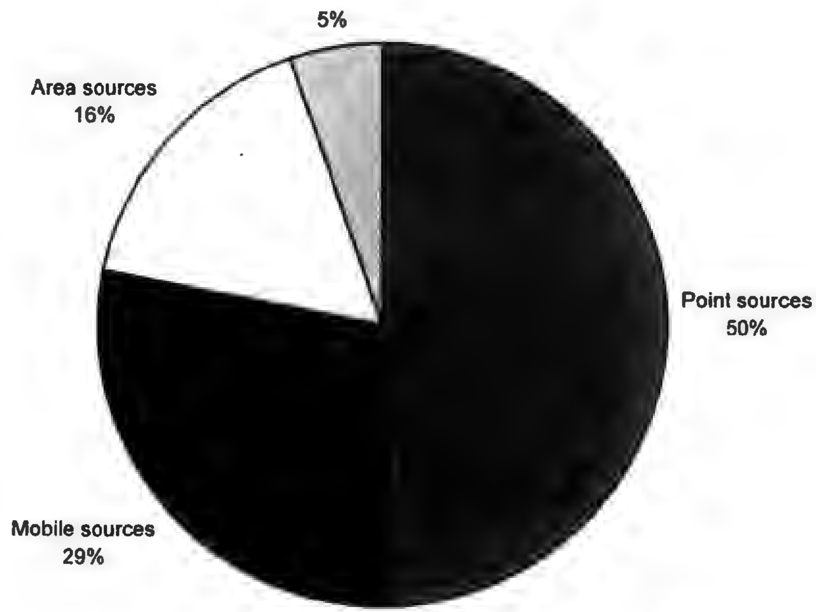


Figure 3-28. Relative Contributions of 1990 Mobile Sources, Non-road Mobile Sources, and Area Sources, and 1994 Point Sources to total Lake County VOC Emissions

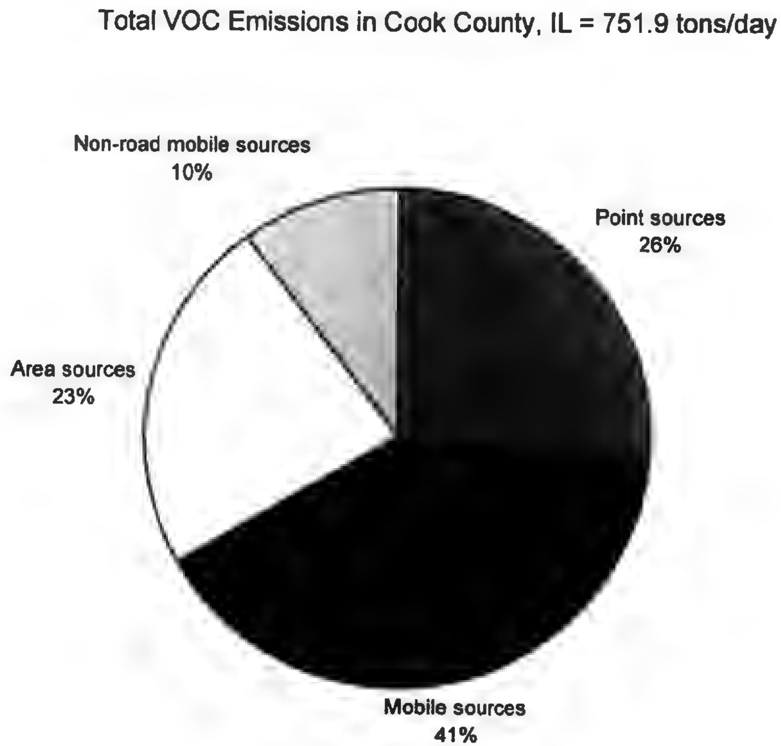


Figure 3-29. Relative Contributions of Different Source Types to Total Cook County VOC Emissions, 1990 (IEPA, 1993)

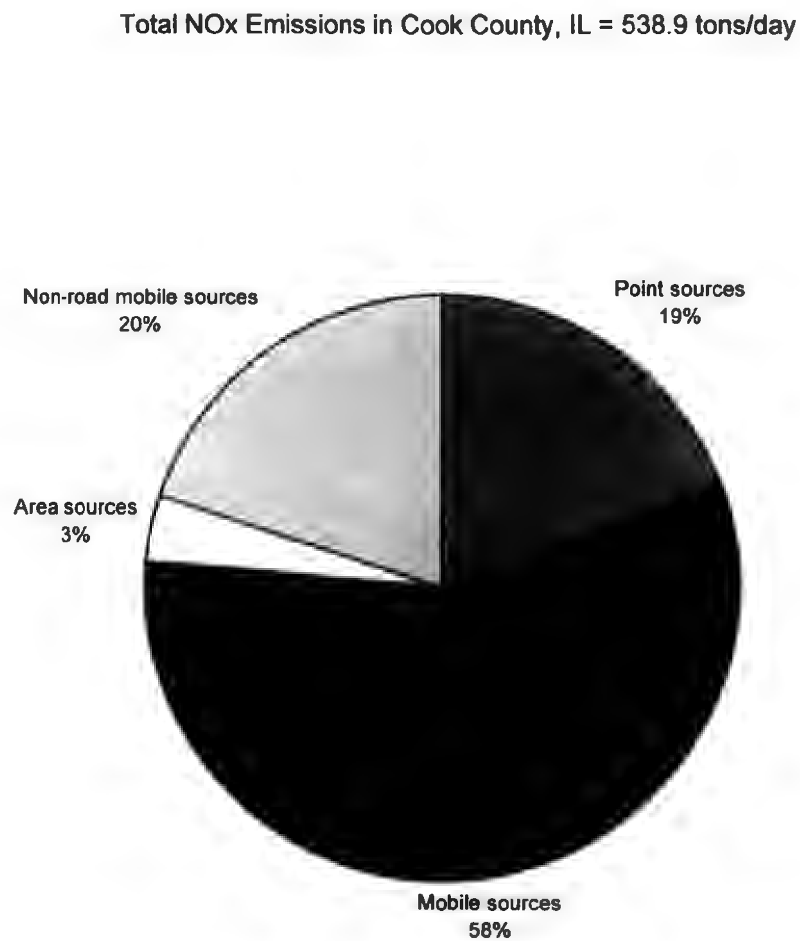


Figure 3-30. Relative Contribution of Different Source Types to Total Cook County NOx Emissions, 1990 (IEPA, 1993)

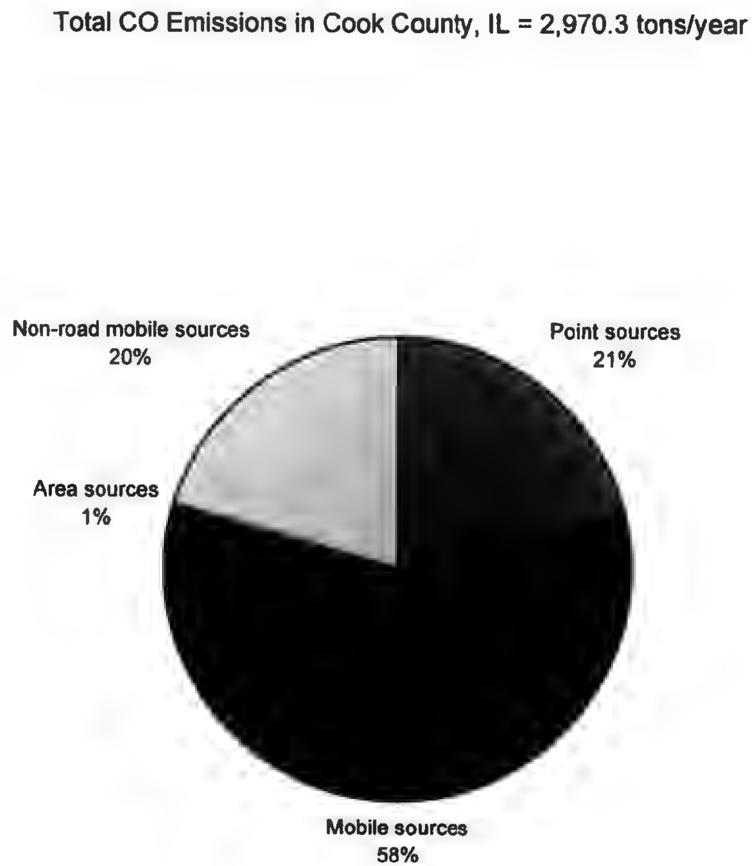


Figure 3-31. Relative Contributions of Different Sources Types to Total Cook Cook County CO Emissions, 1990 (IEPA, 1993)

Pollutant	Cook County Emissions (lb/yr)
Perchloroethylene	2711257.37
Polycyclic Organic Matter	1312445.32
Trichloroethylene	626236.80
Manganese	484057.91
Coke oven gas	254875.70
Cadmium	192728.70
Methylene Chloride	73210.42
Lead	19483.34
1,1,1-Trichloroethane	8748.00
Nickel	6170.49
Arsenic	4162.38
Chromium, total	3966.33
Ethylbenzene	3774.53
Mercury	2797.91
Copper	1951.06
Cobalt	593.15
Chromium, Hexavalent	67.50
Phenol	67.43
Chlorobenzene	8.74
1,2-Dichloroethane	8.42
Fluoranthene	3.43
Total polychlorinated dibenzofurans	0.66
Chrysene	0.39
Carbon tetrachloride	0.31
Total polychlorinated dibenzodioxins	0.22
2,3,7,8-Tetrachlorodibenzo-p-dioxin	5.03E-04
2,3,7,8-Tetrachlorodibenzofuran	1.54E-04

Source: EPA, 1995.

Table 3-33. Total Emissions for Cook County IL, for All Sources Included in the SWLM Pilot Study

Sweet and Vermette (1991) used a chemical mass balance (CMB) modeling approach to apportion Southeast Chicago ambient air concentrations of VOCs to various sources. As shown in Figure 3-32, the study found that under average conditions vehicle emissions accounted over 80 percent of VOCs in the air, degreasing accounted for over 14 percent, and tetrachloroethylene from dry cleaning accounted for about 5 percent. The study also evaluated samples collected at the Washington School in Southeast Cook County, IL. Figures 3-33 and 3-34 present the CMB modeling results from Washington School during a westerly wind for day and night samples, respectively (Sweet and Vermette, 1991). Figures 3-35 and 3-36 present the CMB modeling results from two Washington School samples collected during non-westerly winds. Tables 3-34 and 3-35 present the detailed CMB modeling results for the Southeast Chicago area as a whole and for the Washington School during a pollution episode (i.e., a "high pollution" sample), respectively.

A similar study was conducted on toxic trace elements in the same Southeast Chicago study area (Sweet et al., 1990). Tables 3-36 and 3-37 present the average CMB modeling results for fine and coarse fractions, respectively, and Tables 3-38 and 3-39 present the pollution episode CMB modeling results for fine and coarse fractions, respectively.

Vigyan (1993) estimated emissions from a 16 square mile area surrounding Midway Airport in Cook County, IL. This study estimated emissions of carcinogenic pollutants from all sources in the study area at 26,832 tons/year. Figure 3-37, summarizes carcinogenic pollutant emissions by source category.

3.1.7 Trends in Air Emissions

IDENR conducted a study that looked at air emission trends from various sources in Illinois, including Cook County (IDENR, 1994a). The sources evaluated included: manufacturing, mobile sources, and other urban sources (services, wholesale and retail trade, finance, etc.).

3.1.7.1 *Trends in Manufacturing Emissions*

IDENR found that overall manufacturing output declined by more than 15 percent from 1969 to 1989 (IDENR, 1994a). Trends in Cook County, IL, air emissions from manufacturing sources

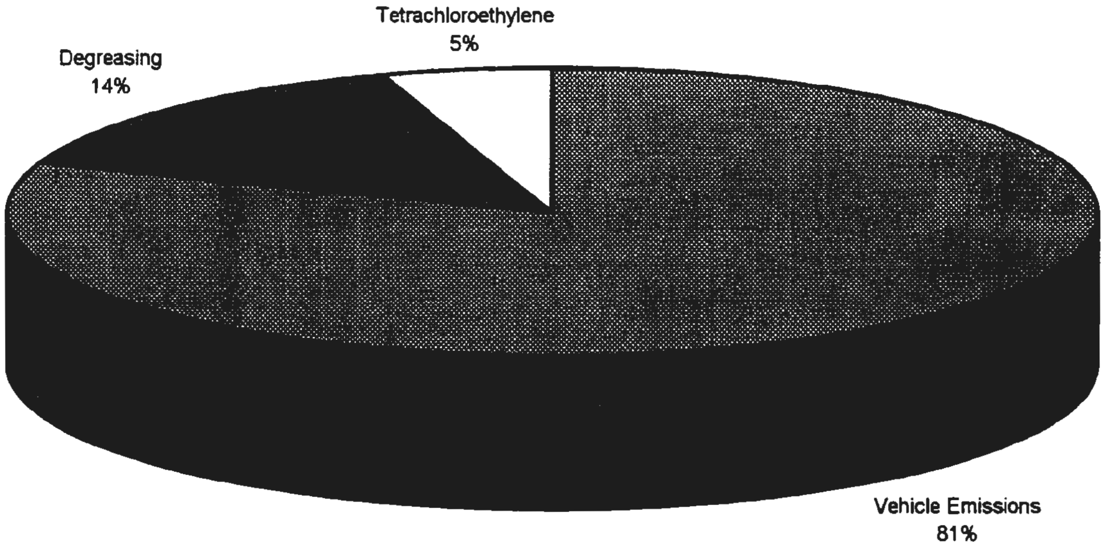


Figure 3-32. CMB Modelling Results for VOC Emissions in Southeast Chicago Under Aerage Conditions (Sweet, 1991).

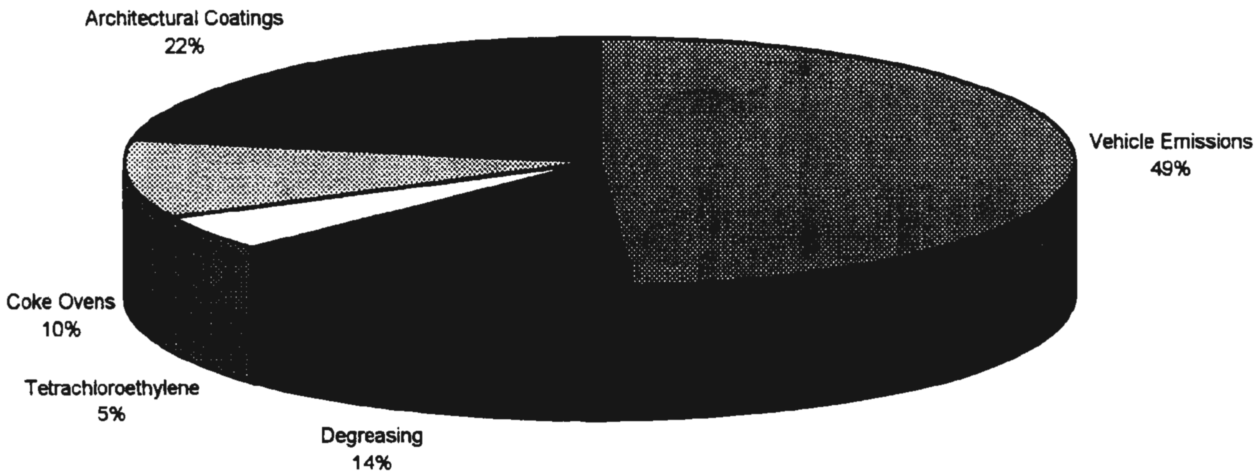


Figure 3-33. CMB Modelling Results for Washington School Day Sample During Westerly Winds (Sweet, 1991).

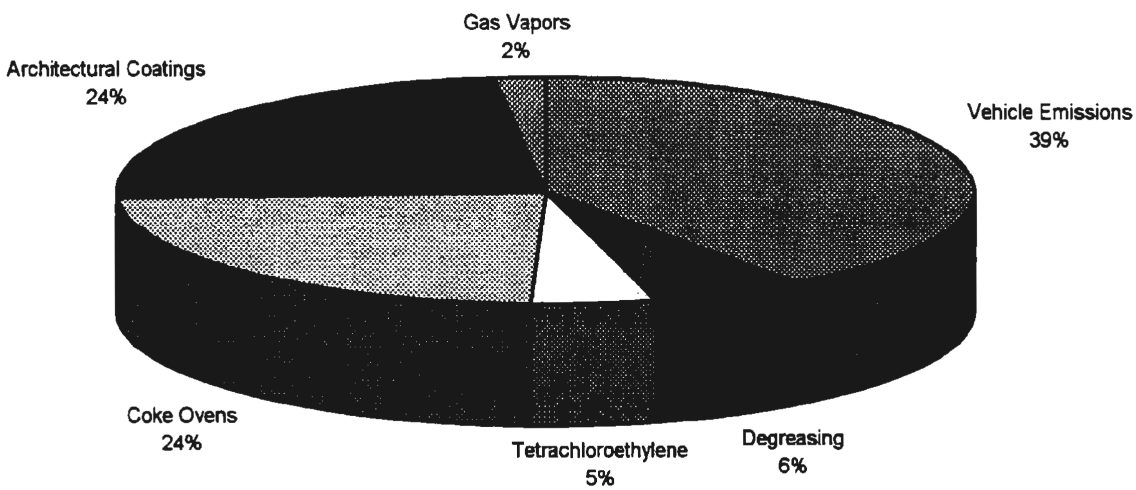


Figure 3-34. CMB Modelling Results for Washington School Night Sample During Westerly Winds (Sweet, 1991).

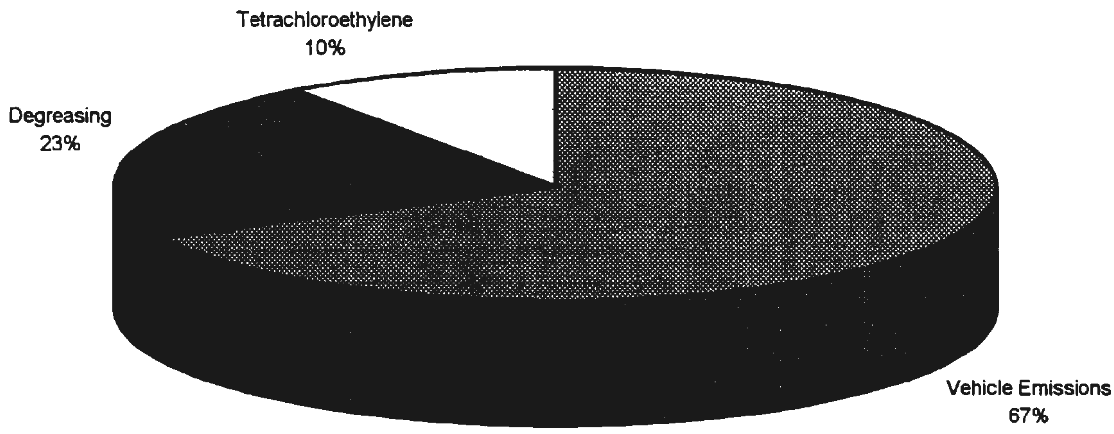


Figure 3-35. CMB Modelling Results for Washington School Sample #1 During Non-Westerly Winds (Sweet, 1991).

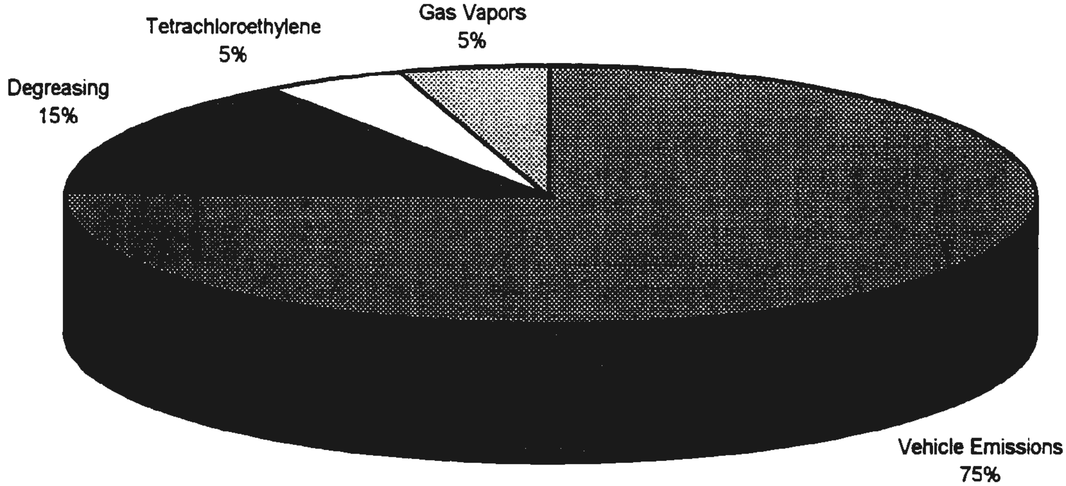


Figure 3-36. CMB Modelling Results for Washington School Sample #2 During Non-Westerly Winds (Sweet, 1991).

Table 3-34. Average CMB Modeling Results for the Southeast Chicago Area

Pollutant	Sources (Percent of Emissions)		
	Vehicle Exhaust	Degreasing Solvents	Dry Cleaning
Benzene	100.0	0	0
Toluene	100.0	0	0
Ethyl benzene	100.0	0	0
m,p-Xylene	100.0	0	0
o-Xylene	100.0	0	0
1,1,1-Trichloroethane	0	100.0	0
Trichloroethylene	0	100.0	0
Tetrachloroethylene	0	25.3	74.7

Source: Sweet and Vermette, 1991.

Table 3-35. CMB Modeling Results for a Washington School Sample During a Pollution Episode

Pollutant	Sources (Percent of Emissions)					
	Coke Ovens	Vehicle Exhaust	Paint	Gasoline Vapor	Degreasing Solvents	Dry Cleaning
Benzene	71.6	26.3	0.6	2.3	0	0
Toluene	0.8	45.6	52.0	1.8	0	0
Ethyl benzene	17.0	68.3	9.4	5.3	0	0
m,p-Xylene	8.3	71.8	18.4	1.8	0	0
o-Xylene	1.4	66.6	30.3	1.4	0	0
1,1,1-Trichloroethane	0	0	0	0	100.0	0
Trichloroethylene	0	0	0	0	100.0	0
Tetrachloroethylene	0	0	0	0	12.9	87.1

Source Sweet and Vermette, 1991

Table 3-36. Average Fine Fraction CMB Modeling Results for the Southeast Chicago Area

Pollutant	Sources (Percent of Emissions)				
	Coke Dust	Steel (Stack and Fugitive)	Incineration	Regional Background and Sulfate	Coal Burning
Vanadium	23.1	26.7	0	28.6	22.1
Chromium	5.6	78.8	4.0	7.1	5.4
Manganese	0	92.5	0.8	6.3	0
Nickel	0.6	10.8	12.1	70.6	6.7
Copper	69.8	2.9	14.8	11.4	1.2
Zinc	4.2	2.5	85.9	6.3	0.2
Arsenic	36.1	0	0	46.8	19.0
Selenium	0	0	1.7	37.3	61.5
Cadmium	17.7	0	61.8	22.2	0.9
Tin	0.3	0	99.7	0	-
Lead	6.5	3.8	89.0	0.1	-

Source Sweet et al , 1990

Table 3-37. Average Coarse Fraction CMB Modeling Results for the Southeast Chicago Area

Pollutant	Sources (Percent of Emissions)			
	Urban Dust	Steel	Blast Furnace	Motor Vehicle
Vanadium	63.8	6.1	30.0	0
Chromium	35.7	21.3	42.9	0
Manganese	71.3	26.5	2.1	0
Nickel	55.2	6.6	38.4	0.1
Copper	43.6	35.1	20.5	0.3
Zinc	93.3	6.6	0	0.1
Lead	59.9	12.9	5.4	22.1

Source Sweet and Vermette, 1990

Table 3-38. Pollution Episode Fine Fraction CMB Modeling Results for the Southeast Chicago Area

Pollutant	Sources (Percent of Emissions)			
	Coke Dust	Steel (Stack and Fugitive)	Power Plant	Oil Burning
Vanadium	1.7	30.0	1.4	66.4
Chromium	0.5	96.6	0.2	0.4
Manganese	0	99.7	0.2	0
Copper	60.4	35.6	1.5	2.1
Zinc	10.0	85.4	0.4	2.4
Lead	5.0	88.8	0	0

Source Sweet et al , 1990

Table 3-39. Pollution Episode Coarse Fraction CMB Modeling Results for the Southeast Chicago Area

Pollutant	Sources (Percent of Emissions)			
	Urban/Steel Dust	Steel (Stack and Fugitive)	Coal Dust	Oil Burning
Vanadium	31.1	4.9	0	64.7
Chromium	79.3	20.5	0	0.5
Manganese	87.6	12.9	0	0
Copper	45.9	52.4	0	1.8
Zinc	92.5	7.5	0	0.9
Lead	68.6	27.2	4.1	0.9

Source Sweet et al., 1990

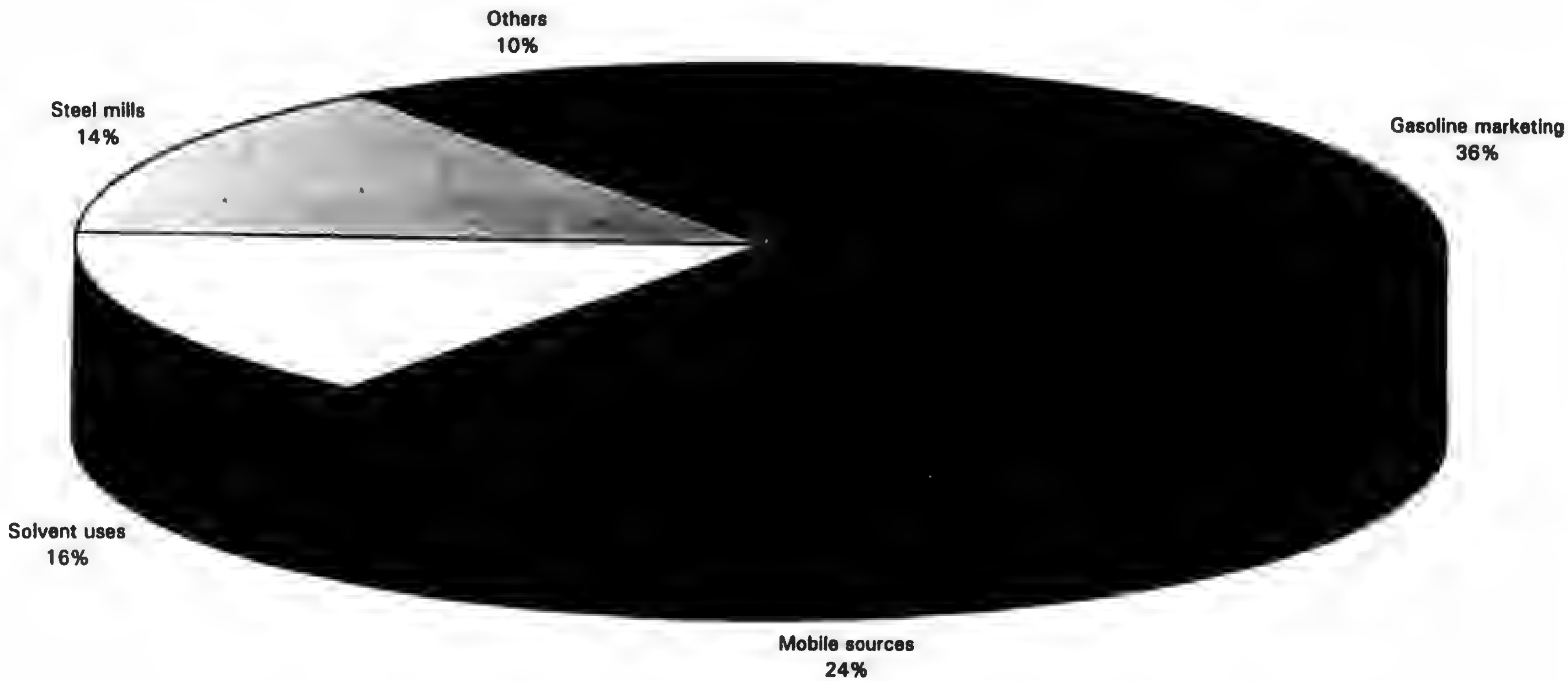


Figure 3-37. Relative Contribution to Carcinogenic Emissions by Sources in Southwest Chicago, Cook County, IL

Source: Vigyan, 1993.

were evaluated from 1973 to 1989 for particulate matter (PM), SO_x, NO_x, hydrocarbon, and CO and are shown in Figure 3-38. By 1989, Cook County, IL, PM emissions had declined by 93 percent from 1973 emission levels of almost 200,000 tons per year. For SO_x, emissions declined from almost 200,000 tons/year in 1973 to less than 50,000 tons/year in 1989; NO_x emissions went from about 75,000 tons/year in 1973 to about 25,000 tons/year in 1989; and hydrocarbon emissions decreased from 1973 levels of about 100,000 tons/year to less than 60,000 tons/year in 1989. Although state-wide CO emissions decreased from 1973 to 1989, Cook County, IL, emissions rose slightly from about 40,000 tons/year in 1973 to over 50,000 tons/year in 1989.

3.1.7.2 *Trend in Emissions from Mobile Sources*

According to an IDENR study (IDENR 1994a), vehicle miles traveled in Cook County, IL, grew by about 10 percent between 1973 and 1982, and by almost 30 percent between 1982 and 1991. Furthermore, as shown in Figure 3-39, the Chicago Area Transportation Study (CATS, 1996a) reported that the number of registered vehicles in Cook County, IL, increased by 9 percent between 1970 to 1980, by 17 percent between 1980 and 1990, and by 5 percent between 1990 and 1995. As Figure 3-40 demonstrates, this study (CATS, 1996a) reported that average daily vehicle miles traveled in Cook County, IL, have also steadily increased. During this same general period, however, Cook County, IL, vehicle emission rates (cars and light trucks) decreased. Specifically, as shown in Figure 3-41, IDENR found that for NO_x, although emission rates did increase by 5 percent between 1973 and 1982, emission rates decreased by about 18 percent from 1982 to 1991 (IDENR, 1994a). For VOCs, emissions declined by about 22 percent between 1973 and 1982 and by 30 percent between 1982 and 1991. Similarly, CO emissions decreased by 20 percent from 1973 to 1982 and by over 30 percent from 1982 to 1991.

For mobile sources as a whole (highway, rail, air, and water), the IDENR study found that Cook County, IL, emissions of CO and VOCs decreased by over 45 percent and NO_x emissions by over 25 percent between 1973 to 1991 (IDENR, 1994a).

The 1990 Lake County, IN, mobile source inventory estimated combined mobile source emission from rural, suburban, and urban roads at 44.7 tons/day for VOCs, 258.6 tons/day for CO, and 37.2 tons/day for NO_x (Koch, 1997b). Because Lake County, IN, is a nonattainment area for

Key: CO = Carbon monoxide; PM = particulate; SOx = sulfur oxides; NOx = nitrogen oxides; HC = hydrocarbon

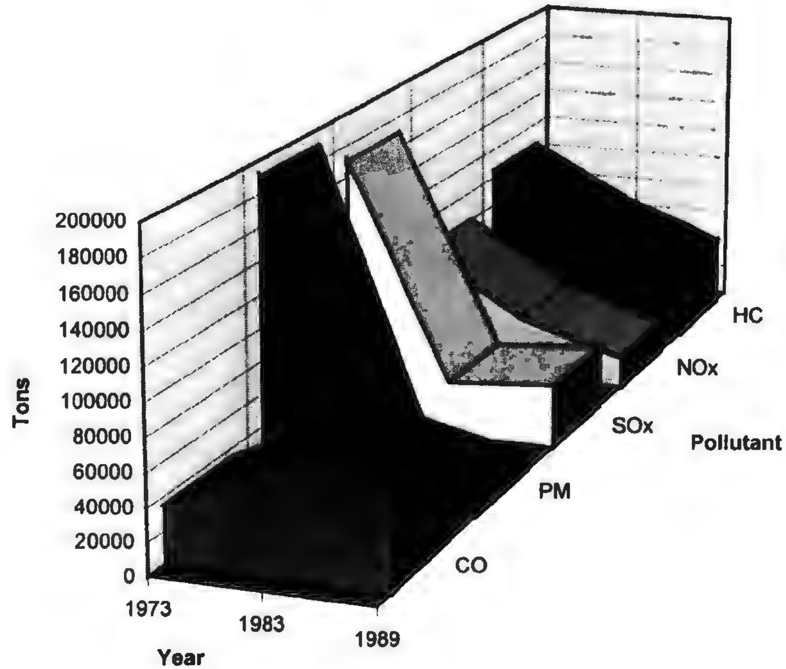


Figure 3-38. Trends in Cook County Emissions from Manufacturing (IDNER, 1994)

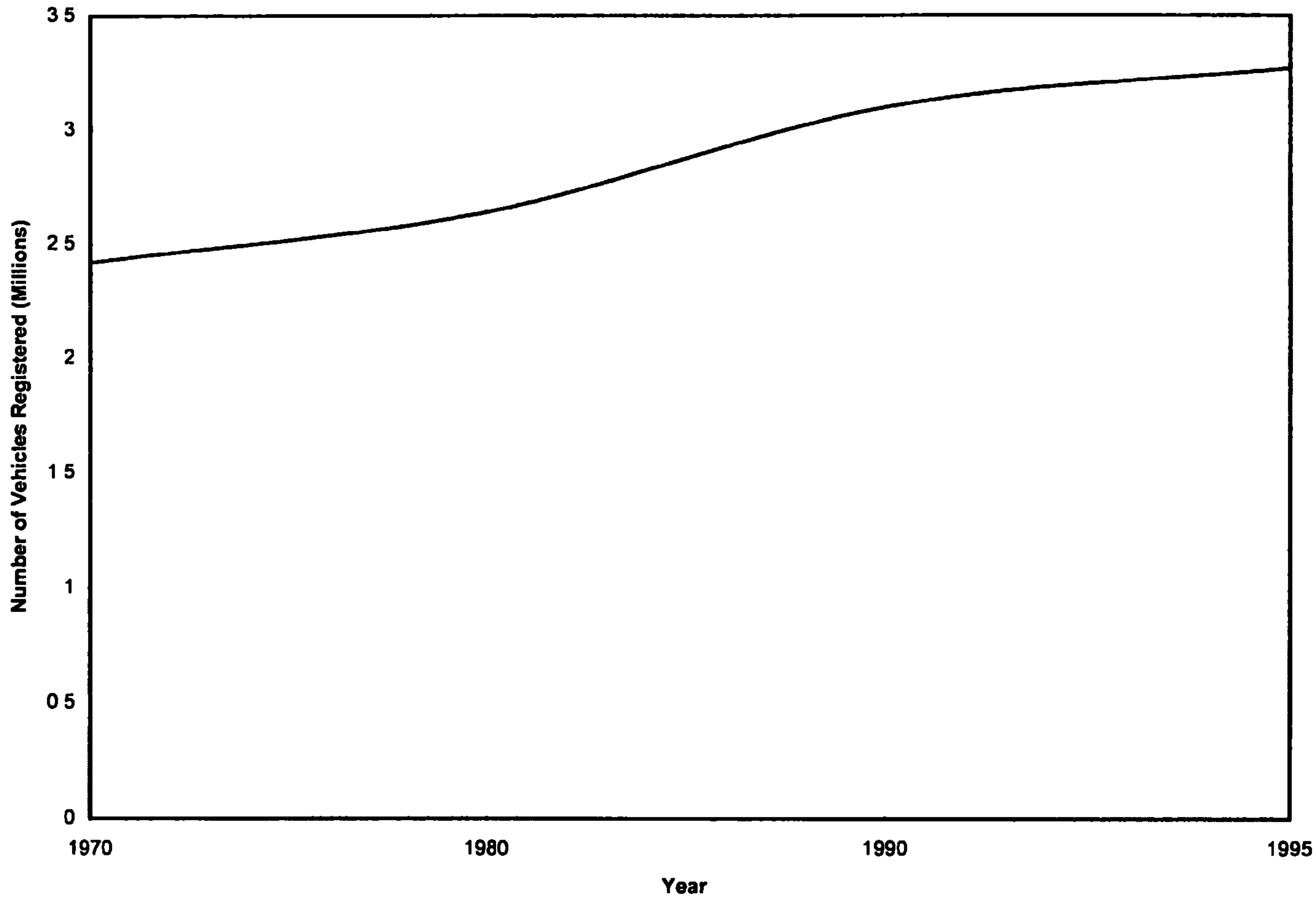


Figure 3-39. Trend in Number of Total Vehicles Registered in Cook County, IL (CATS, 1996)

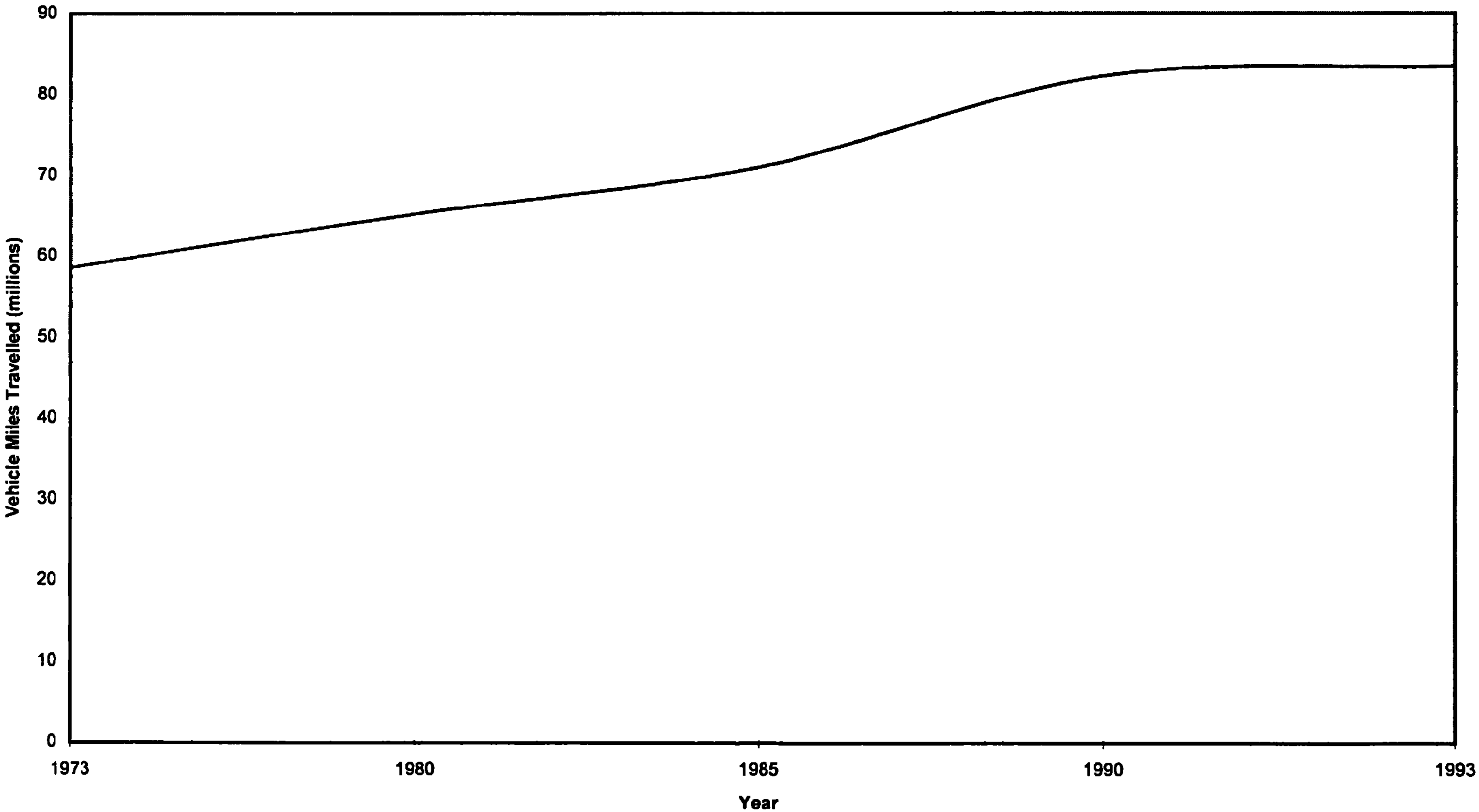


Figure 3-40. Vehicle Miles Travelled in Cook County (CATS, 1996)

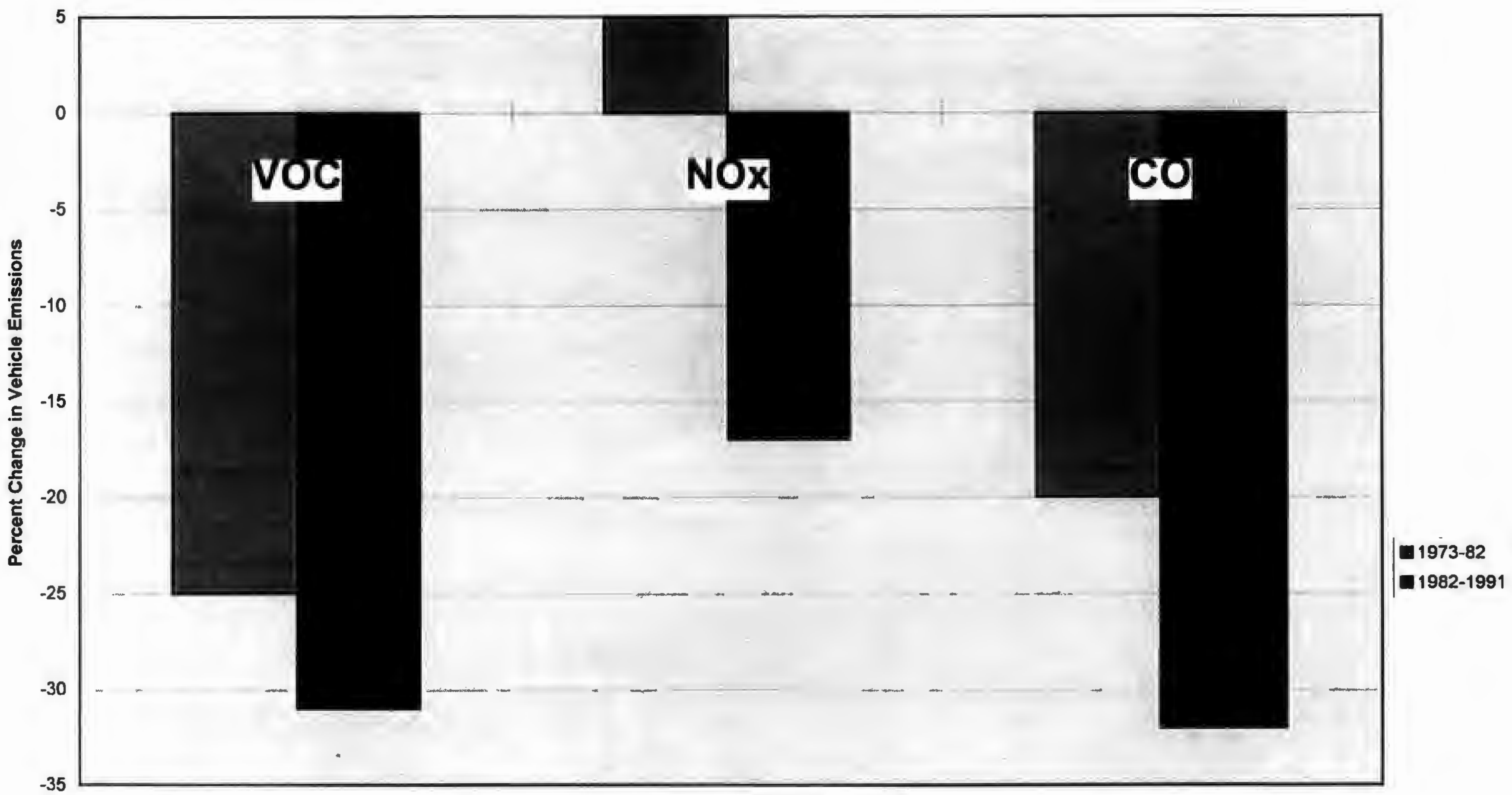


Figure 3-41. Trends in Emission Rates of Cook County Vehicles (IDNER, 1994)

ozone, Indiana was required to prepare an SIP to reduce emissions. The Northwest Indiana Regional Planning Commission (NIRPC) developed mobile source VOC and NO_x emissions estimates for Lake County, IN, assuming the SIP would, and would not be implemented for the years 1996, 2002, 2007, and 2010 (NIRPC, 1994). Table 3-40 presents these estimated emissions. In both cases, emissions decrease until 2007 when they begin to increase as increased travel starts to offset emission reductions through improvements in technology. Another study, conducted for Northeast Illinois (including Cook County), found that estimated hydrocarbon emissions from personal vehicles (commercial vehicles were not included in the estimates) will continue to decrease beyond 2010 (Zavattero et al., 1997). These results are presented in Table 3-41.

3.1.7.3 *Emissions Trends in Other Urban Sources*

An IDENR study evaluated emission trends from other urban sources (IDENR, 1994a). Other urban sources included construction (SIC Code 15-17), wholesale trade (SIC Code 50-51); retail trade (SIC Code 52-59); finance, insurance, and real estate (SIC Code 60-67); services (SIC Code 70-89); and government (SIC Code 91-97). As shown in Figure 3-42, VOC emissions from urban sources in Cook County, IL, have remained relatively constant (between 250 and 300 tons/summer day). Emissions rose slightly from 1970 to 1980 and then dropped to below 1970 levels from 1980 to 1990. Similarly, Cook County, IL, CO emissions rose from about 75 tons/summer day in 1970 to almost 90 tons/summer day in 1980, and then dropped to about 80 tons/summer day in 1990. Cook County, IL, NO_x emissions also rose between 1970 and 1980 from slightly over 40 tons/summer day to more than 50 tons/summer day, and then declined to about 45 tons/summer day by 1990.

3.2 DISCHARGES TO SURFACE WATERS

Loadings can be estimated for about 86 facilities in Cook County, IL, and Lake County, IN, which directly discharge pollutants to

Loadings to Surface Waters

- Point Source Discharges in Cook County, IL, and Lake County, IN
- Largest Sources and Waterbodies Receiving the Largest Loadings
- Major Pollutants Discharged
- Nonpoint Source Loadings Estimates

Table 3-40. Estimated Lake County, IN, Mobile Source Emissions With and Without Implementation of the SIP

Year	Emissions with SIP Implementation		Emissions without SIP Implementation	
	VOC (tons/day)	NOx (tons/day)	VOC (tons/day)	NOx (tons/day)
1996	54.1	79.6	54.1	79.7
2002	36.2	69.1	36.4	69.4
2007	30.1	63.8	30.3	64.1
2010	32.0	67.9	32.3	68.0

Source. NIRPC, 1994

Table 3-41. Projected Hydrocarbon Emission Rates in the Northeast Illinois Area.

Year	Hydrocarbon Emissions (tons/day)
1970	1,357
1990	544
1996	237
2001	155
2007	131
2010	126

Source. Zavattero et al , 1997.

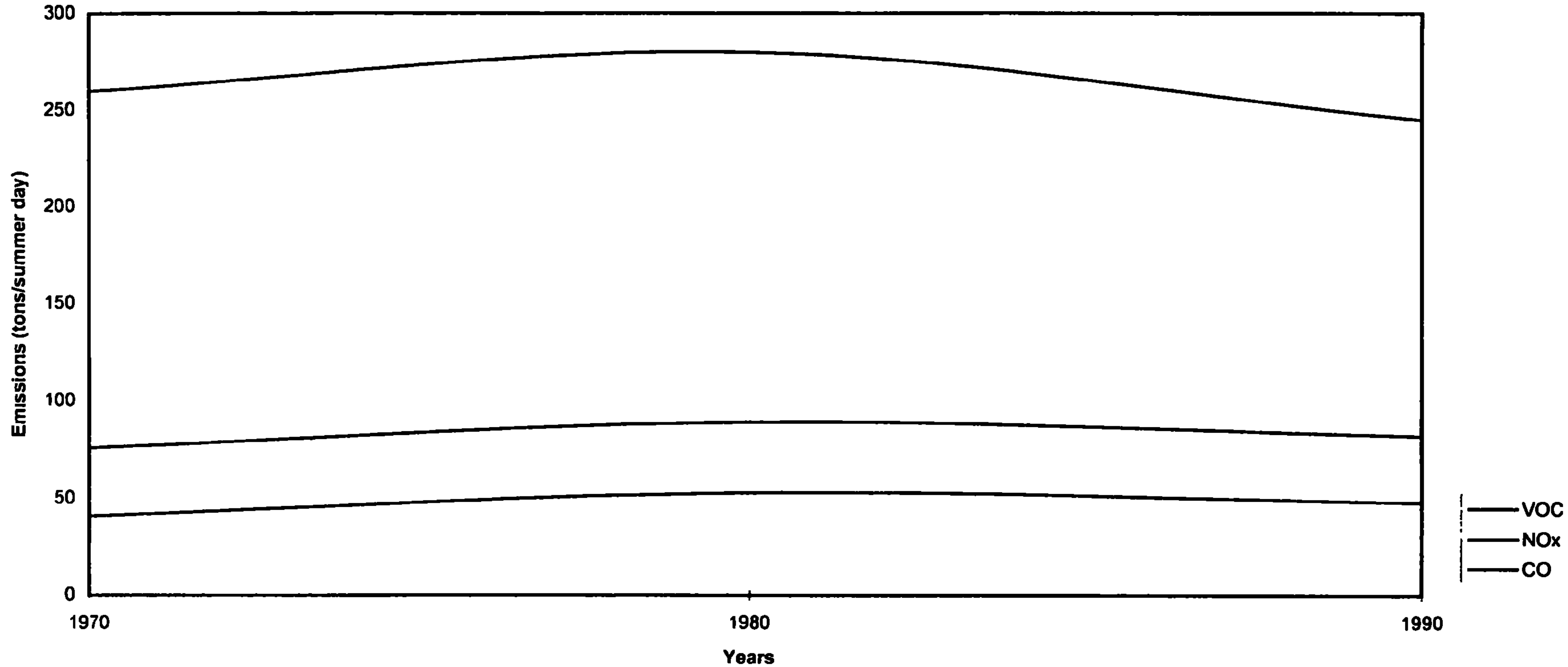


Figure 3-42. Trend in Urban Dynamics Emissions for Cook County (IDNER, 1994)

surface waterbodies. More than 414-million pounds of pollutants were discharged from these facilities to waterbodies in 1995. Such discharges are permitted under the authority of the CWA and the National Pollutant Discharge Elimination System (NPDES). Wastewater loadings were derived from 1995 data contained in EPA's Permit Compliance System (PCS). The monthly Discharge Monitoring Report (DMR) data available in PCS were analyzed using Effluent Data Statistics (EDS) to estimate annual loadings from these point sources. This approach included using the standard assumption that nondetected parameters are present at one-half the detection level. (See Section 1.4 for limitations of these loadings estimates.) This subsection details the point sources in the study area, including the facilities with the largest loadings and the pollutants discharged. Following this discussion is information on estimated loadings from nonpoint source runoff.

Industries in Cook County, IL, and Lake County, IN, have a long history of disharging to waterbodies in the area, as shown in Bhowmik and Fitzpatrick (1998) and many other references. This section characterizes the facilities with the largest mass loadings, as well as the types of pollutants discharged. It should be noted that many industrial facilities in these areas discharge indirectly to POTWs for treatment and discharge to surface waters. Particularly in Cook County, thousands of commercial and industrial facilities discharge to the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). These indirect discharges go to seven MWRDGC facilities located throughout Cook County for treatment and discharge. The discussion in this section focuses on direct discharges because they are indicators of the actual loadings of concentrational (e.g., total suspended solids, nutrients), as well as toxic (e.g., lead) water pollutants (PCS, 1997).

Of the 86 facilities in the study area that discharged in 1995, 43 are located in Cook County, IL, and 43 are in Lake County, IN. The loadings from Lake County, IN, are substantially larger than those from Cook County, IN. Specifically, Lake County's loadings were about five times larger than Cook County's (346,437,145 pounds compared to

Largest Sources

- 86 Point Source Dischargers in Study Area
- Largest Loadings from Sewage Treatment Plants in Hammond, Gary, and Chicago (Stickney)
- Grand Calumet River Received More Than 300-Million Pounds of Discharges in 1995

68,338,657 pounds) in 1995. Figure 3-43 displays the total mass of pollutants discharged in 1995 in both counties.

3.2.1 Largest Sources Discharging to Surface Waters

By a considerable margin, the largest dischargers to surface waters in the study area are municipal sewage treatment plants and some large industrial facilities. According to the total mass of pollutants discharged, only three facilities comprise 72 percent of the total for the entire study area. Table 3-42 presents the largest facilities in the study area, based on this measure. The three largest facilities (based on total mass of discharges) are the Hammond Municipal Sewage Treatment Plant (STP), the Gary Wastewater Treatment Plant, and Stickney STP. Sanitary wastewaters from Chicago and much of Cook County is handled by the Stickney Water Reclamation Plant, operated by the MWRDGC. The Stickney STP is the largest wastewater treatment facility in the world, handling household and industrial wastewaters, in addition to stormwater runoff (Ricondo, 1996). Specifically, the Stickney plant serves almost 2.4-million people in Chicago and 43 suburban communities through a design treatment capacity of 1,200-million gallons per day. These 16 facilities collectively contribute more than 99 percent of the total mass of pollutants discharged in the entire study area.

Tables 3-43 through 3-45 present the loadings of pollutants from 1995 from the Hammond Municipal STP, Gary Wastewater Treatment Plant, and MWRDGC Stickney STP, respectively (PCS, 1997). Conventional pollutants made up the majority of the effluents from these POTWs; however, metals and other toxic pollutants were discharged. In fact, the Stickney STP discharged 44,344 pounds of lead in 1995, 79 percent of the total amount of lead discharged in Cook and Lake Counties (Table 3-46). Other dischargers of lead in 1995 included MWRDGC North Side STP, Inland Steel, LTV Steel, and Chemical Waste Management - CID (Figure 3-44). Phenolics were also discharged from 14 facilities in the study area in 1995, the largest of which was the MWRDGC Calumet Sewage Treatment Plant. Figure 3-45 displays the facilities that discharged phenolics (total recoverable) into surface waters in 1995.

The waterbody receiving the largest loadings in the entire study area is the Grand Calumet River. The majority of the dry weather flow of the Grand Calumet River is input from the municipal

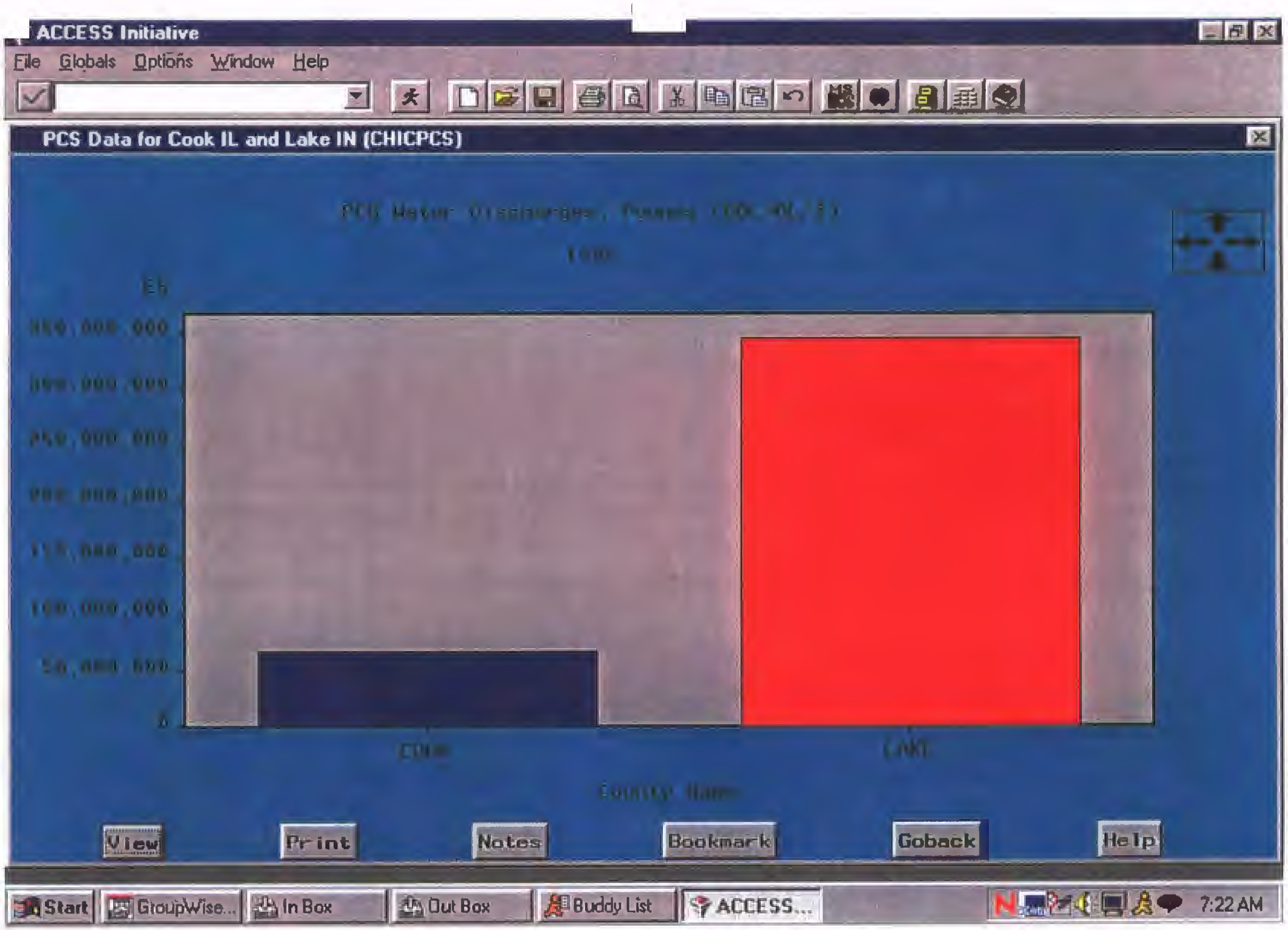


Figure 3-43. Total Quantity of Water Discharged by County in 1995

Source: PCS, 1997.

Table 3-42. Major Point Source Dischargers to Surface Waters in 1995 in Cook County, IL, and Lake County, IN

Facility	Total Mass of Pollutants Discharged (lbs/yr)
Hammond Municipal STP	182,783,675
Gary Wastewater Treatment Plant	69,177,958
MWRDGC Stickney STP	45,443,631
East Chicago Municipal STP	33,852,917
E.I. DuPont DeNemours	21,612,173
LTV Steel Company	14,926,047
MWRDGC Calumet STP	10,755,231
Inland Steel Company	10,591,292
U.S. Steel - Gary Works	7,175,826
MWRDGC Northside STP	6,332,293
American Oil Co. (Amoco)	3,235,798
CERESTAR USA	1,476,491
MWRDGC Kirie STP	1,212,248
Citgo Petroleum	1,029,991
Thorn Creek Basin S.D.	879,081
USX-USS South Works	676,276

Source: PCS, 1997.

Table 3-43. Wastewater Discharge Loadings in 1995 from Hammond Sewage Treatment Plant

Rank	Discharge in Lbs.	Cumulative Percent	Pollutant/Parameter
1	120,659,323	66.00%	SOLIDS, TOTAL DISSOLVED
2	32,218,772	83.64%	SULFATE, TOTAL (AS SO4)
3	27,545,291	98 71%	CHLORIDE (AS CL)
4	727,909	99.11%	OXYGEN, DISSOLVED (DO)
5	594,414	99 43%	OIL AND GREASE FREON EXTR-GRAV METH
6	332,010	99.61%	BOD, CARBONACEOUS 05 DAY, 20C
7	273,340	99 76%	SOLIDS, TOTAL SUSPENDED
8	226,909	99 89%	NITROGEN, AMMONIA TOTAL (AS N)
9	130,626	99.96%	FLUORIDE, TOTAL (AS F)
10	26,913	100.00%	PHOSPHORUS, TOTAL (AS P)
11	25,720	100.00%	ZINC, TOTAL (AS ZN)
12	6,841	100.00%	IRON, DISSOLVED (AS FE)
13	5,604	100 00%	COPPER, TOTAL (AS CU)
14	4,761	100.00%	NICKEL, TOTAL (AS NI)
15	1,826	100.00%	CHLORINE, TOTAL RESIDUAL
16	1,254	100.00%	PHENOLICS, TOTAL RECOVERABLE
17	1,020	100 00%	CADMIUM, TOTAL (AS CD)
18	460	100 00%	CYANIDE, TOTAL (AS CN)
19	325	100 00%	LEAD TOTAL RECOVERABLE
20	206	100 00%	CHROMIUM TOTAL RECOVERABLE
21	137	100 00%	FLOW, WASTEWATER BY-PASSING TRTMNT PLANT
22	15	100 00%	MERCURY TOTAL RECOVERABLE
Total	**182,783,675**	**100.00%**	

Source: PCS, 1997.

Table 3-44. Wastewater Discharge Loadings in 1995 from Gary Wastewater Treatment Plant

Rank	Discharge in Lbs.	Cumulative Percent	Pollutant/Parameter
1	56,046,424	81.02%	SOLIDS, TOTAL DISSOLVED
2	8,275,498	92 98%	SULFATE, TOTAL (AS SO4)
3	2,396,895	96.45%	CHLORIDE (AS CL)
4	1,016,479	97.91%	OXYGEN, DISSOLVED (DO)
5	578,753	98.75%	OIL AND GREASE FREON EXTR-GRAV METH
6	389,869	99.31%	SOLIDS, TOTAL SUSPENDED
7	278,829	99.72%	BOD, CARBONACEOUS 05 DAY, 20C
8	106,421	99.87%	FLUORIDE, TOTAL (AS F)
9	40,892	99.93%	PHOSPHORUS, TOTAL (AS P)
10	15,657	99.95%	NITROGEN, AMMONIA TOTAL (AS N)
11	11,697	99 97%	ZINC, TOTAL (AS ZN)
12	9,597	99 98%	IRON, DISSOLVED (AS FE)
13	3,966	99.99%	CHLORINE, TOTAL RESIDUAL
14	2,051	99.99%	NICKEL, TOTAL (AS NI)
15	1,453	99.99%	LEAD TOTAL RECOVERABLE
16	980	100.00%	CHROMIUM, HEXAVALENT DISSOLVED (AS CR)
17	732	100 00%	CHROMIUM TOTAL RECOVERABLE
18	686	100.00%	CADMIUM TOTAL RECOVERABLE
19	546	100 00%	ARSENIC, TOTAL RECOVERABLE
20	286	100 00%	CYANIDE, TOTAL (AS CN)
21	140	100.00%	FLOW, WASTEWATER BY-PASSING TRTMNT PLANT
22	102	100 00%	COPPER TOTAL RECOVERABLE
23	4	100.00%	MERCURY TOTAL RECOVERABLE
Total	69,177,958	100.00%	

Source: PCS, 1997.

Table 3-45. Wastewater Discharge Loadings in 1995 from MWRDGC Stickney STP

Rank	Discharge in Lbs.	Cumulative Percent	Pollutant/Parameter
1	17,983,974	39.57%	OXYGEN, DISSOLVED (DO)
2	16,496,801	75.88%	SOLIDS, TOTAL SUSPENDED
3	8,327,568	94.20%	BOD, CARBONACEOUS 05 DAY, 20C
4	2,523,468	99.75%	NITROGEN, AMMONIA TOTAL (AS N)
5	44,960	99.85%	AMMONIA, UNIONIZED
6	44,344	99.95%	LEAD, TOTAL (AS PB)
7	22,516	100.00%	CYANIDE, TOTAL (AS CN)
Total	**45,443,631**	**100.00%**	

Source: PCS, 1997.

Table 3-46. Facilities Discharging Lead to Surface Waters in 1995 in Cook County, IL, and Lake County, IN

Rank	Discharge in Lbs.	Cumulative Percent	Facility Name
1	44,344	79.05%	MWRDGC STICKNEY STP
2	5,169	88.27%	MWRDGC NORTH SIDE STP
3	2,047	91 92%	INLAND STEEL COMPANY
4	1,453	94.51%	GARY WASTEWATER TREATMENT PLANT
5	1,391	96.99%	U S. STEEL - GARY WORKS USX C
6	1,005	98.78%	LTV STEEL COMPANY
7	325	99.36%	HAMMOND MUNICIPAL STP
8	255	99 81%	CHEMICAL WASTE MANAGEMENT - CID
9	105	100%	EAST CHICAGO MUNICIPAL STP
10	0	100%	BUCKEYE PIPE LINE COMPANY LP
11	0	100%	HINSDALE S.D. MCELWAIN STP
12	0	100%	HUNTSMAN CHEMICAL CORP-WILLOW
13	0	100%	MWRDGC CALUMET STP
14	0	100%	USX-USS SOUTH WORKS
Total	**56,094**	**100%**	

Source: PCS, 1997.

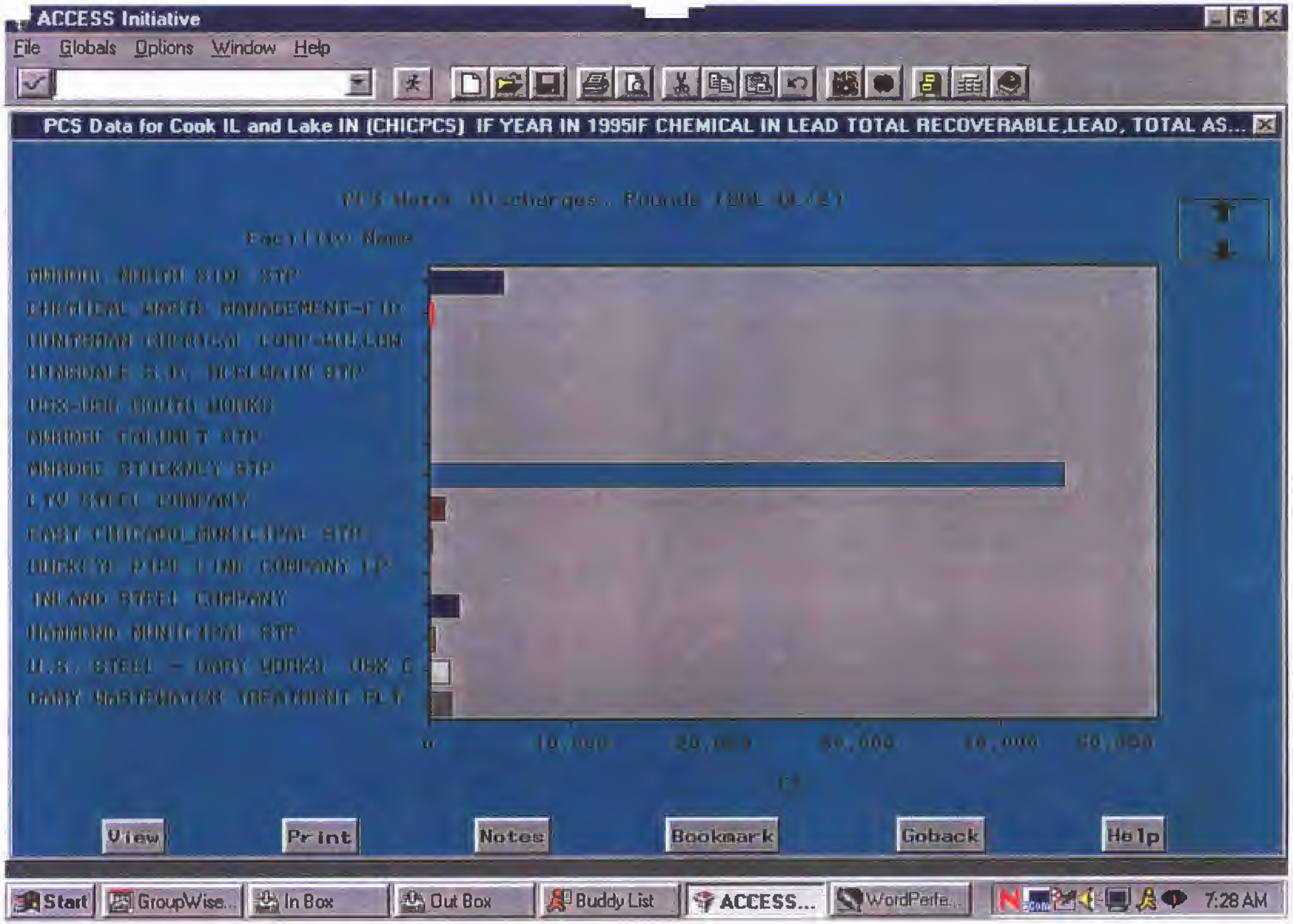


Figure 3-44. Facilities Discharging Lead in 1995 in Cook County, IL, and Lake County, IN

Source: PCS, 1997.

Figure 3-45. Facilities Discharging Phenolics (Total Recoverable) in 1995 in Cook County, IL, and Lake County, IN

Source: PCS, 1997.

and industrial sources that line the river (HydroQual, 1985). Inputs to these waterbodies also include combined sewer overflows (CSOs) and nonpoint source runoff. The Grand Calumet River received almost 315-million pounds of discharges in 1995, from three large STPs in Hammond, East Chicago, and Gary, IN, as well as industrial effluents from industrial facilities such as U.S. Steel-Gary and DuPont. This loading is larger than any other waterbody in the study area by an order of magnitude. Similarly, the Indiana Harbor Ship Canal received wastewater discharges amounting to about 26-million pounds from Inland Steel, American Steel, and LTV Steel.

The majority of the municipal and industrial dischargers to surface waters in Lake County, IN, are located on the Grand Calumet River/Indiana Harbor Ship Canal (GCR/IHSC). Municipal (sewage treatment) and industrial effluents, such as cooling waters and process waters, are discharged under NPDES permits. IDEM (1997a) reported that 19 NPDES permittees are located in the GCR/IHSC area of concern. Collectively, these facilities discharge approximately 833-million gallons per day, which, during dry weather, represent the entire flow of the Grand Calumet River (IDEM, 1997a). Waterbodies in Southeast Cook County also receive discharges from industrial and municipal facilities. In 1995, the Calumet River received about 125,000 pounds of wastewater effluents; the Grand Calumet River received about 675,000 pounds, and the Little Calumet River received about 11-million pounds of pollutants. Loadings to the Little Calumet River (not to mention pollutants flowing into Illinois from Indiana in its portion of the river) included more than 6-million pounds of total suspended solids, 2-million pounds of nutrients ammonia/nitrogen, and the largest inputs of zinc (more than 76,000 pounds) of any waterbody in the study area. The Chicago Sanitary and Ship Canal receives discharges from the Stickney STP and other facilities. About one-third of the loadings to the Chicago Sanitary and Ship Canal in 1995 were total suspended solids. Biological oxygen demand (BOD) loadings to the Chicago Sanitary and Ship Canal from Stickney STP were the highest of any facility and waterbody in the study area, more than 8-million pounds.

3.2.2 Discharges by Type of Industry

Of the 43 dischargers located in Cook County, IL, 16 are listed in PCS as utilities (including municipal sewage treatment plants), 6 are primary metals facilities, and 5 are chemicals facilities. Of the total pollutants discharged from Cook County in 1995 (68,338,657 pounds), almost 97 percent of the mass came from utilities, primarily the POTWs (65,796,734 pounds), 1.5 percent were from the petroleum industry, and about 1 percent are from the primary metals industry; the remainder of discharges were from 13 other industrial categories.

Similarly, 83 percent (286,438,133 pounds/year) of the total mass of pollutants discharged to surface waters in Lake County, IN, (346,437,145 pounds/year) were from utilities such as sewage treatment plants. As shown previously, the Hammond, Gary, and East Chicago sewage treatment plants are among the largest sources in Lake County. Table 3-47 displays the total mass discharged from Lake County's facilities, by two-digit SIC Code. Other significant contributors included primary metals (about 9 percent) and chemicals industries (6 percent).

3.2.3 Pollutants Discharged to Surface Waters

Conventional pollutants were discharged in the largest quantities in both Cook County, IL, and Lake County, IN. Such pollutants included total suspended solids, total dissolved solids, biological oxygen demand (BOD), nitrogen, and others. Descriptions of some of the conventional pollutants and parameters measured in effluents are summarized below:

- Suspended Solids - Can contain many types of pollutants and may act physically on waterbodies by reducing light penetration and altering sediments/habitats;
- Oil and Grease - Can be lethal to fish, inhibit oxygen waste to waterbodies, and may deplete oxygen levels due to chemical oxygen decrease of these compounds;
- Chemical and Biological Oxygen Demand - Can deplete oxygen levels, which can result in mortality or other effects on fish;
- Dissolved Oxygen - A desired parameter in effluents; and
- Nitrogen - Excess nutrients can lead to eutrophication, algal blooms, and possible fouling of drinking water supplies.

Table 3-47. Total Mass of Wastewater Discharges by Industry Types in 1995 in Lake County, IN

Two Digit SIC Code	Description	Pounds Discharged
20	FOOD	1,476,491
26	PAPER	1,734
28	CHEMICAL	22,155,778
29	PETROLEUM	3,235,798
32	STONE/CLAY	21,109
33	PRIMARY METAL	32,744,302
35	MACHINERY	328
46	PIPELINES	2,124
49	UTILITIES	286,693,796
65	REAL ESTATE	104,859
70	HOTELS	0
76	OTHER REPAIR	117
82	EDUCATIONAL	300

		346,437,145

Source: PCS, 1997.

It should be noted that there is some overlap in some of the parameters regularly monitored in effluents. For instance, nitrogen can be measured by several methods. The various parameters have not been summarized to preserve the original data integrity for these pollutant measures. Similarly, the mass of total suspended solids and total dissolved solids would include other parameters/pollutants that are also measured individually. Although numerous toxic constituents are discharged from any number of the 100 facilities in the study area, the magnitude of their discharges was relatively small. Presented below is a summary of the types of pollutants discharged to surface waters in Cook County, IL, and Lake County, IN.

3.2.3.1 *Cook County, IL*

From the 43 facilities in Cook County, there were 85 parameters/pollutants to characterize the content of the discharges. As mentioned previously, the total mass of wastewater discharges in 1995 in Cook County, IL, was 68,338,656 pounds. Five parameters made up more than 98 percent of this mass:

- Total Suspended Solids - 30,011,900 pounds/year (26 facilities);
- Dissolved Oxygen - 18,821,718 pounds/year (2 facilities);
- Biological Oxygen Demand - 12,008,590 pounds/year (13 facilities);
- Nitrogen - 5,434,854 pounds/year (11 facilities); and
- Chemical Oxygen Demand - 789,421 pounds/year (2 facilities).

Toxic pollutants discharged from facilities in 1995 in Cook County, IL, included total lead (49,768 pounds/year), total chromium (2,666 pounds/year), hexavalent chromium (113 pounds/year), and mercury (about 1 pound/year). Table 3-48 presents the pollutants discharged to surface waters from facilities in Cook County, IL, in 1995. This table includes the number of facilities that discharged each pollutant as well as the total pounds of each pollutant/parameter monitored in effluents from point sources and presented in PCS.

An MWRDGC report published in 1986, describes the contribution of five major facilities to the influent pollutant load at the Calumet Sewage Treatment Works (CSTW) in 1982 (MWRDGC, 1986). The facilities studied for the report were the FSC Paper Corporation, Sherwin-Williams,

Table 3-48. Pollutants Discharged into Water Bodies in 1995 in Cook County, IL

Compound Name	Number of Facilities	Water Discharges (lbs)
Total Suspended Solids	28	84,257,712
Oxygen, Dissolved (DO)	2	53,519,591
BOD, Carbonaceous 05 Day, 20C	12	33,762,776
Nitrogen, Ammonia Total (As N)	12	15,708,418
Oxygen Demand, Chem. (High Level) (COD)	2	2,229,880
Chemical Oxygen Demand (COD)	1	851,531
Oil And Grease (Soxhlet Extr.) Tot.	20	541,723
BOD, 5-Day (20 Deg. C)	13	442,058
Zinc, Total (As Zn)	7	374,360
Cyanide, Total (As Cn)	9	194,960
Iron, Total (As Fe)	9	192,425
Fluoride, Total (As F)	4	156,523
Ammonia, Unionized	3	133,772
Lead, Total (As Pb)	7	132,980
Chlorine, Total Residual	17	78,137
Copper, Total (As Cu)	9	64,235
Phenolics, Total Recoverable	8	53,254
Oil And Grease, Freon Extr-Grav Meth.	2	14,839
Total Organic Carbon (TOC)	1	12,287
Chromium, Total (As Cr)	7	7,245
Aluminum, Total Recoverable	1	1,364
Cyanide, Weak Acid, Dissociable	6	984
Manganese, Total (As Mn)	4	856
Halogen, Total Organic	4	550
Sulfide, Total (As S)	1	291
Chromium, Hexavalent (As Cr)	6	125
Ethylbenzene	5	44
Chromium, Trivalent (As Cr)	1	22
Mercury, Total (As Hg)	6	2
Toluene	9	1
Total Discharges (of 87 Pollutants)		192,732,946
Number of Pollutants Comprising 90% of Discharges		3

Source PCS, 1997

Interlake Coke, Republic Steel, and Clark Oil (which had three discharges). During October 1982, at least eight 24-hour composite samples were taken from each discharge point and from the CSTW influent. These samples were analyzed for a number of compounds, including sulfides, sulfites, aniline, benzene, toluene, low-boiling solvents, total phenols, o-cresol, m-cresol, p-cresol, cyanide, ammonia-N, and chlorine (MWRDGC, 1986). Average flow rates for all dischages were determined by averaging daily flow over this same period of time.

By multiplying the average concentrations with the average flow rates, an annual loading rate was derived for those facilities that discharge wastewaters to the CSTW. The results are shown in Table 3-49, along with the percent contribution of the five plants compared to the amount of pollutant in the CSTW influent. While only 6.5 percent of the CSTW influent water came from these plants, much larger loadings of pollutants were found to originate from them. An estimated 77 percent of the cyanide and 89 percent of p-cresol in CSTW's influent were due to effluents from these plants (MWRDGC, 1986). Some caution is urged in interpreting the results, because in calculating them, it was assumed that no compounds are lost from the flow due to settling, evaporation, and other processes.

3.2.3.2 *Lake County, IL*

From the 43 facilities in Lake County, IN, the total mass of pollutants discharged for 1995 was 346,437,145 pounds. Fifty different pollutants were included in the permits or were monitored for in the discharges from these facilities. However, like Cook County, IL, the pollutants/parameters discharged in the largest quantities in 1995 included:

- Total Dissolved Solids - 212,634,096 pounds/year (5 facilities);
- Sulfate - 61,576,733 pounds/year (7 facilities);
- Chloride - 41,671,739 pounds/year (7 facilities);
- Total Suspended Solids - 9,773,013 pounds/year (37 facilities); and
- Oil and Grease - 9,176,923 pounds/year (21 facilities).

These five parameters collectively provided more than 96 percent of the total mass of discharges to surface waters in Lake County, IN. Discharges of toxic chemicals included: lead - total

Table 3-49. Estimated Loading Contributions, in Pounds Per Year, to the CSTW by Five Major Facilities

Pollutant	Sherwin-Williams (lbs/yr)	FSC Paper Corp. (lbs/yr)	Interlake Coke (lbs/yr)	Republic Steel (lbs/yr)	Clark Oil #1A (lbs/yr)	Clark Oil #2A (lbs/yr)	Clark Oil #3A (lbs/yr)	Total for Five Facilities (lbs/yr)	CSTW Influent (lbs/yr)	Contribution to Influent (in Percent)
Sulfide	2,070	3,090	2,790	3,410	310,000	507	69	322,000	965,000	33.3
Sulfite	0	170,000	36,300	34,100	135,000	0	0	375,000	0	--
Aniline	823,000	0	0	0	0	0	0	823,000	0	--
Benzene	518	0	20,900	0	3,640	394	0	25,500	16,100	>100[b]
Toluene[a]	5,690	0	1,950	0	5,470	25,900	41	39,100	53,600	72.9
Low Boiling Solvents[a]	114,000	355,000	15,300	51,200	117,000	1,280,000	3,290	1,930,000	5,840,000	33.1
Phenols (Total)	104,000	55,600	572,000	219,000	51,700	130,000	315	1,130,000	536,000	>100[b]
O-Cresol	6,730	7,720	32,100	12,800	17,500	2,140	82	79,000	161,000	49.1
M-Cresol	8,800	4,630	105,000	46,100	24,400	338	41	189,000	214,000	88.1
P-Cresol	55,900	9,270	47,400	18,800	11,300	225	69	143,000	161,000	88.9
Cyanide	14,000	6,180	36,000	103,000	10,900	28	2	170,000	220,000	77.5
Ammonia-N	151,000	35,500	812,000	930,000	470,000	1,350	1,410	2,400,000	10,500,000	22.8
Chlorine	2,340,000	1,140,000	1,560,000	2,520,000	10,900,000	1,770,000	685	20,300,000	11,300,000	>100[b]

a. Loading Estimates for Toluene and Low Boiling Solvents are based on grab samples obtained in March/April 1983.
b. Estimated contributions to influent over 100% may be due to idealizations used in the calculation.

Source MWRDGC, 1986.

(3,052 pounds/year), total lead recoverable (3,274 pounds/year), hexavalent chromium - dissolved (980 lbs/year), hexavalent chromium (45 pounds/year), and mercury (27 pounds/year). Table 3-50 presents the pollutants discharged to surface waters from facilities in Lake County, IN, in 1995. This table includes the number of facilities discharging each pollutant, as well as the total pounds of each pollutant/parameter monitored in effluents from point sources in 1995 and presented in PCS.

IDEM (1997b) published a comprehensive water quality assessment of Wolf Lake, which is located on the border between Cook County, IL, and Lake County, IN. Dischargers to Wolf Lake include effluents from two industrial sources, storm drainage discharges, and surface runoff (Section 4.2 discusses ambient water quality monitoring data). Inflows to the lake during the 1992-1993 study period were estimated by IDEM (1997b) to be:

- Nineteen percent from direct precipitation;
- Sixteen percent from Hammond Sanitary Districts' stormwater pump stations;
- Thirty percent from Lever NPDES discharge;
- Thirty-one percent from Amaizo NPDES discharge; and
- Five percent from groundwater in flow and/or surface runoff.

3.2.4 Nonpoint Sources/Stormwater Runoff

Nonpoint sources are those sources that cannot be attributed to a single pipe or outlet. For surface water, most nonpoint source pollution is caused by compounds that have settled on the ground and are mobilized by stormwater runoff. As a storm progresses, stormwater runs downhill and can make its way to a surface waterbody or sewer, all the while washing off and carrying pollutants. Pollutants spread over vast, diffuse areas can be transported in this fashion. In urban areas, sewer systems capture much of the runoff, transporting it to wastewater treatment plants. However, if a region is served by combined sewers, as is the case in much of Cook and Lake Counties, intense storm events can cause combined sewer overflows (CSOs). These overflows contain not only the nonpoint source runoff, but also untreated sewage.

Nonpoint source pollution can be particularly significant in well paved, impermeable areas. For example, at Midway Airport, activities such as aircraft washing, fueling, and maintenance can

Table 3-50. Pollutants Discharged into Water Bodies in 1995 in Lake County, IN

Compound Name	Number of Facilities	Water Discharges (lbs)
Solids, Total Dissolved	6	607,424,674
Sulfate, Total (As SO4)	7	174,816,694
Chloride (As Cl)	8	116,749,114
Total Suspended Solids	42	27,451,948
Oil And Grease, Freon Extr-Grav Method	26	23,034,013
BOD, 5-Day (20 Deg. C)	21	8,377,762
Oxygen, Dissolved (DO)	15	7,813,931
Oxygen Demand, Chem. (Low Level) (COD)	2	5,646,326
BOD, Carbonaceous 05 Day, 20C	16	4,265,194
Nitrogen, Ammonia Total (As N)	27	1,476,216
Fluoride, Total (As F)	5	1,073,736
Total Organic Carbon (TOC)	4	1,004,160
Oil & Grease (Freon Extr.-Ir Meth) Total	1	670,606
Chlorine, Total Residual	20	598,580
Chemical Oxygen Demand (COD)	1	446,919
Phosphorus, Total (As P)	11	235,145
Cadmium, Total (As Cd)	2	205,581
Zinc, Total (As Zn)	6	109,236
Iron Total Recoverable	1	104,123
Iron, Dissolved (As Fe)	4	68,482
Zinc Total Recoverable	4	47,056
Oxidants, Total Residual	4	26,444
Copper, Total (As Cu)	3	22,662
Phenolics, Total Recoverable	6	21,507
Cyanide, Total (As Cn)	10	18,469
Nickel, Total (As Ni)	1	13,643
Lead, Total (As Pb)	3	8,322
Lead Total Recoverable	8	5,252
Chromium Total Recoverable	6	5,039
Iron, Total (As Fe)	1	4,749
Nickel Total Recoverable	3	4,306
Benzene	7	4,216
Sulfide, Total (As S)	1	2,751
Chromium, Hexavalent Dissolved (As Cr)	1	2,002
Cadmium Total Recoverable	3	1,470
Arsenic, Total Recoverable	1	1,056
Flow, Wastewater By-Passing Treatment Plant	21	974
Selenium, Total (As Se)	1	552

Table 3-50. Pollutants Discharged into Water Bodies in 1995 in Lake County, IN (continued)

Compound Name	Number of Facilities	Water Discharges (lbs)
Naphthalene	2	368
Chromium, Total (As Cr)	2	216
Copper Total Recoverable	2	205
Chromium, Hexavalent (As Cr)	1	120
Mercury Total Recoverable	3	74
Cyanide, Total Recoverable	1	3
Benzo(A)Pyrene	2	2
Total Discharges (of 45 Pollutants)		981,763,900
Number of Pollutants Comprising 90% of Discharges		3

Source. PCS, 1997

leave fuels, oils, grease, and sediments on the pavement that can run off to surface waters. Application of deicing compounds, of which an estimated 151,100 gallons were used in 1995 (Ricondo, 1996), can intensify pollution problems during the winter. A number of facilities are utilized at Midway Airport to address this runoff problem. These include a separate stormwater sewer system; detention facilities for the stormwater (the Tunnel and Reservoir Plan, discussed in Section 4.2); a valve at the detention facilities, which allows large fuel spills to be pumped away; and maintenance facilities, in which aircrafts are washed (Ricondo, 1996).

Midway Airport generates large quantities of wastewater. Under normal operating conditions, all overflow is sent to the Stickney Water Reclamation Plant for treatment. Calculations were performed to estimate aircraft deicing fluid usage in the years 1995 and 2010, and to project sanitary flow rates expected due to a terminal development project (Ricondo, 1996). It was determined that that additional flow at the project's ultimate development will be an additional 34,250 gallons a day, and a peak of 137,000 gallons per day. Approximately 64,000 gallons of wastewater were generated per day in 1995. It is expected that the Stickney plant, along with the detention and treatment facilities, can accomodate the flows projected (Ricondo, 1996).

Nonpoint source pollutants in the GCR/IHSC area include oil and grease, PCBs, pesticides, cyanide, and mercury (IDEM, 1997a). These pollutants, in combination with total suspended solids, may contribute to low dissolved oxygen in these waterbodies of Lake County, IN. Combined CSO is a significant source of pollutants, especially bacteria, to GCR/IHSC. EPA inventoried 14 CSOs in the early 1980s with an estimated loading of more than 11-billion gallons of untreated wastewater per year (Table 3-51). The CSOs are evenly distributed among the East and West Branches of the GCR and the IHSC (Figure 3-46). Groundwater has been estimated to provide about 10 percent of the loadings to the Grand Calumet River of ammonia, chromium, and cyanide (IDEM, 1991). Similarly, as much as 5 to 10 percent of the loadings of dissolved solids, sulfate, copper, iron, and lead to the river may come from groundwater. Table 3-52 summarizes data on the migration of contaminants in groundwater to the Grand Calumet River (IDEM, 1991).

The ambiguous nature of nonpoint sources confounds direct measurement of nonpoint source loadings. There have been studies estimating the nonpoint source loads to surface waterbodies in Cook and Lake Counties. However, because there were no previously existing estimates as to

Table 3-51. Combined Sewer Overflows to the Grand Calumet River

CSO Number	Mile-Segment[1] [Cross St.]	Sanitary District	Est. Annual Overflow Vol.
1	12.6 - E. Br.	Gary	1.25 bg/year
2	12.3 - E. Br. [Virginia St.]	Gary	0.59 bg/year
3	11.2 - E. Br. [Hwy. 90]	Gary	0.09 bg/year
4	11.0 - E. Br. [Buchanan St.]	Gary	0.27 bg/year
5	10.0 - E. Br. [Bridge St.]	Gary	0.43 bg/year
6	9.4 - E. Br. [Hwy. 90]	Gary	0.89 bg/year
7	7.6 - E. Br.	Gary	0.75 bg/year
8	6.5 - E. Br. [Cline Ave.]	E. Chicago	0.49 bg/year
9	4.7 - E. Br. [Kennedy Ave.]	Hammond	1.80 bg/year
10[2]	4.6 - W. Br. [Indianapolis Boulevard]	E. Chicago	2.93 bg/year
11	6.0 - W. Br. [Columbia Ave.]	Hammond (pump sta.)	1.22 bg/year
12	6.0 - W. Br. [Columbia Ave.]	Hammond	0.09 bg/year
13	1.7 - S. Ca. [Turning Basin]	E. Chicago	0.23 bg/year
14	1.7 - S. Ca. [Opposite turning basin]	E. Chicago	(3)

(1) River miles. Name of Segment or Reach: E Br. = East Branch; W. Br. = West Branch; M. St. = Main Stem; S. Ca. = Ship Canal, from Lake George Branch to Harbor.

(2) Assumed point of entry for Magoun Avenue Pumping Station CSO.

(3) Although listed as a CSO, this outfall is a storm sewer only. This outfall has been included because it discharges significant volumes of oily wastes which infiltrate into the storm sewer from contaminated groundwater and soils at the Energy Cooperative, Inc., site.

Source. IDEM, 1991; U.S. EPA, 1991a

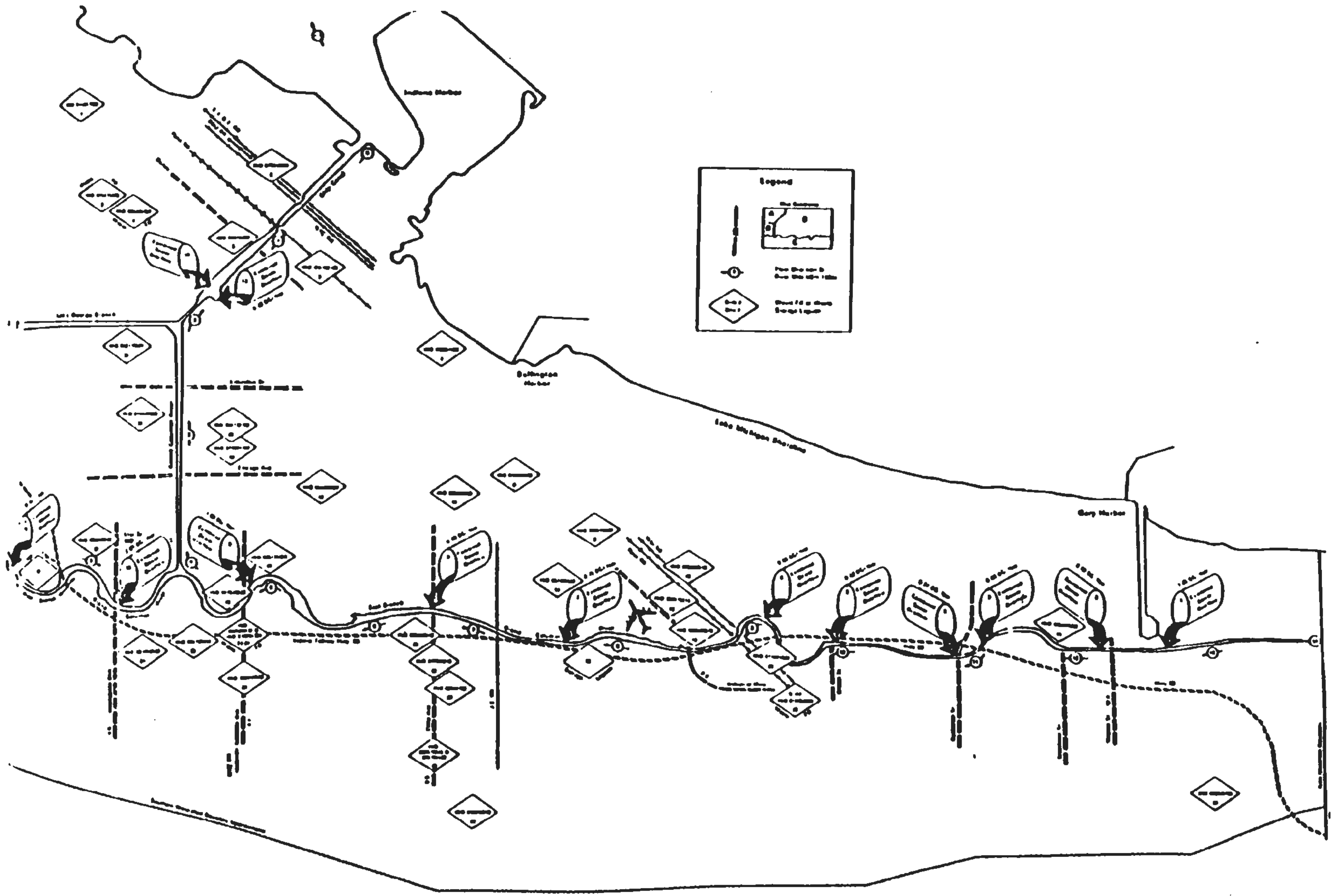


Figure 3-46. Location of Combined Sewer Outflows-Grand Calumet River, IN

Table 3-52. Groundwater Loadings of Pollutants to the Grand Calumet River

Percent of Total Loading	Pollutant
10%	Ammonia Chromium Cyanide
5 to 10%	Dissolved Solids Sulfate Copper Iron Lead
1 to 5%	Chlorine Fluorine Chloride
Less than 1%	Nitrate/Nitrite Phosphorous/orthophosphate Mercury Zinc

Source. IDEM, 1991.

nonpoint source loadings to Cook and Lake Counties as a whole, estimates were made for this report. Both the existing estimates and estimates calculated for Cook and Lake Counties are presented in this section. The estimates suggest that the nonpoint sources may be contributing significantly to the surface water concentrations of several parameters, including lead, copper, zinc, and chemical oxygen demand (COD).

3.2.4.1 *Existing Estimates of Nonpoint Source Loadings*

In September and October 1983, time series testing was performed in the Grand Calumet River (HydroQual, 1985). By measuring concentrations of compounds in the known point outfalls and in the instream water, estimates were determined for the unmonitored source loading rates. These estimates were made for a number of species: the ultimate carbonaceous biological oxygen demand ($CBOD_u$), chlorides, ammonia, iron, lead, mercury, and sulfate. Loading rates are presented in Table 3-53, along with the approximate milepoints (traveling distance from the Indiana Harbor, in miles) at which the unmonitored loadings were centered. The unmonitored loadings are believed to stem not only from sewer overflows, but also from leakage of lagoons, drainage of landfills, nonpermitted outfalls, and unmonitored point source outfalls (HydroQual, 1985). The estimates for the loadings vary greatly with time and position. For example, the $CBOD_u$ loading estimate in October at milepoint 7.75 of the West Branch is about half the loading in September, while the loading estimate at milepoint 5.75 of the West Branch was about 50 percent greater in October than in September.

Terstriep et al. (1990) developed a model that estimates nonpoint source loadings based on inputed values for rainfall, soil parameters, and buildup/washoff parameters. They applied their model to the Greater Lake Calumet area in Illinois, which was divided into four urban drainage basins (Figure 3-47). It was assumed that Regions 1 and 2 drained into the Little Calumet River, while Regions 3 and 4 drained into the Calumet River. The results of the modeling are shown in Table 3-54. The estimates stay relatively constant between the years--about 6,000 pounds of lead per year entered the Little Calumet, and 600 pounds enter the Calumet. Terstriep and Lee attempted to verify the model with water quality data from the Boneyard Creek Basin in Champaign-Urbana, IL, but found little correlation between actual and modeled loading rates.

Table 3-53. Estimated Unmonitored Loads into the Grand Calumet River

	September 1983		October 1983	
Parameter	Milepoint/Branch	Discharge (lbs/day)	Milepoint/Branch	Discharge (lbs/day)
$CBOD_u$	5.75/West	5500	5.75/West	8000
	7.75/West	7500	7.75/West	4000
	12.75/East	2100	12.75/East	2100
	12.25/East	7300	9.25/East	7300
Chlorides	12.75/East	2100	12.75/East	2100
	12.25/East	7300	9.25/East	17000
Ammonia	12.75/East	250	12.75/East	250
	12.25/East	900	9.25/East	900
Iron	5.75/West	300	12.75/East	40
	12.75/East	50	12.25/East	400
	12.25/East	500	12.25/East	320
Lead	12.75/East	25	12.25/East	30
	12:25/East	60	--	--
Mercury	12.25/East	1.5	12.25/East	0.5
Sulfate			12.75/East	21000

Source HydroQual, 1985

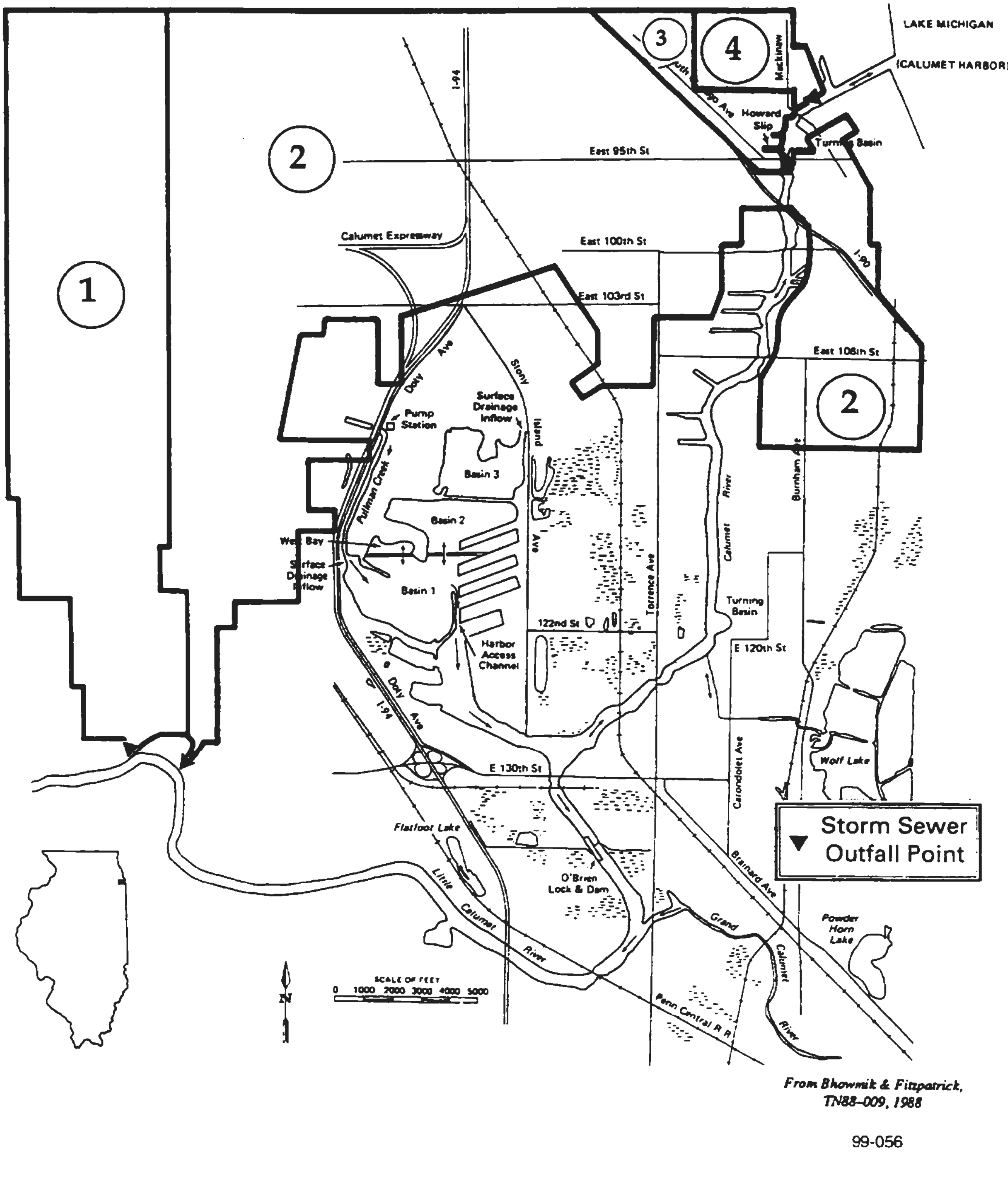


Figure 3-47. Four Drainage Basins Used in Terstriep and Lee Model

Source: Terstriep & Lee, 1990.

Table 3-54. Estimated Nonpoint Source Loadings to the Calumet and Little Calumet Rivers

Year	Constituent	Loading (lbs/yr)	
		Little Calumet	Calumet
1955	Suspended Solids	3,644,200	437,240
	Phosphorus	6,600	770
	Lead	6,400	630
1959	Suspended Solids	2,904,900	352,550
	Phosphorus	5,900	700
	Lead	5,300	540
1971	Suspended Solids	3,646,000	436,100
	Phosphorus	5,000	580
	Lead	5,900	580

Source: Terstriep etal., 1990.

Ketcham and Kunchakarra (1992) performed a study in which they prioritized areas in the Grand Calumet River Watershed for best management practice control. As part of the study, they estimated the nonpoint source loading rate of total suspended solids (TSS) in different regions of the watershed. They used a method outlined in *Urban Targeting and BMP Selection; An Information and Guidance Manual for State NPS Program Staff Engineers and Managers* (U.S. EPA, 1989c). The divisions used in their estimate are shown in Figure 3-48, and their estimates for TSS loadings are presented in Table 3-55. The loading rates of TSS are nearly proportional to the area from which they came, with an average loading rate per area of 21 pounds/year/acre.

3.2.4.2 *Data and Methods Used to Estimate Nonpoint Source Loading Rates*

For Cook County, IL, and Lake County, IN, directly-measured data on nonpoint source loadings were not available at the time of this report. However, methods and data were available that can be used to estimate nonpoint source loading rates. Much of the data are taken from Ketcham and Kunchakarra (1992), who derived values for event mean concentrations (EMCs) (a chemical-specific coefficient that describes the amount of chemical that gets washed away in an average rainstorm), curve numbers and runoff coefficients (values, specific to a given land use type, that describe how much water from a rainstorm directly runs into a surface waterbody), and areas of different land use types. The EMCs in their report were originally from the National Urban Runoff Program (NURP) data base. There are EMCs in the NURP data base for a number of different land uses and for 10 parameters: total suspended solids, BOD, COD, total phosphorus (TP), soluble phosphorous (SP), total Kjeldahl nitrogen (TKN), nitrates and nitrites, copper, lead, and zinc. Values for the EMCs of cadmium were found in *The Areawide Water Quality Management Plan* (NIPC, 1979). EMC values for different land use types are shown in Table 3-56. Values for land use in Chicago and Cook County were taken from *1990 Land Use in Northeastern Illinois Counties* (NIPC, 1990), which describes land use in cities and counties in Illinois. Categorizing land use into the types required considerable estimation, and may be a source of considerable error. Land space that could not be categorized was assumed to be "low-density residential" for the purposes of these calculations.

Using the data described above, nonpoint source loads were determined using a method based on models described in *An Information and Guidance Manual for State NPS Program Staff*

Figure 3-48. Six Divisions of the Grand Calumet River Watershed Used in Ketcham & Kanchakarra Estimate

Table 3-55. Estimated TSS Loading Due To Nonpoint Sources for a 2.75 Inch Storm Event in the Grand Calumet River Watershed

Region	Loading (lbs)
Marquette Park Lagoons	120,000
GC River - within Gary	979,000
Indiana Harbor Ship Canal and Lake George Canal	539,000
Grand Calumet River between E. Chicago and Hammond	292,000
Lake George and Wolf Lake	178,000
Grand Calumet River - Within Hammond	298,000
Total Load	2,406,000

Source Ketcham and Kunchakarra, 1992

Table 3-56. EMCs Used in Nonpoint Source Loadings Calculation for Lake County, IN

	Open Space	Commercial	Industrial	Residential	Highway
TSS (mg/L)	33.00	275.00	140.00	242.00	257.00
BOD (mg/L)	2.00	4.00	8.00	8.00	24.00
COD (mg/L)	25.00	76.00	64.00	106.00	153.00
Soluble Phos. (ug/L)	33.00	1073.00	93.00	98.00	0.00
Total Phos. (ug/L)	91.00	241.00	491.00	510.00	790.00
TKN (ug/L)	889.00	757.00	1494.00	2665.00	3030.00
NO_2 and NO_3 (ug/L)	1108.00	757.00	714.00	732.00	710.00
Lead (ug/L)	38.00	241.00	116.00	148.00	700.00
Copper (ug/L)	37.00	42.00	31.00	55.00	150.00
Zinc (ug/L)	105.00	194.00	234.00	111.00	614.00
Cadmium (ug/L)	4.50	1.10	7.30	0.90	2.20

Sources: Ketcham and Kunchakarra, 1992

NIPC, 1979

Engineers and Managers (U.S. EPA, 1989c). The basic calculation was to multiply the average yearly rainfall with the EMCs and with the runoff coefficients (Table 3-57). This method of calculation does not account for a number of parameters. The calculation does not take into account runoff due to snowmelt or increased runoff due to freezing of soil. It also does not account for the duration or intensity of storm events. These assumptions are not trivial, and they significantly lower the confidence level in the calculations.

3.2.4.3 *Estimates of Loadings from Nonpoint Sources*

Table 3-58 shows the results of the calculation described above. The estimates suggest that large quantities of metals such as lead (567,271 pounds/year) and zinc (520,871 pounds/year) are being washed off by runoff in Cook County, IL, and Lake County, IN. Large quantities of TSS (671,694,922 pounds/year) and BOD (24,158,656 pounds/year) loadings were the result of runoff.

Nonpoint Source Loadings

- Estimates of Chemical Loadings from Stormwater Runoff
- Nonpoint Source Loadings of Lead (567,271 pounds/yr), Zinc (520,871 pounds/yr), and Suspended Solids (671-million pounds/yr)

Loads due to stormwater runoff are not contant throughout time. Table 3-59 shows estimated loads for a 1-day rainfall of 2.5 inches--the mean maximum annual 24-hour storm event (i.e., the nonpoint source loading in 1-day during which, for any given year, the maximum rainfall is expected). Assuming nonpoint source loading is directly proportional to rainfall, regardless of duration or intensity, about 7 percent of the annual nonpoint source loadings are expected to occur in 1-day.

The loading rates per area are relatively constant in Cook and Lake Counties, Chicago, and the Grand Calumet River watershed. The lower loading rates per area in Lake County may be attributed to proportionally less land used for industry and highway. Figures 3-49 and 3-50 show comparisons between the contributions of nonpoint and point sources for conventional and metal loadings, respectively. Point source data come from the PCS, described in Section 3.2.3. According to the estimates, nonpoint copper loadings are about 5 times the point source load, while nonpoint

Table 3-57. Values for CN, Rv, and Area for Each Land Use Type in the Grand Calumet River Watershed

Land Use Type	Weighted CN	Calculated Rv Values	Area (sq. mi)
open space	65.80	0.15	4.48
commercial	93.50	0.75	3.73
light industrial	93.60	0.75	7.05
heavy industrial	90.50	0.65	27.88
low density residential	81.40	0.42	12.86
high density residential	89.20	0.62	2.05
highway	98.00	0.92	1.35
		Total Area:	59.40

Source. Ketcham and Kunchakarra, 1992.

Table 3-58. Estimated Loads, in Pounds per Year, of Nonpoint Sources to Cook County, Lake County, the City of Chicago, and the Grand Calumet Watershed (Upper Lake County)

	Cook County	Chicago	Lake County	GC Watershed	Total Load to Cook and Lake Counties
TSS	438,653,174	123,898,132	213,041,748	27,941,911	651,694,922
BOD	16,691,449	5,318,733	7,467,207	1,318,730	24,158,656
COD	183,925,136	53,219,287	93,638,995	12,220,311	277,564,130
Soluble P	586,476	163,384	102,859	27,264	689,334
Total P	886,197	261,020	468,213	77,431	1,354,411
TKN	3,953,995	1,160,984	2,331,201	275,768	6,285,196
NO_2 and NO_3	1,513,313	406,000	710,771	118,195	2,224,083
Lead	428,949	142,054	138,322	24,543	567,271
Copper	115,078	35,321	49,640	6,616	164,718
Zinc	397,627	131,446	123,243	35,429	520,871
Cadmium	4,409	1,276	1,713	883	6,123

Sources: Ketcham and Kunchakarra, 1992;
NIPC, 1979,
EPA, 1989c, and
NIPC, 1990

Table 3-59. Loading Rates per Area, in lbs/yr/mi^2, for Cook and Lake Counties, Chicago, and the Grand Calumet River Watershed

	Cook County	Chicago	Lake County	GCR Watershed
TSS	467049.80	554230 07	428820.83	470426.30
BOD	17771.99	23792 14	15030.36	22201.96
COD	195831.70	238064 36	188481.14	205739.53
Soluble Phos.	624.44	730 86	207.04	459.02
Total Phos.	943.57	1167 61	942.44	1303.62
TKN	4209.96	5193 40	4692.36	4642.79
NO_2 and NO_3	1611.28	1816 15	1430.67	1989.92
Lead	456.72	635 44	278.42	413.20
Copper	122.53	158 00	99.92	111.38
Zinc	423.37	587 99	248.07	596.48
Cadmium	4.69	5 71	3.45	14.86

Sources: Ketcham and Kunchakarra, 1992;
NIPC, 1979;
EPA, 1989c; and
NIPC, 1990.

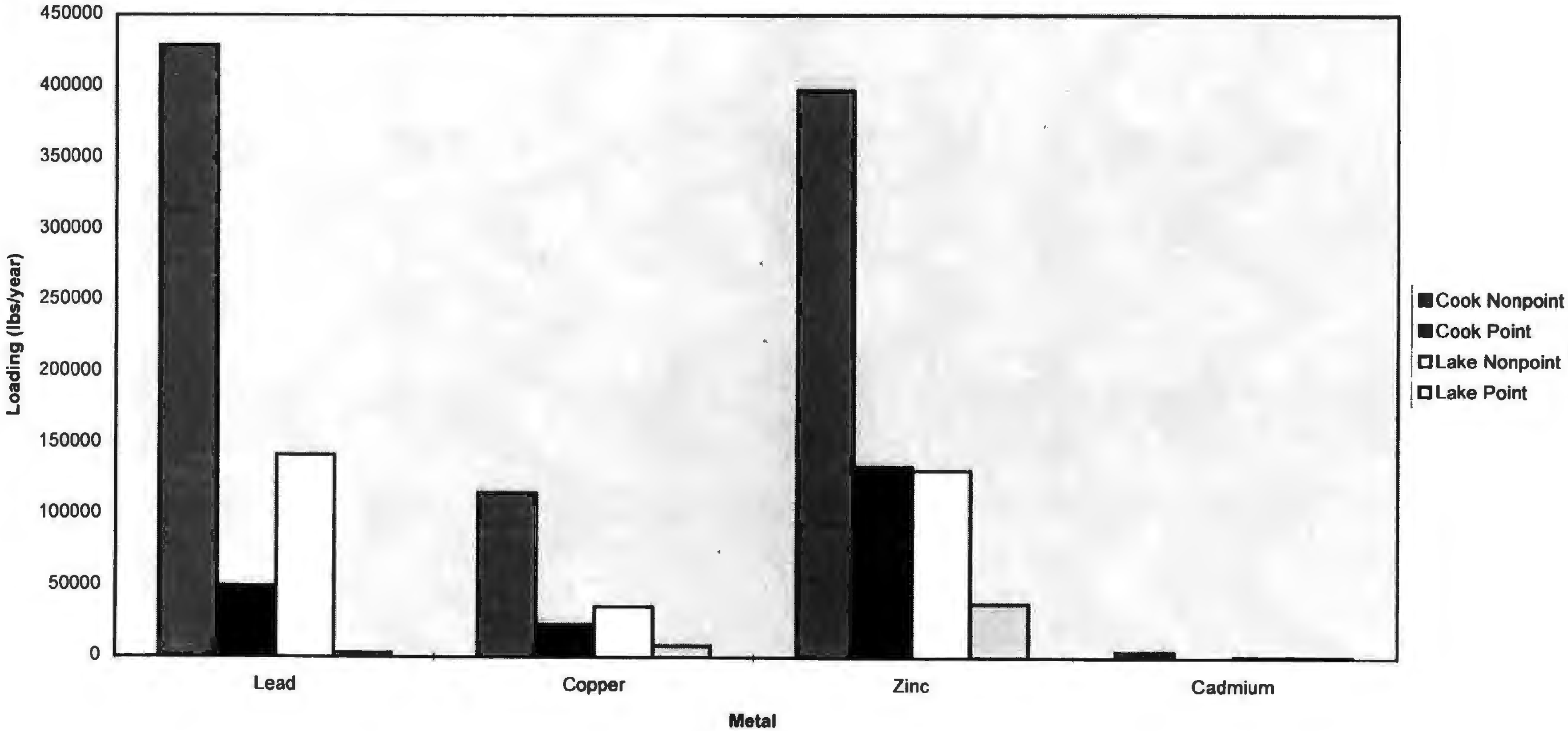


Figure 3-49. Comparison Between Metal Discharges from Point and Nonpoint Sources in Cook, IL and Lake, IN Counties

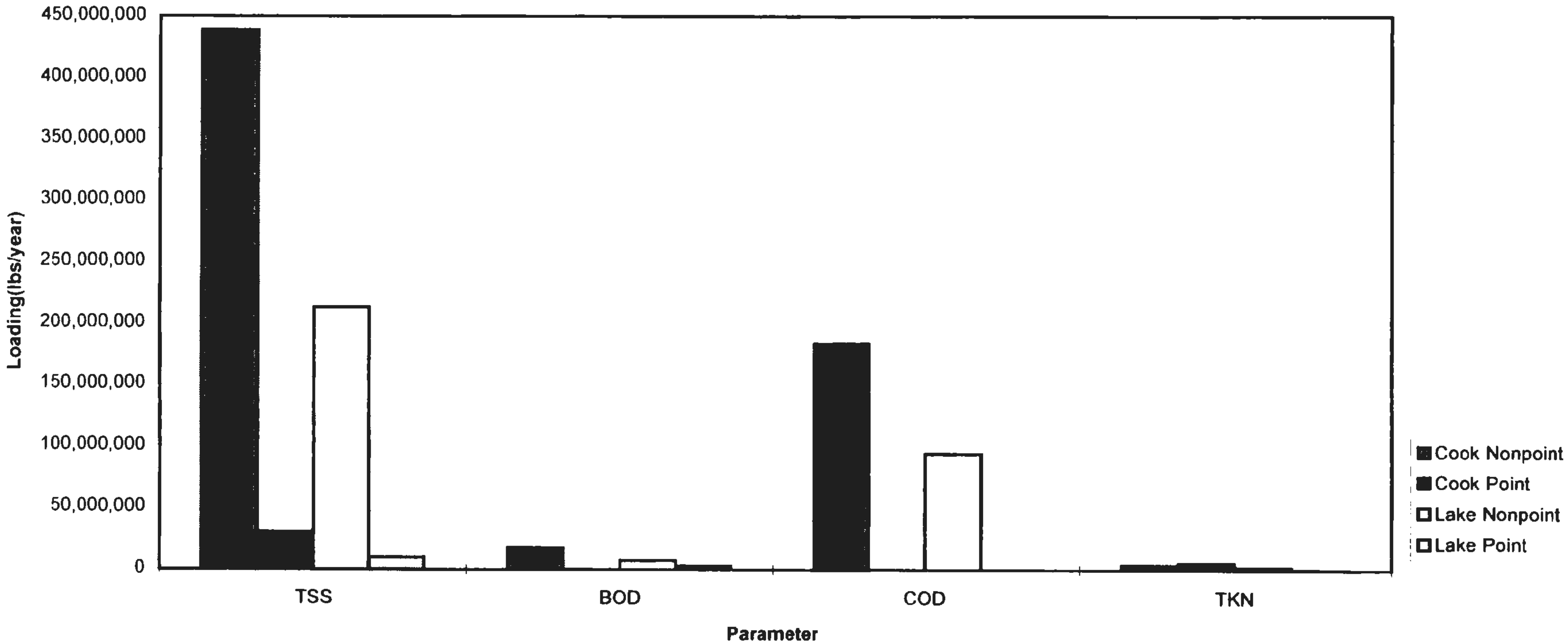


Figure 3-50. Comparison Between Conventional Pollutants from Point and Nonpoint Sources in Cook, IL and Lake, IN Counties

lead loadings are about 10 times the point source load. There is overlap between the point and nonpoint source loadings, because a large portion of stormwater finds its way into sewer systems and wastewater treatment plants. However, during large storms, a combined sewer system can overflow, causing some of the runoff to enter surface waterbodies untreated.

3.2.5 Trends in Point Source Discharges to Surface Waters

In general, the total mass of point source discharges to surface waters stayed relatively consistent from 1990 to 1995, with a significant increase in 1994. Figure 3-51 displays the trends in total mass discharged for 1990 through 1995. The increase in 1994 can also be observed in the mass of total suspended solids, the majority of which are from the large POTWs in Lake County, IN. Trends in discharges from major POTWs were reported by U.S. EPA (1991a) from studies conducted in 1985. Table 3-60 summarizes the changes in loadings of BOD, TSS, and total flow from these sewage treatment plants from 1968 to 1982 (U.S. EPA, 1991a).

3.3 TOXIC CHEMICAL RELEASES

TRI Releases

- Releases of TRI Chemicals to Air, Water, and Other Media
- Characterization of Facilities with Largest TRI Releases in 1995
- Geographic Areas (ZIP Codes) with Largest TRI Loadings to Air and Other Media
- Trends in TRI Releases

Reporting of releases of toxic chemicals through the Toxic Release Inventory (TRI) is required under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). TRI's purpose is to provide information to the public about toxic chemicals in their communities. Reporting of environmental releases, off-site transfer, treatment, etc. is required if facilities meet certain requirements such as: (1) are primarily engaged in manufacturing activities; (2) have 10 or more full-time employees; and (3) manufacture or process greater than 25,000 pounds or otherwise use greater that 10,000 pounds of a toxic chemical. The list of toxic chemicals ("The TRI List") that are subject to reporting contains approximately 600 specific chemicals and

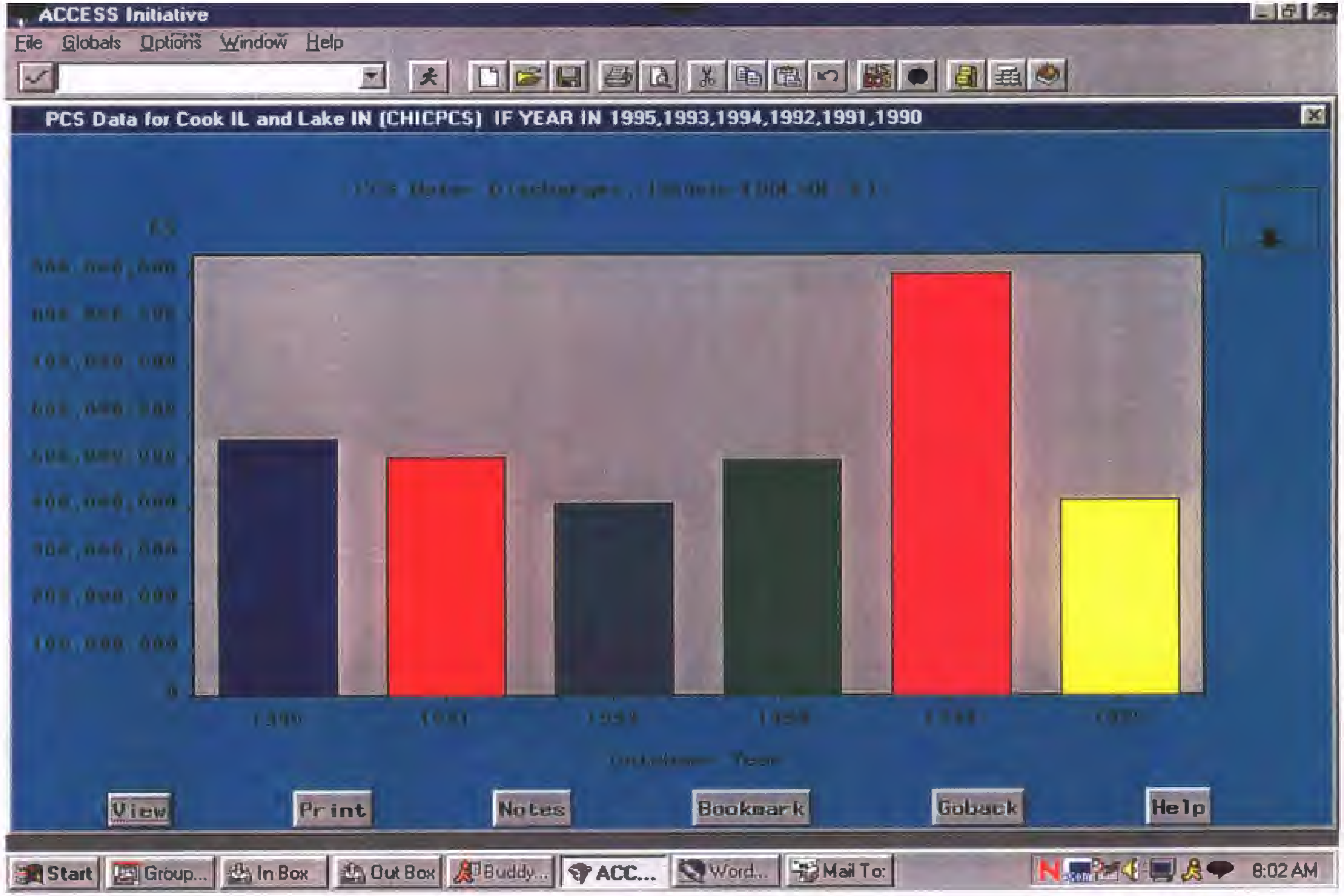


Figure 3-51. Trends in total Wastewater Dicharges in Cook County, IL, and Lake County, IN (1990-95)

Source: PCS, 1997.

Table 3-60. Trends in POTW Discharges in Lake County, IN from 1968 to 1982

Facility	Parameter/Unit	Annual Loadings	
		1968	1982
East Chicago	Flow (mg/day) BOD_5 (lb/day) TSS (lb/day)	11.3 13,700 10,400	16.7 10,400 15,000
Hammond	Flow (mg/day) BOD_5 (lb/day) TSS (lb/day)	33.4 10,800 9,360	37.9 540 600
Gary	Flow (mg/day) BOD_5 (lb/day) TSS (lb/day)	48.5 4,590 8,480	41.4 3,107 2,070

Source: U.S. EPA, 1991a.

chemical categories. Such information is submitted to EPA on EPA Form R, and is entered into the Toxic Chemical Release Inventory System (TRIS) data base. TRIS contains information about the releases to land, air, and water and off-site transfers of toxic chemicals from the applicable facilities. While data are available for each year, analyses have focused on 1995 TRI releases, the most recent year for which data are available.

Facilities With TRI Releases

- 573 Facilities in Study Area
  - 529 in Cook County, IL
  - 44 in Lake County, IN
- Total Loadings of TRI Chemicals in 1995 Were Almost Equal Between the Two Counties
- Total On-site Releases - More Than 32-Million Pounds in 1995
- Air Emissions Were Majority of the Total - 26-Million Pounds

In the study area, 573 facilities reported releases of toxic chemicals under the TRI program for 1995 (TRI, 1997). Of these facilities, 529 were located in Cook County, IL, while 44 facilities were in Lake County, IN. On-site releases of toxic chemicals from all of these facilities totaled 32,463,363 pounds during 1995. In general, on-site releases were quantified because they are indicators of TRI chemicals released to the local environment to which people may be exposed. The total on-site releases for each county were relatively similar: 16,950,641 pounds for Cook County, IL, and 15,512,722 for Lake County, IN. Table 3-61 presents information from each county on the different types of releases that comprise total on-site releases. Emissions to air (both stack as well as fugitive) dominated the total releases; 26,807,058 pounds (or 83 percent of the total) released were to the air. Land disposal accounted for 5,408,150 pounds (17 percent of the total), while water discharges and underground injections provided less than 1 percent of the total on-site releases in 1995 (TRI, 1997).

For Cook County, IL, the cities with the largest on-site releases were Bedford Park (14 facilities, releasing 5,105,981 pounds) and Chicago (209 facilities, releasing 4,701,253 pounds). These two cities contributed about 58 percent of the total on-site releases of TRI chemicals in 1995 in Cook County, IL. Table 3-62 presents the cities in Cook County, IL, with the largest total on-site TRI releases (comprising 80 percent of the total on-site releases in the county) in 1995. Geographic analyses by ZIP Code for Cook County, IL, indicate that the following areas had the largest on-site

Table 3-61. On-Site Releases of TRI Chemicals in Cook and Lake Counties (Pounds/Yr.)

COUNTY	NUMBER OF FACILITIES	FUGITIVE AIR EMISSIONS	STACK AIR EMISSIONS	WATER DISCHARGES	UNDERGROUND INJECTIONS	LAND DISPOSAL	TOTAL RELEASES
COOK	529	4,292,706	12,587,706	50,090	0	20,139	16,950,641
LAKE	44	7,058,770	2,867,876	197,875	190	5,388,011	15,512,722
TOTAL	573	11,351,476	15,455,582	247,965	190	5,408,150	32,463,363

Source TRI, 1997

Table 3-62. Cities in Cook County, IL, With the Largest On-Site Releases of TRI Chemicals in 1995 (Pounds/Yr.)

CITY	NUMBER OF FACILITITES (lbs.)	FUGITIVE AIR EMISSIONS (lbs.)	STACK AIR EMISSIONS (lbs.)	WATER DISCHARGES (lbs.)	UNDERGROUND INJECTIONS (lbs.)	LAND DISPOSAL (lbs.)	TOTAL RELEASES (lbs.)
BEDFORD PARK	14	627,734	4,478,247	0	0	0	5,105,981
CHICAGO	209	1,206,043	3,467,616	15,835	0	11,759	4,701,253
BRIDGEVIEW	8	331,190	520,982	10	0	0	852,182
ELK GROVE VILLAGE	42	239,333	402,527	30	0	4,490	646,380
ALSIP	12	157,093	442,164	0	0	2,800	602,057
HARVEY	5	372,964	217,786	0	0	0	590,750
MC COOK	4	147,858	387,723	0	0	0	535,581
MELROSE PARK	13	124,040	389,859	0	0	0	513,899
CHICAGO HEIGHTS	15	80,709	275,955	88	0	25	356,777
FRANKLIN PARK	23	108,333	243,765	10	0	0	352,108
CICERO	14	116,913	186,170	30,930	0	0	334,013
BARTLETT	1	100,505	190,010	0	0	0	290,515

Source TRI, 1997

TRI releases: 60501 (3,307,272 pounds or 19 percent), 60638 (1,691,997 pounds or 10 percent), and 60633 (1,240,946 or 7 percent). Further analyses of TRI emissions for Cook County, IL, reveal that stack air emissions comprise the majority (12,587,706 of 16,950,641 pounds, or 74 percent) of the total on-site releases. Fugitive air emissions follow with about 25 percent; water discharges and land disposal were less than 1 percent, and underground injection showed no reported releases for Cook County, IL, in the 1995 TRI.

The 44 TRI facilities in Lake County, IN, collectively had on-site releases totaling 15,512,722 pounds for 1995 (Table 3-63). More than 75 percent (11,678,045 pounds) of the total releases in Lake County, IN, came from 7 facilities in Gary. The 13 facilities in East Chicago released 1,866,023 pounds (12 percent), and 4 facilities in Whiting released 1,542,160 pounds (10 percent). Analyses by ZIP Code provides similar results and are presented on Table 3-64. The ZIP Codes in Lake County, IN, with the largest releases of TRI chemicals in 1995 included 46402 (11,675,427 pounds or 75 percent), 46312, and 46394.

3.3.1 Facilities with the Largest TRI Releases to Air, Water, and Land

The 49 facilities with the largest total on-site TRI releases in Cook County, IL, are presented on Table 3-65. As noted previously, 529 facilities in Cook County had releases to air, water, and land, totaling 16,950,641 pounds for 1995. The largest facilities included: Corn Products and Best Foods (2,747,655 pounds or 16 percent), Viskase Corp. (1,551,050 pounds or 9 percent), and Ford Motor Company (1,185,589 pounds or 7 percent). The 10 facilities in Lake County, IN, with the largest releases are presented in Table 3-66. Unlike Cook County, only two facilities comprise

On-Site TRI Releases in 1995

- Fugitive Air Emissions - 11,351,476 Pounds of Ammonia, Methyl Ethyl Ketone, Trichloroethylene, and Others
- Stack Air Emissions - 15,455,582 Pounds of Hydrochloric Acid, Manganese Compounds, Carbon Disulfide, and Others
- Water Discharges - 247,965 Pounds of Napthalene, Ammonia, Anthracene, and Others
- Land Disposal - 5,408,150 Pounds of Zinc Compounds, Manganese Compounds, Lead Compounds, and Others

Table 3-63. On-Site Releases of TRI Chemicals in 1995 by City in Lake County, IN (Pounds/Yr.)

CITY	NUMBER OF FACILITIES	FUGITIVE AIR EMISSIONS	STACK AIR EMISSIONS	WATER DISCHARGES	UNDERGROUND INJECTIONS	LAND DISPOSAL	TOTAL RELEASES
GARY	7	4,997,088	2,153,956	32,147	0	4,494,854	11,678,045
EAST CHICAGO	13	715,948	190,888	79,015	190	879,982	1,866,023
WHITING .	4	1,242,404	208,128	78,453	0	13,175	1,542,160
HAMMOND	12	56,957	213,486	8,260	0	0	278,703
SCHERERVILLE	2	2,969	65,976	0	0	0	68,945
LOWELL	2	24,071	21,880	0	0	0	45,951
GRIFFITH	3	18,583	13,562	0	0	0	32,145
MUNSTER	1	750	0	0	0	0	750
	44	7,058,770	2,867,876	197,875	190	5,388,011	15,512,722

Source TRI, 1997

Table 3-64. On-Site Releases of TRI Chemicals in 1995 by Zip Code for Lake County, IN (Pounds/Yr.)

ZIP	NUMBER OF FACILITIES	FUGITIVE AIR EMISSIONS	STACK AIR EMISSIONS	WATER DISCHARGES	UNDERGROUND INJECTIONS	LAND DISPOSAL	TOTAL RELEASES
46402	3	4,995,944	2,152,482	32,147	0	4,494,854	11,675,427
46312	13	715.948	190,888	79,015	190	879,982	1,866,023
46394	4	1,242,404	208,128	78,453	0	13.175	1,542,160
46320	7	23,186	177,547	8,260	0	0	208,993
46375	2	2,969	65,976	0	0	0	68,945
46327	3	32,140	18,580	0	0	0	50,720
46356	2	24,071	21,880	0	0	0	45,951
46319	3	18,583	13,562	0	0	0	32,145
46323	2	1,631	17,359	0	0	0	18,990
46406	1	750	750	0	0	0	1,500
46404	1	394	656	0	0	0	1,050
46321	1	750	0	0	0	0	750
46401	1	0	64	0	0	0	64
46403	1	0	4	0	0	0	4
	44	7,058,770	2,867,876	197,875	190	5,388,011	15,512,722

Source TRI, 1997

Table 3-65. Largest Facilities With On-Site Releases of TRI Chemicals in Cook County, IL, in 1995 (Pounds/Yr.)

Facility Name	Fugitive Air Emissions	Stack Air Emissions	Water Discharges	Underground Injections	Land Disposals	Total Releases
CORN PRODS & BEST FOODS	415.405	2,332,250	0	0	0	2.747,655
VISKASE CORP	6,050	1,545,000	0	0	0	1,551,050
FORD MOTOR CO.	109.100	1,076,489	0	0	0	1,185,589
GENERAL FOAM CORP.	285,752	428,633	0	0	0	714,385
ALLIED TUBE & CONDUIT CORP	371.700	217,000	0	0	0	588,700
3M	15,100	538,100	0	0	0	553,200
AKZO NOBEL CHEMICALS INC	138,773	319,274	0	0	0	458,047
ZENITH ELECTRONICS CORP	83,076	344,929	0	0	0	428,005
WHEATLAND TUBE CO.	41,725	253,905	0	0	0	295,630
SENIOR FLEXONICS INC	100,505	190,010	0	0	0	290,515
CHICAGO HEIGHTS STEEL	24,848	223,628	0	0	0	248,476
AMERICAN NATL CAN CO	33,690	200,808	0	0	0	234,498
ILM CHEMICALS INC	24,450	206,855	0	0	2,800	234,105
C P. HALL CO	184,648	6,768	0	0	0	191,416
SUN PROCESS	18,923	170,300	0	0	0	189,223
TENNECO PACKAGING	844	184,947	0	0	0	185,791
VAN LEER CONTAINERS INC.	12,200	164.809	0	0	0	177,009
SHERWIN-WILLIAMS CO	30,981	124,161	0	0	0	155,142
CONTINENTAL WHITE CAP	118,541	31,733	0	0	0	150,274
CENTRAL CAN CO	3,158	146,900	0	0	0	150,058
HI TEMP INC	1,100	131,113	0	0	0	132,213
NABISCO BISCUIT CO	0	129,430	0	0	0	129,430
PRECOAT METALS	82,121	46,170	0	0	0	128,291
KOPPERS IND INC	19,469	67,433	30,930	0	0	117,832
ALLTRISTA METAL SERVICES CO.	19,045	93,574	0	0	0	112,619
HORWEEN LEATHER CO	75,250	37,000	0	0	0	112,250
ARLINGTON PLATING CO	0	106,900	0	0	0	106,900
U S CAN CO	55,638	50,075	0	0	0	105,713
BROCKWAY STANDARD INC	70,381	33,439	0	0	0	103,820
LAKEWOOD ENG & MFG CO	10,200	92,000	0	0	0	102,200
WERNER CO	250	93,000	0	0	0	93,250
ACME STEEL CO	54,110	34,208	1,485	0	660	90,463
NATIONAL CASTINGS INC	74,228	14,927	0	0	0	89,155
RELIABLE POWER PRODS INC	17.487	69.946	0	0	0	87,433
FPM HEAT TREATING INC	22,745	64,550	5	0	0	87,300
MSC LAMINATES & COMPOSITES	48,000	35,426	0	0	0	83,426
SIGNODE	8,150	74,500	5	0	0	82,655
DURACO INC	0	82,560	0	0	0	82,560
CLARK REFINING & MARKETING INC	24,001	53,770	0	0	0	77.771
NOW PRODS INC	0	76,064	0	0	0	76,064
MORTON INTL INC.	61.042	10,037	0	0	0	71,079
CLEAR LAM PACKAGING	41.533	27.479	0	0	0	69,012
H KRAMER & CO	41,972	23.805	0	0	0	65,777
JOHN CRANE INC	65.721	0	0	0	0	65,721
ENAMELERS & JAPANNERS INC	26.250	37.300	0	0	0	63,550
COLOR COMMUNICATIONS INC	50.900	8.550	0	0	0	59.450
ANDERSON COPPER & BRASS CO	41.032	14,297	0	0	0	55,329
ACME FINISHING CO INC	7.600	46.700	0	0	0	54.300
WISCONSIN TOOL & STAMPING CO	0	52.000	0	0	0	52.000

Source TRI. 1997

Table 3-66. Largest Facilities in Lake County, IN, With On-Site Releases of TRI Chemicals (Pounds/Yr.)

Facility Name	Air Emissions	Stack Air Emissions	Water Discharges	Underground Injections	Land Disposals	Total Releases
U.S STEEL	4,995,941	2,152,320	32,147	0	4,494,854	11,675,262
AMOCO OIL CO.	1,239,722	205,534	78,453	0	13,175	1,536,884
LTV STEEL CO. INC.	5,855	115,705	3,000	0	817,100	941,660
AMERICAN STEEL FOUNDRIES	625,110	81	0	0	0	625,191
INLAND STEEL CO.	49,126	71,185	76,015	190	58,125	254,641
SILGAN CONTAINERS CORP.	0	141,310	0	0	0	141,310
AVERY DENNISON DFD	2,964	65,976	0	0	0	68,940
FERRO CORP.	32,140	18,580	0	0	0	50,720
CERESTAR USA INC	21,255	3,355	8,260	0	0	32,870
UNION TANK CAR CO.	28,106	3,418	0	0	0	31,524

Source TRI, 1997

more than 80 percent of the total TRI on-site releases in Lake County, IN. U.S. Steel was the dominant facility, releasing 11,675,262 pounds (or 75 percent) of the total for the county. Other large facilities in Lake County include Amoco Oil Company, LTV Steel, American Steel Foundries, and Inland Steel.

Descriptions below detail the TRI chemicals emitted/released to air, water, and land, as well as the geographic locations of these facilities.

3.3.1.1 *Fugitive Air Emissions of TRI Chemicals*

Fugitive air emissions of TRI chemicals in 1995 totaled 11,351,476 pounds in the study area. Cook County, IL, accounted for 4,292,706 pounds (38 percent) and Lake County, IN, contributed 7,058,770 pounds (62 percent). Characterization of the sources, chemicals, and locations (by ZIP Code) of the facilities with the largest fugitive emissions of TRI chemicals are noted below.

In 1995, 119 TRI chemicals were reported in fugitive air emissions in Cook County, IL. TRI chemicals emitted the largest quantities in Cook County, IL, in 1995 included: methyl ethyl ketone (643,399 pounds or 15 percent of the total), trichloroethylene (600,750 pounds or 14 percent), and n-hexane (450,606 or 10 percent). Table 3-67 presents the 10 chemicals comprising 80 percent of the total fugitive air emissions in Cook County, IL, for 1995. Figure 3-52 presents the geographic locations (by ZIP Code) of the fugitive air emissions in Cook County, IL, for 1995.

In Lake County, IN, 4,000,883 pounds of ammonia were emitted in 1995, which accounted for 57 percent of the total for the county. Other TRI chemicals released through fugitive emissions included: methanol (627,256 pounds or 9 percent), phenol (575,230 pounds or 8 percent), methyl ethyl ketone (568,376 pounds or 8 percent), and toluene (433,072 pounds or 6 percent). One ZIP Code, 46402 in Gary, accounted for almost 71 percent of the total fugitive emissions of TRI chemicals in Lake County, IN (Figure 3-53).

Table 3-67. Most Prevalent TRI Chemicals Found in Fugitive Air Emissions from Cook County, IL (1995)

Chemical	Emissions (lbs)
Methyl Ethyl Ketone	643,399
Trichloroethylene	600,750
N-Hexane	450,606
Dichloromethane	385,155
Certain Glycol Ethers	369,430
Toluene	291,331
Methanol	255,141
Xylene (Mixed Isomers)	198,122
Ammonia	175,462
Methyl Isobutyl Ketone	92,732
Number of Chemicals Comprising 80% of Emissions:	10
Subtotal:	3,462,128
Total Mass Emitted (Total of 119 Compounds):	4,292,706

Source: TRI, 1997.

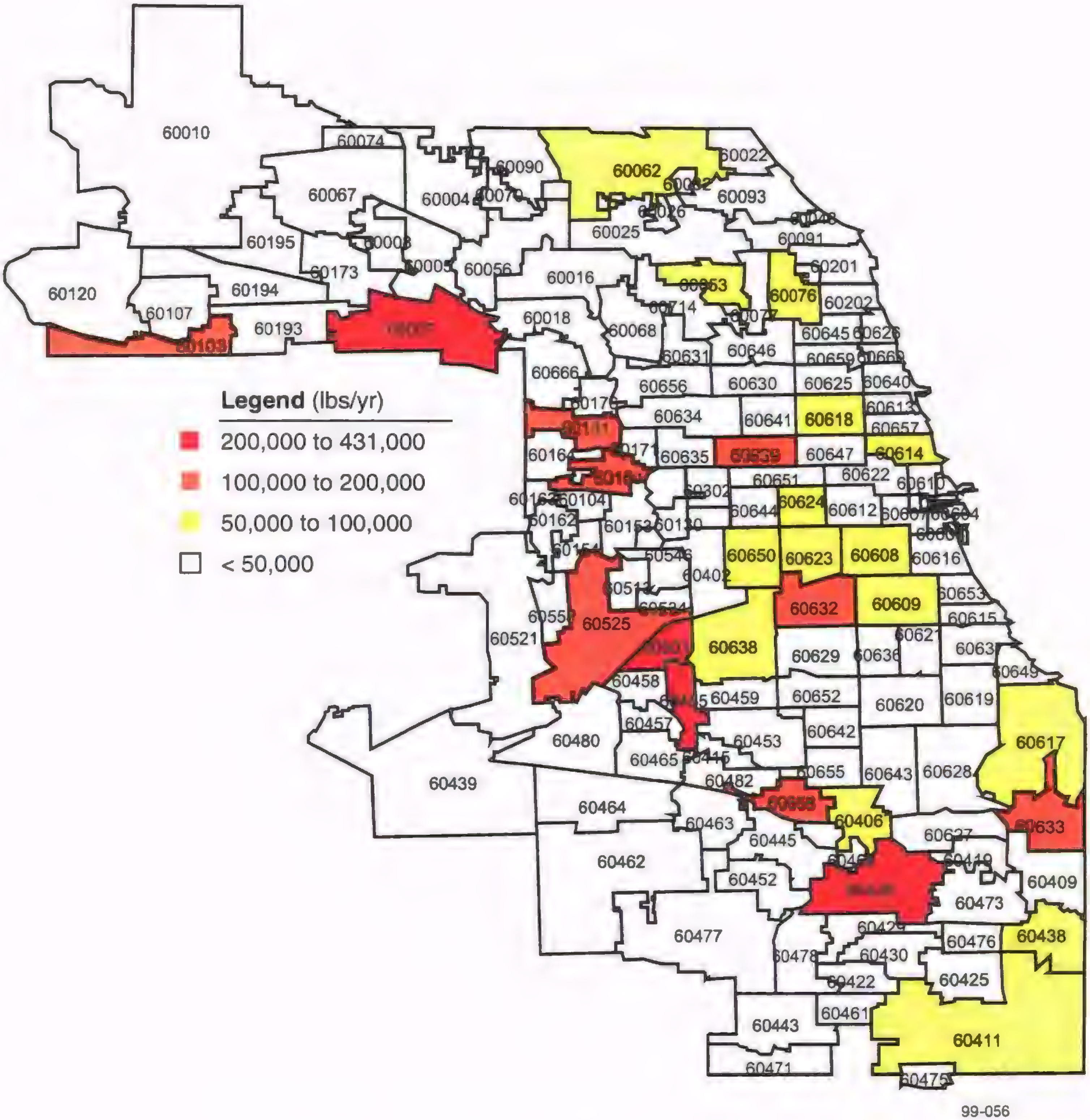


Figure 3-52. Fugitive Air Emissions of Toxic Chemicals by Zip Code in Cook County, IL, in 1995

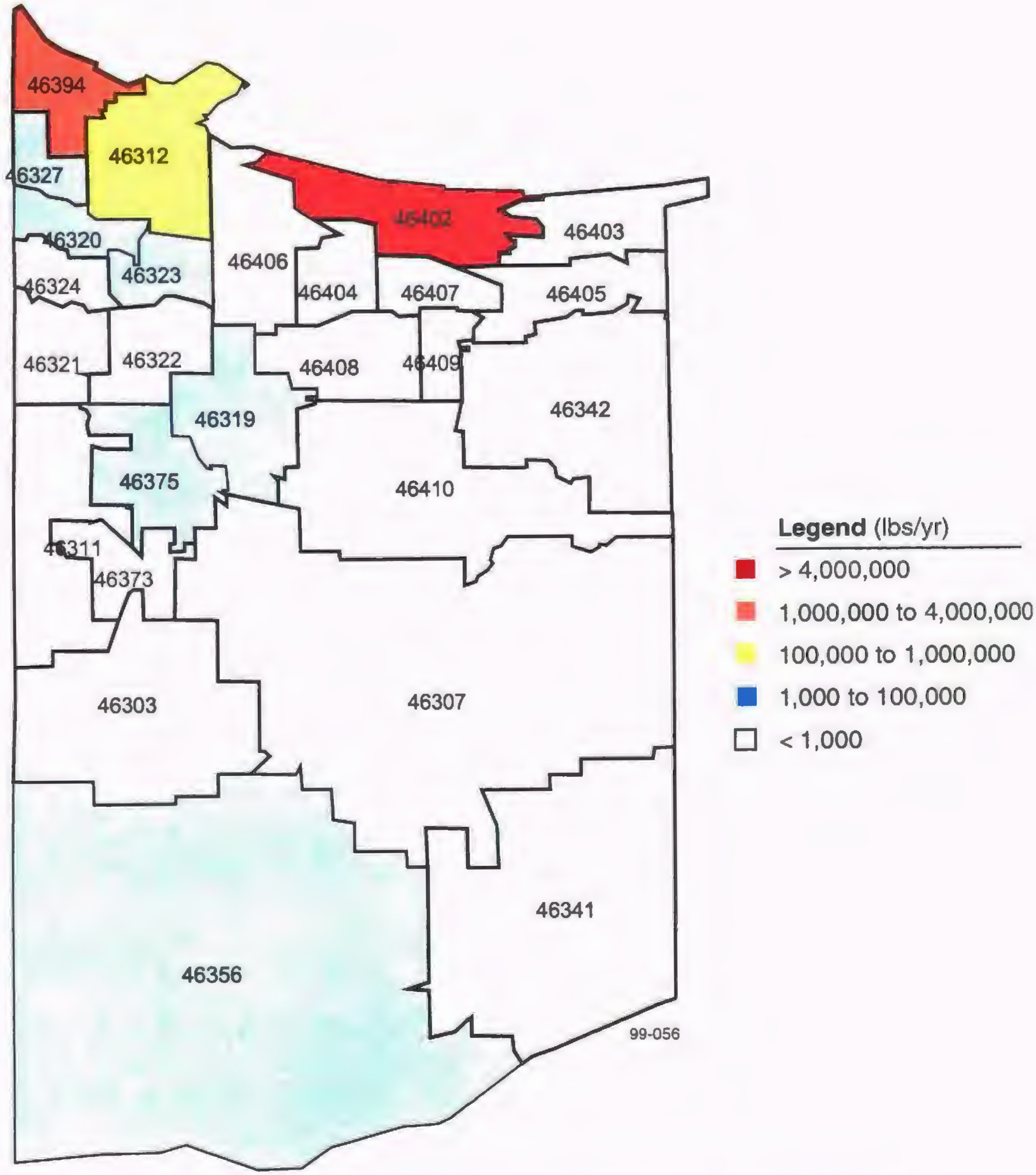


Figure 3-53. Fugitive Air Emissions of Toxic Chemicals by Zip Code in Lake County, IN, in 1995

3.3.1.2 *Stack Air Emissions of TRI Chemicals*

Stack air emissions of TRI chemicals in 1995 totaled 15,455,582 pounds in the two-county area. Most of the stack air emissions (12,587,706 of 15,455,582 pounds) came from Cook County, IN. The chemicals released, as well as the facilities and their locations, are described below for each county.

In Cook County, IL, 123 TRI chemicals were emitted in 1995 through stacks for a total of 12,587,706 pounds. Major chemicals emitted included hydrochloric acid, carbon disulfide, trichloroethylene, and toluene. Table 3-68 presents a list of the 10 chemicals emitted that comprised 80 percent of the total mass. Facilities located in 81 ZIP Codes in Cook County had stack emissions of TRI chemicals in 1995; Figure 3-54 displays the ZIP Codes with the largest stack emissions of TRI chemicals in 1995.

In Lake County, IN, 60 TRI chemicals were emitted through stacks in 1995. Of the 2,867,876 pounds emitted, manganese compounds accounted for almost one-half (1,321,822 pounds or 46 percent). Other chemicals emitted included zinc compounds (280,372 pounds), hydrochloric acid (255,918 pounds), copper compounds (250,238 pounds), lead compounds (113,659 pounds), toluene (104,755 pounds), methyl ethyl ketone (100,623 pounds), and xylenes (91,506 pounds). Collectively, these 7 chemicals comprised more than 80 percent of the total stack emissions for 1995 in Lake County, IN. One ZIP Code (46402) provided more than 75 percent of the total, and four ZIP Codes collectively contributed more than 95 percent of the total stack air emissions of TRI chemicals in Lake County, IN (Figure 3-55).

3.3.1.3 *Water Discharges of TRI Chemicals*

Water discharges of TRI chemicals amounted to 247,965 pounds in the study area in 1995 (TRI, 1997). Lake County, IN, accounted for 80 percent of the total with 197,875 pounds discharged. In Cook County, IL, 30 TRI chemicals totaling 50,090 pounds were discharged. Three chemicals accounted for 80 percent of the total mass in Cook County, IL: naphthalene (23,090 pounds or 46 percent), ammonia (13,838 pounds or 27 percent), and anthracene (4,389 pounds or 9 percent). Facilities in 3 ZIP Codes in Cook County account for 99 percent of the total: 60804 with

Table 3-68. Most Prevalent TRI Chemicals Found in Stack Air Emissions from Cook County, IL (1995)

Chemical Name	Emissions (lbs)
Hydrochloric Acid	2,216,949
Carbon Disulfide	1,530,000
Trichloroethylene	1,209,679
Toluene	997,700
Certain Glycol Ethers	978,497
Xylene (Mixed Isomers)	840,226
Dichloromethane	746,708
Methyl Ethyl Ketone	629,440
Methyl Isobutyl Ketone	554,296
N-Butyl Alcohol	354,891
Number of Chemicals Comprising 80% of Emissions:	10
Subtotal:	10,058,386
Total Mass Emitted (Total of 123 Compounds):	12,587,706

Source: TRI, 1997.

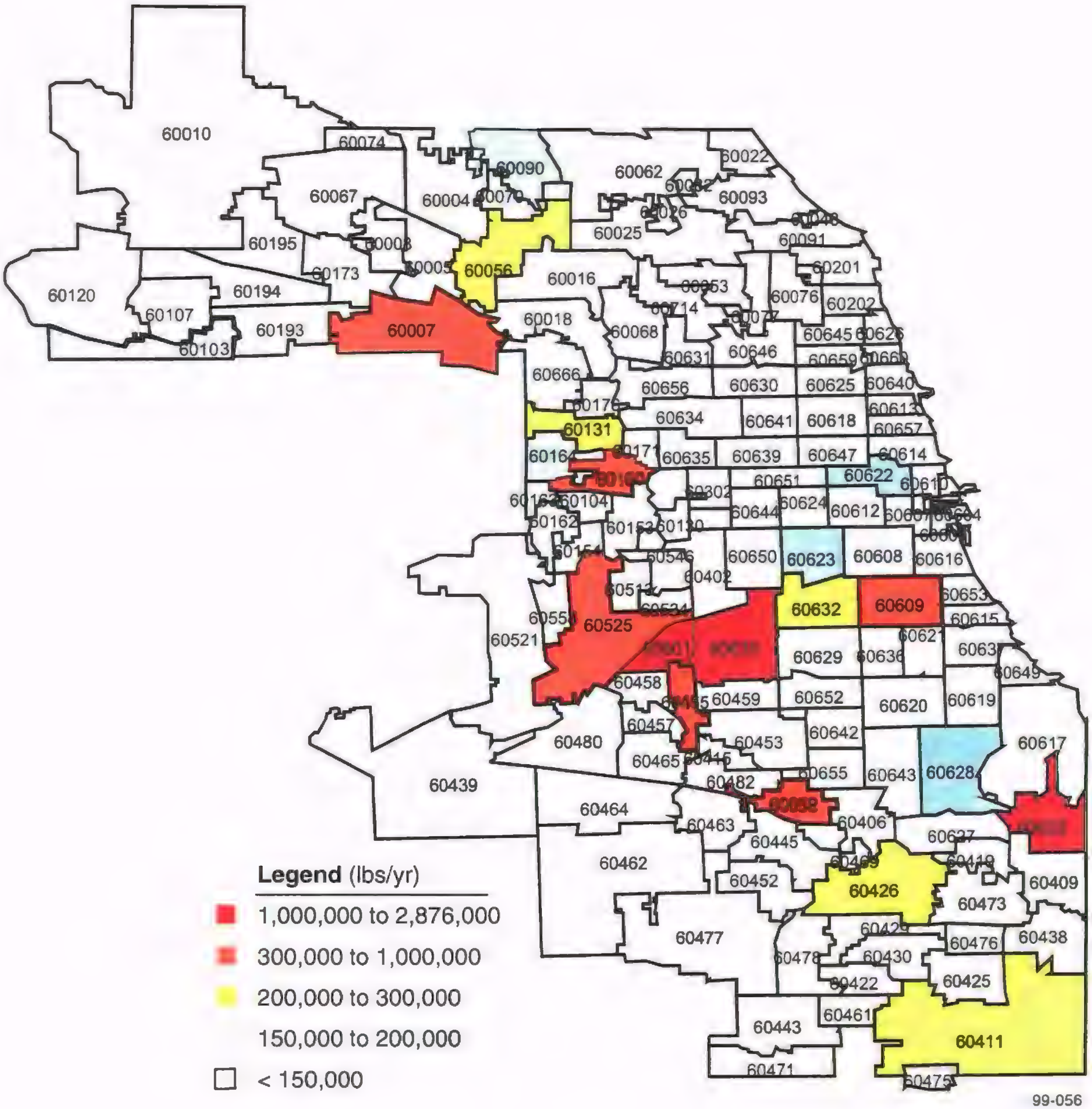


Figure 3-54. Stack Air Emissions of Toxic Chemicals by Zip Code in Cook County, IL, in 1995

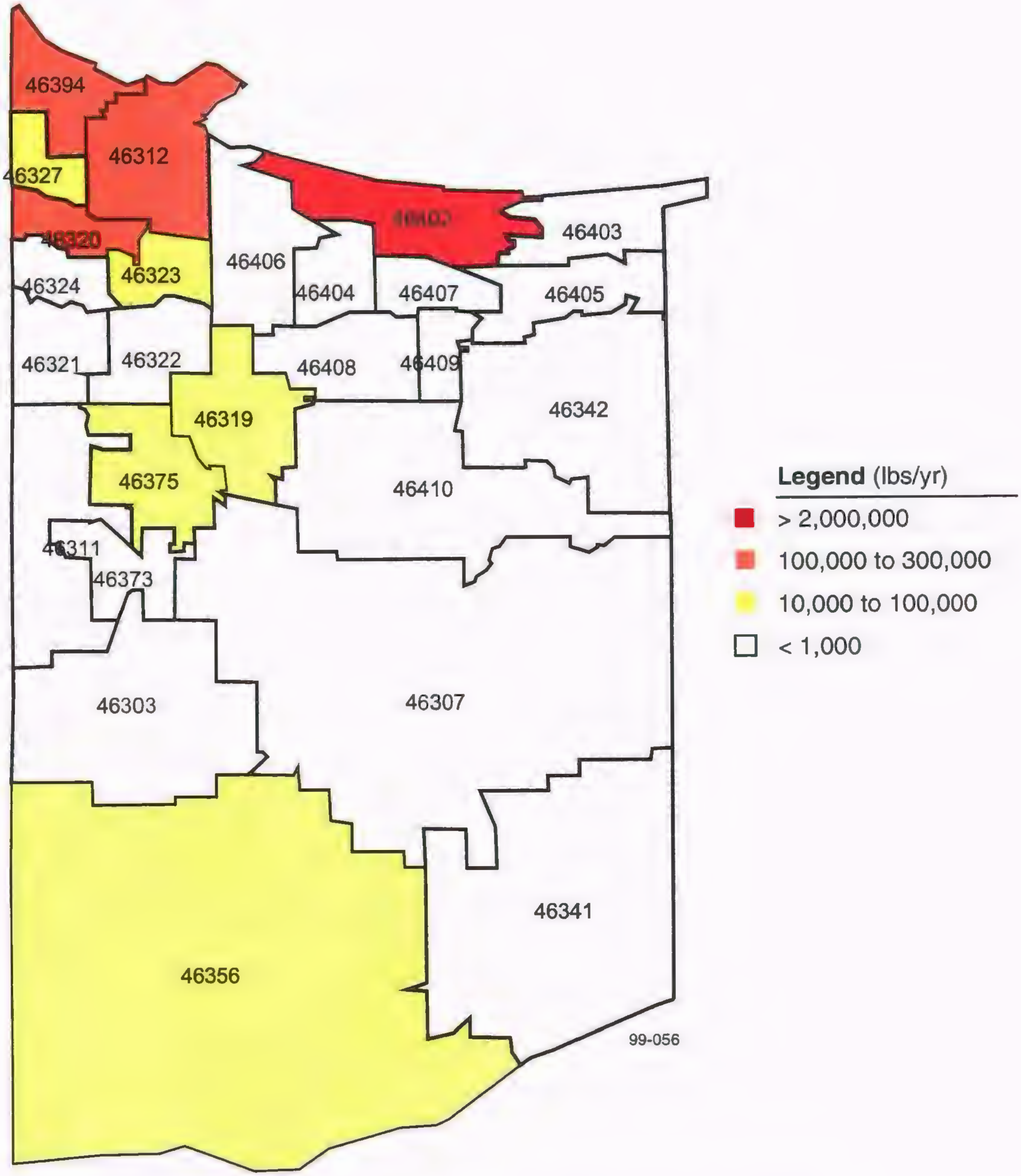


Figure 3-55. Stack Air Emissions of Toxic Chemicals by Zip Code in Lake County, IN, in 1995

30,930 pounds (or 62 percent), 60617 with 15,835 pounds (or 32 percent), and 60627 with 2,845 pounds (or 5 percent). In Lake County, IN, 16 chemicals comprised the 197,875 pounds of TRI discharges reported for 1995 (Table 3-69). Nitrate compounds (68,000 pounds), ammonia (63,699 pounds), ethylene glycol (20,190), and zinc compounds (12,087 pounds) comprised 83 percent of the total mass discharged in Lake County, IN. Four ZIP Codes accounted for all of the 1995 water discharges of TRI chemicals: 46312 (79,015 pounds), 46394 (78,453 pounds), 46402 (32,147 pounds), and 46320 (8,260 pounds).

3.3.1.4 *Land Disposal of TRI Chemicals*

More than 5.4-million pounds of TRI chemicals were land disposed in the study area in 1995 (TRI, 1997). More than 99 percent of the chemicals were land disposed in Lake County, IN. Characterization of the chemicals, facilities, and their geographic locations are summarized below.

Land disposal of TRI chemicals in Cook County, IL, in 1995 totaled 20,139 pounds and was comprised of 13 chemicals (Table 3-70), including methyl ethyl ketone, ethylene glycol, benzene, and xylene. ZIP Codes in Cook County with the largest quantities of TRI chemicals land disposed included: 60623 (10,094 pounds or 50 percent of the total), 60007 (4,490 pounds or 22 percent), and 60658 (2,800 pounds or 14 percent) as shown on Figure 3-56.

Land disposal of TRI chemicals in 1995 in Lake County, IN, totaled 5,388,011 pounds. The TRI chemicals land disposed in the largest quantities included: zinc compounds (3,100,000 pounds or 58 percent), manganese compounds (1,900,000 pounds or 35 percent), lead compounds (160,000 pounds or 3 percent), and other metals, volatiles, and PAHs. Three ZIP Codes accounted for all of the land disposal of TRI chemicals in 1995 in Lake County, IN: 46402 (4,494,854 pounds), 46312 (879,982 pounds), and 46394 (13,175 pounds).

3.3.1.5 *Other Releases and Transfers of TRI Chemicals*

Underground injection of toxic chemicals was limited to one facility in Lake County, which disposed of 190 pounds of chlorine in 1995. Other transfers of toxic chemicals occured in significant quantities in both Cook County, IL, and Lake County, IN. More than 51-million (Cook) and

Table 3-69. Most Prevalent TRI Chemicals Found in Water Discharges from Lake County, IN (1995)

Chemical Name	Water Discharges (lbs)
Nitrate Compounds	68,000
Ammonia	63,699
Ethylene Glycol	20,190
Zinc Compounds	12,087
Phenol	9,065
Methyl Tert-Butyl Ether	8,000
Number Of Chemicals Comprising 90% Of Discharges:	6
Subtotal:	181,041
Total Mass Discharged (Total of 16 Compounds):	197,875

Source: TRI, 1997

Table 3-70. Land Disposal of TRI Chemicals in Cook County, IL (1995)

Chemical Name	Land Disposals (lbs)
Methyl Ethyl Ketone	8,748
Ethylene Glycol	4,490
Benzene	3,080
Xylene (Mixed Isomers)	1,596
Phosphoric Acid	750
Number Of Chemicals Comprising 90% Of Disposals:	5
Subtotal:	18,664
Total Mass Disposed (Total of 13 Compounds):	20,139

Source: TRI, 1997.

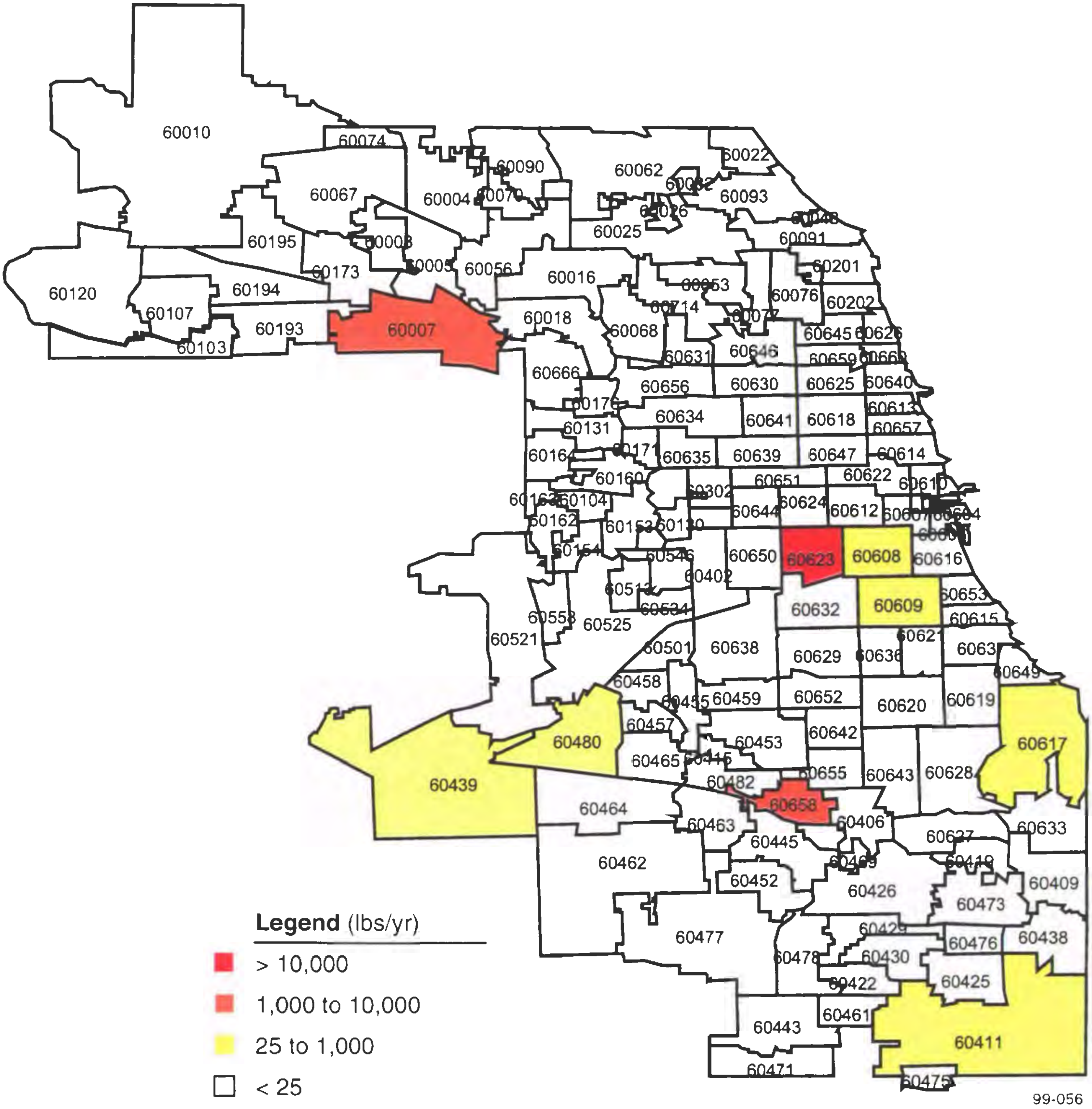


Figure 3-56. Land Disposal of Toxic Chemicals by Zip Code in Cook County, IL, in 1995

29-million (Lake) pounds of TRI chemicals were transferred off-site in 1995. Figure 3-57 displays the geographic locations of the ZIP Codes in Lake County, IN, with the largest amounts of other transfers of TRI chemicals in 1995.

3.3.2 TRI Releases by Industry Type

Releases of toxic chemicals that are reported under TRI come from a variety of industries. It should be noted that some types of businesses such as utilities (e.g., power plants and sewage treatment plants) are not required to report toxic chemical releases under TRI. While utilities were significant sources of air emissions and discharges to water (discussed in Sections 3.1 and 3.2), they did not contribute to releases reported in the TRI program. In the future, some of these other types of industries will be included in TRI reporting.

Industrial Sectors With Largest TRI Releases

- Primary Metals (Steel Mills) Had Largest TRI Loadings (About 50 Percent of Total)
- Metal Fabricators, Food Producers, Chemical Producers, and Plastics Manufactures Had Significant TRI Loadings
- Lake County Loadings Dominated by Primary Metals (87 Percent) and Petroleum (10 Percent) Industries

In Cook County, IL, toxic chemical release by type of industry (SIC Code) is presented in Table 3-71. Of the 16,950,641 total pounds released on-site in Cook County, IL, the major industries included metal fabricators (3,025,997 pounds or 18 percent), food (2,925,542 pounds or 17 percent), plastics (2,496,136 pounds or 15 percent), primary metals (2,276,723 pounds or 13 percent), chemicals (2,215,773 pounds or 13 percent), and transportation (1,372,449 pounds or 8 percent). When examining the mode of release, the major industries with stack air emissions of TRI chemicals were food (2,493,237 pounds) and plastics (2,139,017 pounds). The industry with the largest fugitive air emissions of TRI chemicals in Cook County, IL, was the metal fabrication industry (1,029,426 pounds).

For Lake County, IN, the predominant industry with TRI releases was the primary metals industry (Table 3-72). In fact, more than 87 percent (13,504,641 pounds) of the total releases were

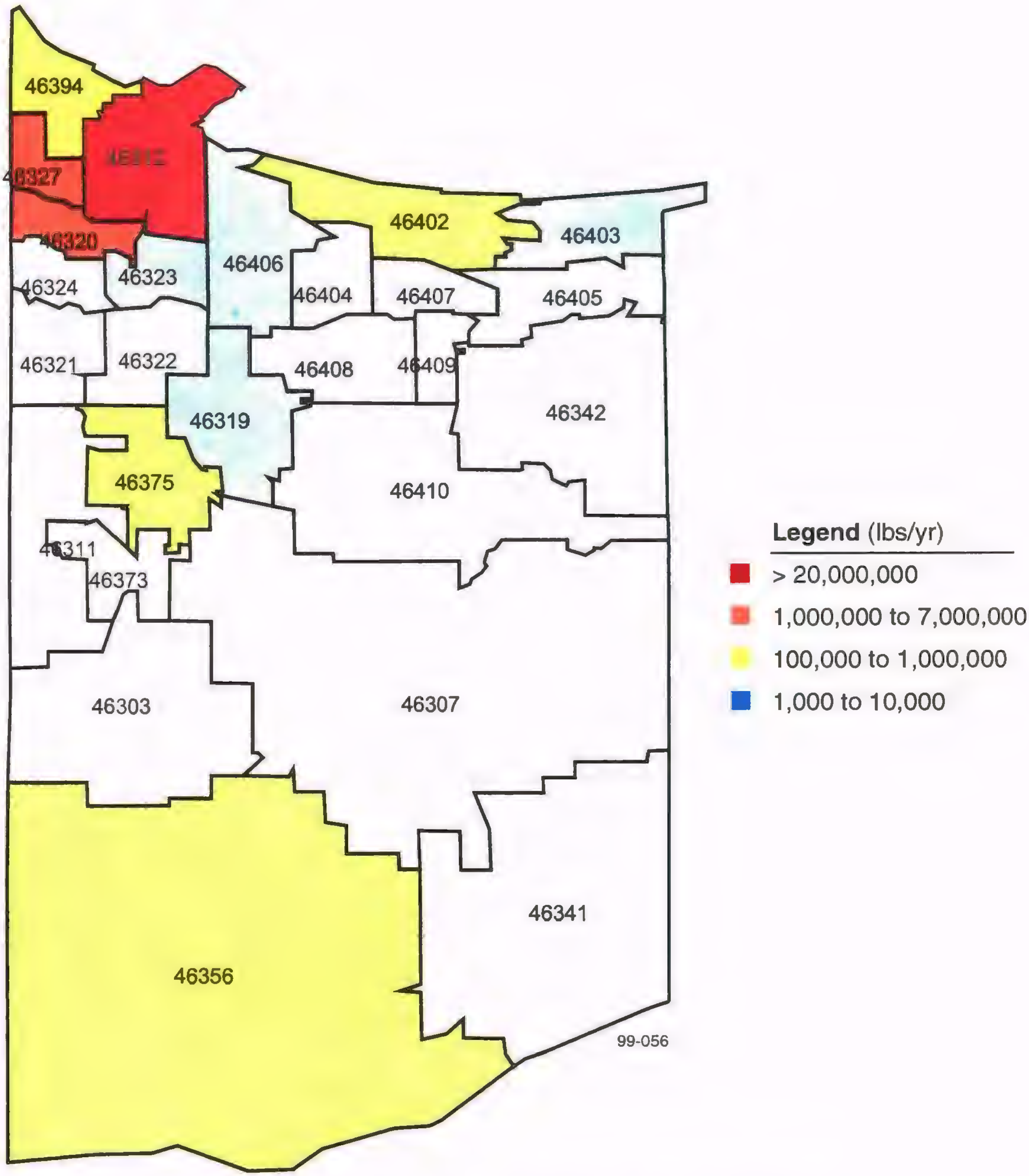


Figure 3-57. Other Transfers of Toxic Chemicals by Zip Code in Lake County, IN, in 1995

Table 3-71. On-Site Releases of TRI Chemicals in 1995 by SIC Code for Cook County, IL (Pounds/Yr.)

TWO DIGIT SIC	SIC DESCRIPTION	NUMBER OF FACILITIES	FUGITIVE AIR EMISSIONS	STACK AIR EMISSIONS	WATER DISCHARGES	UNDERGROUND INJECTIONS	LAND DISPOSAL	TOTAL RELEASES
16	HEAVY CONSTRN	1	5	0	0	0	0	5
20	FOOD	20	432,305	2,493,237	0	0	0	2,925,542
22	TEXTILES	2	13,762	68,486	0	0	0	82,248
23	APPAREL	1	0	10,779	0	0	0	10,779
25	FURNITURE	5	2,010	125,964	0	0	0	127,974
26	PAPER	10	184,010	618,082	0	0	0	802,092
27	PRINTING	9	44,669	77,388	0	0	4,240	126,297
28	CHEMICAL	125	837,345	1,343,101	31,192	0	4,135	2,215,773
29	PETROLEUM	16	39,023	63,717	0	0	250	102,990
30	PLASTICS	31	357,109	2,139,017	10	0	0	2,496,136
31	LEATHER	3	77,570	49,014	0	0	0	126,584
32	STONE/CLAY	8	4,338	3,958	0	0	0	8,296
33	PRIMARY METAL	63	744,682	1,512,523	18,858	0	660	2,276,723
34	FABR. METAL	148	1,029,426	1,985,712	10	0	10,849	3,025,997
35	MACHINERY	17	97,674	181,064	0	0	0	278,738
36	ELECTRICAL	31	145,522	543,975	15	0	5	689,517
37	TRANSPORTATION	11	186,697	1,185,752	0	0	0	1,372,449
38	MEASURE/PHOTO	13	15,480	37,756	5	0	0	53,241
39	MISCELLANEOUS	13	63,919	148,181	0	0	0	212,100
50	DURABLE WHSL	1	17,160	0	0	0	0	17,160
73	BUSINESS SVCS	1	0	0	0	0	0	0
	TOTALS	529	4,292,706	12,587,706	50,090	0	20,139	16,950,641

Source TRI, 1997

Table 3-72. On Site Releases of TRI Chemicals in 1995 by SIC Code for Lake County, IN (Pounds/Yr.)

TWO-DIGIT SIC	SIC DESCRIPTION	NUMBER OF FACILITITES	FUGITIVE AIR EMISSIONS	STACK AIR EMISSIONS	WATER DISCHARGES	UNDERGROUND INJECTIONS	LAND DISPOSAL	TOTAL RELEASES
20	FOOD	1	21,255	3,355	8,260	0	0	32,870
27	PRINTING	1	2,964	65,976	0	0	0	68,940
28	CHEMICAL	13	36,602	62,047	0	0	0	98,649
29	PETROLEUM	2	1,239,991	205,583	78,453	0	17,932	1,541,959
30	PLASTICS	1	15,071	7,880	0	0	0	22,951
32	STONE/CLAY	5	8,952	16,905	0	0	0	25,857
33	PRIMARY METAL	13	5,676,482	2,346,728	111,162	190	5,370,079	13,504,641
34	FABR METAL	4	750	141,319	0	0	0	142,069
37	TRANSPORTATION	3	55,411	17,418	0	0	0	72,829
51	NONDUR WHSL	1	1,292	665	0	0	0	1,957
		44	7,058,770	2,867,876	197,875	190	5,388,011	15,512,722

Source TRI, 1997

from the 13 primary metals facilities in Lake County, IN. The petroleum industry provided about 10 percent of the total, with on-site releases of 1,541,959 pounds. While much of Cook County's TRI releases were through stack emissions, fugitive air emissions (7,058,770 pounds) and land disposal (5,388,011 pounds) were much larger than stack air emissions (2,867,876 pounds) in Lake County, IN. Almost all of the land disposal volume in Lake County, IN, came from the primary metals industry (5,370,079 pounds).

3.3.3 Trends in Releases of TRI Chemicals

The amounts of TRI chemicals released to the environment in the study area have generally decreased since the beginning of the TRI program in 1987. For all types of releases, the amounts released in recent years (e.g., 1993-95) are substantially lower than in the first few years of TRI reporting. Figure 3-58 provides an overview of the trends in TRI releases from 1987 to 1995 (the most recent year for which data are available). Some of the decrease can be attributed to pollution prevention efforts by facilities that manufacture and use toxic chemicals. It should be noted (as described in the limitations discussion in Section 1.4) that several changes have occurred in the reporting requirements over the course of the TRI program; some portions of the reduction may be attributed to these changes, such as the types of facilities that have to report and the chemicals that were added and removed from the TRI list. Nevertheless, from TRI data, it is evident that the amounts of toxic chemicals released to the air, water, and land have decreased in the last decade.

Because of the volumes of chemicals released through fugitive and stack air emissions, as well as the potential for human exposure to these chemicals in the air, analyses of the TRI chemicals in air emissions are presented in Figures 3-59 through 3-61. Specifically, these figures summarize the major TRI chemicals emitted through fugitive and stack air emissions over the course of the TRI program (1987 to the most recent year, 1995). In general, the chemicals emitted to air in the largest amounts included ammonia, toluene, benzene, methyl ethyl ketone, and 1,1,1-trichloroethane.

3.3.4 Pollution Prevention Successes

Pollution prevention (P2) is the process of reducing the generation of hazardous wastes and other releases. P2 is often achieved by recycling, reducing the use of toxic chemicals, and recovering

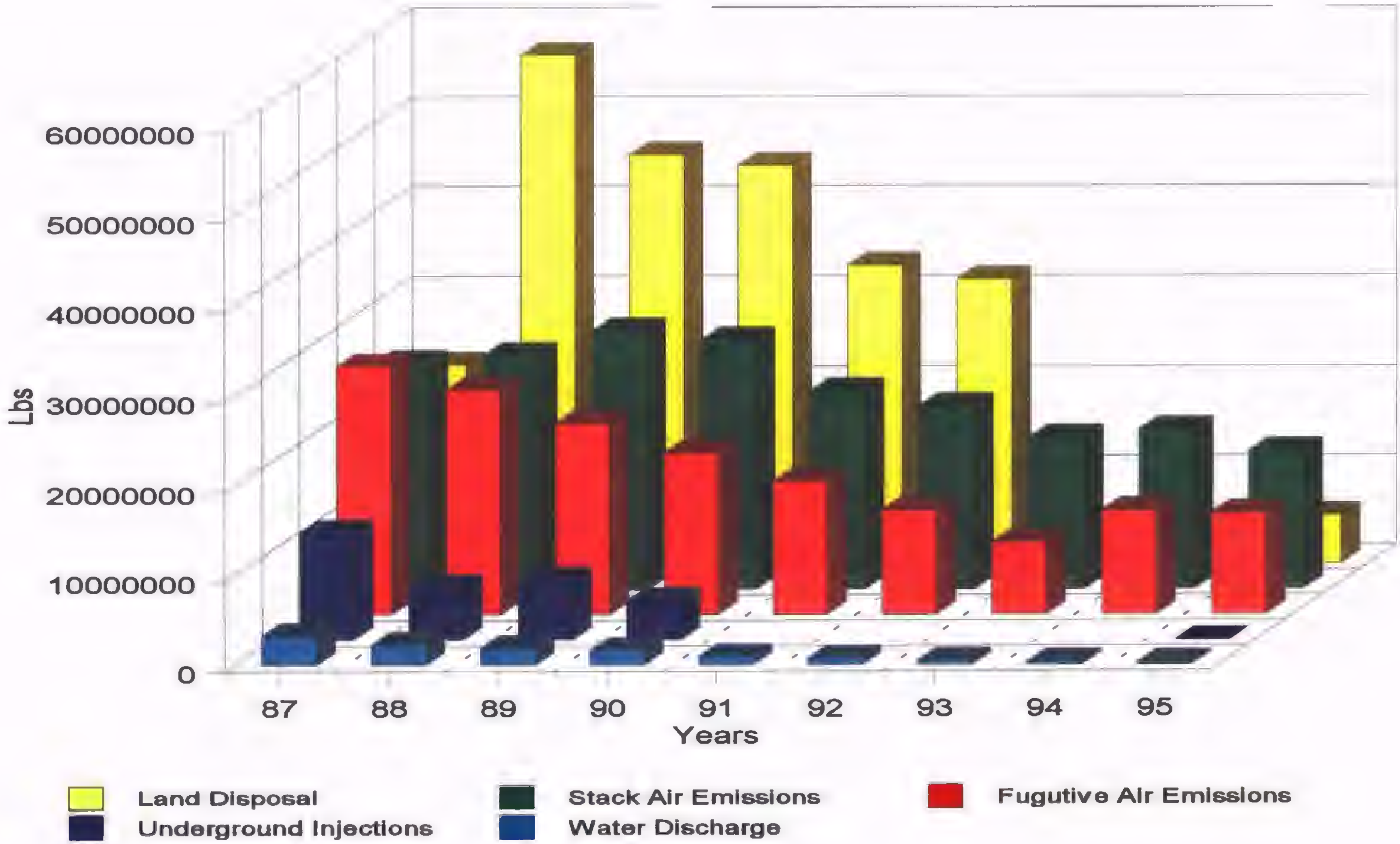


Figure 3-58. Trends in TRI Releases for Cook County, IL, and Lake County, IN.

Source: TRI, 1997.

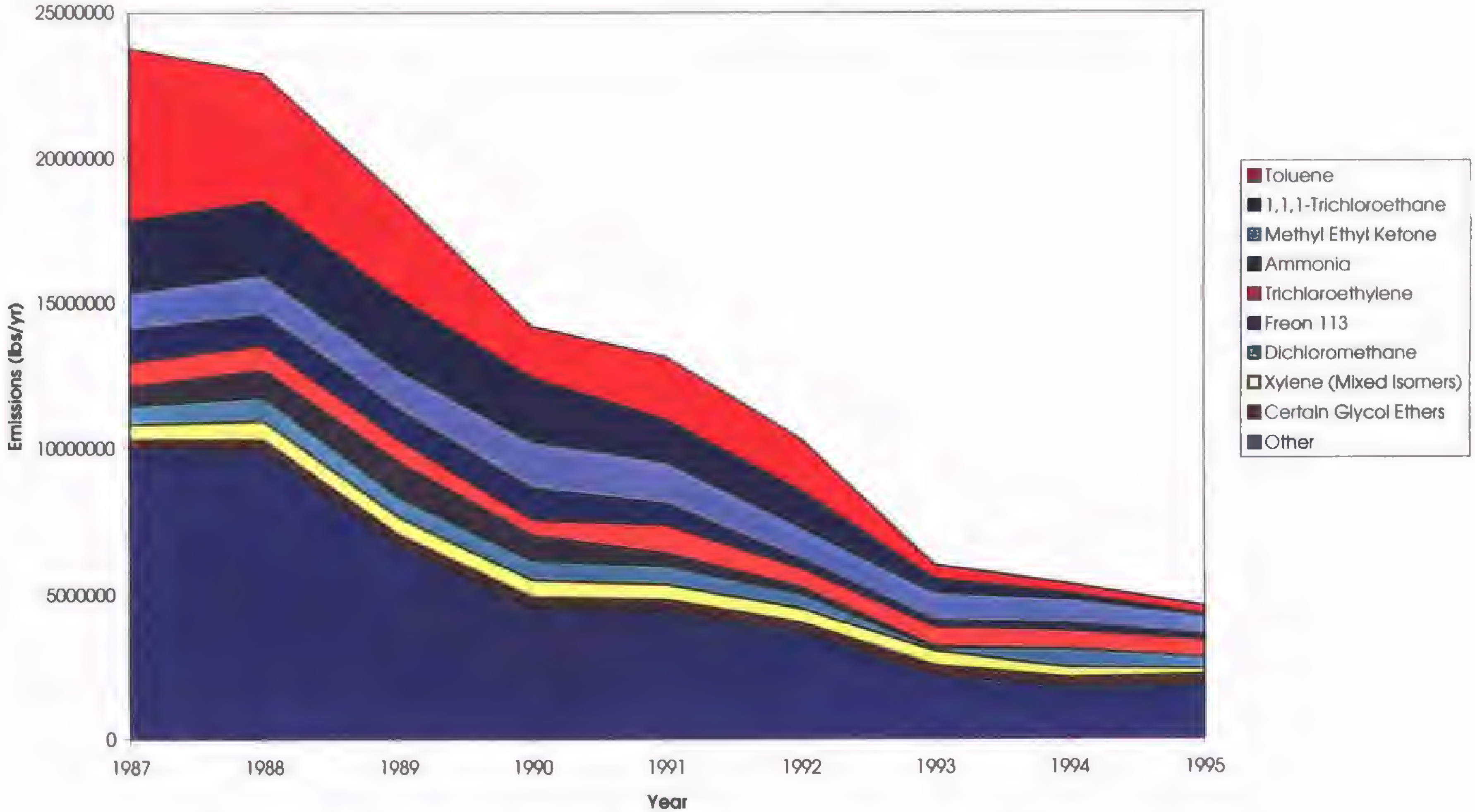


Figure 3-59. Trends in TRI Chemicals in Fugitive Air Emissions from Cook County, IL (1987-1995)

Source: TRI, 1997.

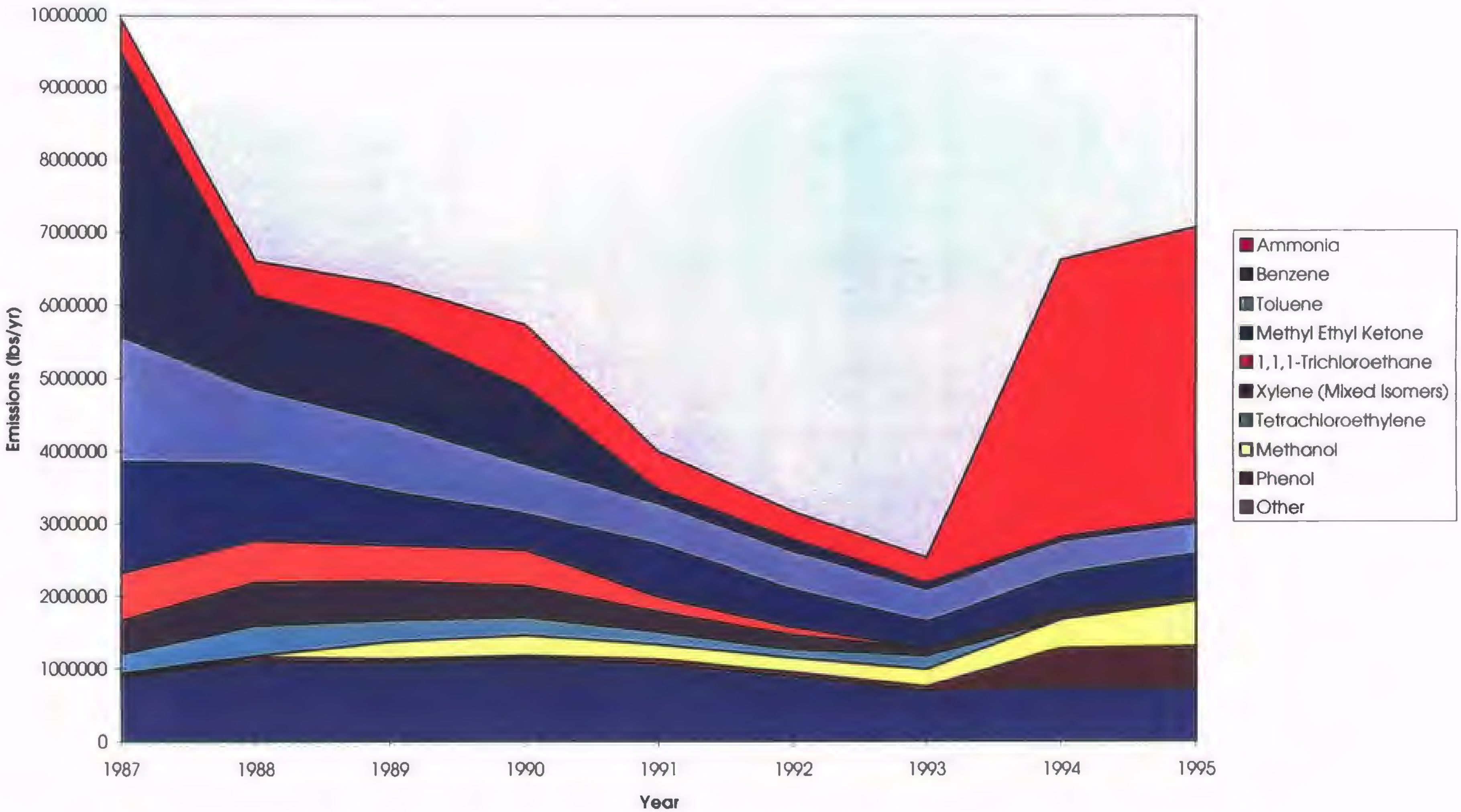


Figure 3-60. Trends of TRI Chemicals in Fugitive Air Emissions in Lake County, IN (1987-1995)

Source: TRI, 1997.

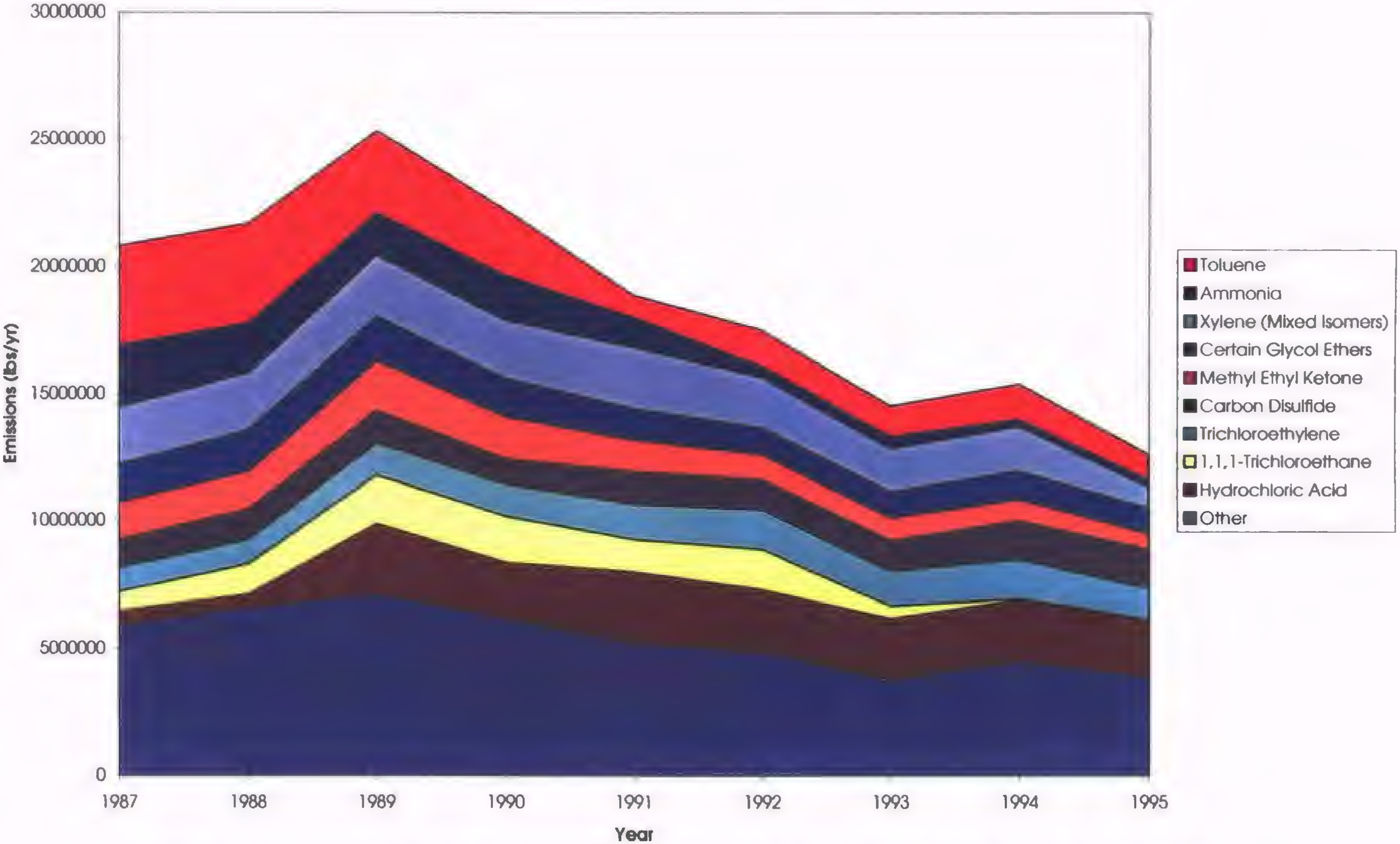


Figure 3-61. Trends of TRI Chemicals in Stack Air Emissions in Cook County, IL (1987-1995)

Source: TRI, 1997.

energy resources. While some reduction in the generation of wastes can be attributed to lower production, P2 is usually achieved through the use of less solvents, substitution of source materials, recycling, and related process changes. P2 progress is usually measured by examining TRI releases to determine reductions. Also, certain other measures in TRI can indicate whether wastestreams were recycled on site, treated on site, or handled in manners that reduce the amounts released to the environment.

Described below are selected P2 success stories summarized from information provided by the Hazardous Waste Research and Information Center (HWRIC) and for EPA's 33/50 Program to promote P2 activities. HWRIC of IDENR published P2 success stories that demonstrate innovative approaches to waste reduction (HWRIC, 1997). These stories show how many businesses in the study area are working to reduce pollutant and toxic loadings to the environment. They include:

- Arens Controls, Incorporated Evanston, IL, reduced waste generation from 350 gallons of spent mineral spirits to less than 5 gallons per month of nonhazardous oil by installing an aqueous-based washing system to replace a mineral spirits method. The useability of cutting oil was prolonged by installing an oil filtering system, which resulted in an off-site disposal reduction of 2,400 gallons per year.

- Crosfields Catalysts of Chicago modified the calcium source of its catalyst manufacturing process. This eliminated 311 drums of wastestream byproducts and saved $40,000 per year in disposal costs.

- At Graham Plating Company of Chicago, HWRIC engineers tested a low-temperature and a reverse osmosis system to recycle the rinsewater wastestream from electroplating operations. The wastestream contained metals considered hazardous waste. Waste volume reductions of 2,600 gallons per year were expected, along with a reduction of water consumption estimated at 1.5-million gallons per year.

- P & H Plating of Chicago eliminated cyanide from the plating process, resulting in a safer working environment, easier compliance with disposal regulations, and reduced treatment and disposal costs. They also developed a closed loop system to recycle plating chemicals for reuse in the electroplating process.

- Sun Chemicals of Chicago produces packaging ink for the printing industry. They employed numerous techniques such as reuse of water rinses into products; reuse and reclamation of cleaning solvents; and dedication of equipment to specific products to reduce their overall waste by 13 percent in 1990.

- Viskase Corporation, which manufactures food casings, eliminated the use of PCB-containing capacitors. Also, by introducing nonhazardous aqueous-based degreasers, they eliminated about 32,000 pounds per year of chlorinated solvents.

In 1991, EPA developed the 33/50 Program aimed at reducing toxic chemical pollution through corporate environmental volunteerism. The goal was a 50 percent reduction by 1995 in nationwide environmental releases and off-site transfers for treatment and disposal of 17 toxic chemicals, using EPA's 1988 TRI as a baseline (U.S. EPA, 1994c). Several corporations in Cook County, IL, and Lake County, IN, are highlighted in EPA 33/50 Program company profile reports, as demonstrating progress toward the targeted reduction goals through voluntary participation.

- In 1994, Acme Metals reported to the 33/50 Program progress in reducing lead emissions in its Riverdale, IL, facility. Lead dross, which was previously landfilled, is now sent to an off-site recycler. This recycling effort resulted in an approximate reduction of 330,000 pounds of releases and transfers of lead (U.S. EPA, 1994c).

- U.S. Steel's Gary, IN, plant installed an inert gas blanketing system in 1994. Toxic chemical vapors of volatile compounds such as benzene, cyanide, toluene, and xylene are unable to escape over an open tank when an inert gas such as nitrogen confines air emissions from these toxic chemicals (U.S. EPA, 1994c).

- Inland Steel reduced releases and transfers of the 17 chemicals targeted by the 33/50 Program by 86 percent between 1988 and 1993. One factor in this reduction was the replacement of its perchloroethylene cleaning process with an aqueous degreasing equipment method. The new process eliminated the use of perchloroethylene and generated no wastewater discharge. Inland also instituted a program for recycling blast furnace and steelmaking dust and sludge. Briquettes, made from dewatered sludge, are reintroduced into the blast and basic oxygen furnaces. This process can produce up to 600 tons of recycled material per day (U.S. EPA, 1994c).

3.4 CHEMICAL SPILLS/ACCIDENTS

Chemical spills/releases/accidents are other sources of chemical releases to the environment. This section describes available information on the number, magnitude, and location of spills/releases/accidents in Cook County, IL, and Lake County, IN. Information was primarily obtained from ERNS, ARIP, and local organizations. These spills include releases/spills from transportation accidents and fixed facilities.

Spills and Accidents

- Spills from Fixed Facilities and Transportation Accidents
- Detailed Lists of Spills in Lake County, IN, in 1995 and 1996
- Data from ERNS and ARIP Data Bases on Accidental Spills

Local Emergency Planning Committees (LEPCs) are the bodies appointed by the State Emergency Response Commission (SERC), as required by EPCRA, to develop comprehensive emergency plans for Local Emergency Planning Districts. LEPCs collect Material Safety Data Sheets (MSDS) and chemical release reports, and provide this information to the public. Each county, and some large city governments, participate in an LEPC. LEPC members include State or local officials, police, fire, public health, environmental, hospital, transportation officials, as well as community groups and the media. LEPCs generally have information on accidents, spills, and releases that occurred in the area of concern; emergency action taken; corrective action, if any, that was taken; nature of the spill, release, or accident; and quantity of hazardous material that was spilled or released. Hazardous substances are substances that may be toxic, flammable, ignitable, or radioactive, including fuel, solvents, and similar materials.

3.4.1 Facilities Handling Hazardous Substances

A list of facilities handling hazardous substances was obtained from the Lake County, IN, LEPC (1997a). The EHS (Extremely Hazardous Substance) Facilities List includes about 82 EHS facilities, which handled EHSs; the second list contained over 290 facilities handling hazardous substances. Related to handling of hazardous substances are underground storage tanks (USTs). In Lake County, IN, 1,082 facilities had USTs in 1996 (IDEM, 1997a). As of June 1996, approximately 400 leaking USTs (LUSTs) were identified in Lake County, IN, of which 236 were low priority LUST sites, 128 medium priority LUST sites, and 32 high priority LUST sites (IDEM, 1997a). IDEM (1991) reported more than 462 USTs in the GCR/IHSC area of concern (AOC). While the AOC does not cover all of Lake County, IN, this figure is an indication of the number of USTs that may exist in the region. More than 150 leaking tank reports were filed in Lake County, IN, in the AOC between 1987 and 1991 (IDEM, 1991). A list of facilities handling hazardous substances from the Chicago LEPC was made available by Citizens for a Better Environment. In Chicago, 927 facilities were handling hazardous substances (Hamblin, 1997).

3.4.2 Accidents/Releases

The Lake County, IN, LEPC provided information on spills that occurred in 1995 and 1996 (Tables 3-73 and 3-74). This information (spill reporting sheets) provided the nature of the spill/release and described the substance spilled or released, and actions taken (Lake County LEPC, 1997 a, b).

Summary for 1995:

- Of the 35 spills/releases reported to the Lake County, IN, LEPC, about half were caused by four major companies including AMOCO, Lever Brothers, Rhone Poulenc, and U.S. Steel.

- Of the 35 reported spills/releases, 14 were diesel oil, furnace oil, or gasoline spills.

Table 3-73. Accidental Releases Reported in 1995 in Lake County, IN

Date	Company	Synopsis
02/02/95	LTV Steel	Ammonia gas release - 500 cu. ft.
02/10/95	Norfolk & Southern	200 gallons of fuel oil spilled in Gary
02/27/95	PVS Technologies	1,644 lbs. of ferric chloride released
04/19/95	Keil Chemical	Ethylenediamine lead, 2 gal.
04/21/95	Lever Bros.	Sulfuric acid leak
04/25/95	Gary Airport	Aviation gas leak, 100 Gal.
05/01/95	LaSalle Steel, Griffith	Sodium hydroxide with chromic acid, controlled leak
05/29/95	USX	Blast furnace water in Sewer
05/30/95	Corrugated Paper Tr.	Diesel fuel spill - Gary
06/04/95	Indiana Harbor Belt	Diesel oil spill - Hammond
06/20/95	AMOCO	130 lbs of sulfur dioxide and 150 lbs of hydrogen sulfide released. Follow-up report
06/23/95	AMOCO	Sulfur dioxide 83 lbs and 70 lbs of hydrogen sulfide released. Follow-up report
07/19/95	Gary Fire Dept.	5 barrels of unknown material
07/26/95	Schererville Fire Dept.	Diesel spill - 75 gallons
07/28/95	Safety Kleen	200 gallons oil spill
07/31/95	Schererville Police	Accident - diesel spill
08/01/95	AMOCO	Hydrogen sulfide - 24 lbs.
08/05/95	USX	Hydrochloric acid - leak
08/06/95	Lever Bros.	1,757 gal. of sodium hydroxide. Follow-up report
08/07/95	AMOCO	Hydrogen sulfide leak
08/09/95	AMOCO	Hydrogen sulfide leak
08/30/95	Lever Bros.	Sulfuric acid leak
08/31/95	Rhone Poulenc	3.5 lbs. Dimethyl ethel; 2.5 lbs. of ammonium chloride
08/31/95	VC Tank Lines	Styrene spill; no report sent to this office, but Chiefs Assn. got reported. Evacuation needed.
09/19/95	Spill Center	Diesel fuel; punctured fuel tank controlled leak. No location.
09/29/95	AMOCO	106 lbs. of Hydrogen sulfide
10/22/95	AMOCO	328 lbs. H2S. Controlled
10/23/95	AMOCO	Slight oil spill. No action.
11/01/95	AMOCO	12,000 gallon leak of aviation fuel at Gary Airport. Contained.

Table 3-73. Accidental Releases Reported in 1995 in Lake County (continued)

Date	Company	Synopsis
11/27/95	Ronning Oil	1,500 gallon leak from gasoline tank.
12/05/95	Rhone Poulenc	60-80 gallons of Sulfuric Acid, contained.
12/05/95	Keil Chemical	Dicyclopentadiene (Sheriff's report had phonetic spelling)? - controlled
12/06/95	U.S. Steel	Trivalent chrome solution, 300-500 gallons - controlled
12/14/95	Rhone Poulenc	Sulfur Trioxide release, 47 to 149 lbs. left property. Investigation and follow-up reports sent on 12/26.
12/17/95	U.S. Steel	Blast furnace recycled water left property (018 discharged), controlled.

Source: Lake County LEPC, 1997b.

Table 3-74. Accidental Releases Reported in 1996 in Lake County

Date	Company	Synopsis
00/00/96	Ferro Corp.	Approx. 148,190 lbs/yr fugitive emissions of Ethylene Dichloride from valves, flanges, open-end lines, pumps, agitators located in Bldg. 4 (Hammond Facility)
01/29/96	Phillips Pipeline Co. EC Terminal East Chicago	Transmix (gasoline mixture) spill due to vandalism
02/09/96	Ryder Dedicated Logistics	25 gallons diesel fuel spilled in the parking lot at 3210 Watling St, East Chicago, IN
02/09/96	Inland Steel Corp	50 gal of diesel fuel spilled in the parking lot
02/23/96	U.S. Steel	Noticed an oil sheen on the river and traced it back to their property
02/29/96	PVS Technology	Ferrous chloride; 130 pounds overflowed from the top of two ferrous chloride storage tanks
03/07/96	Ace Durbin	Diesel fuel leak
03/08/96	U.S. Steel	Coke oven gas release due to rupture
03/18/96	Amoco	Sulphur dioxide emitted, was being monitored and was within authorized limits
03/21/96	U.S. Steel	Used oil release from underground furnace oil transfer line; size of the spill unknown
03/22/96	U.S. Steel	150 gallons pickle liquor (HCL) was spilled on the ground (underground leak)
04/01/96	U.S. Steel	140 lbs of coke oven gas release
04/02/96	U.S. Steel	100 lbs of ammonia was released, due to contact of blast furnace recycled water with the blast furncace material
04/02/96	Amoco Pipeline (East Chicago)	Liquid gas leak. Intake valve was closed.
04/10/96	U.S. Steel	20 gal of spent pickle liquor seeped from corroded flange.
04/11/96	U.S. Steel	Half gallon of Pyranol (PCB) fluid was spilled from a transformer. Greater than 95% of the PCB fluid was contained within a spill pan underneath the transformer. 25 sq. ft of concrete floor and wall space were contaminated.

Table 3-74. Accidental Releases Reported in 1996 in Lake County, IN (continued)

Date	Company	Synopsis
04/12/96	U.S. Steel	Spent pickle liquor acid spilled due to corroded flange
04/16/96	U.S. Steel	Hot strip mill process water feed line was found leaking at a rate of 5 GPM and stopped after one hour (300 gal)
04/18/96	U.S. Steel	150 lbs of Spent Acid was spilled into the soil. Approx 100 sq ft of soil inside the trench was contaminated
04/18/97	U.S. Steel	20 gallons of spent pickling solution leaked from the flange and affected an are approx. 30 sq. ft. inside the open trench
04/19/96	Rhone-Poulenc	Approx. 19 lbs of process gas containing 8.5% of SO2 was released
05/04/96	Werner Enterprises	100 gallons of Diesel fuel was released in Gary, IN on the parking lot at exit 9 off interstate 80/94 southbound
05/21/96	U.S. Steel	Underground used oil release
05/22/96	U.S. Steel	Light igniting oil spill
06/05/96	Ferro Corp	10 gal of NAOH, leak from tanker truck valve
06/17/96	U.S. Steel	Coke oven gas released, due to storm which blew out pilot light. Oven lost suction, failed to ignite causing gas to mix with air
06/18/96	Amoco	Carry over of activated sludge from wastewater treatment plant, due to storm overflow.
06/25/96	Rhone-Poulenc	Approx. 100 to 150 gallons of conc. sulfuric acid was released from tank 17 of the Hammond Plant.
07/02/96	Tri Union Express Line	Diesel fuel
07/03/96	Amoco (Whiting)	Sulphur dioxide gas was released due to weld break.
07/05/96	Amoco (Lake Front Property)	Oil spill
07/17/96	Amoco Refining in Whiting	Approx. 45 gal of liquid oil leaked discharging it into the canal
07/18/96	Amoco (Whiting)	Solids with Oil from the treatment plant overflowed due to excessive rain into the lake
07/18/96	Amoco Refinery	Approx. 500 to 700 lbs of sulphur dioxide released due to overpressure in flare stack
07/18/96	U.S. Steel	Approx. 150 lbs of raw coke oven gas was released
08/06/96	Inland Steel Co.	Approx. 90 lbs of Chlorine spilled from tank
08/07/96	Lake Co. Shf. Dept.	Diesel fuel due to accident on North Junction 2/US41

Table 3-74. Accidental Releases Reported in 1996 in Lake County, IN (continued)

Date	Company	Synopsis
08/17/96	ERD Waste Corp	Assorted inks, paints, oil waste etc. caught fire
08/23/96	Marine Unit	Fuel spill
11/22/96	U.S. Steel	Oil spill on the Grand Calumet river
11/26/96	Gas City	15 gal of diesel fuel
12/13/96	Clark Refinery	15 gal of diesel fuel
12/30/96	U.S. Steel	Oil sheen on the Grand Calumet river

Source: Lake County LEPC, 1997b.

- Reported spills/releases were comprised of the following substances/gases: ammonia, sulfuric acid, hydrochloric acid, ferric chloride, sulfur dioxide, hydrogen sulfide, ethylenediamine lead, sodium hydroxide, tri-valent chrome solution, dicyclopentadine, sulfur trioxide, blast furnace re-cycled water, and styrene. Some of the released/spilled substances were quantified or estimated, few did not report quantities. Table 3-73 describes amounts released/spilled, if reported (Lake County LEPC, 1997b).

Summary for 1996:

- Of the 43 spills/releases reported to the Lake County, IN, LEPC in 1996, about 75 percent were caused by four major companies including U.S. Steel, AMOCO, Rhone Poulenc, and Ferro Corporation.

- Of the 43 reported spills/releases, 19 were oil spills, comprised of diesel oil, gasoline, furnace oil, lubricating oil, and used oil.

- Reported spills/releases were comprised of the following substances/gases: ethylene dichloride, ferrous chloride, coke oven gas, sulfur dioxide, hydrochloric acid, ammonia, blast furnace recycled water, PCBs, spent acid, sodium hydroxide, carry over activated sludge from wastewater treatment plant, and raw coke oven gas. Some of the released/spilled substances were quantified or estimated, few did not report quantities. Table 3-74 describes amounts released/spilled, if reported.

Cook County Government and the Chicago Fire Department were contacted to obtain information on spills/releases/accidents that occured in Cook County, IL, over a 3-year period. The Chicago Fire Department indicated that they had facility reports, but the information was not easily accessed.

The ERNS data base was querried for spills/releases of hazardous substances that occured in Cook County, IL, for the available years 1995 and 1996 (ERNS, 1997). For 1995, 364 spills were reported, and for 1996, only 91 were reported. Figure 3-62 displays the quantity of hazardous materials spilled in 1995 and 1996. Of the total quantity of hazardous substances released/spilled in Cook County, IL, oils (diesel, crude, gasoline, lubricating oils, miscellaneous oils, etc.) generally accounted for approximately 80 percent. The remaining hazardous substances spilled/released were acids, chlorinated solvents, raw coke oven gas, sulfur dioxide, caustic soda, and organic solvents.

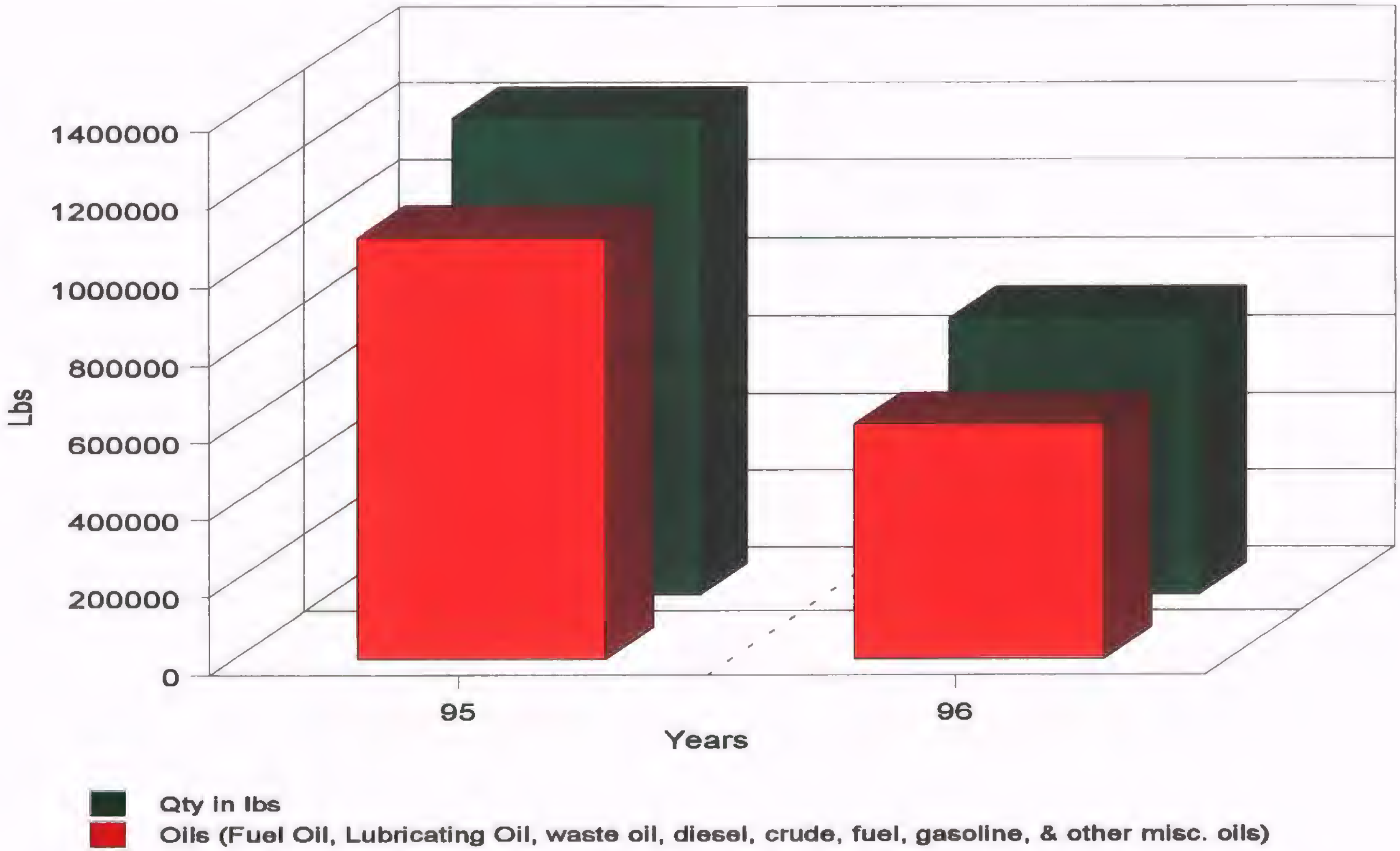


Figure 3-62. Total Quantity of Spill/Releases of Hazardous Materials in Cook County, IL from ERNS.

Source: ERNS, 1997.

The industries that contributed to major spills/releases in Cook County, IL, included Amtrack, PVS Chemicals, Commonwealth Edison, Southern Pacific, Horsehead Resource Development, Hannah Marine Corp, Airport Group Int, Norfolk Southern, Eureka Chemical, and the U.S. Air Force. The major manufacturing facilities that reported significant releases/spills were located in Chicago, Lemont, Blue Island, and Bensenville, and were concentrated in ZIP Codes 60439, 60666, 60606, 60633, 60138, and 60139.

ERNS and ARIP data bases were also querried for information on the number of accidents/spills and the type/amount of chemicals involved. Following are discriptions of information on spills/accidents in ERNS and ARIP for Lake County, IN, and Cook County, IL. The total number of spills/releases of hazardous materials from ERNS for Lake County, IN, are presented in Table 3-75. Except for the years 1990 and 1995, the total hazardous materials spills/releases relative to other years decreased (Figure 3-63). Of the total quantity of hazardous substances released/spilled, oils (diesel, crude, gasoline, lubricating oils, miscellaneous oils, etc.) generally accounted for approximately 30 percent. For some years (such as 1996, 1994, and 1988), oils accounted for as much as 80 percent of the total materials spilled. The very large volume of materials spilled/released in 1989 is explained by one incident where recycled process water from hot strip/mill spilled, discharging approximately 8.3-million pounds into Lake Michigan. For the year 1995, 1.4-million pounds of process water discharged into Lake Michigan because of a pump failure at U.S. Steel. The remaining hazardous substances spilled/or released were acids, chlorinated solvents, raw coke oven gas, sulfur dioxide, caustic soda, and organic solvents.

Analysis of the ERNS data suggests that industries, such as petroleum and steel manufacturing companies (Citgo Petroleum, Inland Steel, U.S. Steel, Amoco, Inland Steel, and LTV Steel), accounted for more than 80 percent of the spills/releases. Other major manufacturing facilities that reported releases/spills include PVS Technologies, Lever Brothers, Georgia Pacific, Rhone Poulenc, and Ferro Corp. Most major manufacturing facilities that reported large releases/spills were located in Gary, East Chicago, Whiting, and Hammond, and were concentrated in ZIP Codes 46312, 46402, 46394, and 46320.

Table 3-75. Number of Spills/Releases per Year in Lake County as Reported in ERNS

Year	No. of Spills/Releases
1987	35
1988	45
1989	60
1990	108
1991	92
1992	75
1993	85
1994	118
1995	102
1996	98

Source· ERNS, 1997.

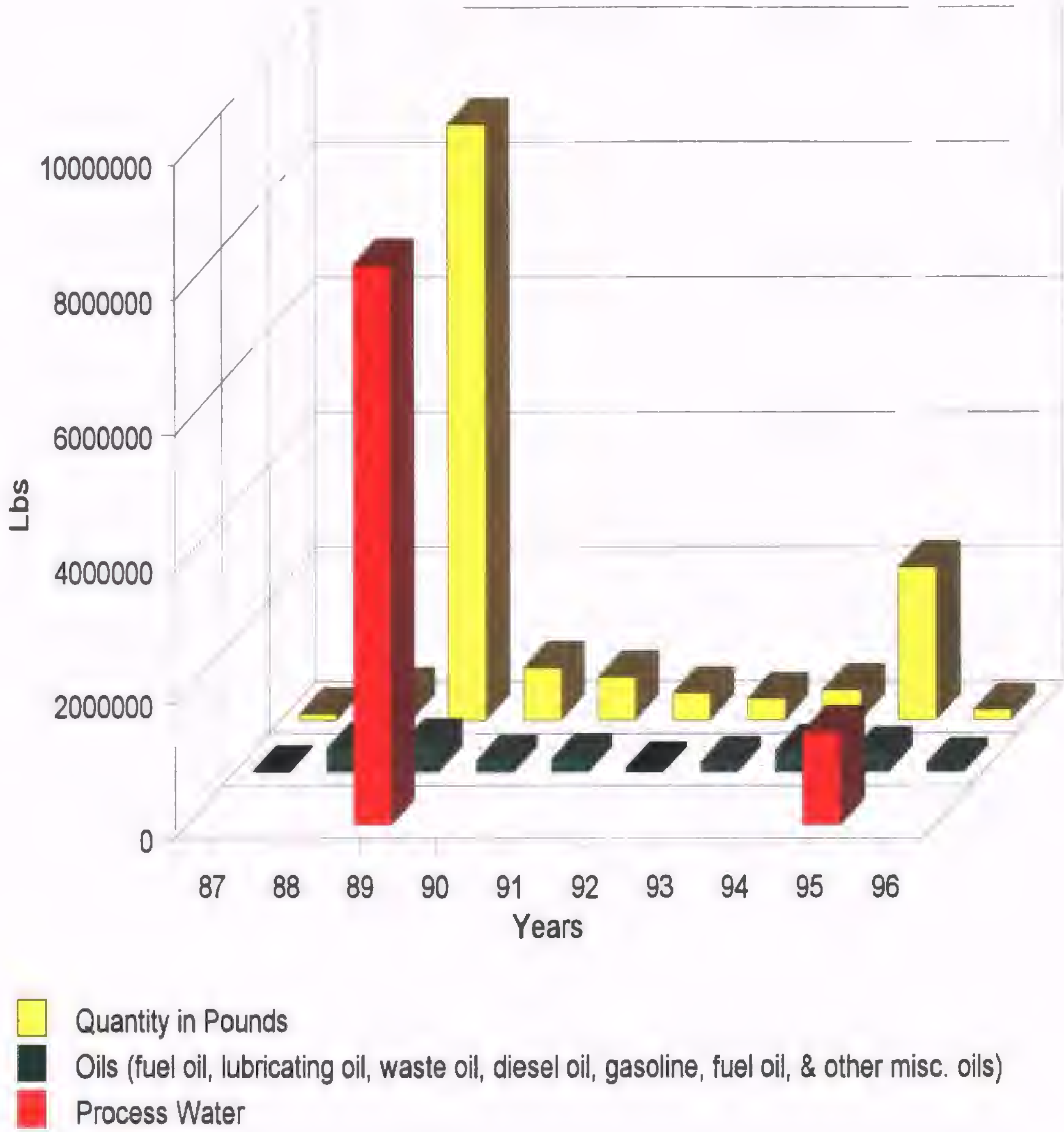


Figure 3-63. Total Quantity of Spills/Releases of Hazardous Material in Lake County, Indiana from ERNS

Source: ERNS, 1997.

3.5 HAZARDOUS WASTE GENERATION/MANAGEMENT

Hazardous Wastes

- Tracking of Hazardous Waste Generation and Management
- Number of Facilities and Amounts of Wastes Generated and Managed in 1993
- Types of Hazardous Wastes Generated/Managed
- Small Quantity Generators

Data on hazardous waste management are primarily available from EPA's RCRIS and BRS data bases, as well as from State agencies. Hazardous waste is a waste or combination of wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness. It may also pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed, and has been identified, by characteristics or listing, as hazardous pursuant to Section 3001 of the RCRA. Under RCRA, hazardous wastes are regulated from generation until they are disposed ("cradle-to-grave"). BRS and RCRIS track information related to all phases of hazardous waste mangaement (facilities, permits, generation, disposal, etc.). Searches of BRS and RCRIS were the primary information sources on the amount and type of wastes generated/managed by facilities in Cook County, IL, and Lake County, IN. BRS data contain characterization of the amount and type of wastes generated, received, shipped, and managed for 1989, 1991, and 1993. These data were augmented by a data base obtained from IDEM on more than 130 small quantity generators of hazardous wastes in Lake County, IN, (Weddle, 1997). Facilities that generate and manage hazardous wastes can be characterized by the amount of waste generated. RCRIS classifies these facilities as follows:

- LQGs - Large Quantity Generators (facilities that generate more than 1,000 kilograms of hazardous waste per month);
- SQGs - Small Quantity Generators (facilities that generate less than 1,000 kilograms of hazardous waste per month); and

- CESQGs - Conditionally-exempt Small Quantity Generators.

A facility is classified as a small quantity generator (SQG) if it generates in 1 calendar month: (1) less than 1,000 kilograms of a hazardous waste; (2) less than 1 kilogram of an acutely hazardous waste; or (3) less than 100 kilograms of any residue or contaminated soil, waste, or other debris resulting from the cleanup of a spill of an acutely hazardous waste. Also, the SQG status applies to any generator that accumulates less than the amounts listed in (2) and (3) above of an acutely hazardous waste on site at any one time.

Characterizing the chemical content of hazardous wastes is not straight forward. While data bases for other media contain information that is well-suited for estimating loadings of individual chemicals, BRS poses significant challenges, because hazardous wastes are assigned waste codes. Waste codes often reflect the type of industrial process that generates the waste, not necessarily the chemical constituents present. Only for characteristic wastes (the "D" wastes, which are defined by the presence of a particular chemical), discarded products ("P" and "U" wastes), and select other waste codes, can one be certain of finding the chemical of interest. Even then, it is not known whether the chemical of interest makes up a small fraction or the majority of the total mass of the waste. One other peculiarity for hazardous wastes is that if multiple waste types are mixed, they will be assigned a string of waste codes to describe the waste. Again in this instance, one cannot determine what portion of the total mass is the waste of interest, much less the chemical makeup. Therefore, this analysis focuses on the mass of waste and the waste codes generated/managed, not individual chemical constituents.

3.5.1 Hazardous Waste Facilities in Cook County, IL, and Lake County, IN

From data in BRS and RCRIS, it is possible to characterize the number of facilities managing hazardous wastes and, in many cases, to quantify the amounts and types of waste generated/managed. More than 8,800 hazardous waste facilities were inventoried from BRS and RCRIS in the study area in 1993. Most of these facilities were listed in RCRIS, for which data on the amount of waste generated/managed are not available. From BRS, 729 facilities were listed, and waste characterization information was available for 1989, 1991, and 1993. In Cook County, IL, 663 total facilities managed a total of 2,681,424 tons of hazardous wastes in 1993. In Lake County, IN, 66 facilities managed 455,979 tons of hazardous waste in 1993. Figure 3-64 provides comparisons between Cook County, IL, and Lake County, IN, with respect to the number of facilities and the amount of hazardous waste generated, received, shipped, and managed in 1993.

3.5.1.1 *Cook County, IL, Hazardous Waste Facilities*

In Cook County, IL, the 663 facilities were classified as: 453 fully-regulated, large quantity generators, 3 conditionally-exempt, 115 small quantity generators, and 92 unclassified. Collectively, these 663 facilities generated 1,796,375 tons, received 301,964 tons, shipped 209,034 tons, and managed 2,681,424 tons of hazardous wastes in 1993. Of the 663 facilities in Cook County, IL, two (Nalco Chemical and Amber Plating Works) managed more than 80 percent of the total mass of hazardous wastes. Table 3-76 presents the largest 20 hazardous waste management facilities in Cook County, IL, comprising more than 99 percent of the total. With respect to generation of hazardous wastes, 1,796,375 tons were generated in 1993 in Cook County, IL. The geographic locations of the hazardous waste generators in 1993 are summarized in Figure 3-65. Examination of the industry type indicates that the chemical industry generated 1,069,911 tons (60 percent of the total), metal fabrication generated 457,855 tons (25 percent), and electrical industry generated 133,030 tons (1 percent). In Cook County, IL, 301,964 tons of hazardous wastes were received by treatment, storage and disposal faclities (TSDFs) in 1993. Major TSDFs include the CID Recycling and Disposal Facility (83,160 tons), Safety-Kleen Envirosystems (78,429 tons), Envirite (70,258 tons), and Clean Harbors of Chicago (32,166 tons).

Of the 1,796,375 tons of hazardous wastes generated in 1993 in Cook County, IL, BRS shows that about 60 percent contained D002 (corrosive wastes), about 22 percent are D003 (reactive), about 7 percent were D007 (chromium wastes), about 4 percent are D001 (ignitable wastes), about 1 percent are F006 (wastewater treatment sludges from electroplating operations). The remaining 5 percent of the wastes included more than 70 waste codes, which were composed of a variety of spent solvents, steel mill wastes, and metal wastes.

Cook County, IL, produced more than 1.3-million tons of hazardous waste in 1994 (IEPA, 1996a) as compared to 14.5-million tons generated by the State of Illinois. Cook County typically accounted for approximately 10 percent of all the hazardous waste generated in the State of Ilinois

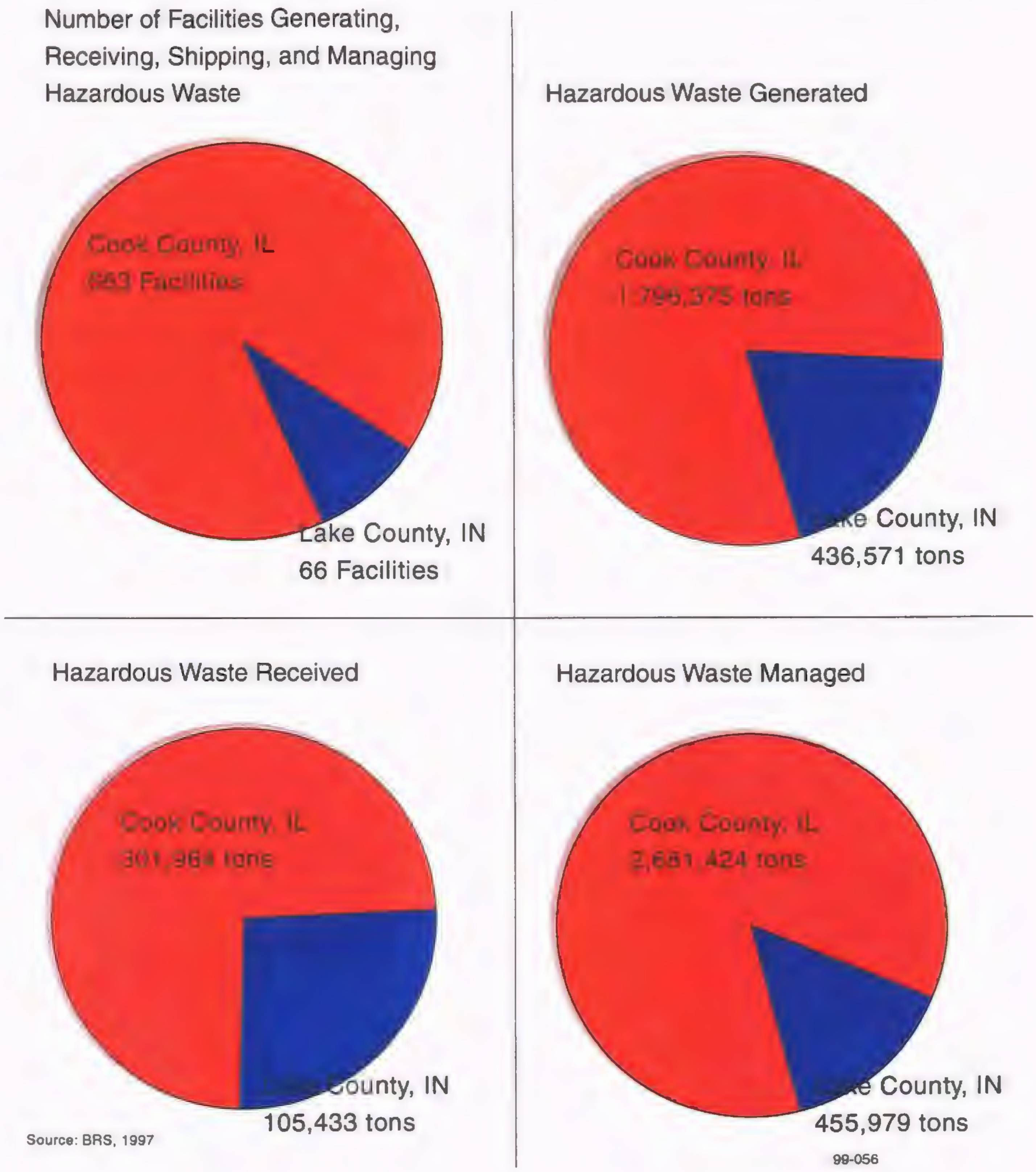


Figure 3-64. Comparisons of Hazardous Waste Facilities by Amounts of Waste Generated, Received, Shipped, and Managed in Cook County, IL, & Lake County, IN (1993)

Table 3-76. Largest Hazardous Waste Management Facilities in Cook County, IL, in 1993

Rank	Wastes Managed in Tons/Year	Cumulative Percent	Facility Name
1	1,793,831	66.90%	Nalco Chemical Co.
2	400,334	81.80%	Amber Plating Works, Inc.
3	114,090	86.10%	Motorola, Inc.
4	96,495	89.70%	CID Recycling & Disposal Facility
5	78,793	92.60%	Safety Kleen Envirosystems
6	70,979	95.30%	Envirite Corp.
7	32,222	96.50%	Clean Harbors of Chicago
8	16,239	97.10%	Precoat Metals
9	14,148	97.60%	Safety-Kleen Corp.
10	11,933	98.00%	Heritage Environmental Services
11	10,894	98.50%	Imperial Eastman
12	9,466	98.80%	Pyle National Co.
13	9,360	99.20%	Beaver Oil Co., Inc.
14	6,801	99.40%	R.R. Donnelley & Sons Co.
15	4,049	99.60%	C.P. Systems, Inc.
16	1,568	99.60%	Joslyn Manufacturing Co.
17	1,392	99.70%	API Industries
18	1,352	99.70%	Gilbert & Bennett Mfg. Co.
19	1,316	99.80%	Safety Kleen Corp.
20	1,103	99.80%	Chicago Extruded Metals Co.

Source: BRS, 1997; RCRIS, 1997

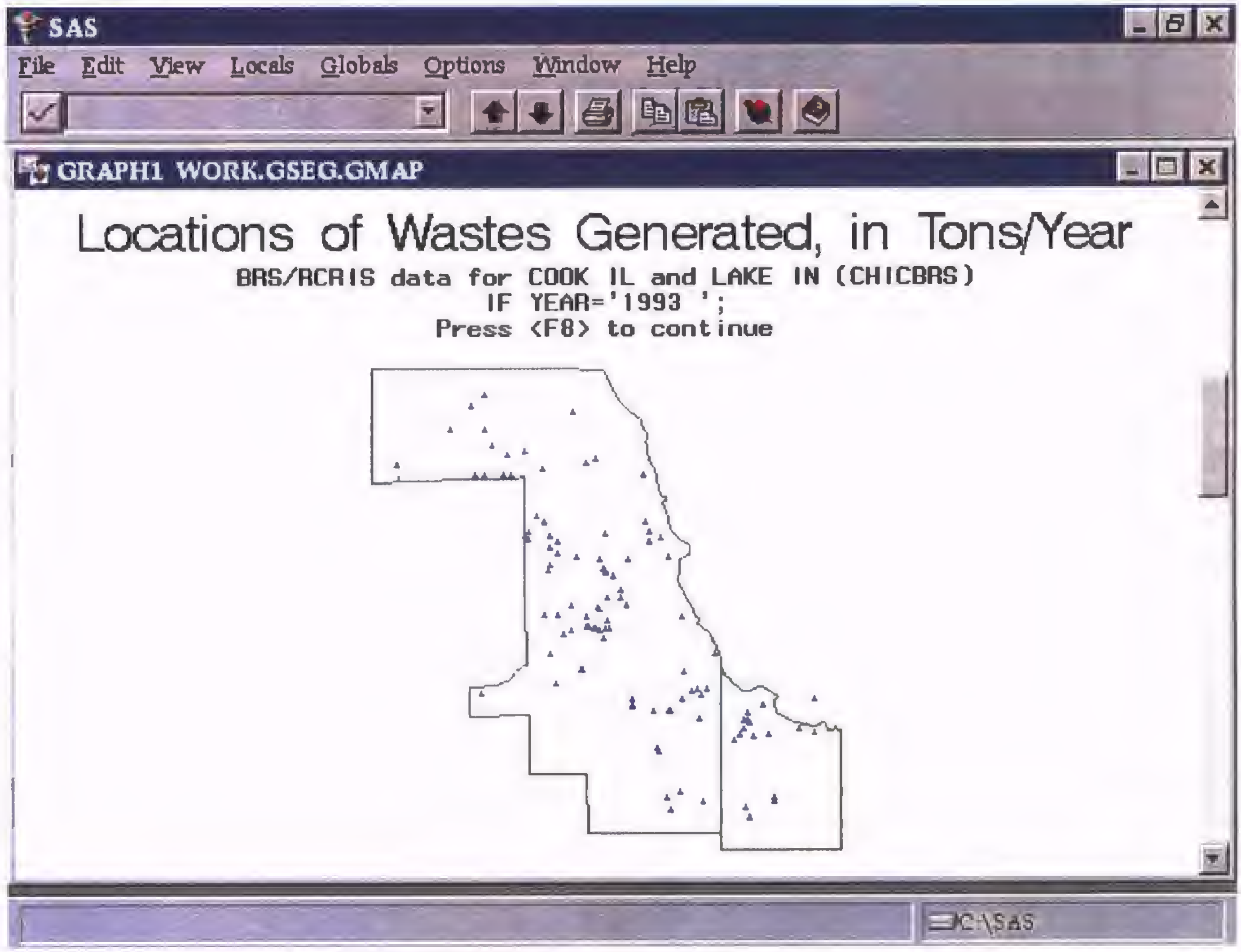


Figure 3-65. Hazardous Waste Generators in 1993 in Cook County, IL, and Lake County, IN

Source: BRS, 1997.

(IEPA, 1996a). The quantities of total hazardous waste generated declined from 1992 to 1994 and are summarized in Figure 3-66. This figure indicates total hazardous waste generated, hazardous waste generated and managed on-site, hazardous waste generated and shipped off-site, and hazardous waste received and managed by TSDR facilities. In 1994, Cook County generators consistantly produced the highest volume of hazardous wastes that were shipped off-site for management, accounting for 48.5 percent of all wastes shipped off-site during 1990 in the State of Illinois (IDENR, 1994b). Of the total hazardous waste generated in Cook County, IL, approximately 75 percent were generated and treated onsite.

3.5.1.2 *Lake County, IN, Hazardous Waste Facilities*

The 66 hazardous waste management facilities listed in BRS in Lake County, IN, included 40 fully-regulated large quantity generators, 2 conditionally-exempt, 8 small quantity generators, and 16 unclassified. Collectively, these facilities generated 436,571 tons, received 105,433 tons, shipped 319,024 tons, and managed 455,979 tons of hazardous wastes in 1993. Of the 66 hazardous waste generators/management facilities in Lake County, IN, Amoco Oil in Whiting was the largest in 1993. Of the total 436,571 tons generated, Amoco Oil accounted for 353,138 tons (77 percent). Ten facilities accounted for more than 99 percent of the total generated (Table 3-77). Similarly, the five largest facilities (Amoco, Safety Kleen, Pollution Control Industries, Rhone-Poulenc, and Mason Corp.) accounted for more than 99 percent of the total wastes managed in Lake County, IN, in 1993 (Table 3-78). Examination of the geographic locations of these facilities indicates that Whiting accounts for the majority of the total. ZIP Codes 46394 and 46312 account for the majority of hazardous wastes generated and managed in Lake County, IN. In 1993, a total of 105,433 tons of hazardous wastes were received by TSDFs in Lake County, IN. These facilities included Safety-Kleen Oil Recovery Co. (65,571 tons), Pollution Control Industries of Indiana (18,354 tons), Rhone-Poulenc (14,615 tons), Mason Corp. (4,321 tons), and Amoco Oil (2,572 tons).

Analysis of waste codes generated in 1993 in Lake County, IN, indicates that F037 (sludges from petroleum refineries) comprised about 70 percent of the mass of the wastes generated, as reported in BRS. Other major wastes included D002 (corrosive wastes), K048 (petroleum refinery wastes), D007 (chromium wastes), and F006 (wastewater treatment sludge from electroplating operations).

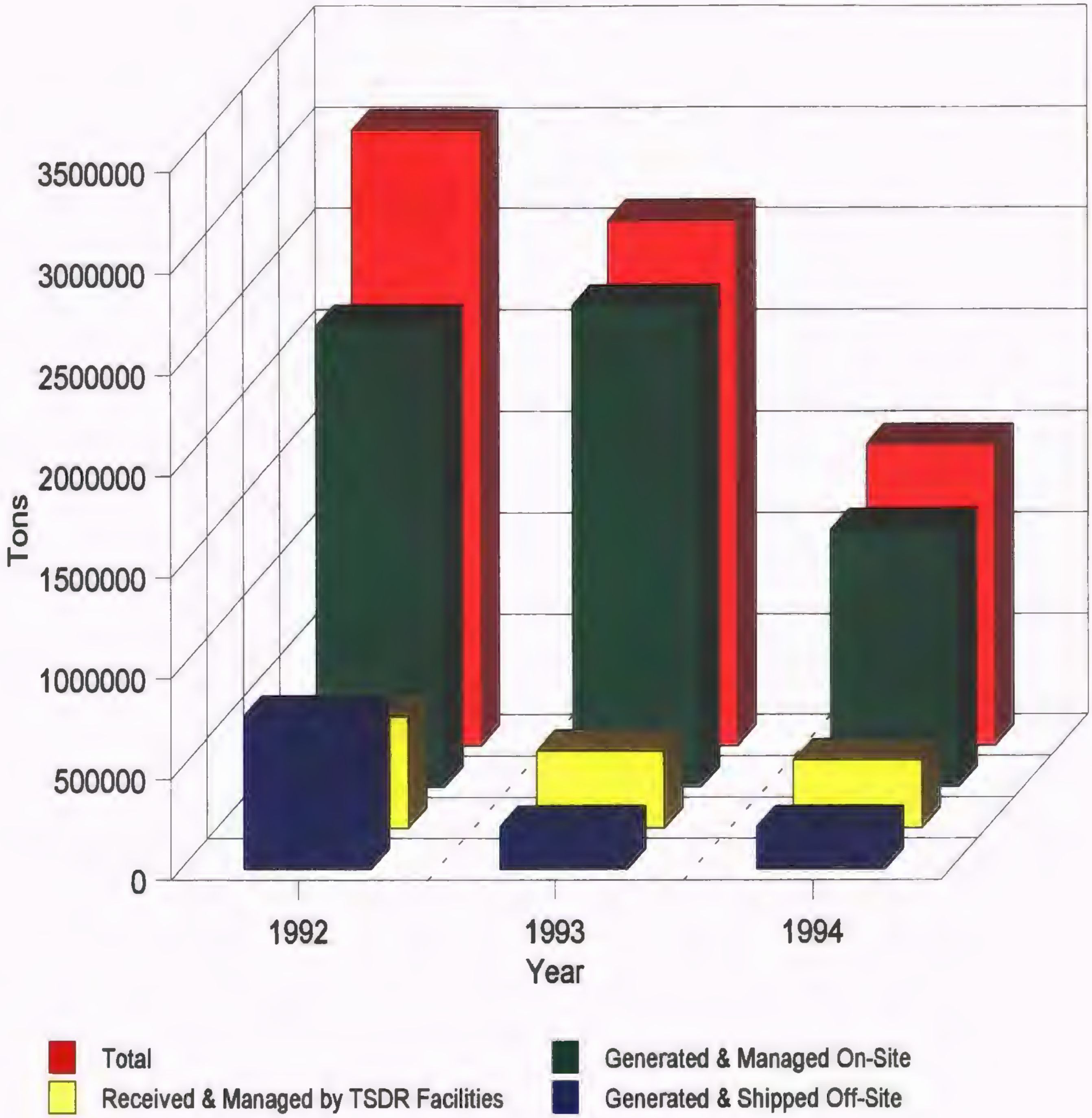


Figure 3-66. Hazardous Wastes Generated and Managed by Cook County, IL, in Tons, 1992-1994.

Source: IEPA, 1994.

Table 3-77. Largest Hazardous Waste Generators in Lake County, IN, in 1993

Rank	Wastes Generated in Tons/Year	Cumulative Percent	Facility Name
1	353,138	80.90%	Amoco Oil Co. - Lakefront
2	70,535	97.00%	LTV Steel Company
3	2,463	97.60%	U.S. Steel - Gary Works
4	1,684	98.00%	Mason Corporation
5	1,534	98.30%	Keil Chemical Divison/Ferro Corp.
6	948	98.60%	Inland Steel Company
7	653	98.70%	Citgo Petroleum Corp.
8	632	98.90%	AMG Resources Corporation
9	522	99.00%	Avery Dennison
10	503	99.10%	Marathon Pipeline Company

Source: BRS, 1997, RCRIS, 1997.

Table 3-78. Largest Hazardous Waste Management Facilities in Lake County, IN, in 1993

Rank	Wastes Managed in Tons/Year	Cumulative Percent	Facility Name
1	352,712	77.40%	Amoco Oil Co. - Lakefront
2	65,571	91.70%	Safety-Kleen Oil Recovery Co.
3	18,354	95.80%	Pollution Control Industries
4	14,615	99.00%	Rhone-Poulenc Basic Chemicals
5	4,321	99.90 %	Mason Corporation

Source. BRS, 1997; RCRIS, 1997.

3.5.2 Small Quantity Generators of Hazardous Wastes in Lake County, IN

Based on information obtained from IDEM, 133 small quantity generators of hazardous waste were located in Lake County, IN, in 1996 (Weddle, 1997). Collectively, these facilities generated about 56,062 gallons of hazardous wastes in 1996 (Table 3-79). In general, these SQGs were manufacturers, automobile repair shops, schools, and other facilities. Examination of the geographic locations of the SQGs indicates that much of the wastes were generated in Hammond (13,597 gallons or 24 percent of the total), Gary (13,068 gallons or 23 percent), and Merrillville (6,562 gallons or 12 percent) in 1996. Table 3-80 summarizes the volume of hazardous wastes generated by SQGs by city in Lake County, IN. Figure 3-67 shows that the 56,062 gallons of wastes generated in 1996 are about 40 percent lower than in previous years (1994 - 90,755 gallons; 1995 - 96,621 gallons). Figure 3-68 indicates that ZIP Code 46320 generated 10,926 gallons in 1996 (20 percent of the total) and 46402 generated 7,754 gallons (14 percent). From data provided by IDEM, it was possible to characterize the type of waste generated by these SQGs (Weddle, 1997). The waste codes generated by SQGs in the largest volumes (Table 3-81) included:

- D001 - ignitable liquid wastes;
- D003 - wastes that contain reactive cyanides and reactive sulfides, and are explosive;
- D039 - wastes that are toxicity characteristic for tetrachloroethylene;
- F001, F003, and F005 - wastes that contain any combination of one or more of the following spent solvents: acetone, benzene, n-butyl alcohol, carbon disulfide, carbon tetrachloride, chlorinated fluorocarbons, chlorobenzene, o-cresol, m-cresol, p-cresol, cyclohexanone, o-dichlorobenzene, 2 ethoxyethanol, ethyl acetate, ethyl benzene, ethyl ether, isobutyl alcohol, methanol, methylene chloride, methyl ethyl ketone, methyl isobutyl ketone, nitrobenzene, 2-nitropropane, pyridine, tetrachloroethylene, tolune, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2-trichloro-1,2,2-trifluorethane, trichloroethylene, trichloromonofluromethane, and/or xylene.

Table 3-79. Small Quantity Generators of Hazardous Waste in Lake County, IN (1996)

Generator Name	Quantity (Gallons)	Address	City	Zip
CERESTAR USA INC	6542	1100 INDIANAPOLIS BLVD	HAMMOND	46320
WHEELING CONSTRUCTION PRODUCTS	4306	2ND & MISSISSIPPI ST	GARY	46402
ART HILL INC LINCOLN MERC	2482	1019 W LINCOLN HWY	MERRILLVILLE	46420
LAKEHEAD PIPE LINE GT TERM	1800	1500 W MAIN ST	GRIFFITH	46319
HADADY CORP	1729	1832 LAKE ST	DYER	46311
SCHNEIDER NATIONAL	1164	7101 W 17TH AVE	GARY	46406
MUNSTER STEEL CO INC	1045	9505 CALUMET AVE	MUNSTER	46321
ELGIN JOLIET & EASTERN RWY CO	979	ONE N BUCHANAN ST	GARY	46402
HOWARD PUBLISHING CO	962	601 45TH AVE	MUNSTER	46321
INDIANA HARBOR BELT RAILROAD	957	2721 161ST ST	HAMMOND	46325
INDUSTRIAL ENGINE SERVICE INC	944	9900 EXPRESS DR	HIGHLAND	46322
NIPSCO GAS MEASUREMENT DEPT HQ	825	3311 E 15TH AVE	GARY	46402
MINNOTTE CROWN POINT CORP	825	1301 N INDIANA	CROWN POINT	46307
ROLL CENTER INC	809	218 MISSISSIPPI ST	GARY	46402
ST MARY MEDICAL CTR	771	1500 S LAKE PARK AVE	HOBART	46342
HOBART PUBLIC WORKS DEPT	708	340 S SHELBY	HOBART	46342
M&S CUSTOM SHOP INC	700	2233 RTE 41	SCHERERVILLE	46375
AMERICAN STEEL FOUNDRIES	660	3761 CANAL ST	EAST CHICAGO	46312
LEVER BROTHERS COMPANY	630	1200 CALUMET AVE	HAMMOND	46320
HARSCO CORP HECKETT PLT NO 11	630	PLT 2 INLAND STEEL	EAST CHICAGO	46312
WEBB FORD INC	589	9809 INDIANAPOLIS BLVD	HIGHLAND	46322
G&N AIRCRAFT INC	585	1701 E MAIN ST	GRIFFITH	46319
SCHEPEL BUICK INC	582	3209 W LINCOLN HWY	MERRILLVILLE	46410
PEPSI COLA GENERAL BOTTLERS	581	9300 S CALUMET	MUNSTER	46321
DIETRICH INDUSTRIES INC	578	1435 165TH	HAMMOND	46320
STRILLICH TECHNOLOGIES INC	573	1011 SUMMIT ST	CROWN POINT	46307
HILL ART FORD INC	567	901 W LINCOLN HWY	MERRILLVILLE	46410
EAST CHICAGO MACH TOOL BALEMASTER DIV	565	980 CROWN CT	CROWN POINT	46307
KOCH MINERALS INC	557	1 N BUCHANAN	GARY	46401

Table 3-79. Small Quantity Generators of Hazardous Waste in Lake County, IN (1996) (continued)

Generator Name	Quantity (Gallons)	Address	City	Zip
ACUTUS INDUSTRIES INC	554	2ND & MISSISSIPPI AVE	GARY	46402
HOFFMAN COLLISION CTR	540	9429 INDIANAPOLIS BLVD	HIGHLAND	46322
ASHLAND PRODUCTS INC	536	790 W COMMERCIAL AVE, TENNANT A	LOWELL	46356
HEURING PAUL MOTOR	536	US HWY 6 & 51	HOBART	46342
SHAVER MOTORS	522	1550 E 61ST	MERRILLVILLE	46410
PRAXAIR INC	520	4400 KENNEDY AVE	EAST CHICAGO	46312
SMITH MOTORS INC	515	6405 INDIANAPOLIS BLVD	HAMMOND	46320
HOFFMAN AUTO BODY	513	9905 W 109TH AVE	CEDAR LAKE	46303
O K CHAMPION	495	4714 SHEFFIELD	HAMMOND	46325
SUN ENGINEERING INC	474	950 MARQUETTE	LAKE STATION	46405
GARY PUBLIC TRANS	446	2101 W 35TH AVE	GARY	46408
SITE SERVICES INC	440	9948 A EXPRESS DR	HIGHLAND	46322
SHERWIN-WILLIAMS COMPANY THE	440	7930 NEVADA ST	HAMMOND	46323
BOSAK MOTOR SALES INC	392	3111 W LINCOLN HWY US 30 W	MERRILLVILLE	46410
MIDWEST PIPE COATING INC	385	925 KENNEDY AVE	SCHERERVILLE	46375
CLASSIC OLDSMOBILE INC	384	6501 BROADWAY	MERRILLVILLE	46410
HARSCO CORP HECKETT PLT NO 7	381	WEST END SLAG DUMP	EAST CHICAGO	46312
VIKING ENGINEERING INC	379	2300 MICHIGAN ST	HAMMOND	46320
PATTEN TRACTOR	371	6400 INDIANAPOLIS BLVD	HAMMOND	46320
TECOM	350	1305 W 11TH AVE	GARY	46401
IMPERIAL WALLCOVERINGS INC	349	724 HOFFMAN ST	HAMMOND	46320
REPUBLIC ENGINEERED STEELS INC	343	4000 E 7TH AVE	GARY	46403
AMERICAN STEEL FOUNDRIES	338	4831 HOHMAN AVE	HAMMOND	46327
OGDEN ENGINEERING CORP	335	372 W DIVISION ST	SCHERERVILLE	46375
PAUL SUR PONTIAC	330	6300 BROADWAY	MERRILLVILLE	46410
INDUSTRIAL STEEL CONST INC	326	86 N BRIDGE ST	GARY	46404
CIRCLE OLDSMOBILE INC	301	1300 US 41	SCHERERVILLE	46375
KERR NIELSEN BUICK INC	290	7301 E MELTON RD	GARY	46403
ST MARGARET HOSPITAL	285	5454 HOHMAN AVE	HAMMOND	46320

Table 3-79. Small Quantity Generators of Hazardous Waste in Lake County, IN (1996) (continued)

Generator Name	Quantity (Gallons)	Address	City	Zip
TENNECO PACKAGING INC	281	300 W MAIN	GRIFFITH	46319
SCHEFFER INC	280	1565 E 91ST AVE	MERRILLVILLE	46410
TRANSPORTATION SUPPORT GROUP	280	5818 COLUMBIA AVE	HAMMOND	46320
TERRY SHAVER PONTIAC	271	2121 45TH AVE	HIGHLAND	46322
INDIANA UNIVERSITY NORTHWEST	257	3400 BROADWAY	GARY	46408
TRUCK CITY OF GARY INC	253	7360 W CHICAGO AVE	GARY	46406
REPUBLIC ENGINEERED STEELS INC	253	2800 E DUNES HWY	GARY	46403
DISCOUNT TRANSMISSIONS INC	241	3615 CENTRAL AVE	LAKE STATION	46405
BEARING HEADQUARTERS	227	6544 OSBURNE	HAMMOND	46327
CON WAY CENTRAL EXPRESS	225	201 BLAINE ST	GARY	46406
CARESTONE INC	223	1646 SUMMER ST	HAMMOND	46320
ALLSTATE ENVIRONMENTAL INC	222	1910 W 9TH AVE	GARY	46404
T&M EQUIPMENT CO INC	211	2880 E 83RD PL	MERRILLVILLE	46410
FURNACE SERVICES INC	206	3550 CALUMET AVE	HAMMOND	46320
METAL MFG	203	3232 CALUMET AVE	HAMMOND	46320
OLSEN CADILLAC	201	2929 W LINCOLN HWY	MERRILLVILLE	46410
FJM AUTO SALES INC	200	3900 E 37TH AVE	HOBART	46342
HIGHLAND HYDRAULICS INC	191	9939 EXPRESS DR	HIGHLAND	46322
BLASKOVICH TOM CHEVROLET INC	190	425 W CHICAGO AVE	EAST CHICAGO	46312
G&J AUTO BODY	188	2943 JEWETT ST	HIGHLAND	46322
SOUTHEND BODY SHOP	180	3643 E 82ND CT	MERRILLVILLE	46410
PERFECTION AUTO RESTORATION INC	180	RR 2 550 N 625 W	HOBART	46342
CROWN POINT CLEANERS	177	600 N MAIN ST	CROWN POINT	46307
CUMMINS MID-STATES POWER INC	175	1440 TEXAS ST	GARY	46402
GOODYEAR AUTO SVC CTR	172	3515 GRANT ST	GARY	46408
SISU SERVICES	165	1710 E MAIN ST	GRIFFITH	46319
VC TANK LINES INC	165	1020 KENNEDY AVE	SCHERERVILLE	46375
VISTA CHEMICAL CO	165	2204 MICHIGAN ST	HAMMOND	46320
IMCO IND MACHINE CORP	160	1201 MERRILLVILLE RD	CROWN POINT	46307

Table 3-79. Small Quantity Generators of Hazardous Waste in Lake County, IN (1996) (continued)

Generator Name	Quantity (Gallons)	Address	City	Zip
ROUSE WELDING & BODY CO INC	156	24031 LAVERNE DR, PO BOX 158	SCHNEIDER	46376
TYSON LINC MERC INC	148	2440 45TH AVE	HIGHLAND	46322
TYSON FORD	134	3333 GRANT ST	GARY	46410
FIELD TECHNOLOGIES	134	9956 EXPRESS DR	HIGHLAND	46322
SHARPS GRIFFITH AUTO ELECTRIC	132	503 E MAIN ST	GRIFFITH	46319
BEARINGS & DRIVE SYSTEMS INC	127	5009 CALUMET AVE	HAMMOND	46320
WHITECO METROCOM INC	110	1770 W 41ST AVE	GARY	46408
LISS BODY & PAINT SHOP INC	110	1020 E SUMMIT ST	CROWN POINT	46307
IVY TECH STATE COLLEGE	108	410 E COLUMBUS DR	EAST CHICAGO	46312
KENNIGERS AUTO BODY SHOP	108	3385 GEORGIA ST	GARY	46409
BRUGOS AUTOMOTIVE INC	107	401 W 73RD AVE	MERRILLVILLE	46410
US GYPSUM CO	105	3501 CANAL ST	EAST CHICAGO	46312
UNITED CONSUMERS CLUB	101	8450 S BROADWAY	MERRILLVILLE	46420
ISAKSON MOTOR SALES	94	55 CENTER ST	HOBART	46342
METRO METALS CORP E CHIC	90	4407 RAILROAD AVE	EAST CHICAGO	46312
THOMAS DODGE OF HIGHLAND INC	87	9604 INDIANAPOLIS BLVD	HIGHLAND	46322
AD CRAFT PRINTERS INC	85	3201 E 83RD PL	MERRILLVILLE	46411
WHITING HIGH SCHOOL	81	1751 OLIVER ST	WHITING	46394
HAMMOND LEAD PROD HALSTAB DIV	80	3100 MICHIGAN ST	HAMMOND	46323
HYDRAULIC COMPONENT SVC INC	76	8010 NEW JERSEY AVE	HAMMOND	46323
DUPONT E I NEMOURS & COMPANY	70	5215 KENNEDY AVE	EAST CHICAGO	46312
CHRISTENSON CHEVROLET INC	62	9700 INDIANAPOLIS BLVD	HIGHLAND	46322
POZZO MACK SALES & SERVICE	61	3001 E 15TH ST PL	GARY	46401
AMOCO ACA MGMT SVCS	60	171 US RT 41	SCHERERVILLE	46375
US GENERAL SVCS ADM	56	257-259 DOUGLAS AVE	HAMMOND	46320
HERALD NEWS GROUP	55	3161 E 84TH PL	MERRILLVILLE	46410
MOBIL OIL CORP 13070 HAMMOND TERMINAL	55	1527 141ST ST	HAMMOND	46327
METHODIST HOSPITAL	54	600 GRANT ST	GARY	46402
MARBLEHEAD LIME CO	52	N CLARK RD & LAKE MICHIGAN	GARY	46402

Table 3-79. Small Quantity Generators of Hazardous Waste in Lake County, IN (1996) (continued)

Generator Name	Quantity (Gallons)	Address	City	Zip
BOB ANDERSON PONTIAC INC	50	1510 N MAIN ST	CROWN POINT	46307
CARROLL CHEVROLET INC	45	1800 N MAIN ST	CROWN POINT	46307
HARDINGS INC	40	109 W COMMERCIAL	LOWELL	46356
AMOCO 19752	39	3550 169TH ST	HAMMOND	46323
RELIANCE ELECTRIC-HIGHLAND	35	2707 GARFIELD AVE	HIGHLAND	46322
PRIMET CO INC	34	7917 NEW JERSEY AVE	HAMMOND	46323
SOUTHLAKE NISSAN INC	32	4201 LINCOLN HWY	MERRILLVILLE	46410
GRE INC DBA WAYNES	32	4010 W 4TH AVE	GARY	46406
HIGHLAND SENIOR HIGH SCHOOL	30	9135 ERIE ST	HIGHLAND	46322
AMOCO ACA MGMT SVCS	30	747 RIDGE RD	MUNSTER	46312
AMOCO ACA MGMT SVCS	30	6450 CALUMET AVE	HAMMOND	43624
MACK MANN BUSS WORKS INC	27	9122 LOUISIANA ST	MERRILLVILLE	46410
PERSONAL TOUCH CLEANERS	24	5664 HARRISON ST	MERRILLVILLE	46410
FIRESTONE	17	489 FAYETTE ST	HAMMOND	46320
AVERY GRAPHICS DIV	16	23326 SHELBY RD	SHELBY	46377
TOLLEY FRANK'S AUTO SER INC	15	1020 E SUMMIT ST- B	CROWN POINT	46307
NIPSCO CONSTRUCTION DEPT HQ	11	2911 E 10TH ST	GARY	46403
Total Generated by 133 SQGs	**56062**			

Source Weddle, 1997

Table 3-80. Total Quantity of Waste Generated by Small Quantity Generators in Lake County, IN by City and by Year

City	Waste Generated (Gallons)		
	1994	1995	1996
HAMMOND	51,196	15,970	13,697
GARY	12,234	32,299	13,068
MERRILLVILLE	7,265	5,582	6,562
HIGHLAND	4,565	5,136	3,659
GRIFFITH	1,450	15,969	2,963
EAST CHICAGO	5,025	5,914	2,754
MUNSTER	1,175	3,231	2,618
CROWN POINT	2,279	2,163	2,520
HOBART	1,752	3,177	2,489
SCHERERVILLE	1,530	3,796	1,946
DYER	17	417	1,729
LAKE STATION	590	853	715
LOWELL	297	1,146	576
CEDAR LAKE	362	206	513
SCHNEIDER	0	191	156
WHITING	35	461	81
SHELBY	0	0	16
ST JOHN	108	0	0
MILLER	0	110	0
SHERERVILLE	275	0	0
BURNS HARBOR	600	0	0
Total	**90,755**	**96,621**	**56,062**

Source: Weddle, 1997.

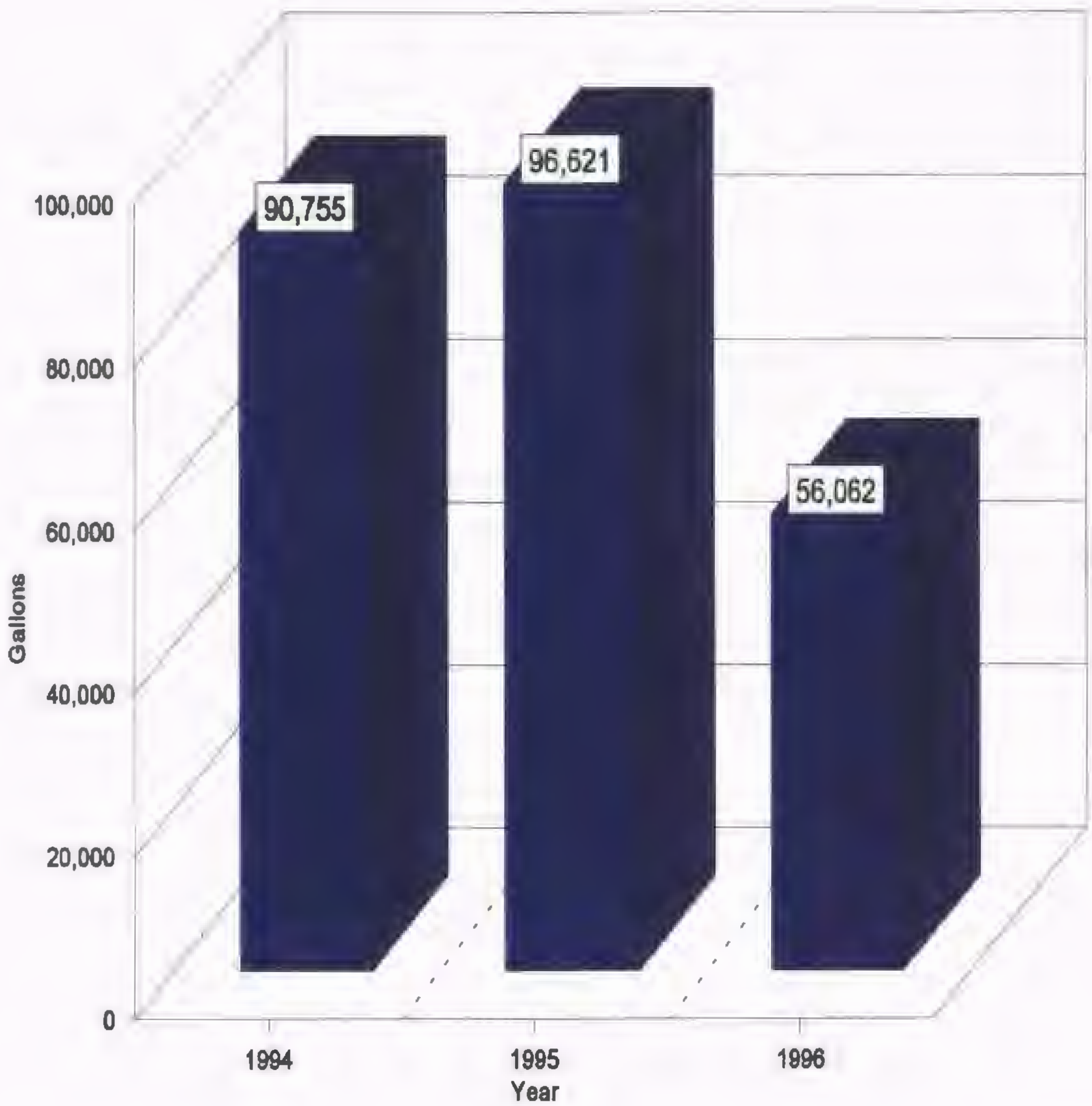


Figure 3-67. Trends of Hazardous Waste Generated by Small Quantity Generators in Lake County, IN, for 1994-96

Source: Weddle, 1997.

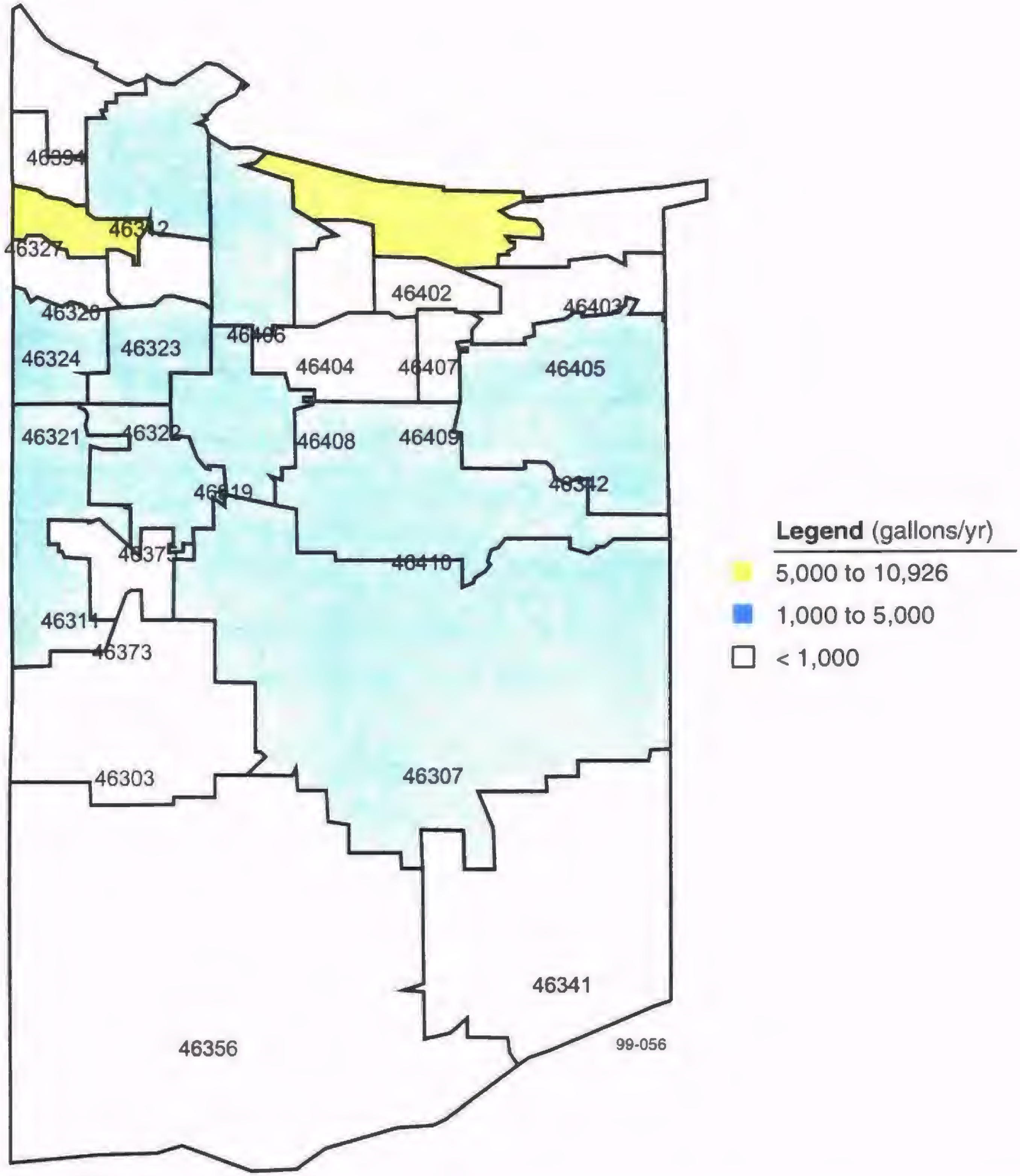


Figure 3-68. Quantity of Hazardous Waste Generated by Small-Quantity Generators in Lake County, IN,in 1996 (by Zip Code)

Source: Weddle, 1997

Table 3-81. Types of Wastes Generated in 1996 by Small Quantity Generators in Lake County, IN

Waste Codes	Waste Generated in 1996 (Gallons)
D001	18,559
F003	6,759
D039	6,314
F001	5,378
D003	5,205
F005	4,752
D018	2,250
D007	1,630
D002	1,355
D009	701
F002	658
D035	330
D006	255
D008	188
D011	115
U002	55
P012	55
F006	48
U121	30
D022	30
D038	30
D010	15
U122	15
P108	5
P106	5
P098	5
P087	5
D004	0
F008	0
D059	0
Identified Waste Codes	54,747
Other Not Specified	1,315
Total	**56,062**

Source: Weddle, 1997

3.6 CERCLIS SITES

> **CERCLIS Sites**
>
> - 608 CERCLIS Sites in Cook County, IL, and Lake County, IN
> - CERCLIS Does Not Contain Environmental Loadings Data
> - 1 NPL (Superfund) Site in Cook County, IL
> - 6 NPL (Superfund) Sites in Lake County, IN

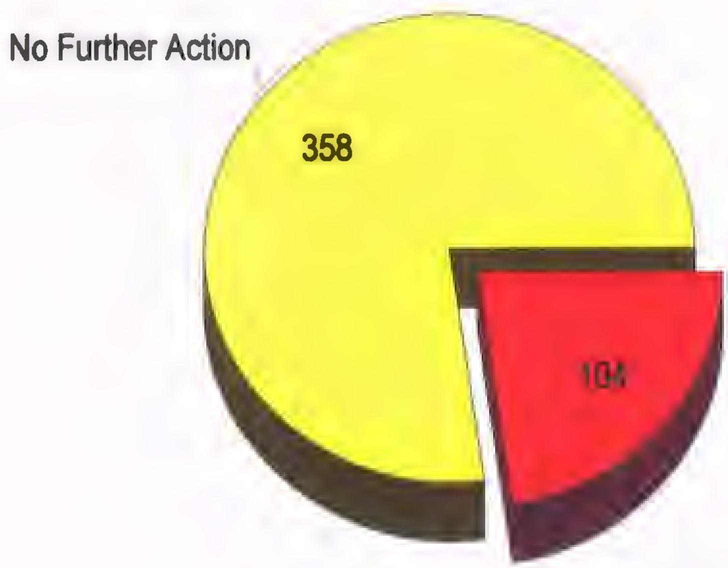
The CERCLA Information System (CERCLIS) is a data base used by EPA to track sites where hazardous substance releases may have occurred. In general, they are sites that may require evaluation or cleanup by the Superfund program. These sites are investigated to determine what further actions (if any) are necessary to protect human health and the environment. Sites may be "scored," using the Hazard Ranking System (HRS), to evaluate its potential risks to human health and the environment and to determine if it should be placed on the National Priorities List (NPL) or "Superfund" List. The CERCLIS information does not contain data on the extent and magnitude of releases from these sties. Therefore, evaluation of CERCLIS does not directly pertain to loadings to the environment. However, HRS scoring information may be available that can indicate the potential risks from such sites. EPA adopted HRS to assess the relative threat associated with actual or potential releases of hazardous substances at sites. Using HRS, a site is evaluated based on four contaminant migration pathways: (1) groundwater; (2) suface water (threats to drinking water, human food sources, and the environment); (3) soil exposure (threats to resident and nearby populations); and (4) air. Three major factors are used to evaluate each pathway: (1) likelihood of release; (2) waste characteristics (toxicity and quantity); and (3) receptor targets (human and ecological components). Based on this scoring, a site may be nominated by EPA for inclusion on the NPL. As such, the HRS score may be a rough indicator of the site's potential impact to human health. (See Sections 4.5 and 4.6 for HRS scores for some of these sites, as well as soil and groundwater data).

Cook County, IL, has 462 CERCLIS sites, and Lake County, IN, has 146 CERCLIS sites. Summaries, presented below, describe the regulatory status of these sites (e.g., whether they are listed on the NPL or no further remedial action planned [NFRAP]), as well as their locations.

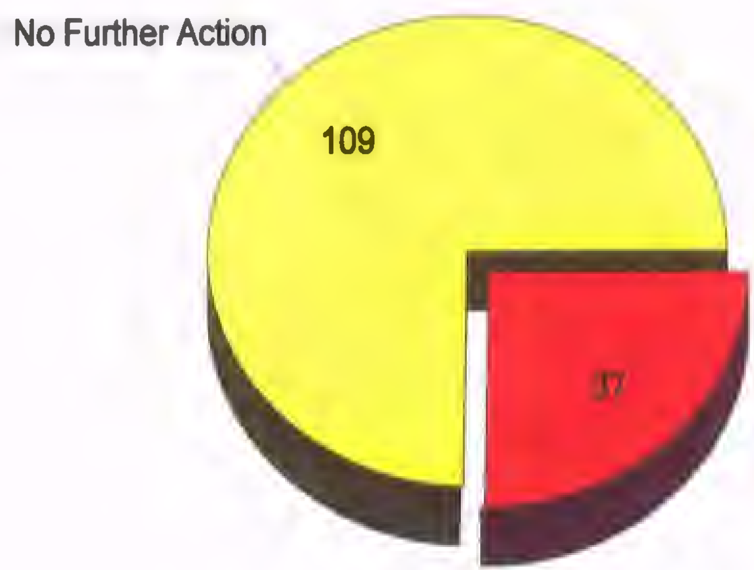
Figure 3-69 displays information on the total number of CERCLIS sites in each county, as well as the number that have been NFRAPed.

Of the 462 CERCLIS sites in Cook County, IL, only 1 site is on the NPL (Lenz Oil); 358 sites have no further action planned, and 1 site was proposed but removed from the NPL. The Lenz Oil site is located in Lemont, IL, in ZIP Code 60439. The cities in Cook County, IL, with the largest number of CERCLIS sites include: Chicago with 211 sites (157 of which are NFRAP), Chicago Heights (23 sites), Elk Grove Village (12 sites), Lemont (12 sites), and Melrose Park (11 sites). The ZIP Codes in Cook County, IL, with the most CERCLIS sites include 60411 (31 sites), 60608 (16 sites), 60622 (16 sites), 60628 (15 sites), 60007 (14 sites), and 60525 (13 sites).

Of the 146 CERCLIS sites in Lake County, IN, 6 are on the NPL, 1 is on the proposed NPL, and 109 have no further remedial action planned. The five NPL sites and the one proposed site are summarized on Table 3-82. Four NPL sites are located in Gary and the fifth is in Griffith. The cities in Lake County, IN, with the largest number of CERCLIS sites include Gary (57 sites), Hammond (41 sites), and East Chicago (21 sites).



462 CERCLIS Sites in Cook County, IL



146 CERCLIS Sites in Lake County, IN

Figure 3-69. Number of CERCLIS Sites in Cook County, IL, and Lake County, IN.

Table 3-82. NPL Sites in Lake County, IN

Site	Nature of Contamination/Pollutants
Ninth Avenue Dump (NPL Site)	Liquid hazardous waste (VOCs, benzene, toluene, xylenes, PAHs, metals, PCBs).
Midwest Industrial Waste Disposal Company (MIDCO) II (NPL Site)	Bulk liquid and drum storage of waste (estimated 50,000 to 60,000 drums).
Midwest Solvent Recovery Company (MIDCO) I (NPL Site)	Estimated 14,000 drums of solvent, pesticide, and PCB wastes.
Lake Sandy Jo (M&M Landfill)	Landfill for construction, municipal, industrial wastes, and drums. Contamination included heavy metals, solvents, PCBs, and pesticides.
American Chemical Service Inc. (NPL Site)	Solvent - reclamation and chemical manufacturing facility. Groundwater contaminated with VOCs, PCBs and phthalates and 35,000 buried drums of sludges and underground wastes.
U.S. Smelter and Lead Refinery, Inc.	Proposed for NPL. Blast furnace slag. Lead containing dust and various metals.

Source: CERCLIS, 1997.

4.0 Environmental Levels

4.0 ENVIRONMENTAL LEVELS

This section describes environmental levels of contaminants in air, water, drinking water, soil, and other media in Cook County, IL, and Lake County, IN. This information is included not only as an indicator of environmental condition, but also because risks to human health may result from exposures to contaminated media. Risks can be the results of exposure to contaminants in foods we eat, the water we drink, the air we breathe, and materials we touch (chemicals in the soil and in our lakes and rivers). We can also be exposed to pollutants at our places of work and in our homes from products that we buy and use. Some of these risks may result from not knowing that adverse health problems may be caused by exposure to these items

Environmental Levels

- Ambient Air
- Surface Water
- Sediments
- Fish Tissue
- Soils
- Groundwater
- Drinking Water
- Human Exposure Biomarkers
- Indoor Air

When exposed to chemicals or pollutants at levels that are too high, or for long periods of time, our health may be affected in various ways. We may be affected for short periods of time (e.g , itchy eyes, skin rashes, and difficulty in breathing), or we may be affected for a longer period of time with health problems such as cancer, emphysema, and kidney or liver disorders. Sometimes these exposures can aggravate existing health problems (e g., air pollutants may aggravate respiratory problems such as asthma).

The three major routes by which a person may be exposed to chemicals are:

1 Inhalation (breathing in pollutants from the air),
2 Ingestion (eating or drinking contaminated foods and water); and
3 Dermal contact (pollutants contacting the surface of the skin)

Figure 4-1 presents examples of how human exposure may occur through the three exposure routes. It should be noted that the Figure does not provide an exhaustive treatment of all exposure examples that could be mentioned. To do so, is beyond the scope of this report. It does, however, provide some typical examples of how an individual may be exposed to chemicals/pollutants.

Human exposures to chemicals are affected by many factors; the presence of sources of pollution is not the sole determinator that impacts to human health will occur. While current and historical sources of pollution to the environment are indicators of the potential for exposure, ambient levels of pollutants in soil, air, water, and other media are determining factors. Furthermore, the frequency, duration, and magnitude of exposures to these media are major influences on the likelihood of adverse effects to human health (ATSDR, 1992a). Figure 4-2 presents a simplified conceptual model of the relationships among sources, environmental levels, and human exposures.

- **Sources** - Factors related to sources of pollution and loadings to the environment include the type and amount of chemicals released and geographic location of the sources. Once released into the environment, chemicals are subject to physical and chemical processes that may carry them away from people, change their form, affect their concentrations, and determine where they eventually reside. For instance, many pollutants discharged to rivers, streams, and lakes will not be found in the water; rather, chemicals may escape to the air or could be deposited in sediments and taken up by fish.

- **Environmental Levels** - Measuring environmental levels in different media is critical in determining the potential for human exposure and resulting risks to human health from air, water, sediments, drinking water, soil, and other media.

- **Human Exposures** - Factors that play roles in exposures include: the concentrations of contaminants in the media; the frequency, magnitude, and duration of exposures; and other factors. Because individuals behave differently, the resulting exposures vary, and because individuals respond differently to the same exposure, their personal risk will vary. Information is available on these "exposure factors" for the general population - such as the amount of water people drink, the amount of fish consumed each day, the amount of soil ingested by children, and many others (U.S. EPA, 1997a). This type of information can be used in conjunction with the environmental levels data presented in this section to estimate the magnitude of exposures that people may encounter.

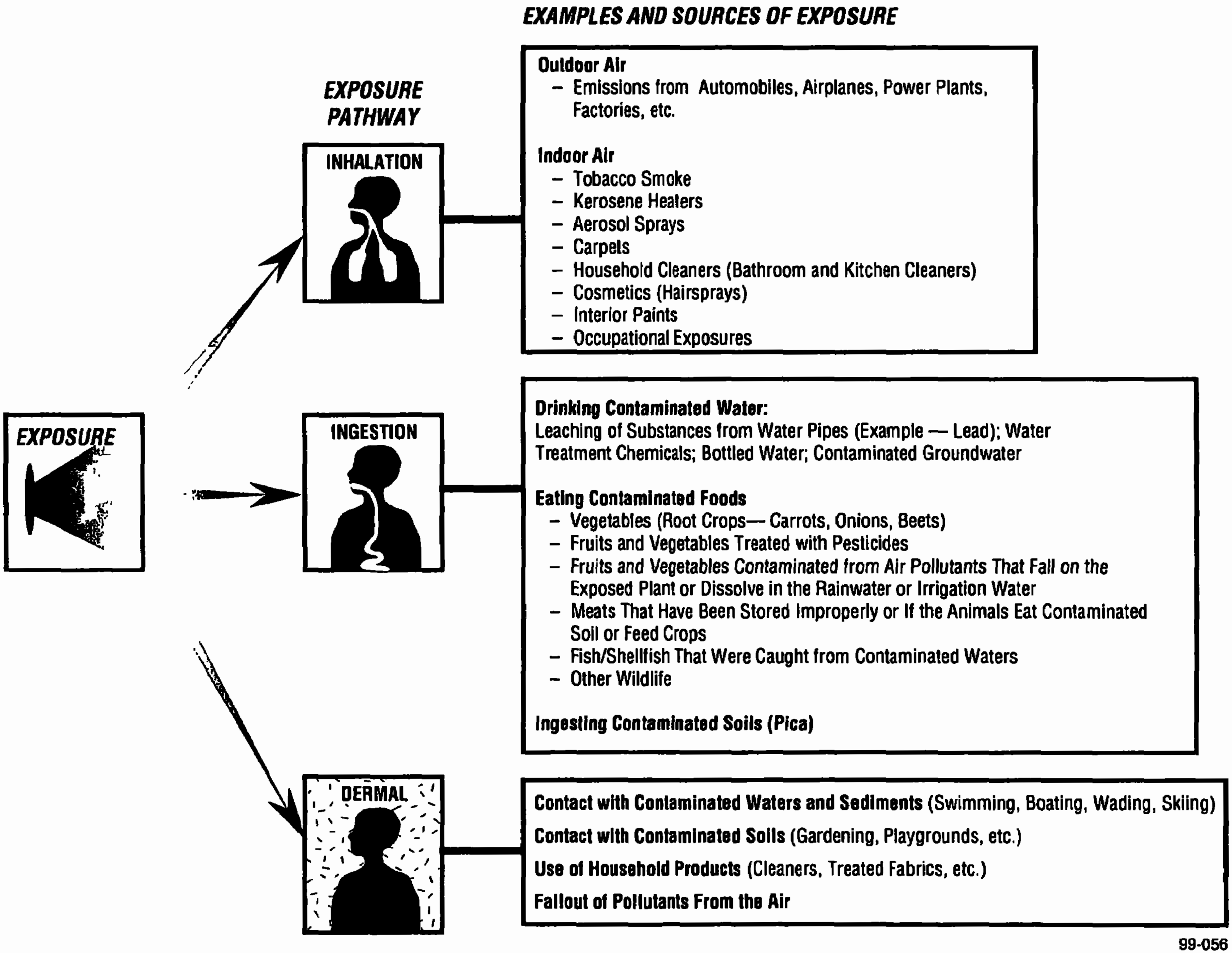


Figure 4-1. Examples Of How One May Be Exposed To Chemicals/Pollutants

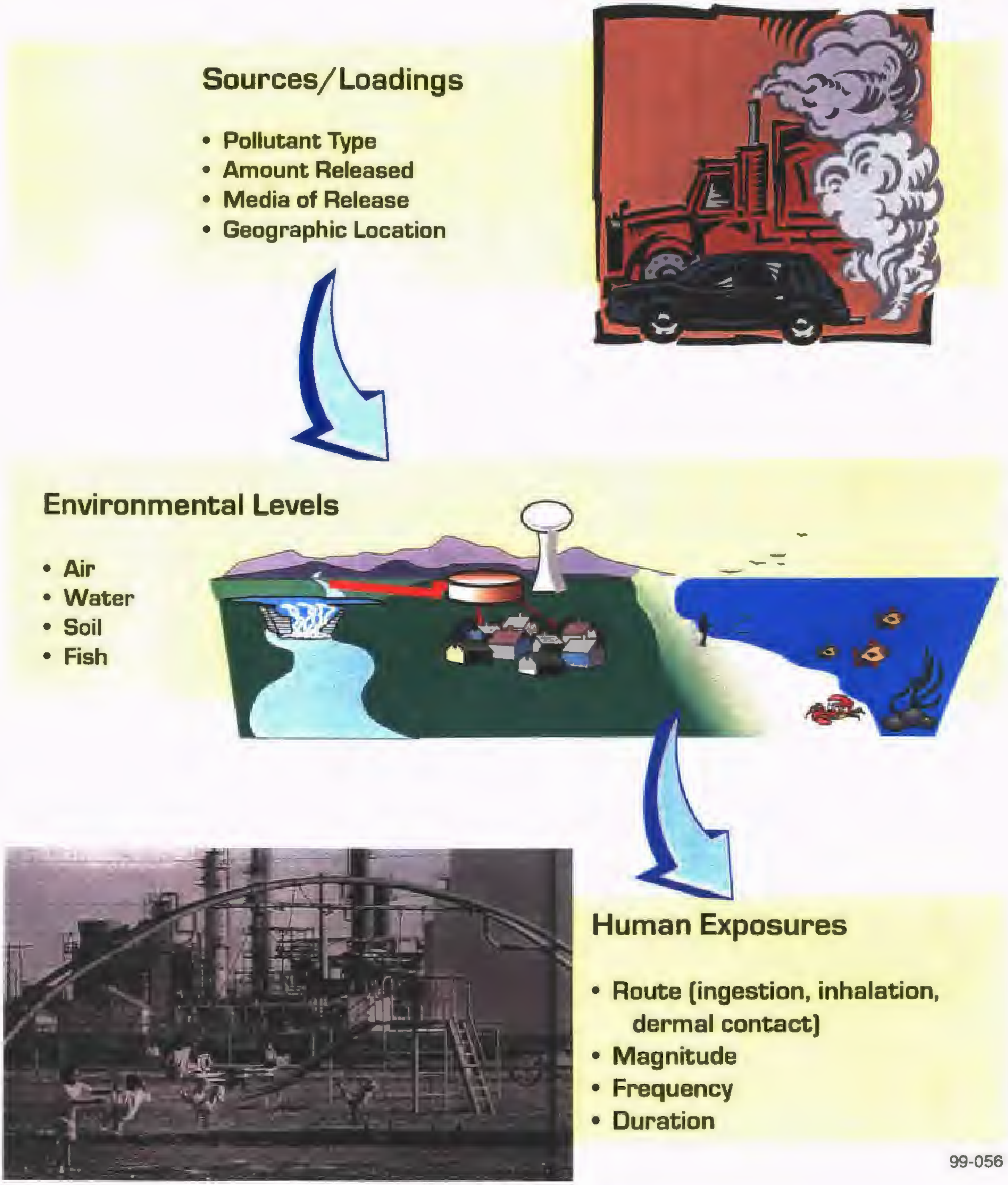


Figure 4-2. Environmental Health Paradigm — Example of Relationships Among Loadings, Environmental Levels, and Exposure

Approaches to estimate exposures and risks to populations and individuals in Cook County, IL, and Lake County, IN, will be developed under Phase III of CCRI. The data on environmental levels presented in this section will assist in these future efforts to assess risks from exposures to pollutants in air, water, drinking water, soil, and other media. It should be noted that heightened concerns exist for children because of their susceptibility and from increased exposures to contaminated soil, lead paint, and certain air pollutants that may aggravate asthma (U.S. EPA, 1996a). Information on exposure-related differences between children and adults is presented in this section, especially in the soil, drinking water, and blood-lead levels subsections.

Information presented in this section was compiled from numerous reports, data bases, and from personal communications with organizations/individuals that monitor environmental pollution in Cook County, IL, and Lake County, IN. Limitations exist because of the fragmented nature of environmental monitoring. Specifically, measurements are made by different organizations, using different methods, in different places, and at different times. Because monitoring is usually focused in particular geographic areas, it is often difficult to combine these data to assess areas at larger scales. Similarly, data gaps are evident because not all media/resources receive the same level of monitoring. For example, some ambient air measurements represent thousands of samples at a location, while certain pollutants in some waterbodies are characterized by only one measurement over a 5-year time period. As such, the quality, completeness, and geographic coverage of the data vary, making assessments difficult. However, it is possible to identify areas and resources that are impacted by pollution in the Cook County, IL, and Lake County, IN, areas.

Key Questions

- Where/When Was Monitoring Conducted?
- What Types of Contaminants Were Measured?
- What Contaminants Were Present at the Highest Levels?
- Where Were the Highest Levels of Contamination Detected?
- Are Levels Changing Over Time?

This section is organized by media. (See below.) The following subsections describe data and information on the condition of the resource, levels of pollutants detected from sampling, the location(s) where levels are highest, trends in levels over time (where available), and related information that quantifies the impact of anthropogenic activities. In general, the data used are up to date and reflect conditions over the last several years.

The focus of this section is on the pollutants that have been detected at the highest concentrations in samples from the various media. It should be noted, as in the previous sections of this report, that no consideration was given to the toxicity or the hazards associated with the chemicals detected; this section reports the concentrations of chemicals in the various media. The environmental media described in this section include:

- **Ambient Air** - Quantifies levels of criteria pollutants and toxics from air quality monitoring conducted in the study area;
- **Surface Water** - Describes the conditions of major waterbodies in the two counties and presents levels of metals, pesticides, and other toxic chemicals measured in the water column;
- **Sediments** - Presents pollutant levels detected in sediments of major waterbodies,
- **Fish Tissue** - Summarizes measured levels of pesticides, PCBs, metals, and other contaminants identified from fish tissue monitoring;
- **Soils** - Provides data on levels of chemicals found in soils in select locations in the study area,
- **Groundwater** - Describes groundwater contamination in the overall region, as well as contaminants detected at select hazardous waste sites;
- **Drinking Water** - Quantifies levels of pollutants present in drinking water supplies to residents in the study area,
- **Human Biomarkers** - Presents information on the incidence of childhood lead poisoning and discusses other lead-related studies of human health; and

- **Indoor Air** - Describes a limited number of studies that have quantified levels of chemicals found in indoor environments, as well as other studies currently underway.

4.1 AMBIENT AIR QUALITY

This section presents information on ambient air quality in Cook County, IL, and Lake County, IN. Data were collected from monitoring, which was conducted as early as 1964 for some pollutants (sulfur dioxide and carbon monoxide), and as recent as 1995 or 1996 for all criteria pollutants, volatile and semivolatile organic compounds (VOCs and SVOCs), and other pollutants. Data for particulate matter (PM) and lead were collected from as early as the late 1960s. Ozone data were located from 1974, and nitrogen dioxide data were located from 1978. For VOCs, data start from 1985.

Ambient Air Quality

- Environmental Levels of Criteria and Hazardous Air Pollutants
  - Ozone
  - Particulate Matter
  - Lead
  - Sulfur Dioxide
  - Nitrogen Dioxide
  - VOCs and SVOCs
  - PCBs, Pesticides, and Others
- Exceedances of National Ambient Air Quality Standards (NAAQS)
- Comparisons of Ambient Levels Across Geographic Areas in Cook County, IL, and Lake County, IN

Many data bases, articles, studies, journals, and reports were researched and reviewed in preparing this section. These data sources contain information related to ambient air concentrations in the City of Chicago and Cook County, IL, and to a lesser extent, data related to the City of Gary and Lake County, IN. Although the reference documents were obviously produced for different purposes and objectives, they all contain data that were extracted to characterize ambient air quality in the study area. Although the search for reference materials was thorough, an exhaustive list of all monitoring data for the study area was not feasible.

The documents that contained the most useful information concerning current data and trends are briefly introduced below. U.S. Environmental Protection Agency (EPA) (1996b) provides information regarding specific local areas including the City of Gary and Lake County, IN, and the City of Chicago and Cook County, IL. For the cities, or "Metropolitan Statistical Areas," the report provides historical data from 1986 through 1995 for the criteria pollutants. Data for other contaminants and for the counties are provided for 1994 and 1995 only. AIRS/AQS (1997) contains data from EPA's Aerometric Information Retrieval System/Air Quality Subsystem (AIRS/AQS) for monitoring stations in the two counties; the data pertain to the six EPA criteria pollutants. Data were extracted from AIRS/AQS for 1990 through 1996. The Illinois Department of Energy and Natural Resources (IDENR, 1994a) reports trends for a variety of pollutants monitored in the Chicago area from 1978 to 1990. Illinois Environmental Protection Agency (IEPA, 1996a) presents and summarizes the ambient air quality monitoring results that the State of Illinois collected for 1995. Pollutants are monitored at over 200 different locations throughout Illinois and at approximately 55 locations in Cook County alone.

Much of the data presented in this subsection are summarized in graphs and tables to facilitate comparisons of the levels detected to air quality standards. Also, these graphs and tables allow the reader to see the relative concentrations of different compounds across geographic areas. Several data sources used in preparing this subsection presented these types of comparisons. One issue associated with collecting information from a variety of sources is that the data are not presented in the same units in all of the documents. Data for solids (particulates) and several other air pollutants are reported in micrograms per cubic meter ($\mu g/m^3$), and data for gases are usually reported in parts per million (ppm) or parts per billion (ppb). The terms ppm and ppb are ways of expressing low concentrations of gases in terms of the number of parts (e.g., liters) of a pollutant in 1-million parts (e.g., 1-million liters) of air. For air monitoring, the term is usually a measurement of a volume of the pollutant to a volume of air. Therefore, these terms are sometimes expressed as ppm by volume (ppmv) or ppb by volume (ppbv). For consistency (where possible), data presented in this report were converted to micrograms per cubic meter ($\mu g/m^3$). For Federal standards, such as the NAAQS, the levels are expressed by EPA in both ppm and $\mu g/m^3$ (except for lead and particulates, which are only in $\mu g/m^3$).

Air Quality Monitoring

- Data from More Than 60 Monitoring Locations in Study Area
- Data Obtained from AIRS/AQS, State Agencies, and Literature Sources

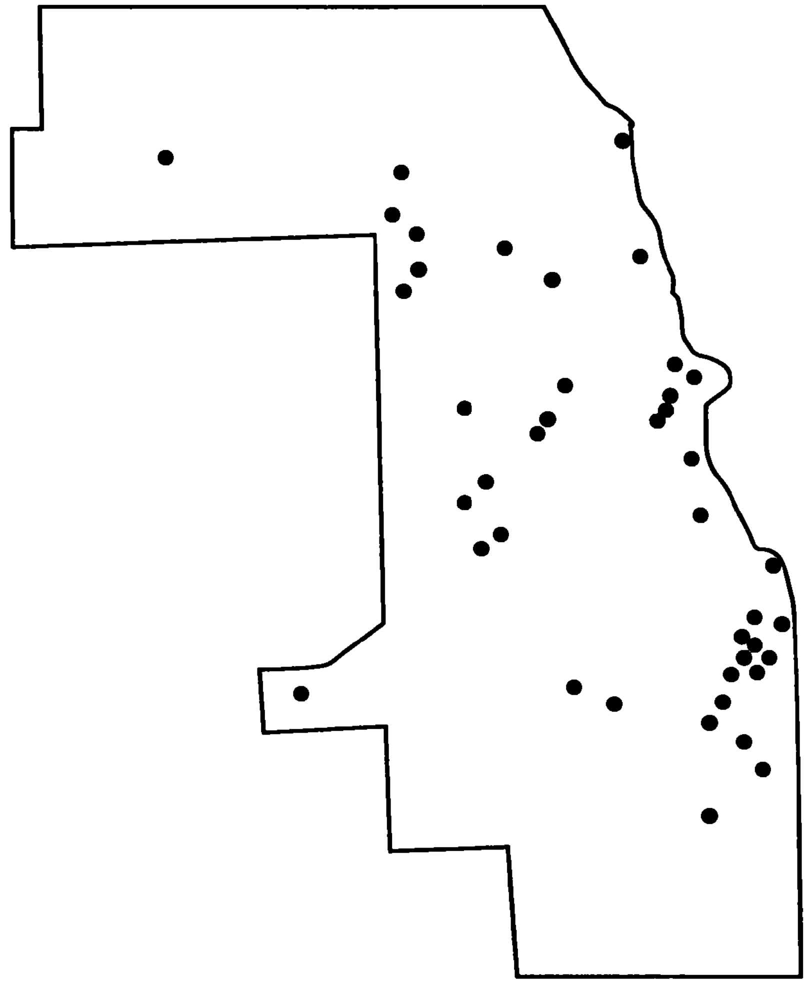
The information obtained from these and other reports represent monitoring data from approximately 55 locations throughout Cook County, IL, (of which, approximately 30 were located in the Chicago metropolitan area), and approximately 20 locations in Lake County, IN. Several documents provide data from locations that are not specifically identified in the text. That is, a report may identify a monitoring location simply as "Chicago" and not provide any additional detail on the specific portion in the city where the monitor was located. Some reports provide data from the Continuous Air Monitoring Program (CAMP) or the Photochemical Assessment Monitoring Stations (PAMS) network. Table 4-1 lists the monitoring stations and their locations as described in the reference materials. Figures 4-3 and 4-4 display the locations of air monitoring stations in Cook County and Lake County, respectively. Figure 4-5 provides more detail on an area of Southeast Chicago, where several monitoring stations are located.

This subsection discusses ambient air concentrations by pollutant: ozone, particulate matter, lead, sulfur dioxide, nitrogen dioxide, carbon monoxide, VOCs and SVOCs, and other pollutants (polychlorinated biphenyls [PCBs], pesticides, and mercury) in and around the study area. EPA designated all or part of the study area as nonattainment for ozone, particulate matter, sulfur dioxide, and/or carbon monoxide in 1996 (Table 4-2).

In general, an area is designated as nonattainment when ambient air concentrations exceed NAAQS for one or more of the EPA's criteria pollutants. A summary of the Federal NAAQS for the primary pollutants is provided in Table 4-3. As shown, both Cook County, IL, and Lake County, IN, are designated nonattainment for ozone. Historical, as well as recent, ozone levels in these counties have been as high as 332 $\mu g/m^3$ (0.166 ppm). Also, particulate matter is a problem in two portions of Cook County, IL, and the northern portion of Lake County, IN. The northern portion of Lake County, IN, also has problems meeting the standards for sulfur dioxide and carbon monoxide.

Table 4-1 Ambient Air Monitoring Locations in Cook and Lake County

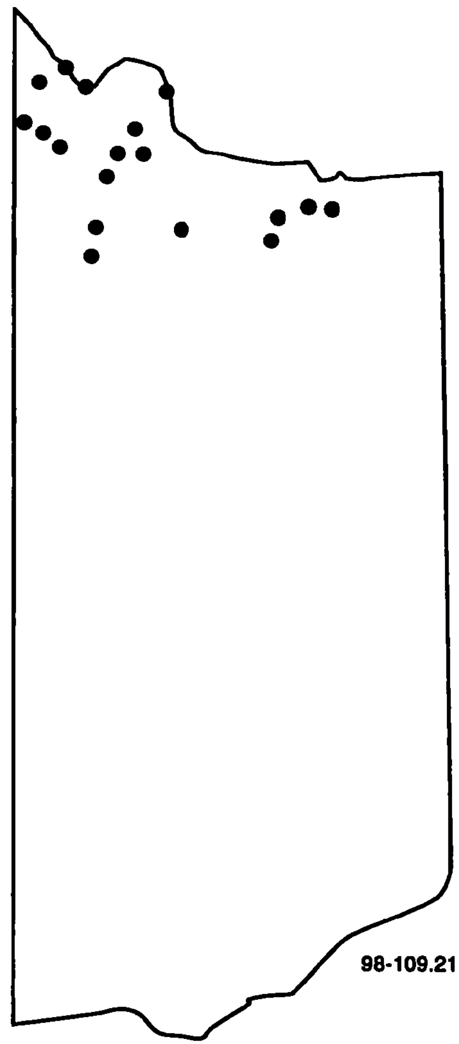
Location	Location description
Chicago sites	
Addams School	4616 2N/453 8E
Bright Elementary School	10740 S Calhoun
Chicago Area Pump Station (CAPS)	805 N Michigan Avenue
Carver High School	13100 S Doty
Cermak	735 W Harrison Street
Chicago University	5720 S Ellis Avenue
CTA Building	320 S Franklin
Edgewater	5358 N Ashland Avenue
Farr Dormitory	3300 S Michigan Avenue
Horsehead 1	2701 E 114th Street
Horsehead 2	2701 E 114th Street
IIT (central Chicago)	1 6 km from Lake Michigan Shore
Industrial site	Southeast Chicago
Inner city-3km west of Chicago's loop	20 meters above ground level
Jardine Water Plant	1000 E Ohio
Lake Michigan - Chicago	PAMS site
Lake Michigan - Chicago/Jardine	PAMS site
Marsh	9810 S Exchange
Mayfair Pump Station	4850 Wilson Avenue
R/V Laurentian	Lake Michigan (offshore of Chicago)
Southeast Chicago	several sites
Southeast Chicago	N/A
Southeast Police Station	103rd & Luella
Southeast Water Filtration Plant (SWFP)	3300 E Cheltenham
Taft High School	6545 W Hurlbut
Urban site (20hr sample)	University of Illinois at Chicago (2 km west of downtown Chicago)
Urban site (4hr sample)	University of Illinois at Chicago (2 km west of downtown Chicago)
Virgil S Grissom Elementary School	12810 South Escanaba
Washington Elementary School	3535 E 114th Street
2 Chicago sites	Jefferson Park & National Lead Plant
Chicago	UATMP site
Chicago	N/A
Chicago	near city center
Chicago	New Gary School Site
Chicago Area	Various locations
Chicago Area	CAMP network
Other sites in Cook County	
Alsip	4500 W 123rd Street
Bedford Park	7800 W 65th Street
Blue Island - Eisenhower High School	12700 Sacramento
Calumet City	1703 State Street
Cicero	1830 S 51st Avenue
Cicero - Roosevelt High School	15th St & 50th Avenue
Cook County	N/A
Des Plaines	Scott Street and Tollplaza Road
Des Plaines - Forest Elementary School	1375 5th Street
Evanston	531 E Lincoln
Hoffman Estates	1100 W Higgins Road
Lemont	729 Houston
Lyons	4043 Joliet Avenue
Lyons Township	50th St & Glencoe Avenue
Maywood	1505 S First Avenue
Maywood - Maybrook Civic Center	1500 Maybrook Drive
Schiller Park	4243 N Mannheim
South Holland	170th and S Park Avenue
Suburban background	55 km north of downtown Chicago
Summit - Graves Elementary School	60th Street and 74th Avenue
Lake County sites	
East Chicago	901 East Chicago Ave PD
East Chicago	Field school, building 92
East Chicago	Franklin school, Alder and 142nd Street
East Chicago	Inland Steel, number 7 Pumphouse
Gary	N/A
Gary	Federal Building, 6th Avenue and Conn
Gary	Ivanhoe School 15th Street
Gary	Gary Armor Plate Annex
Gary	201 Mississippi Avenue
Gary	15th Avenue and Broadway
Hammond	2345 167th Street Superior Engineering
Hammond	Purdue University Calumet City Campus - 2233 171st Street
Hammond	General Services Administration - 3200 Shefield Avenue
Hammond	2325 Summer Street
Hammond - Clark High School	1921 Davis Street, Robertsdale
Hammond	1300 141st Street
Lake County	N/A
Lake Michigan - Gary	PAMS site
Whiting	P O Box 1501 119th Street



99-056

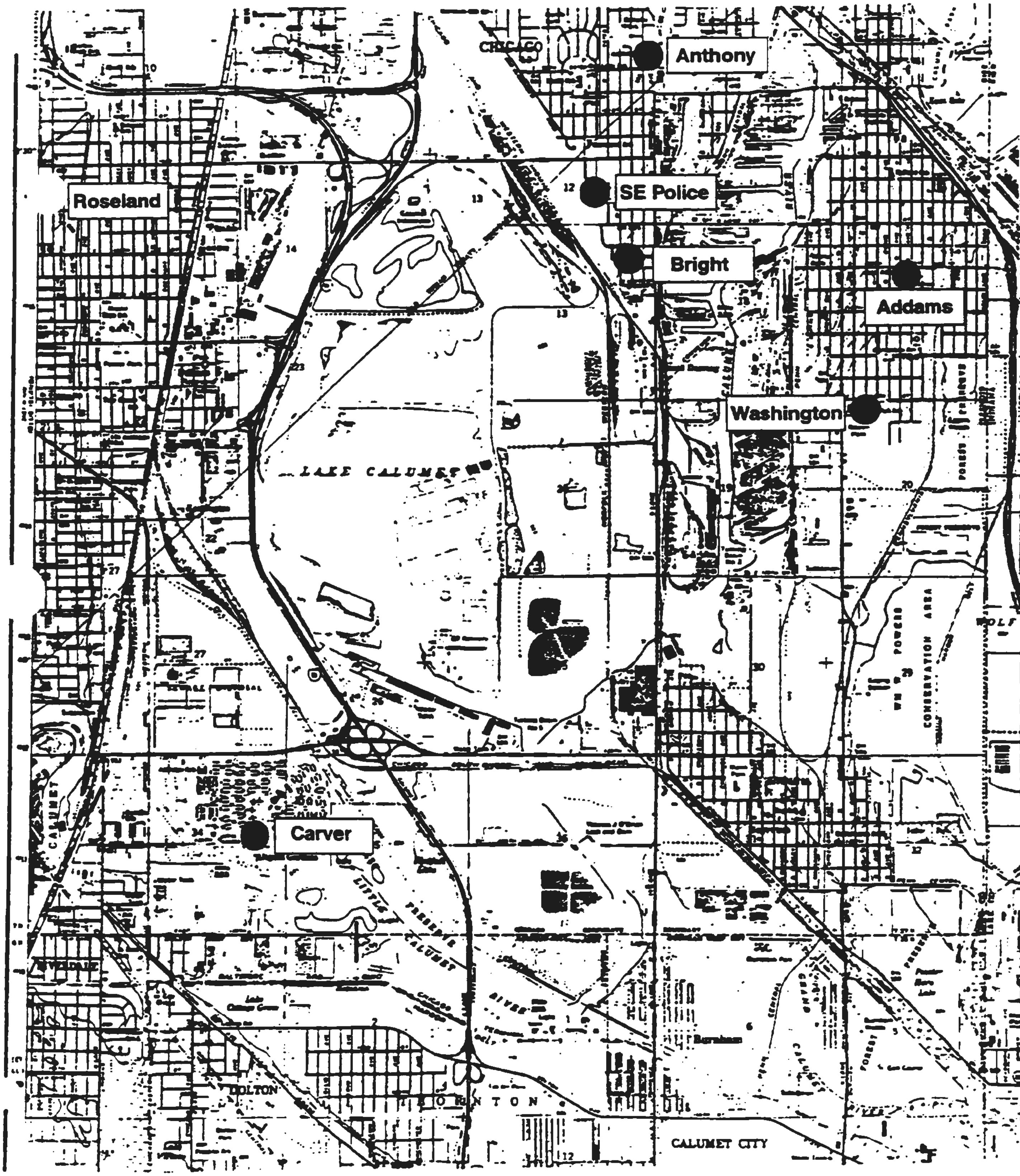
Source: AIRS/AQS, 1997

Figure 4-3. Ambient Air Quality Monitoring Stations in Cook County, IL



Source AIRS/AQS, 1997

Figure 4-4. Ambient Air Quality Monitoring Stations in Lake County, IN



Source: IEPA, 1986

Figure 4-5. Ambient Monitoring Locations in Southeast Chicago

Table 4-2. Designated Nonattainment Areas in the Study Area

Pollutant	Designated Area(s)
Ozone	Cook County, Illinois
	Lake County, Indiana
Particulate matter (PM_{10})	Cook County; Lyons Township
	Cook County; Southeast Chicago
	Lake County; East Chicago, Hammond, Whiting, and Gary
Sulfur dioxide	Northern Lake County, Indiana
Carbon monoxide	Lake County; Portion of City of East Chicago

Source: Code of Federal Regulations, 1996.

Table 4-3. NAAQS for Primary Pollutants

Pollutant	Type of average	NAAQS
Ozone[1]	8-hour	0.08 ppm (160 $\mu g/m^3$)
	1-hour/day	0.12 ppm (235 $\mu g/m^3$)
Particulate matter ($PM_{2.5}$)[2]	annual arithmetic mean	15 $\mu g/m^3$
	24-hour	65 $\mu g/m^3$
Particulate matter (PM_{10})	annual arithmetic mean	50 $\mu g/m^3$
	24-hour	150 $\mu g/m^3$
Lead	quarterly arithmetic mean	1.5 $\mu g/m^3$
Sulfur dioxide	annual arithmetic mean	0.03 ppm (80 $\mu g/m^3$)
	24-hour	0.14 ppm (365 $\mu g/m^3$)
	[3-hour]	0.5 ppm (1,300 $\mu g/m^3$) [secondary standard]
Nitrogen dioxide	annual arithmetic mean	0.053 ppm (100 $\mu g/m^3$)
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)
	1-hour	35 ppm (40 mg/m^3)

1 Ozone 8-hour standard was promulgated on July 18, 1997. Original 1-hour standard is also retained until EPA determines that an area attains this standard.

2 $PM_{2.5}$ standards were promulgated on July 18, 1997. Original PM_{10} levels were retained. Form for determining compliance with PM_{10} 24-hour standard was modified.

$\mu g/m^3$ = micrograms per cubic meter
ppm = parts per million

Source: USEPA, 1996b; Code of Federal Regulations, 1997a,b.

4.1.1 Ozone

> **Ozone**
>
> - Nation's Most Widespread Air Pollution Problem
> - Respiratory Irritant That Aggrevates Asthma
> - Formed From Reactions of VOCs and NO_x in Presence of Sunlight and Heat
> - Cook County, IL, and Lake County, IN, Are Nonattainment Areas for Ozone

Both Cook County, IL, and Lake County, IN, are designated nonattainment areas for ozone. According to IDENR (1994b), there has been a slight downward trend for ozone levels in the Chicago area for the period from 1978 through 1990. (See Figure 4-6.) However, according to U.S. EPA (1996b), trends in recent years (1986 through 1995) show no significant change in ozone levels for either of these two areas. (See Figure 4-7.) Current ozone concentrations may exceed the NAAQS in several portions of the study area, especially during hot summer days. For example, recent high ozone levels of 332 $\mu g/m^3$ (0.166 ppm) were detected at the Southeast Police Station in Chicago (IEPA, 1996a).

Ozone is a powerful oxidant capable of destroying organic matter, and has been called the Nation's most widespread air pollution problem (American Lung Association (ALA), 1996b). Ozone causes respiratory problems and may aggravate asthma and other respiratory diseases. Ground-level ozone is created by sunlight acting on emissions of nitrogen oxides (NO_x) and VOCs from a variety of sources. These include hydrocarbons and nitrogen oxides from sources such as gasoline vapors, chemical solvents, combustion products from various fuels, and consumer products. Often, hydrocarbons and nitrogen oxides can be emitted, or are present in one location, and migrate to another location where sunlight and temperature cause chemical reactions to occur (U.S. EPA, 1996b). As a result, ozone problems extend well beyond Cook County, IL, and Lake County, IN, because of the unique geography and meteorology of the lakeside locations. Emissions of ozone precursors flow out over the lake, "cook" in the sunlight, and are transported back over the land as ozone. Depending on the wind patterns, the high levels of ozone can impact eastern Wisconsin, eastern Indiana, western Michigan, or the Chicago metro area. To protect public health and welfare,

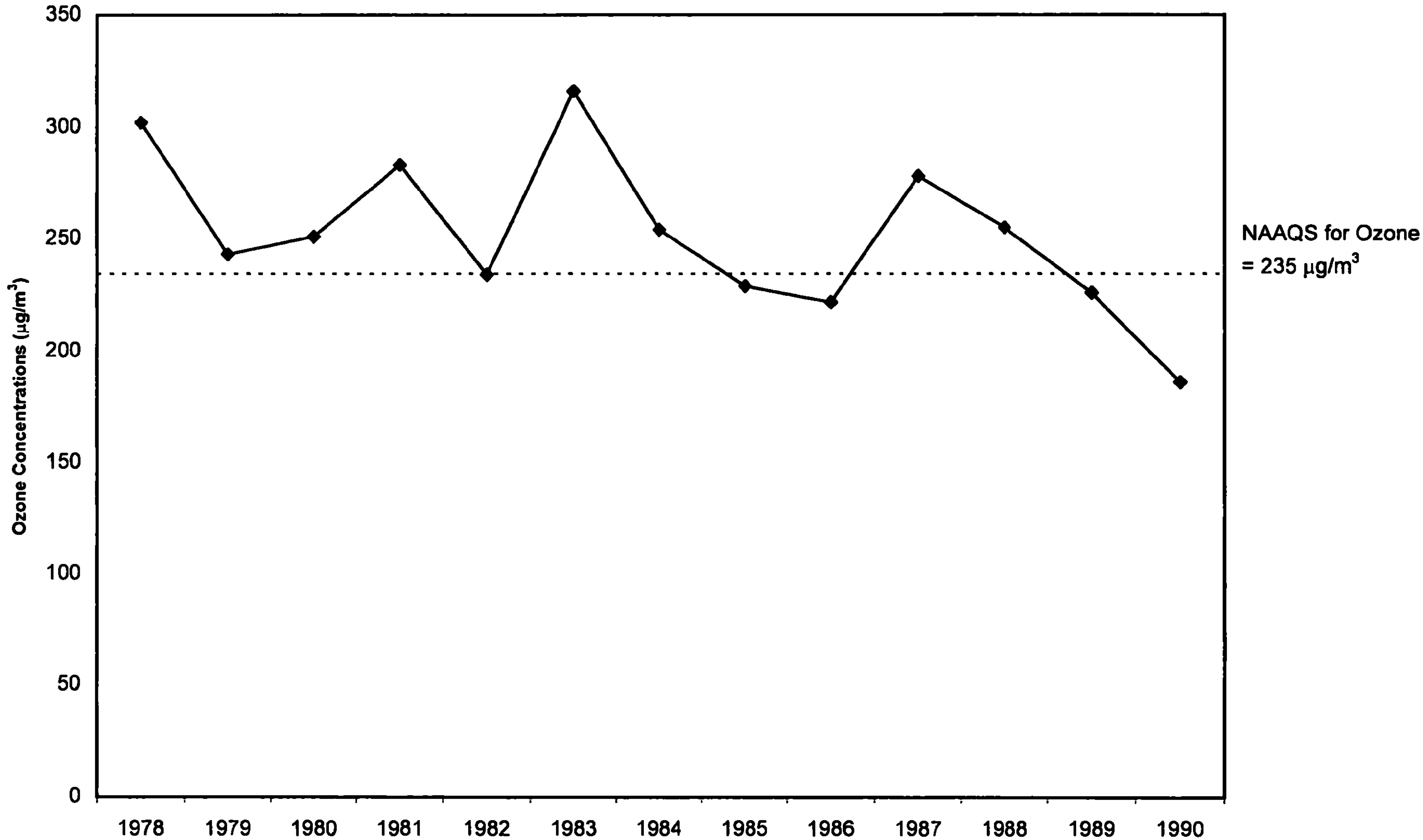


Figure 4-6. Historical Averages of the Maximum Ozone Levels Measured at Individual Sampling Sites in Chicago

Source IDENR, 1994b

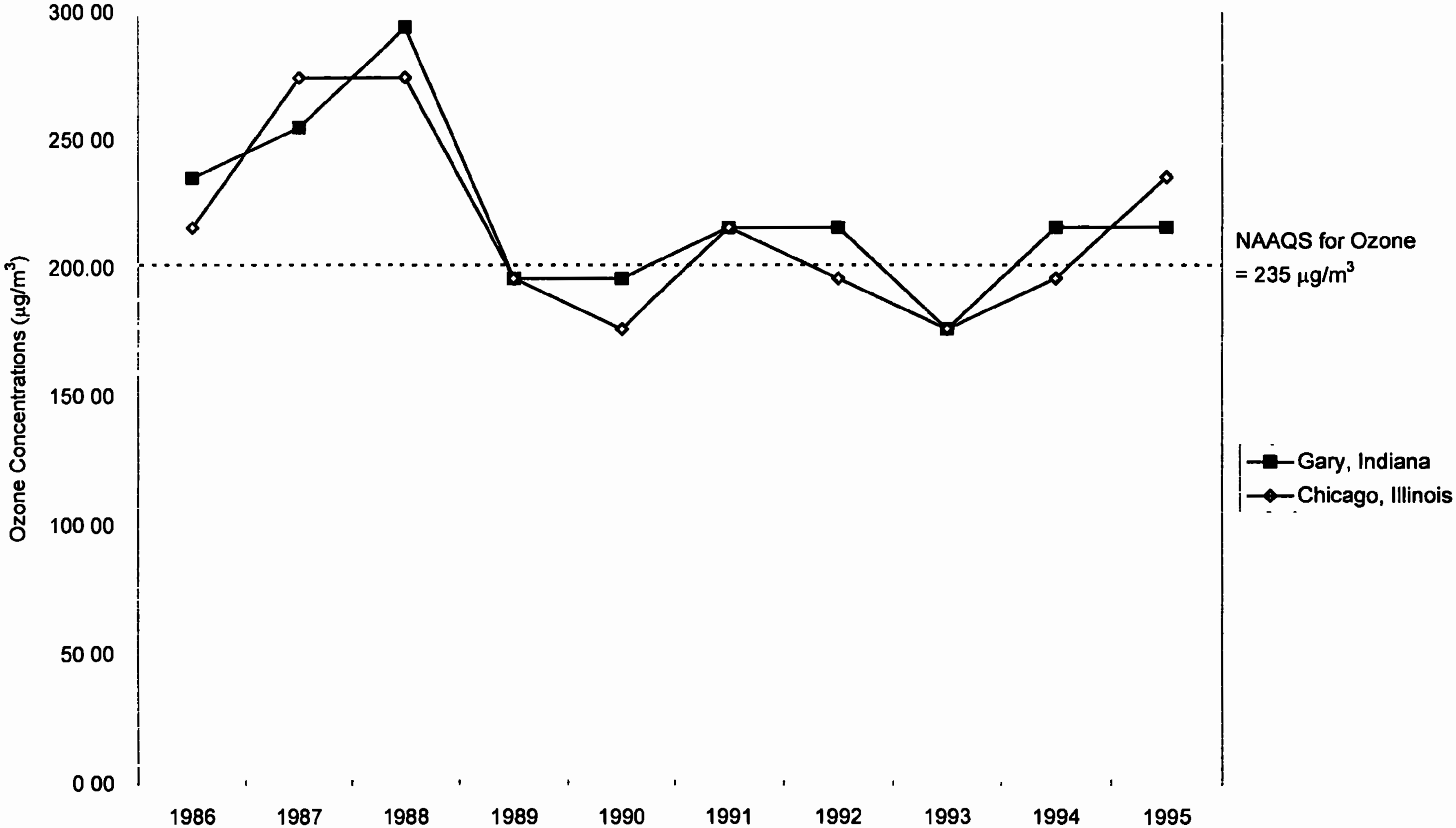


Figure 4-7. Ozone Levels in Gary, IN, and Chicago, IL (2nd 1-Hour Maximum)

Sour ISEPA, 1996

EPA established (in 1979) an NAAQS of 0.12 ppm (235 μg/m^3) 1-hour average, ozone in air. The 1979 standard was recently replaced by an 8-hour standard at a level of 0.08 ppm. This standard was promulgated by EPA in the July 18, 1997, *Federal Register*, with an effective date of September 16, 1997 (CFR, 1997). The 1-hour 0.12 ppm standard also remained effective until EPA determined that an area had air quality meeting the 1-hour standard. To determine if the standard is being met, ambient air is monitored at many locations across the country. EPA collects data from 972 sites nationwide to determine trends of ozone concentrations (U.S. EPA, 1996b). The ozone data collected for this report cover 1974, and 1978 through 1996.

As mentioned earlier, the previous ozone standard was a daily maximum 1-hour concentration of 235 μg/m^3 (0.12 ppm). EPA regulations specified that the level was not to be exceeded more than once per year, averaged over 3 years. Therefore, it was possible for an area to have an exceedance of the standard (i.e., a 1-hour concentration above 235 μg/m^3 at a monitoring station), but not be in violation of the standard. To determine if the standard was achieved, the number of exceedances at a monitoring site are recorded for each calendar year, and then averaged over the previous 3 years. If the average is less than or equal to 1, then the standard has been met. Another way of looking at the regulation is that an area is in violation of the standard when any single monitor records four or more exceedances over 3-year period. (Note: This method of determining compliance was not adopted in the new 8-hour standard of 0.08 ppm. The 8-hour ozone standard is based on the concentration of the fourth highest value measured each year averaged over 3 years.) Because (on the average) an area can have one exceedance per year and still not violate the standard, some references present data for the second 1-hour maximum only, while others present the maximum value measured. This can make a side-by-side comparison of data from different references difficult. Therefore, to provide a consistent picture of ozone levels over time, most of the trends discussed are observations from only one or two reports.

Ozone data from the PAMS network for two sites near metropolitan Chicago show that the maximum ozone levels reported for 1995 were 0.143 ppm (286 μg/m^3) at the Chicago/Jardine area on August 12, and 0.116 ppm (232 μg/m^3) at the Gary area on July 14 (U.S. EPA, 1996b). Additional data from other monitoring stations indicate no significant trends were reported for the second highest daily 1-hour ozone level for Gary, IN, and Chicago, IL, from 1986 through 1995

(U.S. EPA, 1996b). A side-by-side comparison of the data for the two cities reveals that for 3 of these 10 years, the levels were identical, and for the remaining years, the levels differed by no more than 12 percent. (See Figure 4-7.) Another data observation reveals that for half of those years, the second maximum ozone level was slightly higher in Gary than in Chicago, indicating that the levels in Chicago were higher than those in Gary for only 2 of the 10 years.

Data for the highest ozone concentrations reported in Cook and Lake Counties in 1995 are presented in Figure 4-8. As shown in the Figure, 13 of the 16 sites were in Cook County, including the highest reading of 332 $\mu g/m^3$ at the Southeast Police Station in Chicago.

4.1.1.1 *Cook County, IL*

Ozone Levels in Cook County

- 12 Exceedances of the NAAQS for Ozone on 4 Days in 1995:
  - Chicago (4 stations)
  - Evanston (2 stations)
  - Alsip
  - Calumet City
- Maximum Ozone Concentration in 1995 Was 332 $\mu g/m^3$ (0.166 ppm) at Chicago-Southeast Police Station
- Decreasing Levels of Ozone Over Last 15 years

Ozone monitoring at 13 stations in the Cook County, IL, area show the highest 1-hour concentration recorded for ozone was 0.166 ppm (332 $\mu g/m^3$) at the Chicago-Southeast Police Station (IEPA, 1996a). The data also showed 12 exceedances of the ozone standard in Cook County in 1995: four of the monitoring stations in Chicago and one in Evanston had two exceedances each (accounting for 10), and Alsip and Calumet City each recorded one exceedance. Figures 4-8 and 4-9 graphically represent ozone levels from 13 monitoring locations across Cook County, IL, (IEPA, 1996a). The labels to the left of both Figures list the monitoring locations starting with the "cleanest" area (lowest concentration) at the bottom, and end with the stations that measured the highest concentrations at the top. Figure 4-8 identifies 7 (of 13) monitoring locations in Cook County, IL, where the maximum 1-hour ozone concentration exceeded the level (235 $\mu g/m^3$) in 1995. Figure 4-9 identifies five monitoring locations in Cook County, IL, where the second maximum 1-hour ozone concentration exceeded the NAAQS level in

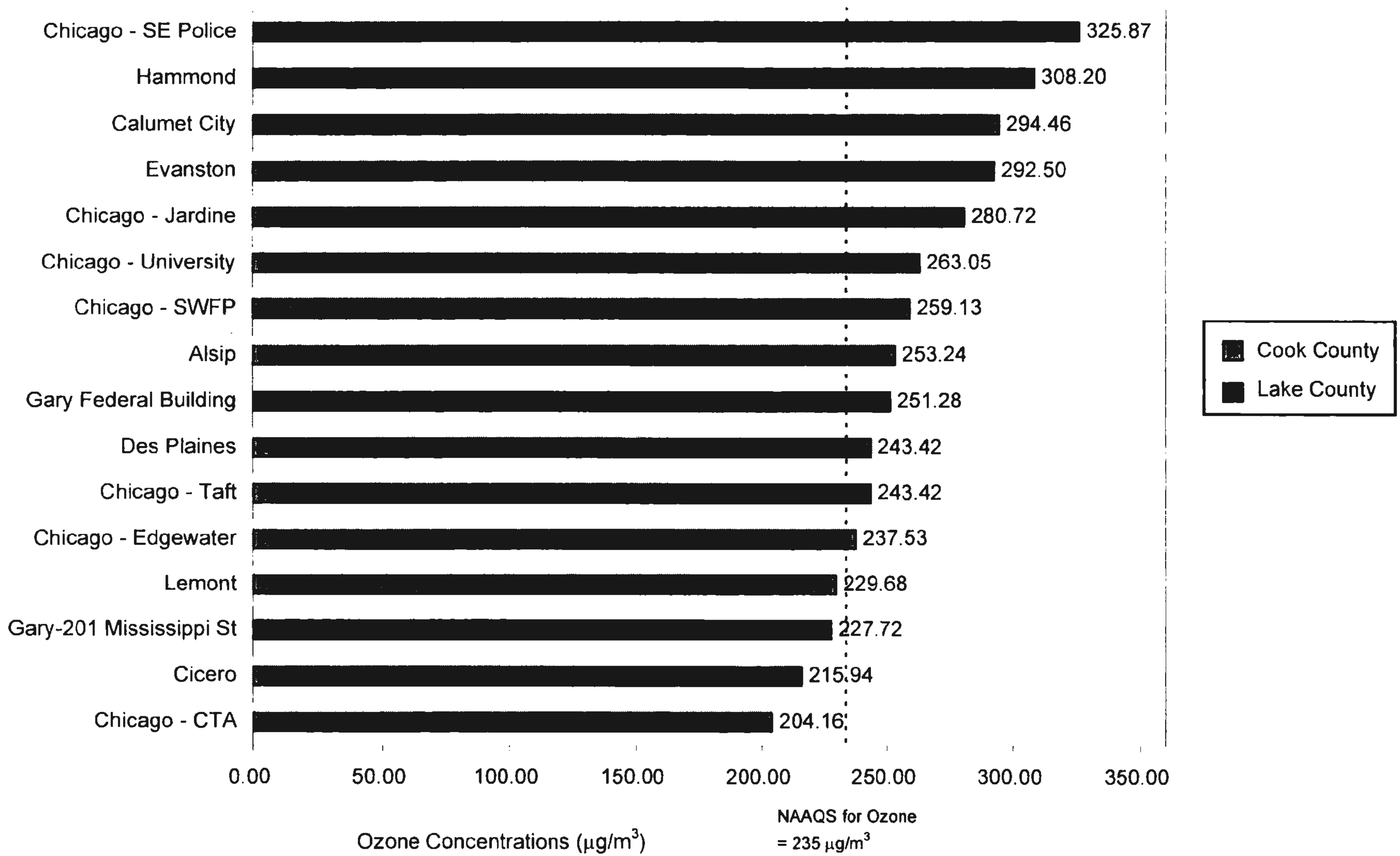


Figure 4-8. Maximum Ozone Levels in Cook County, IL, and Lake County, IN, in 1995

Source: IEPA, 1996; AIRS/AQS, 1997.

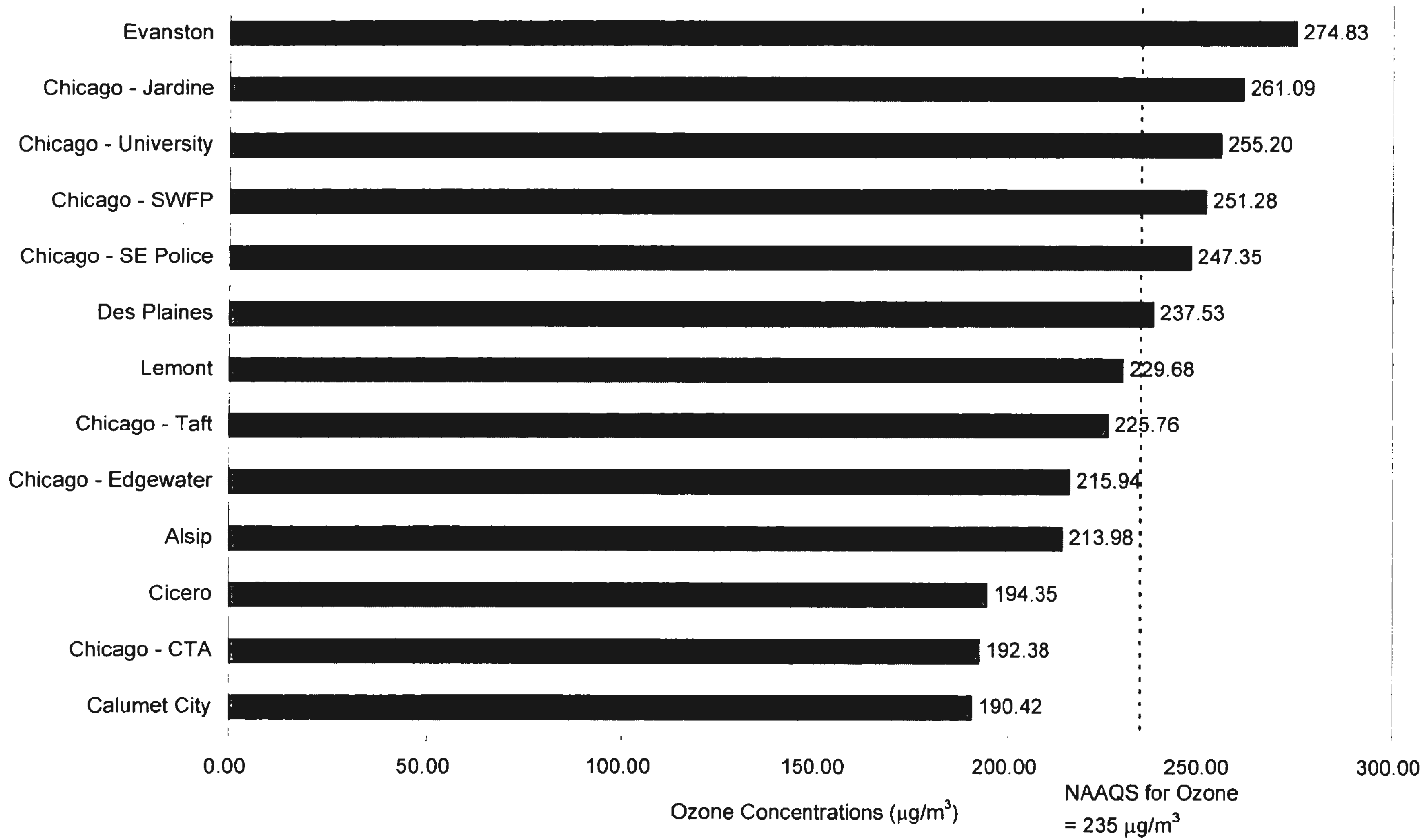


Figure 4-9. Second Maximum Ozone Levels in Cook County, IL, in 1995

Sourc ·EPA, 1996.

1995. As noted above, this parameter (second highest maximum) can be used to identify potential violations of the ozone standard. The highest second maximum 1-hour ozone concentration for Cook County, IL, was just north of Chicago, in Evanston (280 $\mu g/m^3$) (IEPA, 1996a).

In 1994, the American Lung Association of Metropolitan Chicago (ALAMC, 1994) reported that numerous studies suggest that ozone levels as low as 80 ppb (160 $\mu g/m^3$) may result in significant adverse health effects. Therefore, ALAMC asserted that the ozone level that is unhealthy for sensitive population segments is 80 ppb averaged over 1 hour. ALAMC (1994) reports that between 1988 and 1994, the ozone levels in Chicago exceeded the 80 ppb threshold on 286 days, as compared to only 33 days when the ozone levels in Chicago exceeded 120 ppb. As mentioned earlier, the ozone NAAQS was modified by EPA from 120 ppb (1-hour) to 80 ppb (8-hour) on July 18, 1997. Data for ozone levels were presented in the source documents in units of ppm, ppb, and $\mu g/m^3$. When comparing levels from one report to the next, the reader is reminded that 1 ppm is equal to 1,000 ppb. This conversion is applicable to all contaminants in all cases. However, when specifically examining the concentrations of ozone in air, a level of 1 ppb is roughly equivalent to 2 $\mu g/m^3$. This conversion is applicable to ozone only.

IDENR (1994a) presented trends for a variety of pollutants monitored in the Chicago area from 1978 through 1990. For ozone (annual medians of 1-hour maximum values), IDENR (1994a) reported a downward trend during that timeframe. For the 13 years presented in the report, the annual average began at 0.151 ppm (302 $\mu g/m^3$) for 1978, then fluctuated up and down three times with a high of 0.158 ppm (316 $\mu g/m^3$) for 1983, and ended with a low of 0.093 ppm (186 $\mu g/m^3$) for 1990 (Figure 4-6).

Ozone monitoring data presented by Ito and Thurston (1996) were compiled from various sources in Cook County, IL, summarizing monitoring that occurred from 1985 to 1990. The report presented the mean concentration of 38.10 ppb (76.2 $\mu g/m^3$) for 2,191 days of ozone monitoring throughout the entire county. The standard deviation was 19.9 ppb (39.8 $\mu g/m^3$), and the value for the 90th percentile was 65.6 ppb (131.2 $\mu g/m^3$). A maximum value measured was not presented.

Wadden et al. (1992) reported a mean concentration of 15.2 ppb (30.4 $\mu g/m^3$) and a maximum of 63.5 ppb (127 $\mu g/m^3$) for 81 observations, 12-hour ozone samples in Chicago collected during 1990-91. Wadden et al. also reported a mean concentration of 25.5 ppb (51 $\mu g/m^3$) and a maximum of 147.5 ppb (295 $\mu g/m^3$) for 81, 1-hour ozone samples collected in Chicago during the same time.

Historical concentrations of ozone in ambient air in Chicago area, based on data from the CAMP network, show the hourly average concentrations ranged from 0.02 to 0.16 ppm (40 to 320 $\mu g/m^3$) in July 1974, and from 0.02 to 0.14 ppm (40 to 280 $\mu g/m^3$) in August 1974 (IDENR, 1994a). IDENR also reported that the maximum daily 1-hour ozone concentration equaled or exceeded 0.1 ppm (200 $\mu g/m^3$) at one or more Chicago monitoring stations for 15 days in July and 9 days in August 1974.

4.1.1.2 *Lake County, IN*

As noted by IDEM (1997a), Lake County, IN, was designated by EPA as a nonattainment area for ozone. AIRS/AQS (1997) contain data from monitoring stations located in Lake County, IN, that pertain to six EPA criteria pollutants. The ozone data for Lake County, IN, are from three monitoring stations that are operated during the "ozone season" (April 1 to September 30). One station (201 Mississippi Avenue, Gary) was only operational for the second half of the 1995 season, but was in service for all of 1996. Data from the other stations were extracted for 1992 through 1996. Figure 4-10 identifies the stations where ozone was monitored from 1992 through 1996. Figure 4-10 also identifies the monitoring stations where the ozone standard was exceeded in Lake County, IN, in 1995 and in 1996.

Ozone Levels in Lake County

- Three Ozone Monitoring Stations
- Maximum Ozone Concentrations in 1995 at Each Station Were Above the NAAQS
  - Hammond (314 $\mu g/m^3$)
  - Gary-Federal Bldg. (256 $\mu g/m^3$)
  - Gary-Miss. Ave. (244 $\mu g/m^3$)
- No Ozone Exceedences in Lake County, IN, in 1993-94; Only One Exceedence in 1992

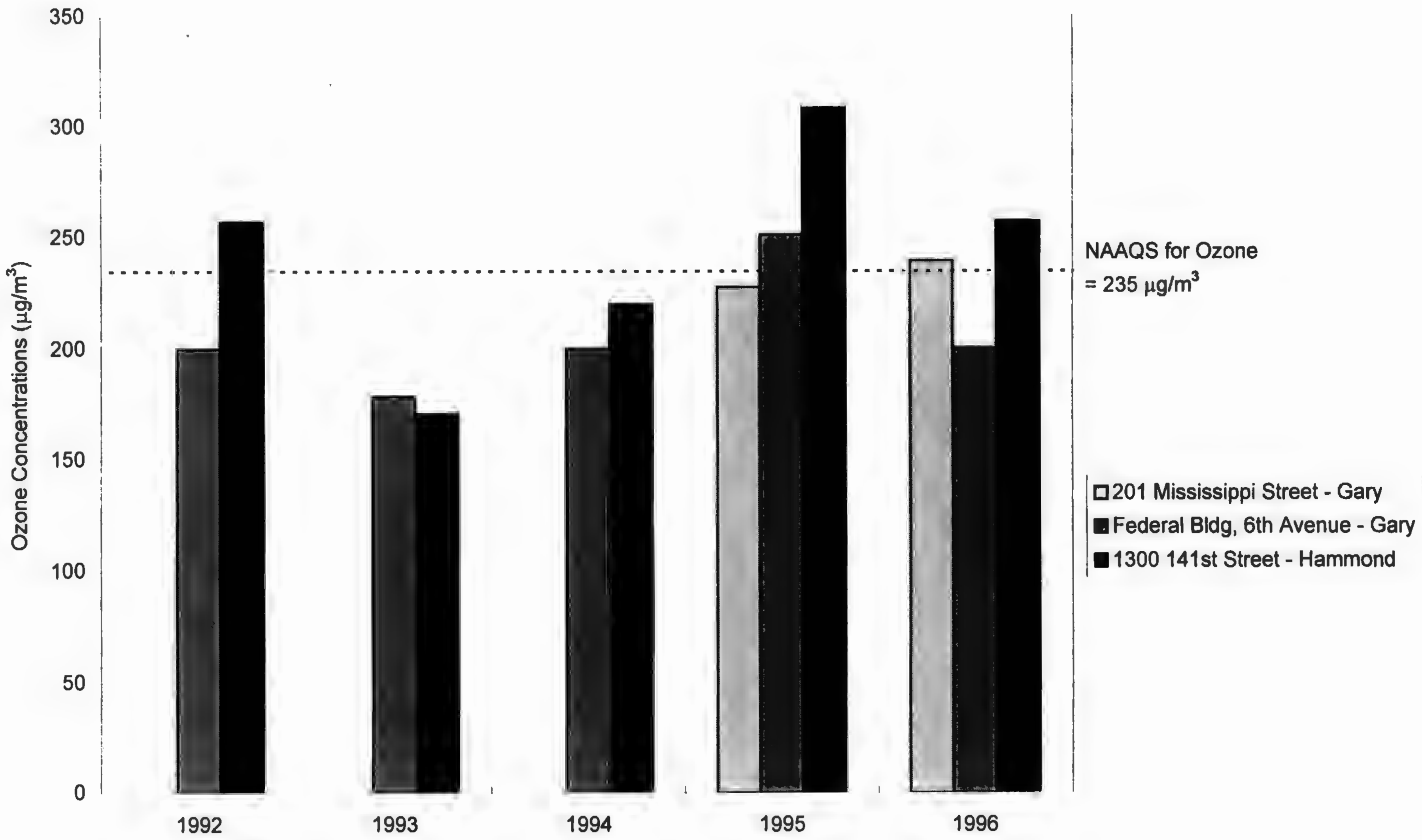


Figure 4-10. Ozone Levels in Lake County, IN (Daily 1-Hour Maximum)

Source: AIRS, 1997.

For both 1995 and 1996, the maximum ozone concentration was recorded at the same monitoring location: 1300 141st Street, Hammond, IN, (0.157 ppm [314 $\mu g/m^3$] in 1995 and 0.131 ppm [262 $\mu g/m^3$] in 1996). The second highest maximum in 1995 was 0.128 ppm (256 $\mu g/m^3$) at the Federal Building in Gary. The second highest maximum in 1996 was 0.122 ppm (244 $\mu g/m^3$) at 201 Mississippi Avenue, also in Gary. AIRS/AQS data show that the ozone standard was not exceeded at the Lake County, IN, monitoring stations in 1993 or 1994. Lake County, IN, recorded one exceedance in 1992 (0.131 ppm (262 $\mu g/m^3$) at the Hammond site). AIRS/AQS (1997) did not identify the specific days on which the standard was exceeded. Figure 4-11 shows the second maximum 1-hour ozone concentrations for Lake County, IN, according to data extracted from AIRS/AQS (1997). None of these values at any of the three sites exceeded the applicable NAAQS ozone level of 235 $\mu g/m^3$ in the past 5 years.

4.1.2 Particulate Matter

Particulate Matter

- Includes Total Suspended Particulates (TSP), PM_{10}, and $PM_{2.5}$
- New NAAQS for $PM_{2.5}$ Recently Promulgated by EPA
- Nonattainment Areas: Lyons Township and Southeast Chicago in Cook County, IL, and Northern Lake County, IN

Particulate matter (PM) is sometimes referred to as total suspended particulates (TSP), and includes an array of atmospheric materials varying in size, composition, and origin (e.g., soot; ashes; windblown dirt, sand, and soil dust; metals; and plant materials such as pollen) (ALA, 1996b). In some cases, the individual metal elements are analyzed and reported in addition to the total PM. For example, because of associated health concerns, EPA established a separate NAAQS for lead; therefore, lead is often separately monitored. Because of the larger volume of data associated with lead than with other PM elements, lead is addressed in a separate subsection (Section 4.1.3).

PM enters the body through the respiratory system, where the most immediate effects occur; smaller-sized particles have been linked to health problems such as cardiopulmonary disease

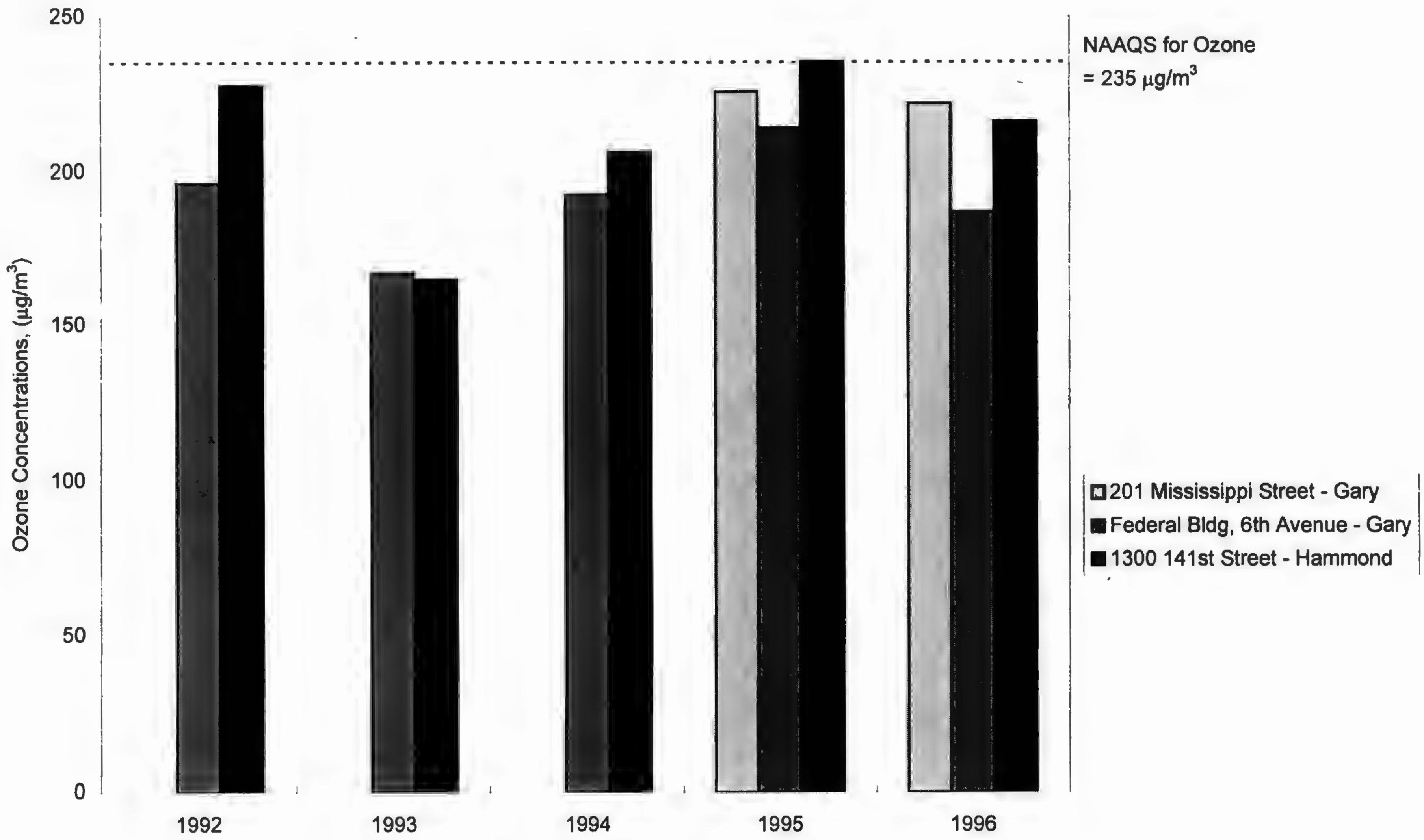


Figure 4-11. Ozone Levels in Lake County, IN (2nd Daily 1-Hour Maximum)

Source: AIRS, 1997.

(ALA, 1996a). These smaller particles are those that are less than 10 or 2.5 microns in diameter (known as PM_{10} or $PM_{2.5}$, respectively). Because of the higher risk posed by smaller particles, the TSP standard was replaced in 1987 by the PM_{10} standard. The NAAQS for PM_{10} is an annual arithmetic mean of 50 $\mu g/m^3$, and a 24-hour maximum of 150 $\mu g/m^3$. EPA recently promulgated a revision to the particulate matter standard that also regulates the concentration of $PM_{2.5}$ in the ambient air. On July 18, 1997, EPA added a new annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and a new 24-hour standard of 65 $\mu g/m^3$ (CFR, 1997a,b).

Cook County, IL, contains two areas that are designated as nonattainment for PM: Lyons Township and Southeast Chicago. The northern portion of Lake County, IN, is also a designated nonattainment area for PM. This includes the cities of East Chicago, Hammond, Whiting, and Gary. While Chicago and Gary (in addition to other portions of the study area) have experienced localized high levels of particulates, recent air quality data shows improvements. (See Figure 4-12 and the discussions in the following subsections.)

4.1.2.1 *Cook County, IL*

Particulate Matter in Cook County

- Highest PM_{10} Concentrations in 1995:
  - Chicago-Farr Station (132 $\mu g/m^3$)
  - Chicago-Washington (117 $\mu g/m^3$)
  - Lyons Township (116 $\mu g/m^3$)
- Average PM_{10} Concentration for 1990-1995 was 35.37 $\mu g/m^3$

IEPA (1996a) monitored PM_{10} at 13 stations throughout Cook County, IL. The maximum PM_{10} concentrations recorded for 1995 were 132 $\mu g/m^3$ at the Chicago-Farr Station on Michigan Avenue, followed by Chicago-Washington (117 $\mu g/m^3$), Lyons Township (116 $\mu g/m^3$), and Chicago-Marsh (98 $\mu g/m^3$). Figure 4-13 presents a graphical representation of these data. All other stations recorded concentrations of PM_{10} at 83 $\mu g/m^3$ or below. The second maximum PM_{10} concentrations recorded for 1995 were 112 $\mu g/m^3$ (Lyons Township) and 108 $\mu g/m^3$ (Chicago-Washington). All other stations recorded 83 $\mu g/m^3$ or below. Figure 4-14 presents a graphical representation of these data. The average PM_{10} concentration recorded for 1995 was 34.15 $\mu g/m^3$. The average of all PM_{10} concentrations recorded for 1990

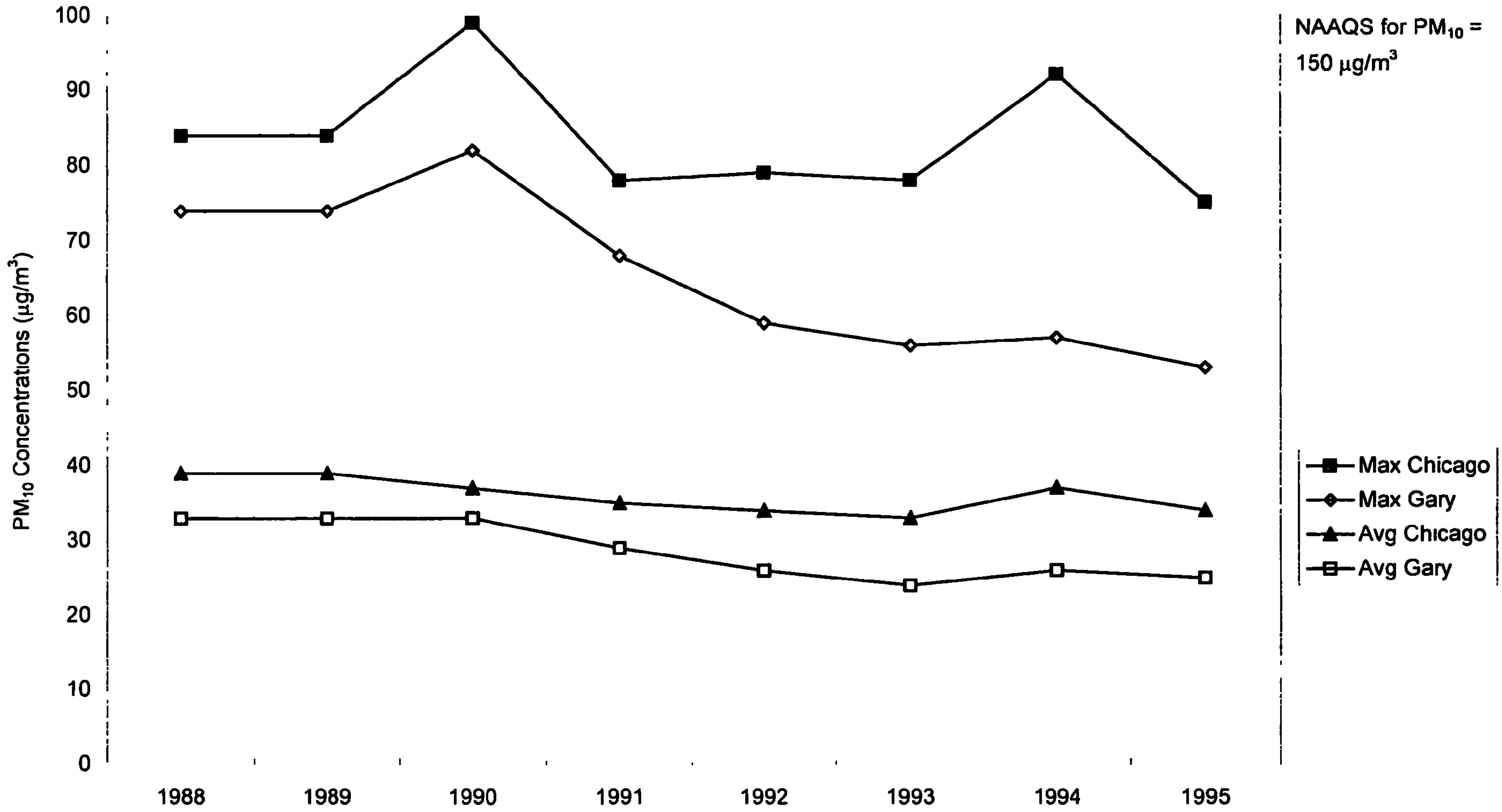


Figure 4-12. PM_{10} Trends for Gary, IN, and Chicago, IL (2nd 24-Hour Max)

Source US EPA, 1996

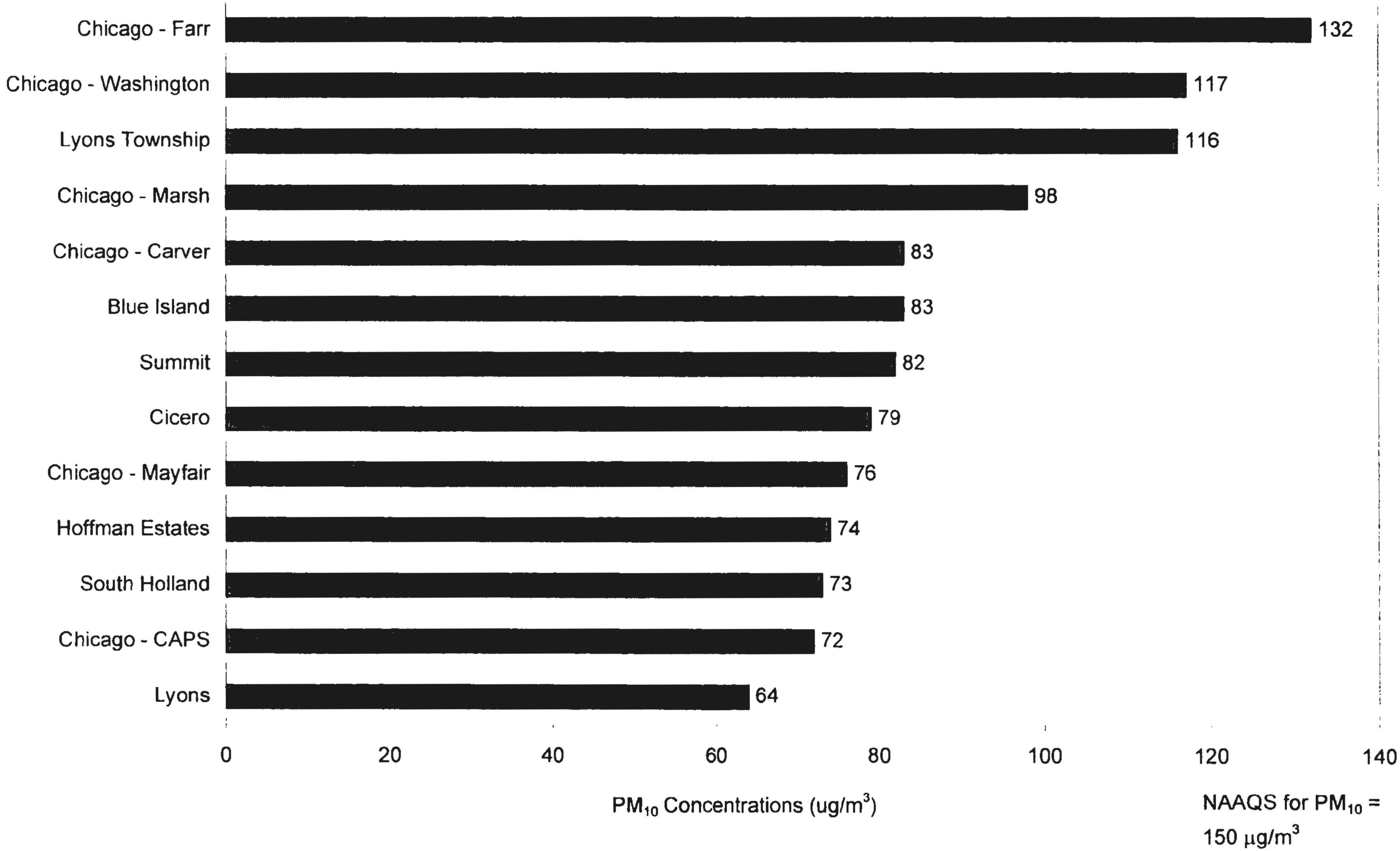


Figure 4-13. Levels of PM_{10} in Cook County, IL, in 1995 (24-Hour Max)

Sour EPA, 1996.

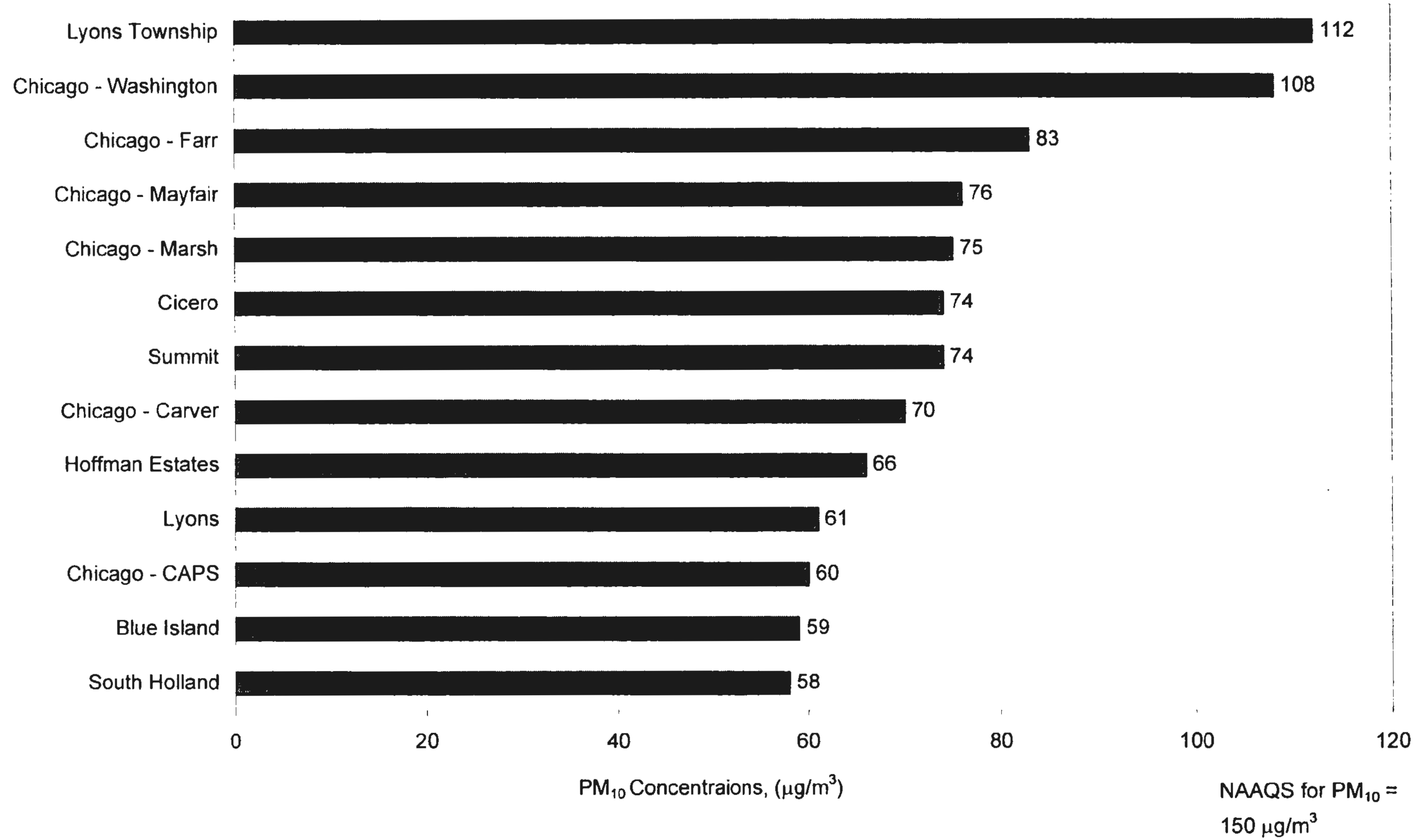


Figure 4-14. Levels of PM_{10} in Cook County, IL, in 1995 (2nd 24-Hour Max)

Source: IEPA, 1996.

through 1995 was 35.37 $\mu g/m^3$. During that period, the average PM_{10} concentrations recorded for 1990 and 1994 were 38.18 $\mu g/m^3$ and 38.58 $\mu g/m^3$, respectively. The average PM_{10} values for all other years were below 35 $\mu g/m^3$. Table 4-4 presents the averages reported for PM_{10} in Cook County from 1990 to 1995. IEPA (1996a) analyzed PM_{10} samples for select metals and found that iron had the highest reported TSP value of 7.86 $\mu g/m^3$ at a monitoring site in Maywood. The mean values for iron ranged from 0.7 to 3.0 $\mu g/m^3$. The next highest mean TSP values reported were for manganese, ranging from 0.034 to 0.187 $\mu g/m^3$. All other TSP means were at 0.01 $\mu g/m^3$ or lower.

There is no significant trend for the monitored values for PM_{10} for the Chicago, IL, area for the period from 1988 through 1995 (U.S. EPA, 1996b). The data are represented graphically in Figure 4-12, along with data for Gary, IN. (See earlier at Section 4.1.2.) The data for Chicago appear to have the following characteristics:

- The second highest 24-hour concentrations start at 84 $\mu g/m^3$ in 1986 and end at 75 $\mu g/m^3$ in 1995, with two "peaks" of 99 $\mu g/m^3$ in 1990, and 92 $\mu g/m^3$ in 1994.
- The second highest 24-hour PM_{10} concentration for Cook County, IL, was reported as 112 $\mu g/m^3$.
- The weighted annual mean for PM_{10} in Chicago starts at 39 $\mu g/m^3$ in 1986, decreases steadily to 33 $\mu g/m^3$ by 1993, has an increase to 37 $\mu g/m^3$ in 1994, and decreases again to 34 $\mu g/m^3$ in 1995. None of the data presented in this report were above the NAAQSs for PM_{10} (U.S. EPA, 1996b).

Ito and Thurston (1996) summarize data compiled from various sources in Cook County, IL, representing monitoring that occurred from 1985 to 1990. The report presented the mean concentration for PM_{10} as 40.70 $\mu g/m^3$, based on 1,529 days of sampling.

Prior to the implementation of the PM_{10} standard, monitoring was primarily conducted on TSP (i.e., the particulate matter on which the NAAQS was based). Historical TSP data for Chicago are presented for 1978 through 1990 IDENR (1994a). TSP (average annual 24-hour maximum) levels remained relatively constant from 1978 to 1990 (IDENR, 1994a). With the exception of two outliers (495.5 $\mu g/m^3$ in 1983 and 297 $\mu g/m^3$ in 1985), the values begin at 189 $\mu g/m^3$ in 1978, slowly

Table 4-4. Average PM_{10} Levels in Cook County ($\mu g/m^3$)

Monitoring Station	Year					
	1990	1991	1992	1993	1994	1995
Blue Island	37	32	31	30	36	31
Chicago - Carver	37	35	34	31	36	36
Chicago - CAPS	40	-	33	30	36	33
Chicago - Farr	39	30	29	33	37	34
Chicago - Mayfair	40	38	42	47	44	38
Chicago - Marsh	-	-	-	-	41	35
Chicago - Washington	37	35	33	34	36	35
Cicero	37	34	34	35	39	37
Hoffman Estates	-	-	-	-	-	27
Lyons	38	28	32	29	36	31
Lyons Township	45	46	-	-	46	37
South Holland	31	-	30	27	34	31
Summit	39	35	34	37	42	39
Average:	38.18	34.78	33.20	33.30	38.58	34.15

Source: IEPA, 1996a.

decrease to 123 $\mu g/m^3$ in 1986, and then slowly increase to 220 $\mu g/m^3$ in 1990. The document reported no significant trend for annual mean TSP values from 1978 to 1990 (IDENR, 1994a). The maximum value reported for annual mean TSP was 68 $\mu g/m^3$ in 1979, and the minimum was 50 $\mu g/m^3$ in both 1985 and 1986. These data are presented in Figures 4-15 and 4-16. In addition to lead, annual mean data reported by IDENR (1994a) also showed the following metals: arsenic, cadmium, chromium, iron, manganese, and nickel. An 11.1 percent decrease was reported for arsenic from 1978 to 1990. No significant trend was reported for any of the other metals mentioned above (IDENR, 1994a). Data were not provided for chromium and nickel for each year during the 1978 to 1990 timeframe.

Historical concentrations of TSP in ambient air in Chicago were reported by IDENR (1994a) for 1966 to 1970. The annual average remained fairly constant, with a slight decrease from 113 $\mu g/m^3$ in 1966 to 100 $\mu g/m^3$ in 1970. Minimum values also remained fairly constant, with an overall decrease over the 5-year period. Maximums ranged from a low of 202 $\mu g/m^3$ in 1967 to a high of 296 $\mu g/m^3$ in 1969 (IDENR, 1994a).

Vermette and Landsberger (1991) presented data on particulate matter from sampling conducted from 1985 to 1988 in Southeast Chicago, and compared those values to modeled concentrations, based on emissions inventories, used as an ingredient in an airshed box model. Monitored ambient air concentrations of total $PM_{2.5}$ emissions were reported as 23 $\mu g/m^3$, and total $PM_{2.5}$-PM_{10} emissions were 18 $\mu g/m^3$. The highest elemental result reported was for sulfur at 2.3 $\mu g/m^3$ (Vermette and Landsberger, 1991). The next highest elements were calcium and iron at 1.10 $\mu g/m^3$ and 1.23 $\mu g/m^3$, respectively. The remaining elements were reported below 1.0 $\mu g/m^3$. Emissions information was also presented in the report. (See Section 3.1.)

Ambient air monitoring was conducted from October 1985 to June 1988 at four Illinois metropolitan areas (Sweet, et al., 1990). Samples for the Chicago area were collected at the Bright Elementary School, 10740 South Calhoun Street, and the Washington Elementary School, 3611 E 114 Street. Results presented for these locations were for elements and PM_{10}. Maximum values for total PM_{10} were 49 $\mu g/m^3$ and 80 $\mu g/m^3$, respectively. The highest average reported was for total PM_{10} at 41 $\mu g/m^3$. The report separated the elements into fine, coarse, and total particulates. The

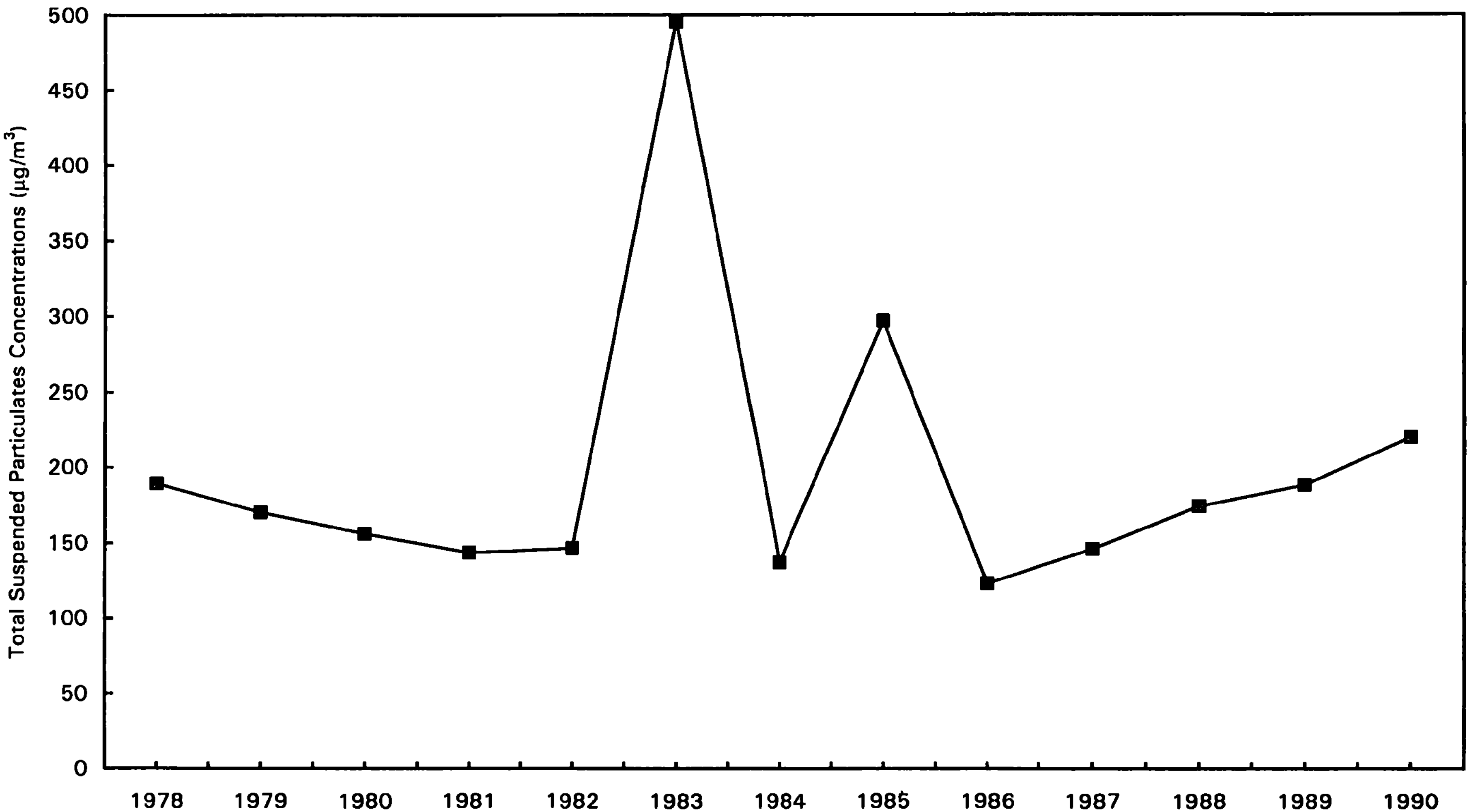


Figure 4-15. Trends in 24-hour Maximum Total Suspended Particulates Reported in Chicago, 1978-1990

Source IDENR, 1994b

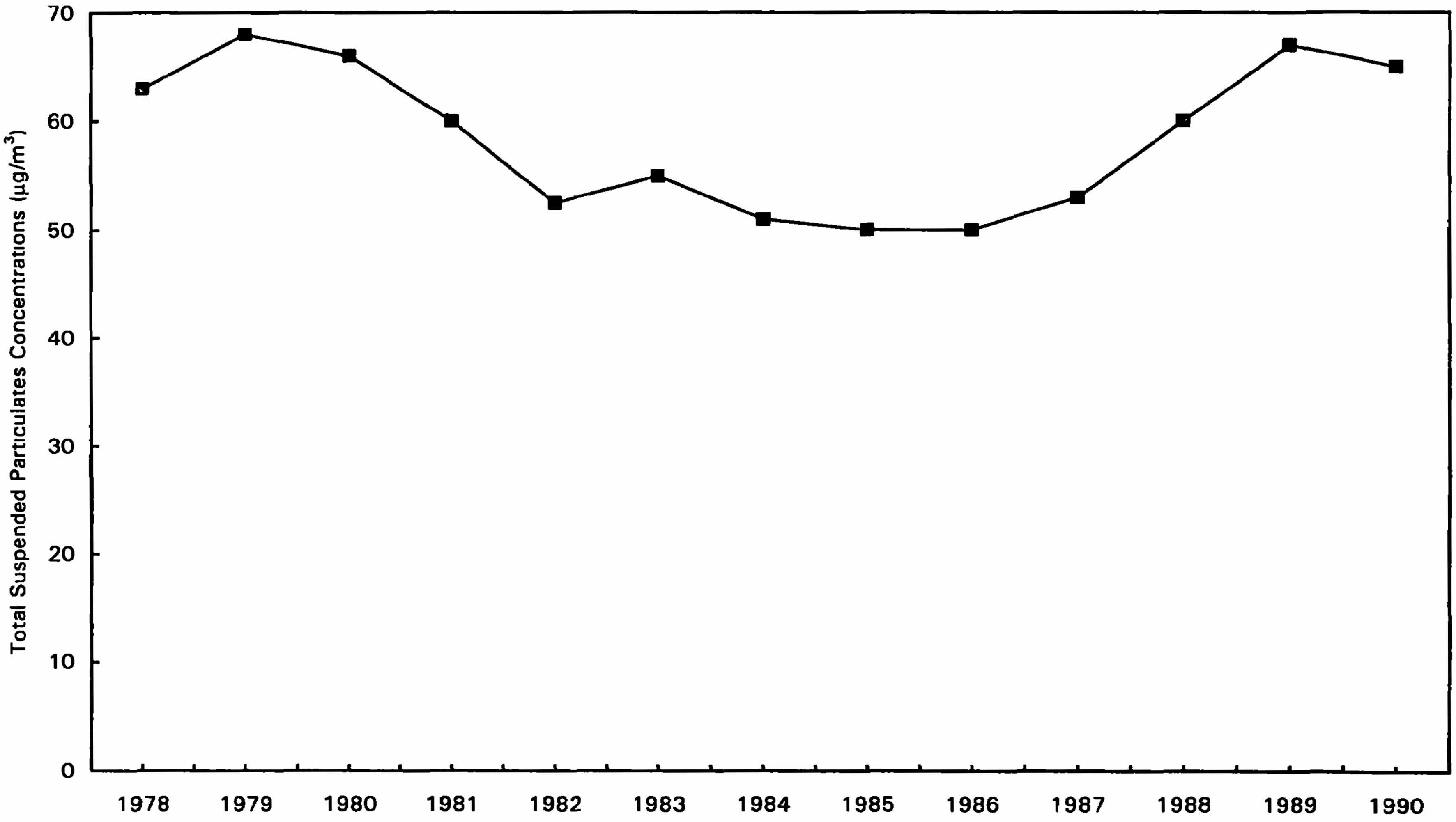


Figure 4-16. Trends in Annual Mean Total Suspended Particulates Reported in Chicago, 1978-1990

Sourc· IDENR, 1994b

highest element reported was zinc, with an average concentration of 0.166 $\mu g/m^3$, and the averages for lead and manganese ranged from 0.02 $\mu g/m^3$ to 0.166 $\mu g/m^3$. All other elements had averages reported below 0.02 $\mu g/m^3$. The single highest observation by Sweet, et al. (1990) was for fine lead particulates, collected from a "streaker" sample at 2.2 $\mu g/m^3$. These types of samples are collected over a relatively short period of time (2 hours) and can more accurately estimate "peak" concentrations than the standard sample of 12 to 48 hours. Once again, zinc, lead, and manganese topped the list of elements with the highest concentrations, with maximums ranging from 2.2 $\mu g/m^3$ for lead to 0.21 $\mu g/m^3$ for zinc. The remaining elements were all below 0.2 $\mu g/m^3$ (Sweet et al., 1990).

Sweet and Gatz (1988) present results from sampling conducted from July 1986 to June 1987 at four Illinois sites. One site is the Bright Elementary School in Chicago. Results presented for this location include fine, coarse, and total elements and PM_{10}. The averages reported for fine and coarse PM_{10} were 27 $\mu g/m^3$ and 19 $\mu g/m^3$, respectively. The highest averages reported for elements were lead, manganese, and zinc (0.156 $\mu g/m^3$, 0.043 $\mu g/m^3$, and 0.136 $\mu g/m^3$ for fine particulates, and 0.028 $\mu g/m^3$, 0.056 $\mu g/m^3$, and 0.039 $\mu g/m^3$ for coarse particulates).

Sampling data presented by Wadden (1992) for 1990 and 1991 ambient air in Chicago showed that PM_{10} concentration ranged from 0.24 to 73.77 (with a mean of 30.3 $\mu g/m^3$); and mean concentrations of elemental particulate matter ranged from 0.05 ng/m^3 for hafnium to 1,200 ng/m^3 for silicon.

During the summer of 1991, ambient air monitoring was conducted at four Chicago area sites by Keeler (1994). Two were at locations that are remote to Chicago (Kankakee and South Haven), one was in central Chicago (IIT), and one was on the research vessel R/V *Laurentian*, while moored on Lake Michigan (offshore of Chicago). The IIT site is 1.6 kilometers (km) from the Lake Michigan shore. Over 1,200 ambient air monitoring samples were collected at these sites (Keeler, 1994). For fine particulates (<2.5 μm), or $PM_{2.5}$, sulfur had the greatest average concentration of 2.44 $\mu g/m^3$ at the IIT site and 1.23 $\mu g/m^3$ on the R/V *Laurentian*. Sulfur also had the highest maximum concentration for the monitored elements, with 7.57 $\mu g/m^3$ at the IIT site and 4.71 $\mu g/m^3$ on the R/V *Laurentian*. Average concentrations of silicon and iron were 0.17 $\mu g/m^3$ and 0.12 $\mu g/m^3$, respectively, at the IIT site. All other average concentrations (at both sites) were less than 100 nanograms per cubic meter (ng/m^3) (Keeler, 1994).

For coarse particulates (2.5 to 10 μm), silicon showed the greatest average concentration of 2,000.2 nanograms per cubic meter (ng/m^3) at the IIT site and 713.3 ng/m^3 on the R/V *Laurentian*. Silicon also showed the highest maximum concentration for the elements that were studied, with 8,368.1 ng/m^3 at the IIT site and 1,862.5 ng/m^3 on the R/V *Laurentian*. Average concentrations of calcium, aluminum, and iron were 1,150.7 ng/m^3, 615.6 ng/m^3, and 589.2 ng/m^3, respectively, at the IIT site. All other average concentrations (at both sites) were less than 500 ng/m^3 (Keeler 1994).

Weston (1994) presents data for a small number of chemicals monitored at the New Gary School site in Chicago, and compares the monitored values with IEPA background data. For all chemicals monitored, the average values were greater than the health criterion and the IEPA background data. The report presented average values for arsenic (0.0015 μg/m^3), cadmium (0.0018 μg/m^3), chromium (0.0290 μg/m^3), and manganese (0.0847 μg/m^3).

4.1.2.2 *Lake County, IN*

Lake County, IN, has the most serious PM pollution in Indiana; therefore, PM emissions have historically been a significant concern there. In the 1970s and 1980s, ambient levels of TSP frequently exceeded health standards by significant margins. The northern portion of Lake County, IN, has been designated as nonattainment for PM (IDEM, 1997a).

A downward trend for PM_{10} levels was reported for the Gary, IN, area during the 10-year timeframe from 1988 through 1995 (U.S. EPA, 1996b). The data appear to have the following characteristics:

- The second highest 24-hour concentrations start at 74 μg/m^3 in 1988, "spike" at 82 μg/m^3 in 1990, and generally decrease to 53 μg/m^3 in 1995.
- The second highest 24-hour PM_{10} concentration for Lake County, IN, was reported as 157 μg/m^3.

- The weighted annual mean for PM_{10} in Gary starts at 33 $\mu g/m^3$ in 1988, and generally decreases to 25 $\mu g/m^3$ by 1995.

- The 24-hour PM_{10} concentration for Lake County of 157 $\mu g/m^3$ exceeds the NAAQS of 150 $\mu g/m^3$ for this parameter.

Figure 4-12 (presented in Section 4.1.2) graphically presents the data for these two parameters for PM_{10} for Chicago, IL, and Gary, IN. The graph shows how similar the two cities were with respect to parameters, especially in the late 1980s/early 1990s. None of the data presented in this report were above the NAAQSs for PM_{10} (U.S. EPA, 1996b). Additional data, however, indicate that Lake County, IN, continues to have particulate matter levels that exceed the NAAQS. One monitoring station (located at 201 Mississippi Avenue in Gary) reported 24-hour maximum readings of 162, 157, 151, and 149 $\mu g/m^3$ in 1995. The station reported 24-hour maximums below the 150 $\mu g/m^3$ standard for the other years for which data were acquired (AIRS/AQS, 1997).

4.1.3 Lead

Lead exposure occurs through inhalation of air and the ingestion of lead in food, water, soil, or dust, and accumulates in the blood, bones, and soft tissues. Because it is not readily excreted, lead can affect the kidneys, liver, nervous system, and other organs (U.S. EPA, 1996b). Acute lead poisoning can affect both adults and children; however, the main concern is chronically elevated levels of lead, particularly in children. In small children, elevated lead levels can cause nervous-system damage, resulting in

Lead in Ambient Air

- Lead Is a Pollutant of Concern, Especially for Children
- Leaded Gasoline Was Historical Source Until Phase-out in Late-1970s
- Decreases in Lead Levels in Cook County, IL, and Lake County, IN, Over Last 20 Years
- Maximum Levels in Last 5 Years Found in Southeast Chicago Near Horsehead Facility

irreversible mental and developmental defects (ALA, 1996b). The NAAQS for lead is a quarterly arithmetic mean of 1.5 $\mu g/m^3$.

In the past, automotive sources were the major contributor of lead to the atmosphere. For the period from 1967 to 1969, Chicago was among the areas that reported maximum quarterly lead averages in excess of 2 $\mu g/m^3$; and one Chicago monitor reported a concentration of 2.8 $\mu g/m^3$, averaged over the 4 fall months in 1971 (IDENR, 1994a). A 1972 study of two Chicago sites showed the calculated average lead values in ambient air ranged from 1.26 $\mu g/m^3$ to 8.53 $\mu g/m^3$ (IDENR, 1994a). As a result of the reducing lead in gasoline, the contribution from transportation sources has declined significantly in recent years. Nationwide, lead concentrations in ambient air decreased 97 percent between 1976 and 1995 (U.S. EPA, 1996b). Currently, the highest lead concentrations are found near nonferrous smelters and other stationary lead emissions sources (U.S. EPA, 1996b).

EPA (1996b) reported a downward trend for the maximum quarterly mean lead level for both Gary, IN, and Chicago, IL, for the period from 1986 through 1995. These data are presented in Figure 4-17. During this timeframe, the levels of lead in ambient air were higher in Gary than in Chicago. However, a significant drop in this parameter was reported for Gary from 1987 (1.19 $\mu g/m^3$) to 1989 (0.28 $\mu g/m^3$). Data for Chicago show a much less significant downward trend. From 1989 to 1995, the maximum quarterly mean lead levels for both cities were similar; neither exceeded 0.3 $\mu g/m^3$, which is much lower than the NAAQS of 1.5 $\mu g/m^3$ for this parameter. In 1995, the maximum quarterly mean lead concentration for Gary (0.14 $\mu g/m^3$) was lower than the Lake County, IN, value of 0.19 $\mu g/m^3$. Similarly, the maximum quarterly mean lead concentration for Chicago (0.05 $\mu g/m^3$) was lower than the Cook County, IL, value of 0.99 $\mu g/m^3$ in 1995 (U.S. EPA, 1996b).

Data for maximum lead concentrations in the ambient air in Cook and Lake Counties were extracted from AIRS/AQS (1997) for 1990 through 1995. These data are presented in Table 4-5. Data for eight of the sites for 1991-1995 are presented graphically in Figure 4-18. Most of the results are below 0.15 $\mu g/m^3$. In 1990, the highest values reported were at the Gary Federal Building (2.929 $\mu g/m^3$) and at the monitoring station at 3535 E. 114th Street (1.583 $\mu g/m^3$). The three highest values

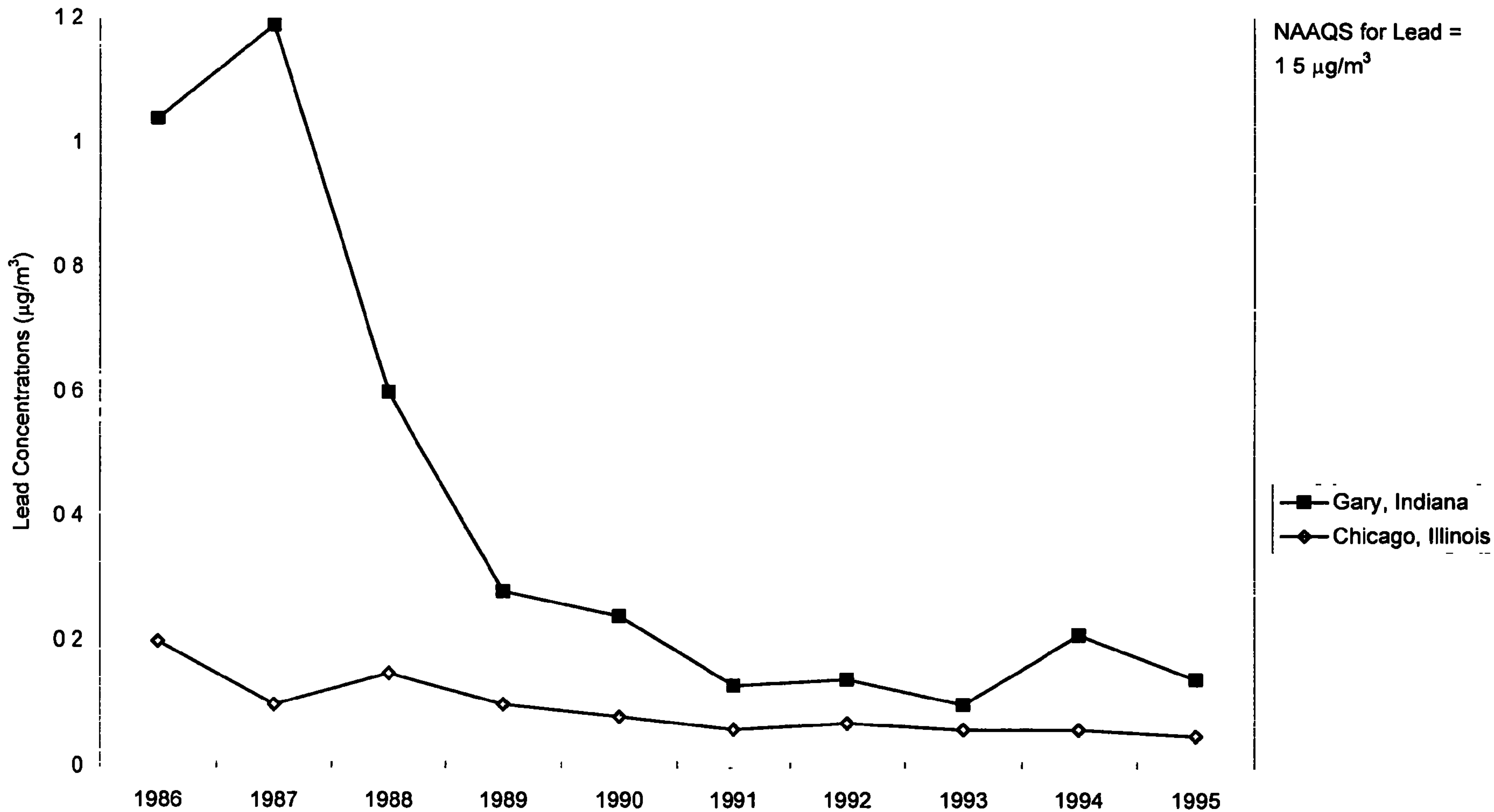


Figure 4-17. Maximum Quarterly Mean Lead Levels for Chicago and Gary

Source· US EPA, 1996

Table 4 - 5. Trends in Maximum Lead Concentrations in Ambient Air from 1990-1995

Site	Lead Concentrations in Total Suspended Particles (µg/m³)					
	1990	1991	1992	1993	1994	1995
Gary Federal Bldg 6th Ave. & Conn.	2.929	--	--	--	--	--
Chicago Site 2 -SW, 2701 E.114th St.	--	0.582	0.649	0.272	0.325	0.464
Chicago 3535 E.114th St.	1.583	0.044	0.027	0.026	0.041	0.015
Chicago Site 3 - SE, 2701 E.114th St.	--	0.268	0.330	0.245	0.299	0.416
Chicago Site 1 - N, 2701 E.114th St.	--	0.161	0.330	0.263	0.065	0.346
Hammond 2325 Summer St.	0.148	0.093	0.050	0.039	0.131	0.051
Bedford Park 7800 W. 65th St, Bedford Park	0.452	0.014	0.007	0.009	0.007	0.008
East Chicago Field School, Block & James Streets	0.035	0.047	0.074	0.052	0.051	0.138
Hammond 2345 167th St Superior Engineering	0.052	0.020	0.026	0.029	0.155	0.032
Chicago Cermak PMG Station 735 W Harrison St.	0.056	0.056	0.038	0.029	0.040	0.018
Chicago 10740 Scalhoun, Bright School	0.034	0.049	0.031	0.031	0.022	0.014
Hammond 1300 141 Street	0.049	0.017	0.011	0.012	0.015	0.015
Maywood 1500 Maybrook Dr., Maybrook Civic Center	0.020	0.025	0.016	0.019	0.020	0.013
Chicago Mayfair Pump Sta., 4850 Wilson Ave.	0.016	0.011	0.013	0.027	0.015	0.012
Alsip 4500 W. 123rd St.	0.014	0.011	0.013	0.009	0.011	0.009
Schiller Park 4243 N. Mannheim	0.010	0.008	0.009	0.018	0.010	0.007
Summit Graves Elem. School 60th St. & 74th Ave.	--	--	--	--	--	0.048
Chicago 13100 S. Doty	0.028	0.005	--	--	--	--
Chicago CTA Training Cntr, 642 N. Pulaski Rd.	--	--	--	--	--	0.011
Chicago Scentex Inc, 4645 W. Augusta	--	--	--	--	--	0.009

Source: AIRS/AQS, 1997.

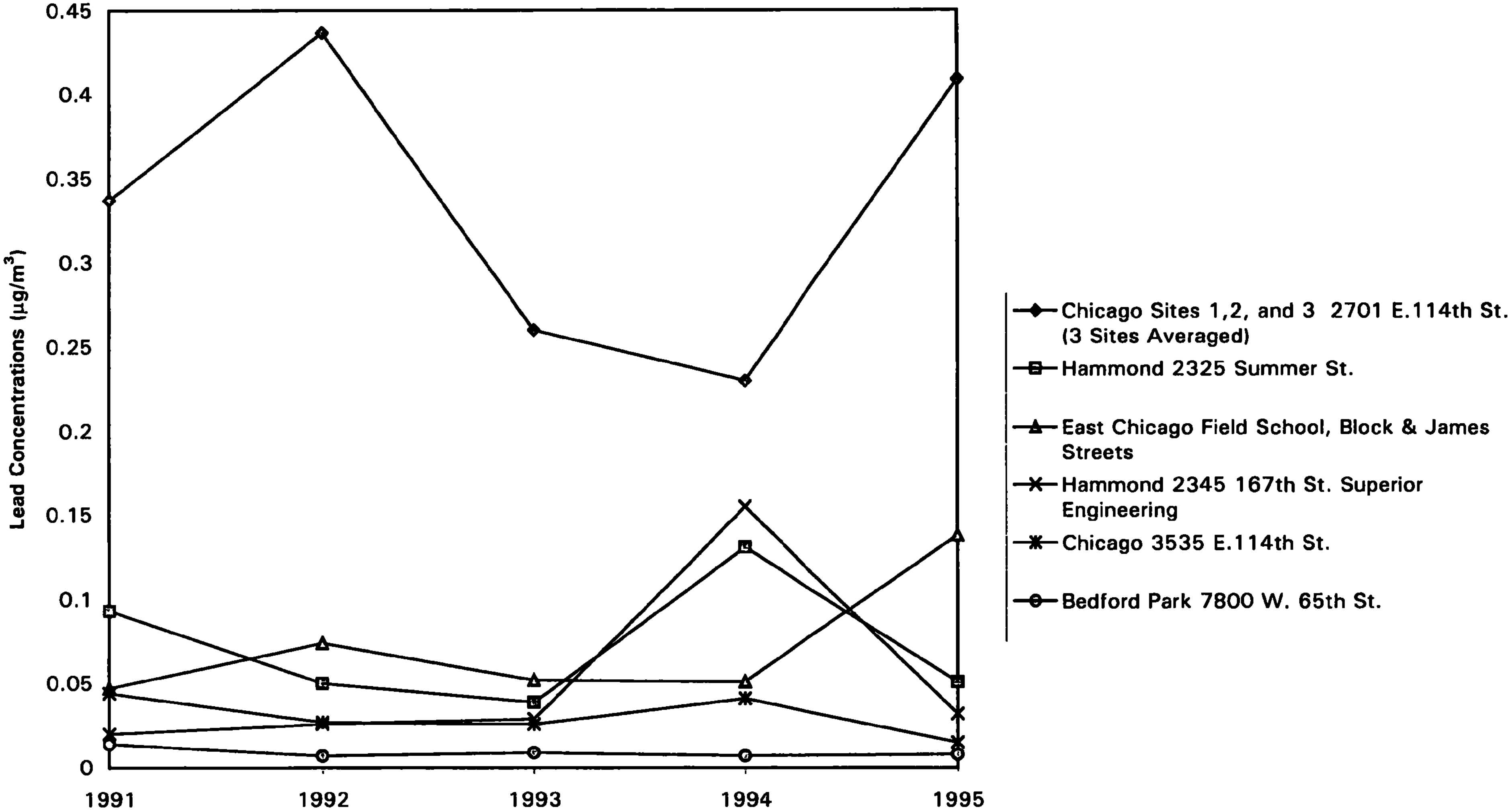


Figure 4-18. Trends in Maximum Lead Concentrations in Ambient Air (Total Suspended Particles) from 1991-1995

Source AIRS/AQS, 1997.

for 4 of the next 5 years (1991 through 1995) were from the three monitoring stations at 2701 E. 114th Street in Southeast Chicago (Horsehead Sites 1, 2, and 3).

4.1.3.1 *Cook County, IL*

IEPA (1996a) reported monitoring results for lead at 10 stations in the Cook County, IL, area in 1995. The average recorded concentration was 0.123 $\mu g/m^3$. The maximum was 0.59 $\mu g/m^3$ at the Chicago-Horsehead 2 site, and the second maximum was 0.33 $\mu g/m^3$ at the Chicago-Horsehead 1 site. All other sites reported annual mean lead levels of 0.06 $\mu g/m^3$ or less. When the two highest sites are removed, the average of the values from the remaining sites is only 0.04 $\mu g/m^3$. Figure 4-19 graphically presents the values from all 10 sites. The Figure shows the significant difference between the values from the Chicago-Horsehead sites and the other sites in the County. According to IEPA (1996a), the Horsehead sites (located at 2701 E. 114th Street) were source-oriented, and recorded some of the highest quarterly lead averages in the State in 1995. These monitoring sites are adjacent to the Horsehead Resource Development Company (HRDC), which performs metals smelting operations.

IDENR (1994a) reported a decrease of 21.2 percent over the period from 1979 to 1990 for lead in the Chicago area, with a high of 0.425 $\mu g/m^3$ in 1979 and a low of 0.04 $\mu g/m^3$ in 1989. The annual mean for lead shows a pronounced decreasing trend. This trend is shown in Figure 4-20.

4.1.3.2 *Lake County, IN*

Data extracted from the AIRS data base (AIRS/AQS, 1997) show ambient lead levels in Lake County, IN, increased from 1992 to 1996. For three of the four monitoring stations that reported quarterly arithmetic means for ambient lead, the concentrations either increased or remained constant each year. Data from the other station showed an alternating "up and down" cycle from one year to the next, but with a trend to increase greater than each previous year's decrease. The maximum concentration reported for all stations in 1996 was 0.13 $\mu g/m^3$, which is still well below the NAAQS of 1.5 $\mu g/m^3$.

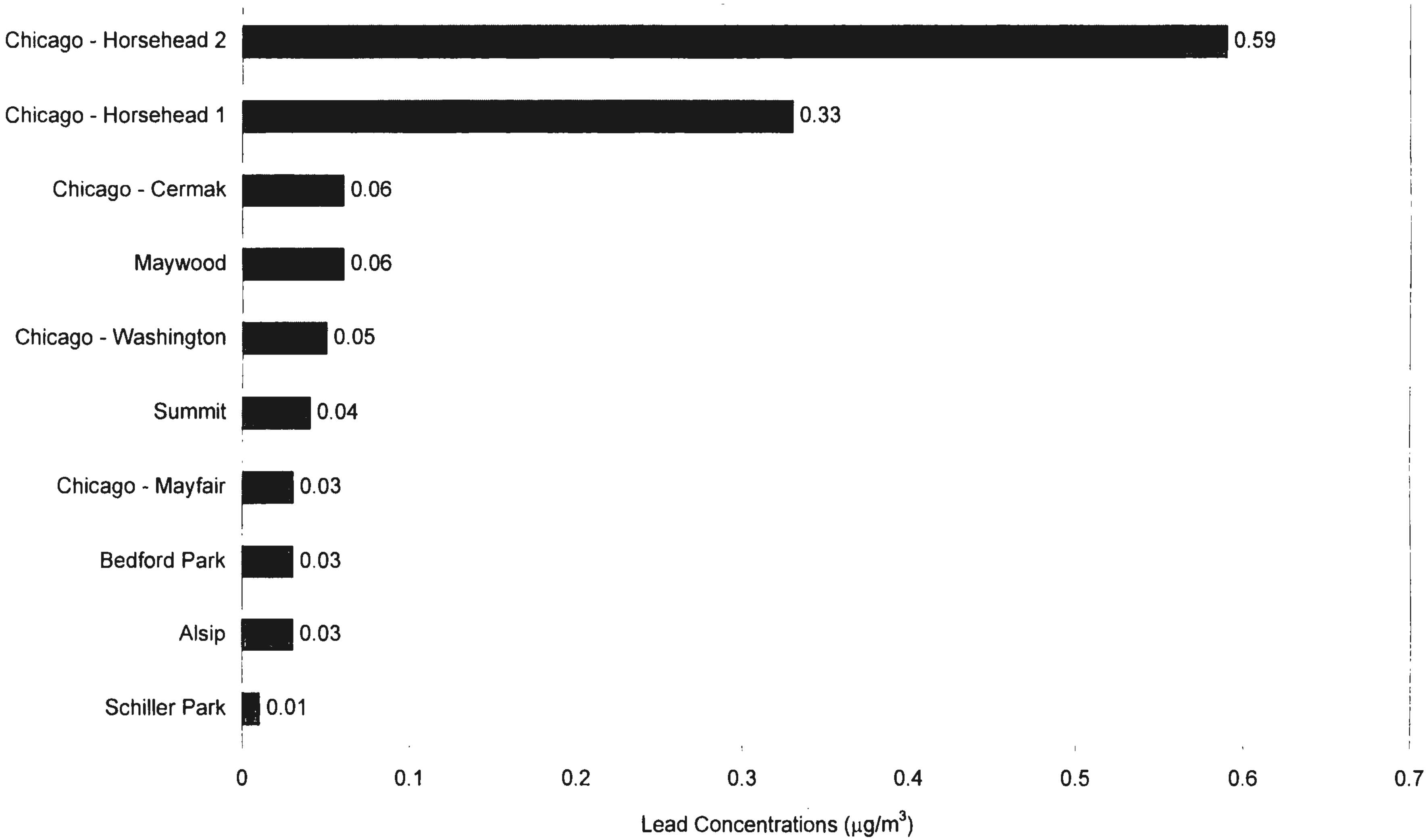


Figure 4-19. 1995 Annual Mean Lead Levels for Sites in Cook County

Source: IEPA, 1996.

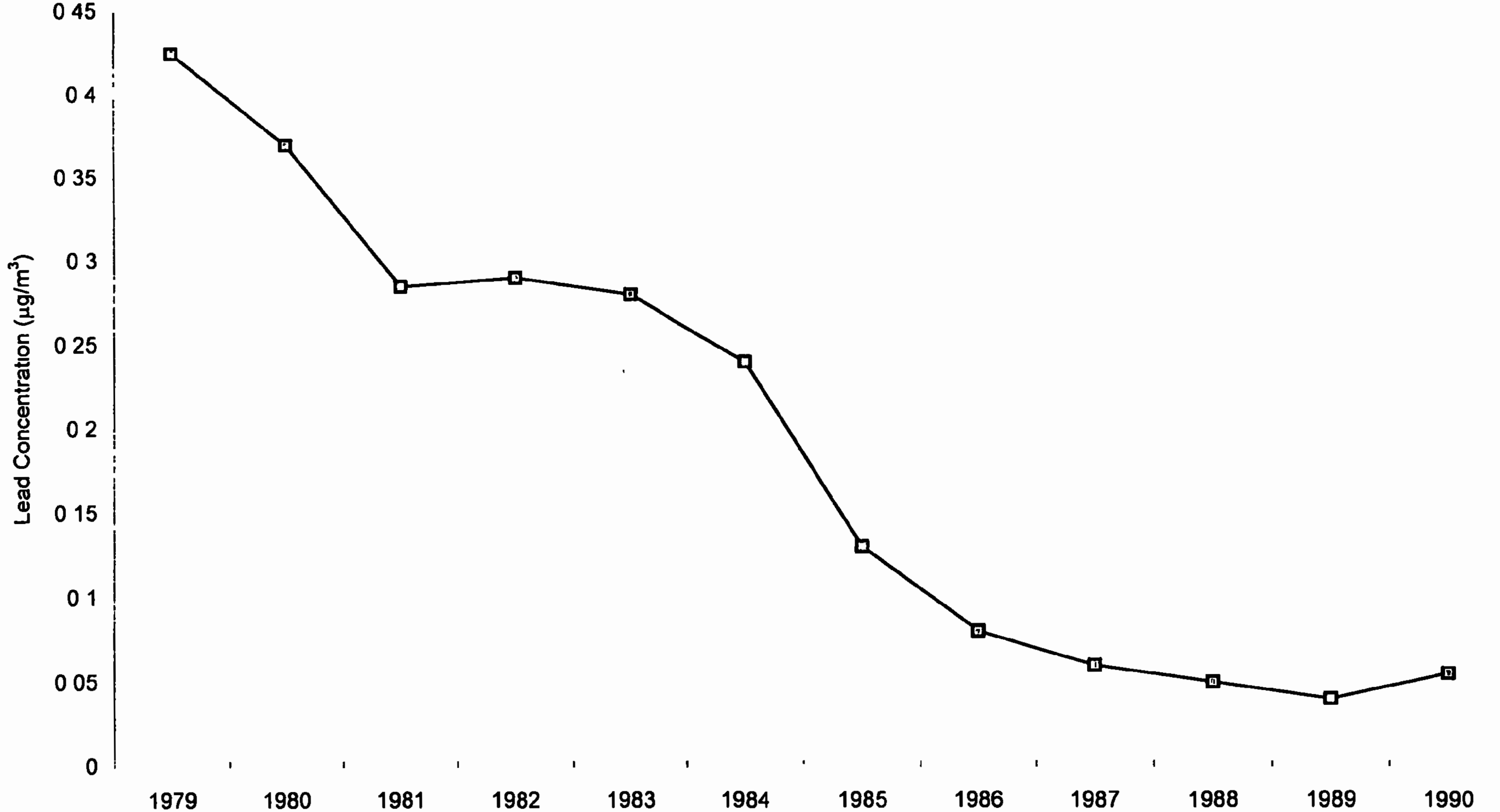


Figure 4-20. Trends in Annual Mean Lead Levels in Chicago (1979-1990)

Sour DENR, 1994b

Maximum lead concentrations for Lake County, IN, were also reported at these four monitoring stations. The feature that is of interest at these three stations is that each (two during 1994 and one in 1995) had a "spike" that was at least 2.5 times higher than the average of the other 4 years for that station. At a site in Hammond, the spike of 1.55 $\mu g/m^3$ was 5 times the average of the other 4 years reported. This value also represents the highest reported maximum lead concentration for Lake County, IN. The lowest reported maximum was 0.11 $\mu g/m^3$, and the highest maximum (excluding the 3 "spikes") was 0.74 $\mu g/m^3$ (AIRS/AQS, 1997).

4.1.4 Sulfur Dioxide

It is sometimes difficult to quantify the specific effects of sulfur dioxide (SO_2), because it frequently occurs in conjunction with other known pollutants, such as PM and/or ozone. For most healthy people, SO_2 is a temporary irritant, chiefly causing subjective and comparatively minor discomfort (ALA, 1996b). SO_2 is also of concern because of its role in the formation of acid rain. The primary NAAQS for SO_2 is an annual arithmetic mean of 0.03 ppm (80 $\mu g/m^3$), and a 24-hour maximum of 0.14 ppm (364 $\mu g/m^3$). The secondary NAAQS is an 8-hour maximum of 0.5 ppm (1,300 $\mu g/m^3$). The northern portion of Lake County, IN, has been designated as nonattainment for SO_2 (IDEM, 1997a).

Sulfur Dioxide Levels in Ambient Air

- SO_2 Is a Respiratory Irritant and Ingredient in Acid Rain
- Northern Lake County Is a Nonattainment Area for SO_2
- Comparable Levels of SO_2 in Chicago, IL, and Gary, IN

A downward trend for the arithmetic mean and second highest 24-hour SO_2 levels for both Gary, IN, and Chicago, IL, were reported by EPA for the period from 1986 through 1995 (U.S. EPA, 1996b). For all of the 10 years, the levels for both parameters measured in Gary were greater than or equal to the corresponding measurements in Chicago. In Gary, significant fluctuation was reported in the second highest 24-hour SO_2 level from 1986 to 1991. Beginning in 1991, the values for Gary and Chicago were similar (i.e., they never differed by more than 0.005 ppm [13 $\mu g/m^3$]).

Both showed a small downward trend from 1991 to 1995. The data for the arithmetic mean are highly comparable between the two cities. For the entire 10-year period, these values differed by only 0.001 or 0.002 ppm (2.6 or 5.2 $\mu g/m^3$), or were the same. Finally, the second highest 24-hour SO_2 concentration for Lake County, IN, was 101 $\mu g/m^3$ (0.04 ppm) in 1995, compared to the value of 0.027 ppm (70.2 $\mu g/m^3$) for Gary. The second highest 24-hour SO_2 concentration for Cook County, IL, was also 101 $\mu g/m^3$ (0.04 ppm) in 1995, compared to the value of 0.023 ppm (59.8 $\mu g/m^3$) for Chicago. None of the geographic areas mentioned in the report identified concentrations greater than the NAAQS for either SO_2 parameter.

4.1.4.1 *Cook County, IL*

SO_2 was monitored at 10 stations in the Cook County, IL, area in 1995. Over 7,500 samples were collected at each station. The highest concentration recorded was 0.126 ppm (327.6 $\mu g/m^3$) at the Lemont sampling location on Houston Street. The average reading taken in 1995 was 0.0046 ppm (12 $\mu g/m^3$). The average recorded concentration for 1990 through 1995 was 0.006 ppm (15.6 $\mu g/m^3$) (IEPA, 1996a).

IDENR (1994a) reported that the average annual 3-hour maximum for SO_2 in the Chicago area decreased 3.5 percent from 1978 to 1990, with a high of 0.145 ppm (377 $\mu g/m^3$) (1983), and a low of 0.066 (172 $\mu g/m^3$) ppm (1990). For SO_2 (average annual 24-hour maximum), no significant trend was indicated during the same period, with a high of 0.082 ppm (213 $\mu g/m^3$) (1979), and a low of 0.026 ppm (68 $\mu g/m^3$) (1990). From 1984 to 1990, the values for this parameter slowly decreased from 0.046 to 0.026 ppm (120 to 68 $\mu g/m^3$). For SO_2 (annual mean) a decrease of 5.2 percent was reported over the period, with a high of 0.012 ppm (31 $\mu g/m^3$) (1979), and a low of 0.006 ppm (16 $\mu g/m^3$) (1986). For sulfate (annual mean), a 1.6 percent decrease was reported over the period in question, with a high of 12.55 $\mu g/m^3$ in 1980, and a low of 10 $\mu g/m^3$ in 1987 (IDENR, 1994a).

Wadden (1992) reported a mean concentration of 9.4 ppb (24.44 $\mu g/m^3$) and a maximum of 39.1 ppb (101.66 $\mu g/m^3$) for SO_2 in Chicago for the 1990-91 sampling events. Ito and Thurston (1996) presented data that were compiled from various sources in Cook County, IL, summarizing monitoring that occurred from 1985 to 1990. The report presented the mean concentration for SO_2 as 24.50 ppb (63.7 $\mu g/m^3$).

IDENR (1994a) reported on the historical concentrations of SO_2 in ambient air in Illinois, including data from as early as 1964. From 1964 to 1968, the average monthly concentrations recorded by the CAMP network in the Chicago area ranged from 0.084 to 0.175 ppm (218 to 455 $\mu g/m^3$). Also, the CAMP network recorded 24-hour maximums of 0.67 ppm (1,742 $\mu g/m^3$) in 1964 and 0.55 ppm (1,430 $\mu g/m^3$) in 1965. All of these values exceed the current NAAQS for SO_2. IDENR (1994a) also reports that SO_2 levels in Cook County, IL, exceeded the NAAQS during 1978, 1980, and 1984. These values were not presented.

4.1.4.1 *Lake County, IN*

AIRS/AQS (1997) contains SO_2 ambient air monitoring data from three stations in Lake County, IN. Data were collected for two stations from 1992 to 1996, and from 1992 to 1994 for the third station. The annual mean decreased or remained the same for the two stations that reported data for 5 years, and increased or remained the same for the station that reported for only 3 years. The maximum concentration reported for this parameter was 0.01 ppm (26 $\mu g/m^3$), which is below the NAAQS of 0.03 ppm (80 $\mu g/m^3$). The NAAQS for the 24-hour maximum SO_2 is 0.14 ppm (365 $\mu g/m^3$). For the 5 years of data extracted from AIRS/AQS (1997), the SO_2 24-hour maximums fluctuated up and down at all three monitoring stations, and generally varied from a low of 0.018 ppm (47 $\mu g/m^3$) to 0.077 ppm (200 $\mu g/m^3$). The secondary NAAQS for the 3-hour maximum SO_2 is 0.5 ppm (1,300 $\mu g/m^3$). The interesting feature of the data collected for this parameter is that over the course of the 5 years, the values from the respective stations began to get closer. In 1992, the three monitoring stations had readings that ranged from 0.055 ppm (143 $\mu g/m^3$) and 0.207 ppm (538 $\mu g/m^3$). In 1995, the two remaining stations that collected data reported nearly the same value (0.111 and 0.112 ppm or, 288.6 and 291.2 $\mu g/m^3$).

4.1.5 Nitrogen Dioxide

Nitrogen dioxide (NO_2) appears to weaken human defenses against respiratory infection. Nitrogen dioxide also contributes to ozone formation (ALA, 1996b). The NAAQS for NO_2 is an annual arithmetic mean of 0.053 ppm (100 $\mu g/m^3$). EPA (1996b) presented limited nitrogen data from the PAMS network for three Lake Michigan sites near the Chicago metropolitan area. The data are for mean and maximum values of NO_2, as well as nitric oxide (NO) and NO_x. Comparing the Chicago data (1994) to Chicago/Jardine data (1995), shows a decrease of all reported values. The 1995 data indicate that the Gary site had higher mean and maximum concentrations of NO and NO_x, while the Chicago/Jardine data site had higher NO_2 concentrations (U.S. EPA, 1996b).

4.1.5.1 *Cook County, IL*

NO_2 was monitored at eight stations in the Cook County, IL, area in 1995. An average of over 7,200 samples were collected at each station. The highest concentration recorded was 0.113 ppm (213 $\mu g/m^3$) at the Chicago-Edgewater location on Ashland Street. The average of the readings taken in 1995 was 0.021 ppm (40 $\mu g/m^3$). The average of the recorded concentrations for 1990 through 1995 was 0.024 ppm (45 $\mu g/m^3$) (IEPA, 1996a).

EPA (1996b) reported no significant trend for the arithmetic mean for NO_2 concentration in Chicago, IL, for the period from 1986 through 1995. During this period, the reported values for this parameter started at 0.029 ppm (55 $\mu g/m^3$), ranged from a low of 0.024 ppm (45 $\mu g/m^3$) in 1991 to a high of 0.031 ppm (58 $\mu g/m^3$) in 1994, and ended at 0.03 ppm (57 $\mu g/m^3$). An arithmetic mean of 0.0322 ppm (61 $\mu g/m^3$) was reported for Cook County, IL, and 0.023 (43 $\mu g/m^3$) for Lake County, IN, in 1995. The highest value presented (61 $\mu g/m^3$ or 0.0322 ppm) was nearly 40 percent lower than the NAAQS of 100 $\mu g/m^3$ (0.053 ppm) for this parameter (U.S. EPA, 1996b).

For NO_2, IDENR (1994a) reported that the average annual 1-hour maximum decreased 5.5 percent over the 12-year period, with a high of 0.225 ppm (425 $\mu g/m^3$) in 1978 and a low of 0.089 ppm (168 $\mu g/m^3$) in 1990. NO_2 (average annual 24-hour maximum) showed a 5.2 percent decrease over the period, with a high of 0.097 ppm (183 $\mu g/m^3$) in 1978 and a low of 0.0495 ppm (93 $\mu g/m^3$)

in 1990 (IDENR, 1994a). These parameters oscillated up and down over the 13 years studied in the IDENR report, but showed a generally decreasing trend. For NO_2 (annual mean), the report showed a decrease of 6.8 percent over the same period, with a high of 0.051 ppm (96 $\mu g/m^3$) in 1979 and a low of 0.022 ppm (42 $\mu g/m^3$) in 1988. The annual mean for NO_2 showed a pronounced decreasing trend, with only minor fluxuations. For nitrate (annual mean), no significant trend was reported for the period, with a high of 6.3 $\mu g/m^3$ in 1983 and a low of 4.75 $\mu g/m^3$ in 1980 (IDENR, 1994a).

Wadden (1992) reported a mean concentration of 31.90 ppb (60 $\mu g/m^3$) and a maximum of 70.4 ppb (133 $\mu g/m^3$) for NO_2 in Chicago from 1990-91. Wadden, also reported a mean concentration of 22.6 ppb (28 $\mu g/m^3$) and a maximum of 112.5 ppb (141 $\mu g/m^3$) for NO in Chicago during the same timeframe.

The Scheff and Wadden report (unknown date) presents a summary of 1987 monitoring data from various other reports and provides average NO_x concentrations from three Chicago area locations. One location, classified as "Industrial," was on Chicago's southeast side. The "Urban" location (which collected both 4-hour and 20-hour samples) was at the University of Illinois at Chicago, located 2 kilometers west of downtown Chicago. The "Suburban" background site was described as approximately 55 kilometers north of downtown Chicago. The exact location of the suburban site was not provided by Scheff and Wadden; however, based on the description, it appeared to be near Waukegan (just outside Cook County, to the north). The average concentrations reported for NO_x were 44.4 $\mu g/m^3$ at the suburban location, 72.4 $\mu g/m^3$ and 78.3 $\mu g/m^3$ at the urban sites, and 97.0 $\mu g/m^3$ at the industrial location.

4.1.5.2 *Lake County, IN*

AIRS/AQS (1997) presents NO_2 ambient air monitoring data from two stations in Lake County, IN. Data are presented for one station for 1992 to 1996 and from 1995 and 1996 for the other station. The annual mean increased (to a maximum of 0.025 ppm or 47 $\mu g/m^3$) and then decreased for the station that reported data for 5 years. This maximum concentration was below the NAAQS of 0.053 ppm (100 $\mu g/m^3$) annual arithmetic mean for this parameter. There are no NAAQS levels for 1-hour maximum NO_2 For the 5 years extracted from AIRS, the NO_2 1-hour maximums reported remained fairly constant, except for a "spike" of 0.434 ppm (819 $\mu g/m^3$) in 1994. For the other years, this parameter was never greater than 0.125 ppm (236 $\mu g/m^3$) (AIRS/AQS, 1997).

4.1.6 Carbon Monoxide

When inhaled, carbon monoxide (CO) does no appreciable harm to the lungs; the impact is that it interferes with oxygenation of the entire human body. CO combines chemically with hemoglobin, the oxygen-transporting element of the blood, to form carboxyhemoglobin, which cannot carry oxygen to the brain, heart, and other vital organs (ALA, 1996b). The NAAQS for carbon monoxide is 9 ppm (10 $\mu g/m^3$) for 8 hours and 35 ppm (40 $\mu g/m^3$) for 1 hour.

EPA (1996b) reported no significant trend for the second highest 8-hour CO level for both Gary, IN, and Chicago, IL, for the period from 1986 through 1995. A side-by-side comparison of the data for the two cities reveal that for 5 of these 10 years, the levels were similar (different by only about 6 percent or less). However, for 2 of the remaining years, the levels differed by about 50 percent. In 1990, the second highest 8-hour CO for Gary was 3.8 ppm (4.3 $\mu g/m^3$), compared to 5.6 ppm (6.3 $\mu g/m^3$) for Chicago. In 1994, this parameter was 4.6 ppm (5.2 $\mu g/m^3$) in Gary, and 7.1 ppm (8.0 $\mu g/m^3$) in Chicago. Another data observation reveals that except for 3 years, the CO level for this parameter was higher in Chicago than in Gary. Finally, the second highest 8-hour CO for Lake County, IN, was 4.0 ppm (4.5 $\mu g/m^3$) in 1995, compared to the value of 3.7 ppm (4.2 $\mu g/m^3$) for Gary (U.S. EPA, 1996b). Similarly, the second highest 8-hour CO for Cook County, IL, was 5.1 ppm (5.8 $\mu g/m^3$) in 1995, compared to the value of 3.8 ppm (4.3 $\mu g/m^3$) for Chicago.

4.1.6.1 *Cook County, IL*

IEPA (1996a) presented CO monitoring data from eight stations in the Cook County area for 1995. Over 8,300 samples were collected at each station. The highest concentration recorded was 8.4 ppm (9.5 $\mu g/m^3$) at the Maywood sampling location on First Avenue.

Historical concentrations of CO in ambient air in Chicago, including data from as early as 1964, show that from 1964 to 1968, the average annual concentrations recorded by the CAMP network in the Chicago area ranged from a high of 17.1 ppm (19.3 $\mu g/m^3$) in 1965 to a low of 6.2 ppm (7.0 $\mu g/m^3$) in 1968 (IDENR, 1994a). Recognizing that data for 1967 were not available, this parameter steadily decreased from 1965 to 1968. Also, the CAMP network recorded daily hourly averages in 1964 ranging from 6.4 to 13.6 ppm (7.2 to 15.4 $\mu g/m^3$). IDENR (1994a) also cited a study of the Chicago area that used various instruments at various sites to monitor ambient air from late August through early November of 1973. Study results indicated that average carbon monoxide levels ranged from 4 to 7 ppm (4.5 to 7.9 $\mu g/m^3$) during that time.

CO (average annual 1-hour maximum) decreased 3.7 percent from 1978 to 1990, with a high of 14.4 ppm (16.3 $\mu g/m^3$) in 1983, and a low of 7.3 ppm (8.2 $\mu g/m^3$) in 1989 (IDENR, 1994a). CO (average annual 8-hour maximum) decreased 5.3 percent over the same period, with a high "spike" of 10.9 ppm (12.3 $\mu g/m^3$) in 1983 and a low of 3.7 ppm (4.2 $\mu g/m^3$) in 1990. This parameter oscillated up and down from 1978 to 1983, and then decreased quickly to 5.55 ppm (6.27 $\mu g/m^3$) in 1985. From 1985 to 1990, the average annual 8-hour maximum for CO has slowly decreased from 5.55 ppm (6.27 $\mu g/m^3$) to 3.7 ppm (4.2 $\mu g/m^3$) (IDENR, 1994a).

During 1990-91, a mean concentration of 0.91 ppm (1.03 $\mu g/m^3$) and a maximum of 1.89 ppm (2.14 $\mu g/m^3$) for CO was reported in ambient air in Chicago (Wadden, 1992). Ito and Thurston (1996) presented data that were compiled from various sources in Cook County, IL, summarizing monitoring that occurred from 1985 to 1990. The mean concentration for CO was reported as 2.05 ppm (2.32 $\mu g/m^3$).

4.1.6.2 *Lake County, IN*

CO data from the AIRS/AQS (1997) data base were only available from two stations in Lake County, IN. Both stations reported a 1-hour and an 8-hour maximum. Data for the 1-hour maximums show a "cyclic" trend that alternates from increasing to decreasing for each successive year; however, there was an overall decrease (the 1996 value for each station is lower than the corresponding 1992 value). Data for the 8-hour maximums at one monitoring site show a slight increase, followed by a more significant drop in 1996. The data reported from the other station were irregular, with an average of 5.64 ppm (6.37 $\mu g/m^3$) and a maximum of 8.2 ppm (9.3 $\mu g/m^3$) (AIRS/AQS, 1997).

4.1.7 Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs)

Common VOC sources include gasoline vapors, chemical solvents, and consumer products. Often, VOCs can be emitted or are present in one location, and migrate to another location where sunlight and temperature cause chemical reactions to occur (U.S. EPA, 1996b). As mentioned earlier, ozone is created from a reaction of NO_x and VOCs in the presence of heat and sunlight. The health effects of ozone were also discussed earlier in this section.

VOCs monitoring results are presented from a number of reports. Two sources (U.S. EPA, 1996b and IEPA, 1996a) present results in units of parts per billion carbon (ppbC). IEPA indicates that this type of sampling "reduces all of the results to a common basis in terms of single carbon atoms" (IEPA, 1996a). These sampling results are discussed briefly below, but are not presented with or compared to the other reports, which present data using more conventional units such as parts per billion by volume (ppbv) or $\mu g/m^3$. Comparison of the relative magnitude of the different compounds is possible with the data sets from each study, and graphs and tables are presented to facilitate these comparisons.

VOC data presented by EPA (1996b) for 1994 and 1995 from the PAMS network include two Lake Michigan sites near the Chicago metropolitan area. For 1994, data were only presented for the Chicago site. For the VOCs monitored in 1994, toluene was detected at the highest concentration (106.1 ppbC), and had the highest mean (23.5 ppbC). The next highest mean concentrations reported at the Chicago site were for formaldehyde (9.6 ppbC), benzene (9.6 ppbC), and ethylene (13.4 ppbC). For 1995, benzene was the highest VOC detected (160 ppbC) at the Gary site; however, the highest mean concentration recorded was toluene (11 ppbC) at the Chicago/Jardine site. The next two highest recorded mean concentrations were formaldehyde (9.2 ppbC) and benzene (7 ppbC), both at the Chicago/Jardine site. Figure 4-21 shows the benzene data presented by EPA (1996b). Both the average and maximum for the Chicago area decreased from 1994 to 1995. In

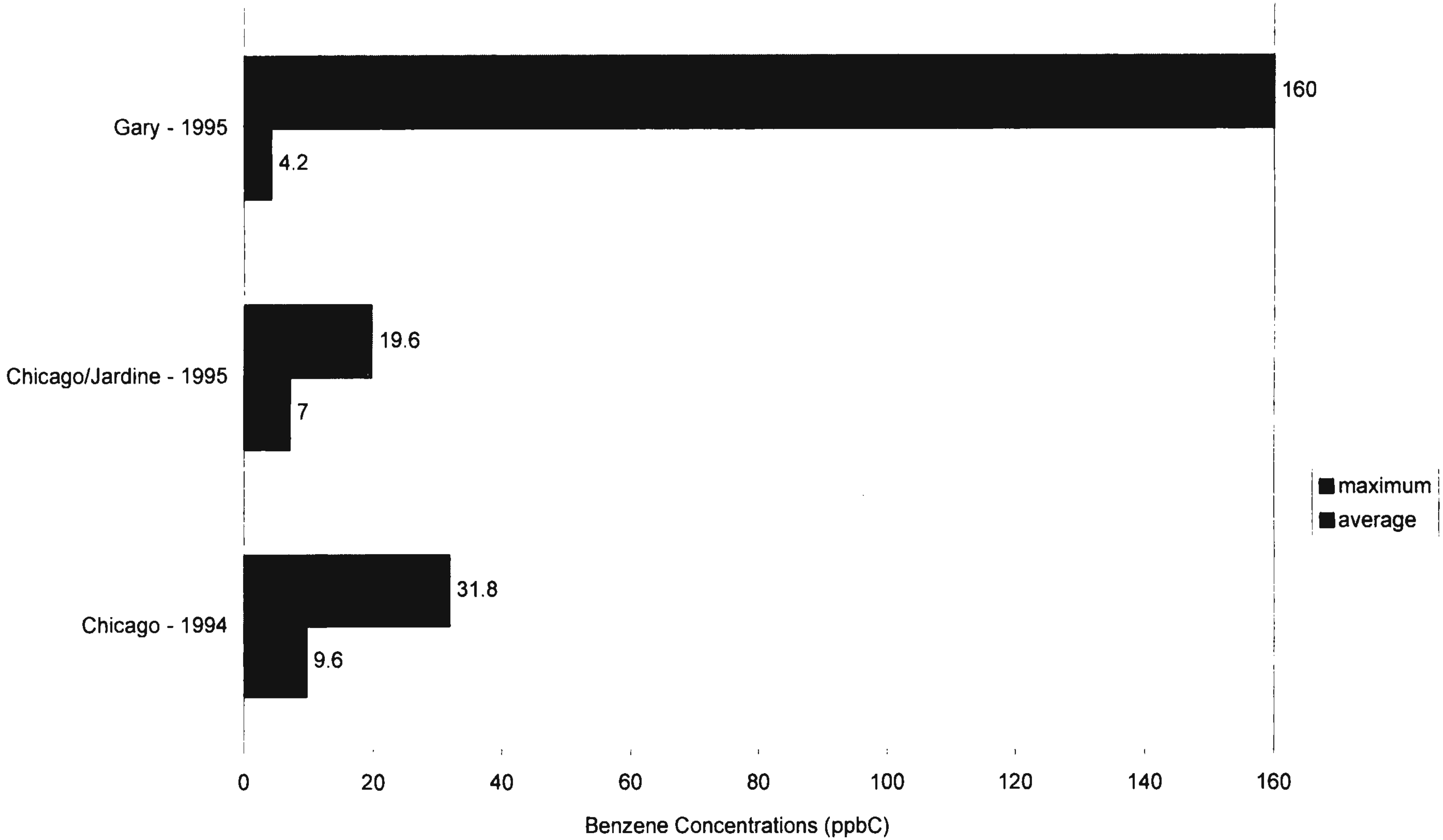


Figure 4-21. Benzene Levels in Chicago, IL, and Gary, IN in 1994-1995

Source: EPA, 1996.

1995, the average benzene level was higher in Chicago than in Gary, but only by a small amount. The 1995 maximum in Gary (160 ppbC) was significantly higher than that same value for Chicago.

The highest maximum value reported by IEPA (1996a) for VOCs in the Cook County, IL, area was for formaldehyde at 86 ppbC. The highest averages reported were for isopentane (11.9 ppbC), toluene (11 ppbC), formaldehyde (9.2 ppbC), ethane (8.9 ppbC), benzene (7 ppbC), and propane (7 ppbC). The 53 remaining VOCs had average concentrations less than 7 ppbC (IEPA, 1996a). Results for a few VOCs, based on sampling conducted during 1986 and 1987 at the Bright Elementary School in Chicago, IL, showed the highest averages were for benzene (1.6 ppbv), toluene (1.7 ppbv), and o-xylene (2.2 ppbv) (Sweet and Gatz, 1988). All other organics were reported below 1 ppbv.

McAlister, et al. (1991) presents the results for the 1990 UATMP for 38 target organic compounds at 12 sites in the United States. Analysis of 30 air toxic pollutants were reported for the UATMP site in Chicago. Only 8 of these 30 compounds were identified in all 29 samples collected at the Chicago site. Mean concentrations of these compounds were provided as follows: ethylbenzene (0.39 ppbv), carbon tetrachloride (0.44 ppbv), styrene/o-xylenes (0.84 ppbv), 1,1,1-trichloroethane (1.44 ppbv), tetrachloroethylene (1.53 ppbv), benzene (1.55 ppbv), m&p xylene (2.18 ppbv), and toluene (3.04 ppbv). Trichloroethylene was identified in 16 samples, and methylene chloride and p-dichlorobenzene were identified in 12 samples. The remaining 18 compounds were identified in 6 samples or less. The highest maximum values reported for specific compounds were for acetylene (11.70 ppbv), propylene (14.97 ppbv), and methylene chloride (25.05 ppbv). All other maximums were below 10 ppbv. The highest mean values reported for specific compounds were for propylene (7.21 ppbv), vinyl chloride (8.50 ppbv), and methylene chloride (8.66 ppbv). All other mean values were below 5 ppbv. Radian Corporation (1991) presents the results for the 1990 Urban Air Toxics Monitoring Program (UATMP) for three carbonyl compounds at 12 sites in the United States. The three compounds were identified in all 28 samples collected at the Chicago site. Mean concentrations of these compounds were provided as follows: formaldehyde (4.7529 ppbv), acetaldehyde (2.0377 ppbv), and acetone (2.9138 ppbv). Maximum values were reported as follows: formaldehyde (13.64 ppbv), acetaldehyde (4.83 ppbv), and acetone (7.82 ppbv). Table 4-6 provides

Table 4-6: VOCs Monitored at the Chicago UATMP Site in 1990 and 1991 (ppbv)

Chemical	number of samples	positive samples	concentration range mean	minimum	maximum
acetylene	29	4	4.18	0.94	11.70
1,3-butadiene	29	4	0.13	0.10	0.18
vinyl chloride	29	1	8.5	8.50	8.50
chloromethane	29	1	2.45	2.45	2.45
methylene chloride	29	12	8.66	0.87	25.05
trans-1,2-dichloroethylene	29	4	0.4	0.14	0.94
1,1-dichloroethane	29	1	0.49	0.49	0.49
chloroprene	29	6	0.28	0.05	1 05
1,1,1-trichloroethane	29	29	1.44	0.28	7.94
carbon tetrachloride	29	29	0.44	0.11	3.48
benzene	29	29	1.55	0.09	5.51
trichloroethylene	29	16	0 36	0.02	0.83
1,2-dichloropropane	29	4	0.73	0 08	1.09
bromodichloromethane	29	2	0.12	0 07	0.16
trans-1,3-dichloropropylene	29	2	1.08	0.70	1.45
toluene	29	29	3.04	0.64	8.53
n-octane	29	6	0.68	0.04	1.83
n-octane/t-1,3-dichloropropylene	29	2	0.46	0.16	0.76
cis-1,3-dichloropropylene	29	1	0.32	0.32	0.32
1,1,2-trichloroethane	29	4	0.03	0.02	0.04
tetrachloroethylene	29	29	1.53	0.17	5.78
chlorobenzene	29	3	0.03	0.02	0.04
ethylbenzene	29	29	0 39	0.05	1.46
m&p xylene	29	29	2 18	0.22	8.74
styrene/o-xylenes	29	29	0 84	0.07	2.86
1,1,2,2-tetrachloroethane	29	3	0.38	0.05	1.04
m-dichlorobenzene	29	6	0.08	0 01	0.27
p-dichlorobenzene	29	12	0.3	0.08	1.48
o-dichlorobenzene	29	4	0.33	0.05	0.88
propylene	29	4	7.21	3.05	14.97
formaldehyde *	28	28	4.7529	2.445	13.64
acetaldehyde *	28	28	2.0377	0.925	4.83
acetone *	28	28	2.9138	0.83	7.82

Sources: McAlister, et al, 1991; Radian, 1991.

minimum, maximum, and mean values for these 38 compounds and the 3 compounds discussed in the McAlister et al. (1991) and Radian (1991) reports.

Keeler (1994) provides summaries of monitoring data collected in 1991 from one central Chicago site and one site located offshore of Chicago on Lake Michigan. According to the report, the VOC analyses presented were "somewhat suspect," and data quality was poor due to a contaminant problem with a majority of the samples (Keeler, 1994). For the IIT site, the highest averages for VOCs were for 1,1,2-trichloro-1,2,2-trifluoroethane, trichloro-fluoromethane, and toluene at 1.76 ppbv, 1.94 ppbv, and 2.33 ppbv, respectively. The maximums for these compounds were 6.32 ppbv, 8.76 ppbv, and 15.08 ppbv, respectively. All other VOCs studied had averages less than 1 ppbv (Figure 4-22). For the site aboard the R/V *Laurentian*, maximums for dichlorodifluoromethane, toluene, m&p xylene, and trichlorofluoromethane were 1.05 ppbv, 2.39 ppbv, 2.1 ppbv, and 1.33 ppbv, respectively. All other maximums were below 1 ppbv. The highest average value was for trichlorofluoromethane at 0.78 ppbv. For the polycyclic aromatic hydrocarbons (PAHs) studied, the greatest averages reported at the IIT site were for phenanthrene at 0.168 $\mu g/m^3$) and naphthalene at 0.507 $\mu g/m^3$. At the R/V *Laurentian* site, the highest average was for naphthalene at 0.119 $\mu g/m^3$. (See Figure 4-23.) All other averages were less than 100 ng/m^3 (0.1 $\mu g/m^3$) (Keeler, 1994). Table 4-7 presents the VOC and PAH data obtained from the Keeler (1994) report.

Weston (1994) presented average values for benzene (64 $\mu g/m^3$), methylene chloride (11 $\mu g/m^3$), and toluene (2,500 $\mu g/m^3$) in ambient air at the New Gary School in Chicago, but monitoring dates were not provided. Data for benzene from various sources are provided in Figure 4-24. Benzene data from this report are not included, because they are significantly higher than data from other reports and distort the graphic.

Some data on VOC monitoring were collected from several studies and compiled into one report (IDENR, 1994a). These data represent monitoring from 1986 through 1991, covering 3 monitoring stations and over 30 compounds. The highest average values presented for VOCs in the IDENR (1994a) report were for o-dichlorobenzene (20.4 $\mu g/m^3$ at Chicago, center city), m&p xylene (20.6 $\mu g/m^3$ at Carver High School and 24.6 $\mu g/m^3$ at Chicago, center city), bromodichloromethane

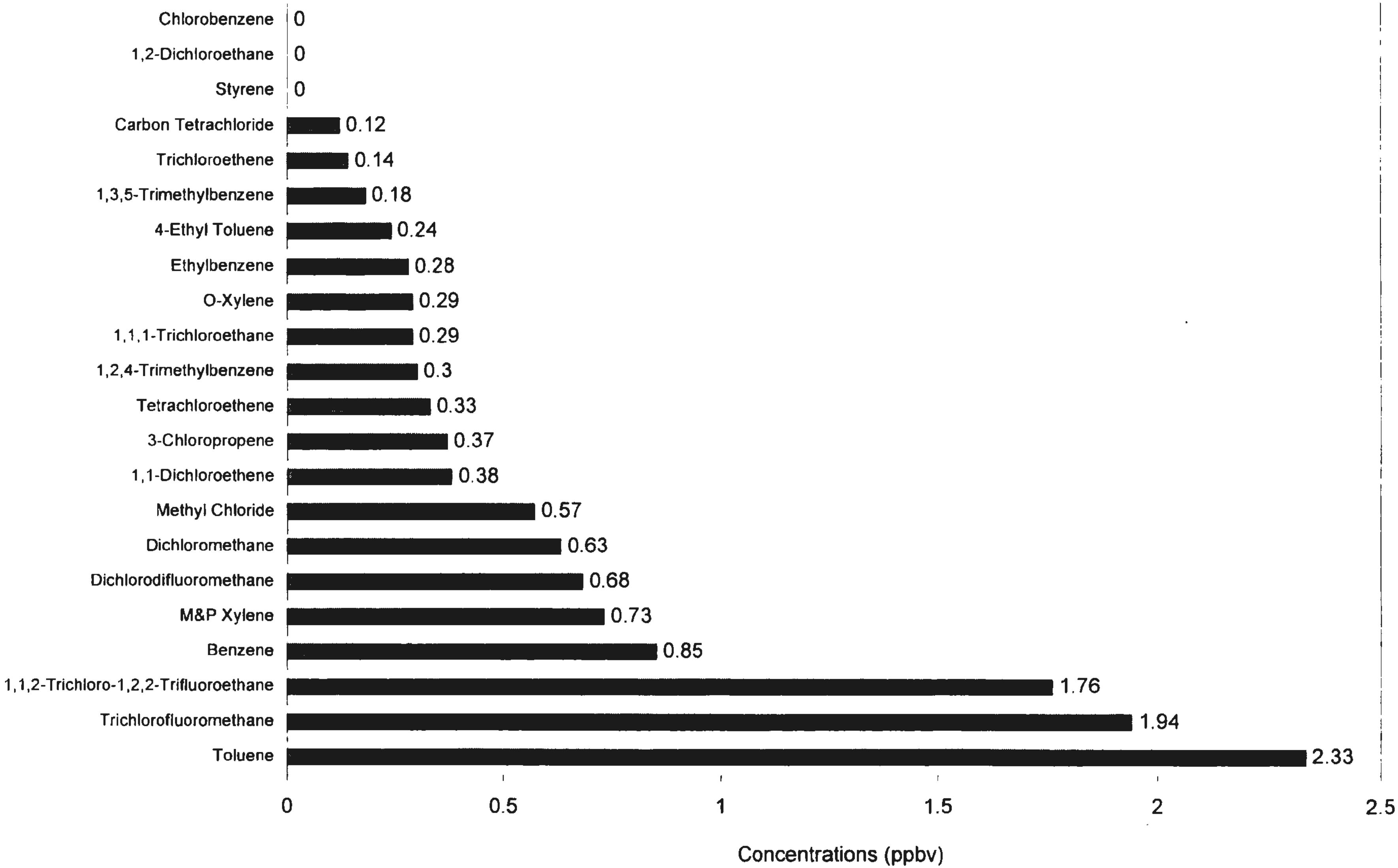


Figure 4-22. VOCs Monitored at IIT Site in Central Chicago (1991)

Source: Keeler, 1994.

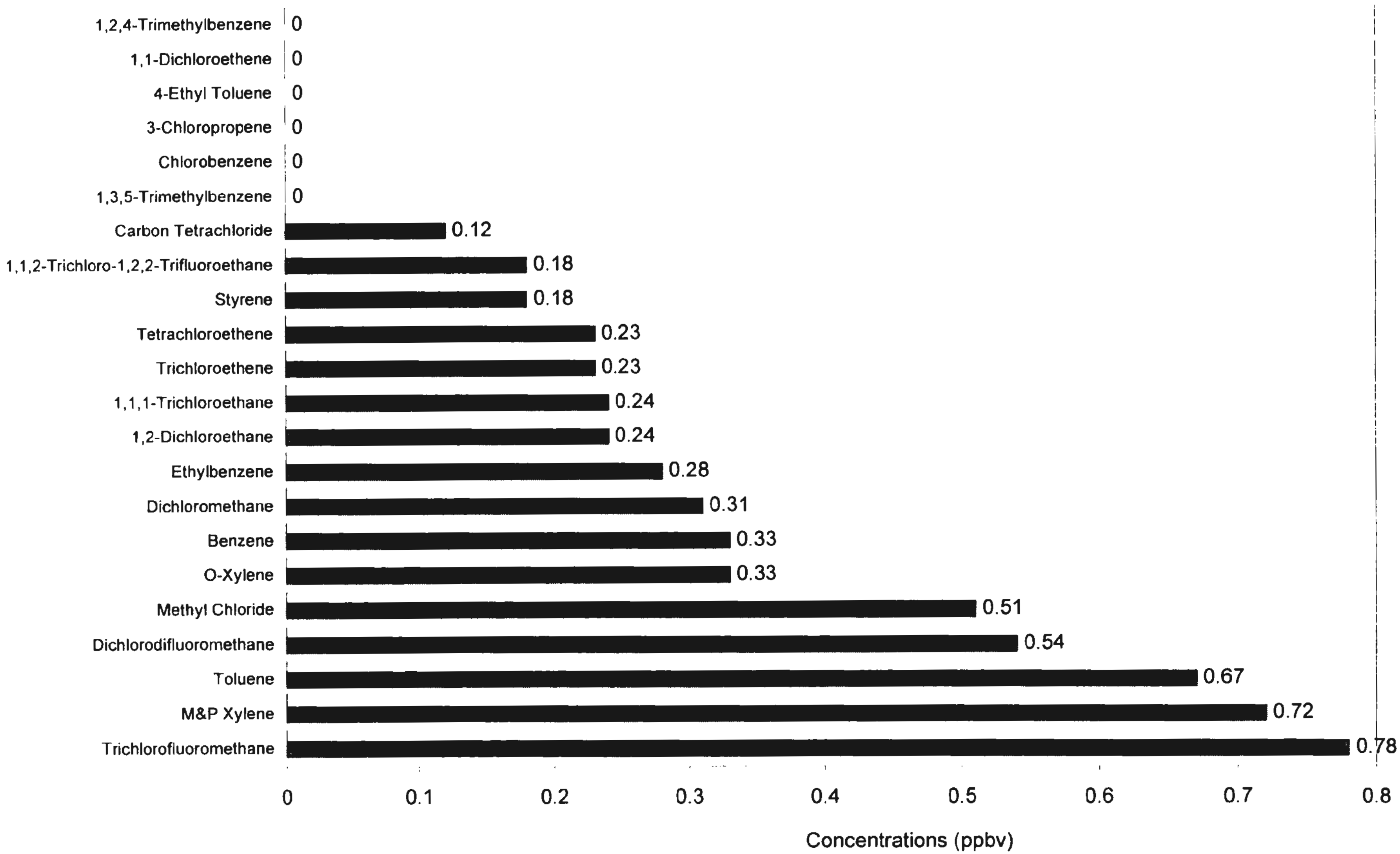


Figure 4-23. VOCs Monitored Aboard the R/V Laurentian Off-Shore Near Chicago (1991)

Sourc 'eeler, 1994.

Table 4-7. VOCs and PAHs Monitored in Chicago Area in 1991

Chemical	mean concentration	maximum concentration	notes
Volatile Organic Chemicals (values in parts per billion volume)			
toluene	2.33	15.08	(a)
trichlorofluoromethane	1.94	8.76	(a)
1,1,2-trichloro-1,2,2-trifluoroethane	1 76	6.32	(a)
benzene	0.85	4.11	(a)
m&p xylene	0.73	6.87	(a)
dichlorodifluoromethane	0.68	1.22	(a)
dichloromethane	0.63	1.40	(a)
methylene chlonde	0.57	0.89	(a)
1,1-dichloroethene	0.38	0.47	(a)
3-chloropropene	0.37	0.45	(a)
tetrachloroethene	0.33	1.44	(a)
1,2,4-trimethylbenzene	0 30	1.95	(a)
1,1,1-trichloroethane	0.29	0.76	(a)
o-xylene	0.29	2.52	(a)
ethylbenzene	0.28	1.96	(a)
4-ethyl toluene	0.24	0.79	(a)
1,3,5-tnmethylbenzene	0.18	0.55	(a)
tnchloroethene	0.14	0.23	(a)
carbon tetrachloride	0.12	0.25	(a)
styrene	<0.1	N/A	(a)
1,2-dichloroethane	<0.1	N/A	(a)
chlorobenzene	<0.1	N/A	(a)
tnchlorofluoromethane	0.78	1.33	(b)
m&p xylene	0.72	2.1	(b)
toluene	0.67	2.39	(b)
dichlorodifluoromethane	0.54	1.05	(b)
methy chloride	0.51	0.75	(b)
o-xylene	0 33	0.72	(b)
benzene	0.33	0.61	(b)
dichloromethane	0.31	0.33	(b)
ethylbenzene	0.28	0.47	(b)
1,2-dichloroethane	0.24	0.24	(b)
1,1,1-trichloroethane	0.24	0.41	(b)
tnchloroethene	0.23	0.23	(b)
tetrachloroethene	0.23	0.23	(b)
styrene	0.18	0.27	(b)
1,1,2-tnchloro-1,2,2-trifluoroethane	0.18	0.35	(b)
carbon tetrachlonde	0.12	0.23	(b)
1,3,5-trimethylbenzene	<0.1	N/A	(b)
chlorobenzene	<0.1	N/A	(b)
3-chloropropene	<0.1	N/A	(b)
4-ethyl toluene	<0.1	N/A	(b)
1,1-dichloroethene	<0 1	N/A	(b)
1,2,4-tnmethylbenzene	<0 1	N/A	(b)

Table 4-7. VOCs and PAHs Monitored in Chicago Area in 1991

Chemical	mean concentration	maximum concentration	notes
Polynuclear Aromatic Hydrocarbons (values in nanograms per cubic meter)			
naphthalene	507.25	805.66	(a)
acenaphthylene	4.79	14.21	(a)
acenaphthene	55.91	133.38	(a)
fluorene	53.67	132.29	(a)
phenanthrene	167.92	427.53	(a)
anthracene	7.59	17.60	(a)
fluorenone	12.08	23.42	(a)
retene	0.58	0.92	(a)
fluoranthene	46.58	109.70	(a)
pryene	23.58	55.30	(a)
benz[a]anthracene	3.02	8.88	(a)
chrysene	5 17	12.96	(a)
cyclopenta(cd)pryene	0.22	0.63	(a)
benzofluoranthenes	10.16	32 89	(a)
benz[e]pyrene	2 81	9.09	(a)
benz[a]pyrene	3.04	15.31	(a)
indeno[1,2,3-cd]-pyrene	3.90	10.21	(a)
dibenzo[a,h]-anthracene	1.39	3.24	(a)
benzo[g,h,i]perylene	3.32	7.99	(a)
coronene	1.39	3.90	(a)
naphthalene	119.38	421.42	(b)
acenaphthylene	1.41	3.81	(b)
acenaphthene	2.28	8.10	(b)
fluorene	7.17	15.69	(b)
phenanthrene	10.78	31 13	(b)
anthracene	0.27	0.78	(b)
fluorenone	1.11	2.39	(b)
retene	0.57	1.30	(b)
fluoranthene	3.22	8.80	(b)
pryene	1.60	5.18	(b)
benz[a]anthracene	0.26	1.25	(b)
chrysene	0 62	2.50	(b)
cyclopenta(cd)pryene	0.09	0.52	(b)
benzofluoranthenes	0.91	3 74	(b)
benz[e]pyrene	0.25	1.03	(b)
benz[a]pyrene	0.25	0.80	(b)
indeno[1,2,3-cd]-pyrene	0.41	1.63	(b)
dibenzo[a,h]-anthracene	0.21	0.58	(b)
benzo[g,h,i]perylene	0.33	1.39	(b)
coronene	0.16	0 43	(b)

NOTES:

(a) Monitoring location IIT site in central Chicago, 1 6 km from Lake Michigan

(b) Monitoring location aboard R/V Laurentian, offshore of Chicago, on Lake Michigan

Source Keeler, 1994

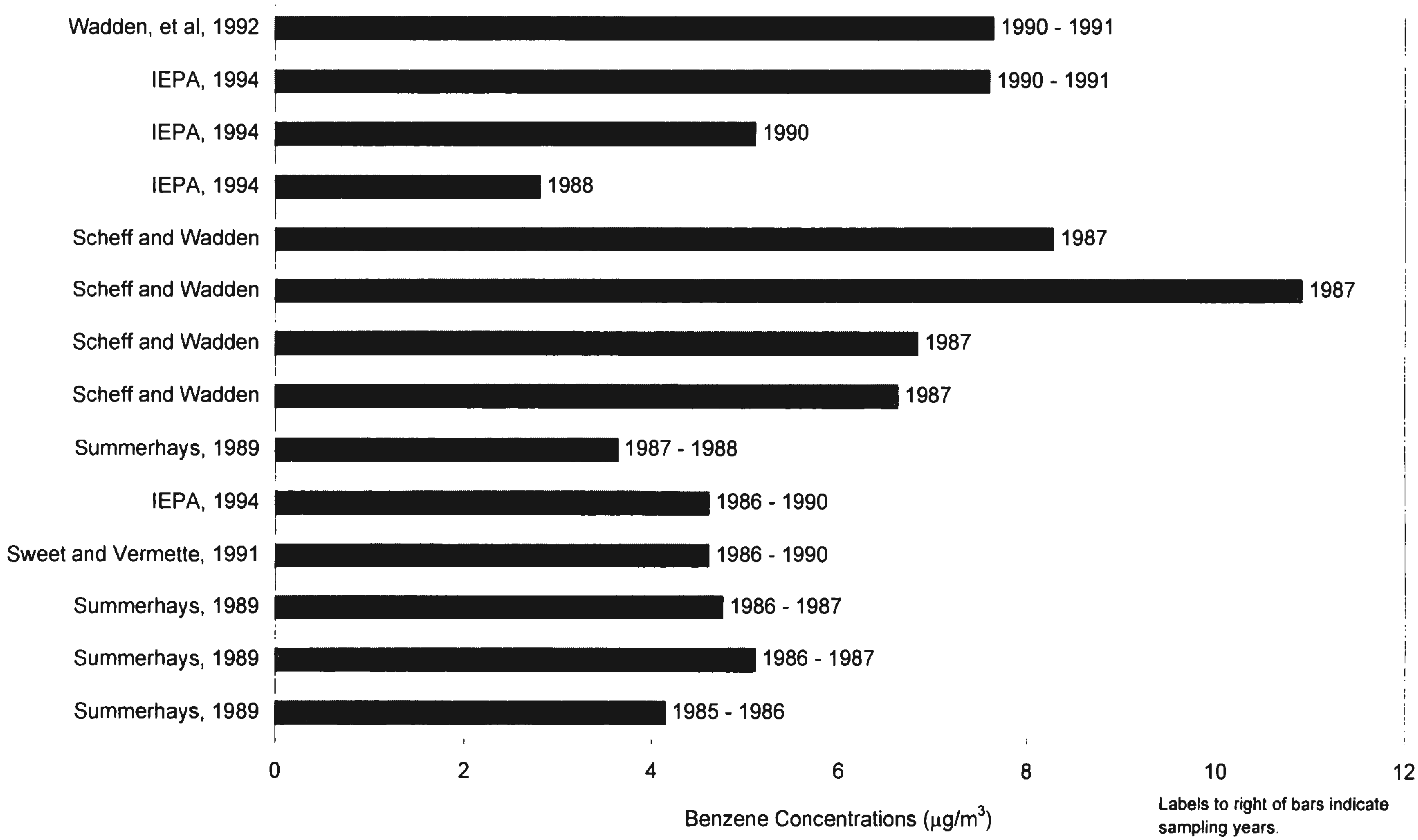


Figure 4-24. Ambient Benzene Levels for Chicago Presented by Various Sources

(20.7 $\mu g/m^3$ at Chicago, center city), toluene (23.5 $\mu g/m^3$ at Chicago, center city, and 61.1 $\mu g/m^3$ at Carver High School), and dibromochloromethane (81.8 $\mu g/m^3$ at Chicago, center city). All other VOCs were reported below 20 $\mu g/m^3$. These data are presented in Table 4-8.

The U.S. EPA (1989a) report focused on a 65-square-mile area of Southeast Chicago. Ambient air monitoring was conducted at the Southeast Police Station and various elementary and high schools in the area from 1985 through 1988. Monitored concentrations of benzene, toluene, and xylenes and styrene were as high as 5.1, 13, and 43 $\mu g/m^3$, respectively. Average values of carbon tetrachloride, chloroform, ethylene, formaldehyde, and perchloroethylene were reported as 2.7, 2.78, 4.61, 2.5, and 2.37 $\mu g/m^3$, respectively (U.S. EPA, 1989a). All other monitored constituents were reported below 1 $\mu g/m^3$. Data quality is expected to be good, because the studies were conducted by EPA, IEPA, and other Federal and State organizations.

The Scheff and Wadden report (unknown date) presents average concentrations of 23 VOCs sampled in 1987 from three Chicago area locations classified as: Industrial (Southeast Chicago), Urban (University of Illinois at Chicago), and Suburban (approximately 55 km north of downtown Chicago). The suburban site is probably located just outside Cook County, IL. The top five monitored organics at the "Industrial" location were: 1,1,1-trichloroethane [TCA] (21.9 $\mu g/m^3$), isopentane (19.3 $\mu g/m^3$), n-pentane (13.8 $\mu g/m^3$), toluene (10.97 $\mu g/m^3$), and n-butane (10.8 $\mu g/m^3$). These were also the top five compounds monitored at the 4-hour "Urban" location (the highest levels were for 1,1,1-trichloroethane at 11.6 $\mu g/m^3$ and isopentane at 13.7 $\mu g/m^3$). The top 5 organics at the 20-hour "Urban" location were: 1,1,1-TCA (15.9 $\mu g/m^3$), isopentane (15.37 $\mu g/m^3$), n-pentane (13.9 $\mu g/m^3$), benzene (10.9 $\mu g/m^3$), and toluene (10.3 $\mu g/m^3$). The average concentration of 1,1,1-TCA at the "Suburban" monitoring location was 13.1 $\mu g/m^3$. All other values reported were below 10 $\mu g/m^3$.

Sweet and Vermette (1991) present data collected for 11 VOCs from three monitoring sites in Southeast Chicago, located at Bright, Washington, and Carver Schools. Samples were collected from May 1986 through April 1990. For the data presented, the highest averages were for toluene (8.9 $\mu g/m^3$) and benzene (4.6 $\mu g/m^3$). The remaining VOCs had reported averages less than 4 $\mu g/m^3$. The highest maximums reported were also for toluene (56 $\mu g/m^3$) and benzene (54 $\mu g/m^3$). The next

Table 4-8: Volatile Organic Compounds Monitored Near Chicago

(values presented in mircograms per cubic meter)

Chemical	number of samples	concentration range		location	location description	sample year
		mean	maximum			
acetaldehyde	28	3 8	9 00	Carver High School	4611 7N/450 9E	1990
acetylene	60	5 2	13 40	Chicago	near city center	1990-91
acetone	28	7 2	19 00	Carver High School	4611 7N/450 9E	1990
benzene	103	4 6	54 00	southeastern Chicago	several sites	1986-90
benzene	34	2 8	23 00	Carver High School	4611 7N/450 9E	1988
benzene	29	5 1	18 00	Carver High School	4611 7N/450 9E	1990
benzene	78	7 6	38 00	Chicago	near city center	1990-91
bromodichloromethane	56	20 7	582 00	Chicago	near city center	1990-91
butane	71	13	241 00	Chicago	near city center	1990-91
i-butane	64	7	91 00	Chicago	near city center	1990-91
carbon tetrachloride	103	0 7	1 70	southeastern Chicago	several sites	1986-90
carbon tetrachloride	29	2 9	23 00	Carver High School	4611 7N/450 9E	1990
carbon tetrachloride	63	7 4	34 00	Chicago	near city center	1990-91
chlorobenzene	103	0 3	1 60	southeastern Chicago	several sites	1986-90
chloroform	103	0 3	1 60	southeastern Chicago	several sites	1986-90
chloroform	66	4 6	40 00	Chicago	near city center	1990-91
cumene	65	6 4	277 00	Chicago	near city center	1990-91
n-decane	53	8 6	282 00	Chicago	near city center	1990-91
dibromochloromethane	63	81 8	1,025 00	Chicago	near city center	1990-91
o-dichlorobenzene	52	20 4	150 00	Chicago	near city center	1990-91
2,2-dimethylbutane	76	4 5	41 00	Chicago	near city center	1990-91
ethane	60	9 9	22.80	Chicago	near city center	1990-91
ethylbenzene	103	1 4	7 60	southeastern Chicago	several sites	1986-90
ethylbenzene	34	3	26 00	Carver High School	4611 7N/450 9E	1988
ethylbenzene	29	1 8	6 60	Carver High School	4611 7N/450 9E	1990
ethylbenzene	78	8.8	195 00	Chicago	near city center	1990-91
ethylene	60	7 3	16 70	Chicago	near city center	1990-91
formaldehyde	28	6	17 00	Carver High School	4611 7N/450 9E	1990
n-heptane	56	6 4	45 00	Chicago	near city center	1990-91
hexane	78	9 2	137 00	Chicago	near city center	1990-91
2-methylbutane	77	16 7	76 00	Chicago	near city center	1990-91
methylene chloride	65	19 5	174 00	Chicago	near city center	1990-91
2-methylpentane	77	7 1	40 00	Chicago	near city center	1990-91
3-methylpentane	77	6 4	39 00	Chicago	near city center	1990-91
n-octane	39	1 5	3 70	Chicago	near city center	1990-91
pentane	78	8 6	72 00	Chicago	near city center	1990-91
alpha-pinene	60	0 1	1 40	Chicago	near city center	1990-91
n-propylbenzene	74	8 5	247 00	Chicago	near city center	1990-91
tetrachloroethylene	103	1 8	9 10	southeastern Chicago	several sites	1986-90
tetrachloroethylene	29	10 7	41 00	Carver High School	4611 7N/450 9E	1990
tetrachloroethylene	60	1 8	83 00	Chicago	near city center	1990-91
toluene	103	8 9	56 00	southeastern Chicago	several sites	1986-90
toluene	34	61 1	1,284 00	Carver High School	4611 7N/450 9E	1988
toluene	29	11 8	33 00	Carver High School	4611 7N/450 9E	1990
toluene	78	23 5	131 00	Chicago	near city center	1990-91
1,1,1-trichloroethane	103	3 3	25 00	southeastern Chicago	several sites	1986-90
1,1,1-trichloroethane	34	4 1	23 00	Carver High School	4611 7N/450 9E	1988
1,1,1-trichloroethane	29	8 1	45 00	Carver High School	4611 7N/450 9E	1990
1,1,1-trichloroethane	73	17 5	125 00	Chicago	near city center	1990-91
trichloroethylene	103	1	5 90	southeastern Chicago	several sites	1986-90
trichloroethylene	29	1 2	5 00	Carver High School	4611 7N/450 9E	1990
trichloroethylene	76	3 2	13 70	Chicago	near city center	1990-91
1,3,5-trimethylbenzene	77	6 8	212 00	Chicago	near city center	1990-91
m&p xylene	103	3 9	22 00	southeastern Chicago	several sites	1986-90
m&p xylene	34	20 6	301 00	Carver High School	4611 7N/450 9E	1988
m&p xylene	29	9 8	39 00	Carver High School	4611 7N/450 9E	1990
m&p xylene	78	24 6	763 00	Chicago	near city center	1990-91
o-xylene/styrene	103	2 9	44 00	southeastern Chicago	several sites	1986-90
o-xylene/styrene	34	3 9	54 00	Carver High School	4611 7N/450 9E	1988
o-xylene/styrene	29	3 7	13 00	Carver High School	4611 7N/450 9E	1990
o-xylene/styrene	78	18 8	650 00	Chicago	near city center	1990-91

Source IDENR, 1994a

highest maximums were for m&p xylene, 1,1,1-trichloroethane, and o-xylene/styrene at 22 $\mu g/m^3$, 25 $\mu g/m^3$, and 44 $\mu g/m^3$, respectively (Sweet and Vermette, 1991). All remaining VOCs had reported maximums less than 10 $\mu g/m^3$.

The following observations of the ambient air in Chicago in 1990 and 1991 can be made from the data presented by Wadden et al. (1992): mean concentrations of nonmethane organic compounds ranged from 0.14 $\mu g/m^3$ for α-pinene to 24.57 $\mu g/m^3$ for m&p-xylene. Mean concentrations of halogenated organics ranged from 1.82 $\mu g/m^3$ for perchloroethylene to 646.17 $\mu g/m^3$ for dibromo-chloromethane. Mean concentrations of semi-volatile organics ranged from 0.40 $\mu g/m^3$ (0.0004 $\mu g/m^3$) for coronene to 495 ng/m^3 (0.495 $\mu g/m^3$) for naphthalene.

4.1.8 PCBs, Pesticides, and Other Compounds

Keeler (1994a) provides summaries of PCB monitoring data collected from one central Chicago site (IIT), and one site located offshore of Chicago on Lake Michigan. The average total PCBs measured at the IIT site were at 2,139 picograms per cubic meter (pg/m^3). A picogram is 1-million times smaller than a microgram. Therefore, for clarity (and because the concentrations of PCBs and pesticides in air are relatively low), these two paragraphs discuss concentrations in pg/m^3. The next highest averages were for total di-PCBs (186.00 pg/m^3), total hexa-PCBs (230.00 pg/m^3), total tri-PCBs (422.00 pg/m^3), total tetra-PCBs (463.00 pg/m^3), and total penta-PCBs (707.00 pg/m^3). Total PCBs, measured at the R/V *Laurentian* site, were at an average concentration of 808 pg/m^3. The next highest averages were for total tetra-PCBs (101.00 pg/m^3), total di-PCBs (107.00 pg/m^3), total mono-PCBs (164.00 pg/m^3), and total penta-PCBs (290.00 pg/m^3). Remaining PCB averages (at both sites) were all less than 100 pg/m^3.

In regard to the pesticides, Keeler (1994) indicates that the highest averages at the IIT site were for atrazine (183.00 pg/m^3), 4,4'-DDT (183.00 pg/m^3), dieldrin (159.00 pg/m^3), P,P'-DDE (119.00 pg/m^3), alpha-HCH (111.86 pg/m^3), and simazine (103.00 pg/m^3). The highest averages at the R/V *Laurentian* site were for atrazine (286.00 pg/m^3), alpha-HCH (169.20 pg/m^3), hexachlorobenzene (104.00 pg/m^3), and lindane (103.00 pg/m^3). All other averages for pesticides were less than 100 pg/m^3.

Keeler (1994) reports that analysis of 58 samples for vapor-phase mercury revealed an average of 8.7 ng/m^3 (0.0087 μg/m^3) and a maximum of 62.7 ng/m^3 at (0.0627 μg/m^3) the IIT site. The 25 samples taken aboard the R/V *Laurentian* indicated an average of 2.3 ng/m^3 (0.0023 μg/m^3) and a maximum of 4.9 ng/m^3 (0.0049 μg/m^3). Most other metals that are considered hazardous are such when they are solids, and fall under the category of particulate matter. Ambient air levels for lead and other metal particulates were discussed earlier in this document. (See Sections 4.1.2 and 4.1.3.)

The IEPA report (1985) presents estimated PCB concentrations at two Southeast Chicago locations, based on the Real-Time Air Quality Model (RAM). The model predicted that the highest concentrations at the Orville T. Bright and Virgil S. Grissom Elementary School sites would be 0.0034 μg/m^3 and 0.0007 μg/m^3, respectively. However, the report only presented the plan to evaluate PCBs in these locations; actual air monitoring was not completed when the report was published.

4.2 SURFACE WATER QUALITY

Surface water quality in Cook County, IL, and Lake County, IN, is an indicator of the condition of the environment, especially from the standpoint of the potential for human exposure and risk from toxic chemicals. Human risks from contaminated surface waters can result from direct exposure through recreational use (swimming/wading and ingestion of water), and indirectly through fish consumption and drinking water. In general, the waterbodies in this area are stressed from past and present municipal/industrial discharges, nonpoint source runoff, combined sewer overflow, physical alteration, and other sources. (See Section 3.2.) Although improvements in water quality are evident, pollutants are still present in many waterbodies at levels above standards.

Surface Waters

- Assessing Levels of Contaminants and the Condition of Major Waterbodies
  - Rivers/Streams
  - Lakes
  - Lake Michigan
- Identification of Levels of Contaminants Present

This section presents data and water quality assessments from monitoring activities conducted by Federal, State, and local organizations. In general, much of the surface water (and related sediment and fish tissue) monitoring has been conducted by State agencies and other organizations responsible for managing these aquatic resources. Some organizations responsible for water quality monitoring/assessment activities are summarized in Table 4-9. The discussion in this section is organized according to major waterbodies, such as the Grand Calumet River/Indiana Harbor Ship Canal, Lake Calumet, select streams/rivers and lakes, and Lake Michigan. Data and assessments presented in this section primarily are results of studies and monitoring activities presented in reports, while other data are from STORET. Although much of the data are from recent monitoring activities (early 1990s to the present), some data sources are from studies conducted in the early-to-mid 1980s.

State 305(b) Reports

- Biennial Assessments of Water Quality of Streams, Rivers, and Lakes
- Based on Chemical, Biological, and Human Use Measurements
- 1994-95 Reports Most Recent Assessments Available

Quantification of pollutant levels is presented for numerous major waterbodies, first from literature sources such as State 305(b) reports. The biennial State water quality assessments, or 305(b) reports, document the conditions of lakes and streams/rivers in each State based on chemical, physical, and biological monitoring. These reports assess water quality according to the degree that waters attain designated uses (e.g., recreational use, aquatic life use, drinking water use, etc.). For example, the five degrees of overall use support used by IEPA (1996c) in its 305(b) report are:

- Full Support - The water quality meets the needs of all designated uses protected by applicable water quality standards.
- Full/Threatened - Water quality is presently adequate to maintain designated uses, but if a declining trend continues, only partial support may be attained in the future.

Table 4-9. Major Organizations Conducting Water Quality Monitoring and Assessment Activities in Cook County, IL, and Lake County, IN

Organization	Monitoring, Assessment, and Resource Management Activities
U.S. Army Corps of Engineers	Assessing sediment quality for Remedial Action Plan (RAP) and sediment management/dredging activities
U.S. Environmental Protection Agency	Assessing water quality for RAP activities related to Great Lakes water quality
Indiana Department of Environmental Management Illinois Environmental Protection Agency	Monitoring and assessing water quality for 305(b) reporting, RAP-related activities, and resource management
Illinois State Water Survey and Illinois Waste Management and Research Center (formerly the HWRIC)	Water quality monitoring in Lake Calumet area and streams/rivers in Cook County
City of Chicago - Metropolitan Water Reclamation District of Greater Chicago	Monitoring water quality in Lake Michigan near intakes for drinking water purification plants

- Partial Support/Minor Impairment - Water quality is impaired, but only to a minor degree. Minor exceedences in applicable water quality standards or criteria for assessing the designated use attainment may exist.

- Partial Support/Moderate Impairment - Water quality conditions are impaired to a greater degree inhibiting the waterbody from meeting all the needs for that designated use.

- Nonsupport - Water quality is severely impaired and not capable of supporting the designated use to any degree.

> **STORET Data**
>
> - More than 70 Pollutants Examined from 1990-1995 Monitoring Data
> - Highest Levels of the Most Number of Contaminants Found in:
>   - Grand Calumet River
>   - Wolf Lake
>   - Chicago River
>   - Cal-Sag Channel

STORET contains data that summarize environmental levels of select pollutants from monitoring conducted from 1990-1995. Summaries of articles and reports present those contaminants that were detected; the retrievals from STORET focus on select parameters to describe water quality and levels of contaminants. Specifically, these parameters include several conventional pollutants (dissolved oxygen, biological/chemical oxygen demand, nutrients), toxics (metals, pesticides), and bacteria (fecal coliform). More than 70 pollutants/parameters of interest, from more than 70 monitoring stations, were included in summaries of the STORET data from 1990-1995. Table 4-10 presents the STORET surface water quality parameters included in these analyses. Descriptions of each waterbody include discussion of the pollutants present in the highest concentrations, as well as comparisons to other waterbodies in the study area.

4.2.1 Water Quality of the Grand Calumet River and Indiana Harbor Ship Canal (GCR/IHSC)

The Grand Calumet River (GCR) flows east-west across the northern portion of Lake County, IN, and connects to the Indiana Harbor Ship Canal (IHSC), which flows into Lake Michigan (Figure 4-25). The flow of the river is highly influenced by industrial and municipal effluents. In

Table 4 - 10. Select Surface Water Parameters Presented in STORET Data Sets

STORET Parameter No.	Parameter	Units
299	Dissolved Oxygen (DO) Analysis by Probe	MG/L
300	Dissolved Oxygen (DO)	MG/L
310	5 Day Biological Oxygen Demand (BOD)	MG/L
335	Low Level Chemical Oxygen Demand (COD)	MG/L
530	Total Non-Filterable Residue	MG/L
535	Volatile Non-Filterable Residue	MG/L
556	Oil and Grease (Freon Extr.-Grav. Method)	MG/L
560	Oil and Grease (Freon Extr.-IR Method)	MG/L
610	Total Nitrogen and Ammonia	MG/L
623	Dissolved Kjeldahl Nitrogen	MG/L
625	Total Kjeldahl Nitrogen	MG/L
630	Total Nitrite and Nitrate	MG/L
665	Total Phosphorous	MG/L
666	Dissolved Phosphorous	MG/L
671	Dissolved Orthophosphate	MG/L
720	Cyanide	MG/L
1002	Arsenic	UG/L
1007	Barium	UG/L
1012	Beryllium	UG/L
1027	Cadmium	UG/L
1032	Hexavalent Chromium	UG/L
1034	Chromium	UG/L
1042	Copper	UG/L
1045	Iron	UG/L
1051	Lead	UG/L
1055	Manganese	UG/L
1067	Nickel	UG/L
1077	Silver	UG/L
1082	Strontium	UG/L
1087	Vanadium	UG/L
1092	Zinc	UG/L
1097	Antimony	UG/L
1105	Aluminum	UG/L
31616	Fecal Coliform	/100ML
32101	Bromodichloromethane	UG/L
32103	1,2-Dichloroethane	UG/L
32104	Bromoform	UG/L
32105	Dibromochloromethane	UG/L

Table 4-10. (Continued)

STORET Parameter No.	Parameter	Units
32106	Chloroform	UG/L
32730	Phenols	UG/L
34010	Toluene	UG/L
34336	Diethyl Phthalate	UG/L
34423	Methylene Chloride	UG/L
34475	Tetrachloroethylene	UG/L
34496	1,1-Dichloroethane	UG/L
34506	1,1,1-Trichloroethane	UG/L
34531	1,2-Dichloroethane	UG/L
34596	Di-N-Octyl Phthalate	UG/L
39032	Pentachlorophenol (PCP)	UG/L
39100	Bis(2-Ethylhexyl) Phthalate	UG/L
39110	Di-N-Butyl Phthalate	UG/L
39180	Trichloroethylene	UG/L
39300	P,P'DDT	UG/L
39330	Aldrin	UG/L
39340	Gamma-BHC (Lindane)	UG/L
39356	Metolachlor (Dual)	UG/L
39370	DDT	UG/L
39415	Metolachlor	UG/L
39500	PCB-1248	UG/L
39516	PCB	UG/L
39630	Total Atrazine	UG/L
39632	Dissolved Atrazine	UG/L
45617	1,2-Dichloroethene	UG/L
46342	Alachlor (Lasso)	UG/L
70300	Total Filterable Residue (Dried at 180°C)	MG/L
71890	Dissolved Mercury	UG/L
71900	Total Mercury	UG/L
77093	Cis-1,2-Dichloroethylene	UG/L
77416	2-Methylnapthalene	UG/L
77825	Alachlor	UG/L
80082	Carbonaceous 5 Day BOD at 20°C	MG/L
81284	Trifluralin	UG/L
81408	Metribuzin (Sencor)	UG/L
81551	Xylene	UG/L
81552	Acetone	UG/L

Source: STORET, 1997.

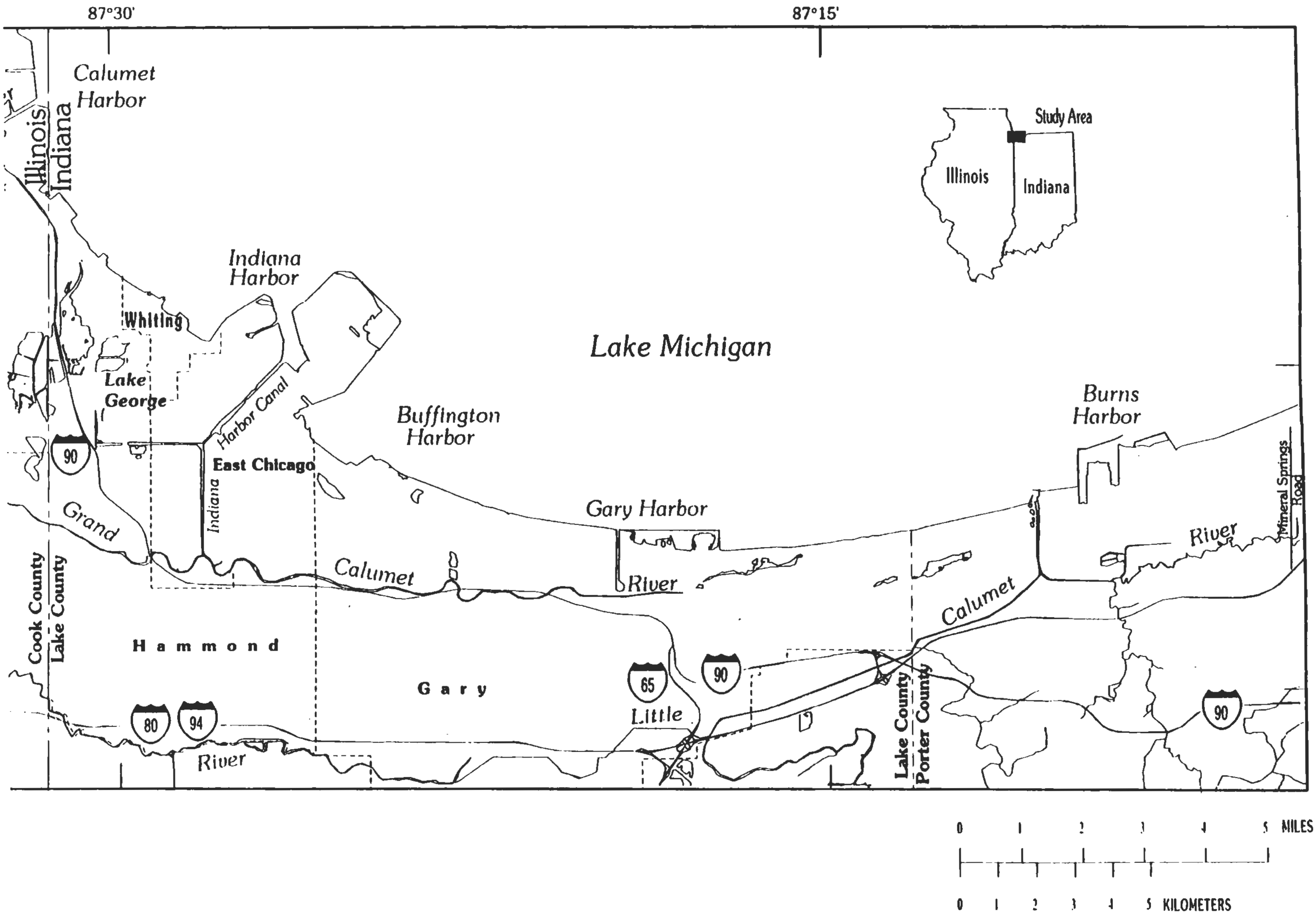


Figure 4-25. Grand Calumet River and Indiana Harbor Canal

> **GCR/IHSC**
>
> - Historic Water Quality Problems
> - Industrial and Municipal Effluents
> - Metals, Cyanide, Bacteria, etc.
> - A Great Lakes Area of Concern

fact, the flow of the river during dry periods can be solely from discharges from these point source outfalls (U.S. EPA, 1994a). The contribution of surface water runoff and other nonpoint sources is limited because of the relatively small watershed (HydroQual, 1985). The East Branch of the GCR is dominated by discharges of noncontact cooling water and process water from U.S. Steel in Gary (U.S. EPA, 1994a). The flow of the West Branch comes from the treated effluents from the Hammond Sewage Treatment Plant and the East Chicago Sanitary District; however, the eastern portion of the West Branch flows east toward the IHSC, while the western portion primarily flows to the west into Illinois to the Cal-Sag Channel and, eventually, to the Mississippi River (IDEM, 1991). IHSC is an important transportation pathway; however, the U.S. Army Corps of Engineers (U.S. ACOE) has not dredged it since 1972 because of difficulty in disposing the highly-contaminated sediments (IDEM, 1997a). The Indiana Harbor is one of the most highly contaminated harbors in the Great Lakes, and the sediments are a source of contamination to the water column (U.S. EPA, 1994a).

More than 33 studies have been undertaken to monitor water quality in the GCR/IHSC system. The biennial water quality (305(b)) assessment from IDEM for 1994-95 (IDEM, 1996a) reported that the system continues to have persistent water quality problems, especially for cyanide, ammonia, and bacteria (E. coli). The entire river, as well as IHSC, is "nonsupporting for both aquatic life and recreational use," with probable causes of oil and grease, lead, PCBs, pesticides, mercury, ammonia, and combined sewer overflows (CSOs) (IDEM, 1996a). IDEM's 305(b) report also recognized that water quality has been improving. While contaminant levels are lower than in the past, some still exceed applicable water quality standards. New water quality standards were promulgated by IDEM on March 3, 1990, to help upgrade the use of GCR/IHSC as whole body contact recreation waters (IDEM, 1991; U.S. EPA, 1994a). Part of the improvement in water quality has been demonstrated in the resident populations of several species of fish, including salmonids. However, it must be noted that the GCR/IHSC has a Group 5 fish consumption advisory (warning people not to consume any fish) because of the high levels of PCBs, mercury, and other contaminants. In fact, all 1994 fish tissue samples from the IHSC had PCB concentrations that exceeded 2.0 ppm (total), and the system has the highest levels of fish contamination in the State (IDEM, 1996a).

The numerous studies and assessments of the GCR/IHSC confirm IDEM's conclusions in its 305(b) report. Previous studies conducted by EPA and other organizations have reported very high levels of contaminants in these waterbodies. Major contaminants of concern include metals, PCBs, PAHs, phenol, cyanide, as well as bacteria (U.S. EPA, 1991a). Ranges of select water quality parameters from monitoring activities from the late 1970s and 1980s are presented in Table 4-11. Data from 1988 water quality monitoring in the GCR/IHSC indicated that metals, ammonia, phosphorus, oil and grease, cyanide, and PCBs were present at levels that exceeded standards (IDEM, 1991). Of particular concern were mercury, copper, lead, and cadmium. A 1988 survey detected 24 of 145 organic compounds in ambient water samples (IDEM, 1991). Select contaminants in the GCR/IHSC water column identified in the Indiana 305(b) water quality report for 1988-89 are presented in Table 4-12. 1,2-dichloroethane was identified at levels that exceeded water quality standards. Similarly, monitoring data from 1988-89 show that dissolved oxygen levels are chronically low; levels in portions of the West Branch of the GCR were measured several times at 0.0 milligrams per liter (mg/L) (IDEM, 1991). Water quality monitoring results from studies conducted in 1988 in the Grand Calumet River are presented by EPA (1994a). Sample results for select toxic metals and 1,2-Dichloroethane from the water column were averaged to produce mean concentrations. A value of one-half the detection limit was used by EPA (1994a) for deriving the mean values. Table 4-13 presents the mean concentrations of these pollutants.

Water quality monitoring in the GCR/IHSC, conducted in 1983 by HydroQual (1985), studied dissolved oxygen (DO) levels. Surveys conducted in the system during September and October 1983 found that DO levels were generally lowest in the Canal. Specifically, the East Branch had DO levels well above the water quality standards of 4.0 mg/L. The West Branch of the Grand

Table 4-11. Ranges of Water Quality Parameters in the Grand Calumet River and Indiana Harbor Ship Canal in Lake County, IN

Parameter	Concentration
Arsenic	<0.001 - 0.003 mg/L
Cadmium	<0.0001 - 0.0007 mg/L
Chromium	<1.0 - 8.0 μg/L
Copper	<1.0 - 61.0 μg/L
Iron	210 - 6,000 μg/L
Lead	<1.0 - 28.0 μg/L
Mercury	<1.0 - 2.5 μg/L
Nickel	4.0 - 24.0 μg/L
Zinc	20.0 - 410.0 μg/L
Fecal Coliforms	210 - 270,000 mg/L
Oil & Grease	1.3 - 20.0 mg/L
BOD	1.0 - 41.0 mg/L
COD	0.5 - 30 mg/L
Hardness (CaCO3)	30 - 360 mg/L
Cyanides	0.01 - 0.17 mg/L
Ammonia	0.06 - 11.0 mg/L
Nitrogen, Kjeldahl	0.1 - 81.7 mg/L
Nitrate	0.9 - 10.2 mg/L
Nitrite	0.01 - 1.8 mg/L
TOC	2.3 - 7.9 mg/L
Phenols	<1.0 - 64.0 μg/L
Total Phosphorus	<0.01 - 0.58 mg/L
Ortho Phosphorus	<0.01 - 0.30 mg/L

Table 4-11. Ranges of Water Quality Parameters in the Grand Calumet River and Indiana Harbor Ship Canal in Lake County, IN (continued)

Parameter	Concentration
Sulfate	22 - 5,900 mg/L
Fluoride	0.1 - 4.7 mg/L
Chloride	11 - 438 mg/L
TDS	162 - 9,100 mg/L
TSS	<1.0 - 16.0 mg/L
DO	2.9 - 9.9 mg/L
Temperature	35.0 - 15.0 Degrees C
Specific Conductance	240 - 1,800 uS/cm
pH	6.1 - 8.6
Bis(2-ethylhexyl) phthalate	15 - 360 μg/L

μg/L = micrograms per liter
mg/L = milligrams per liter
μ S/cm = micro siemens per centimeter

Source. U S. EPA, 1991a.

Table 4-12. Pollutants Identified in Ambient Surface Water of the Grand Calumet River/Indiana Harbor Ship Canal in 1988-89

Chemical	Concentration (μg/L)
Arsenic	10 - 13
Copper	25 - 112
Lead	10 - 14
Cyanides	5 - 19
1,2-Dichloroethane	5 - 40,500

μg/L = micrograms per liter

Source: IDEM, 1991

Table 4-13. Mean Surface Water Contaminant Levels from 1988 Monitoring of the Grand Calumet River

Chemical	Mean Concentration (mg/L)
Antimony	0.076
Arsenic	0.0021
Barium	0.049
Chromium (hexavalent)	0.0077
Copper	0.021
Manganese	0.21
Mercury	0.0017
Nickel	0.0038
Zinc	0.068
1,2-Dichloroethane	0.26

mg/L = milligrams per liter

Source: U.S. EPA, 1994a.

Calumet River had DO levels of 7 mg/L (near the junction with the East Branch), but much lower levels towards the west, when they were below standards (HydroQual, 1985). To the west of the State line, DO levels were extremely low (near 0.0 mg/L during the September survey and around 2.0 mg/L during the October survey). Similarly, the West Branch of the Grand Calumet River had much higher concentrations of suspended solids, phosphorous, as well as fecal coliform measurements in excess of 10,000 per 100 mL. Overall, this system exhibited improved water quality relative to similar measurements from the 1970s (HydroQual, 1985).

Dissolved Oxygen

- Critical to Aquatic Life
- Chemical/Biological Wastes and Nutrients Contribute to Reduced DO Levels
- Water Quality Standard for DO Is 4 mg/L

Ambient water quality monitoring data for the years 1990-1995 were obtained from STORET (1997) to characterize environmental levels of pollutants in the GCR/IHSC. Select parameters of interest were identified from STORET to represent water quality: several conventional parameters (dissolved oxygen, nutrients, etc), numerous toxics (metals, organics, pesticides), and bacteria (fecal coliform). Seven monitoring stations were used to measure water quality in GCR/IHSC (Table 4-14). Available monitoring results from STORET for this waterbody are presented in Tables 4-15 and 4-16, as minimum, maximum, and average concentrations for data collected between 1990 and 1995. Contaminants present in the water column of the GCR included metals, volatile organics, and pesticides. Similarly, the IHSC contained numerous metals. The GCR had some of the highest concentrations of pollutants in the entire study area. Specifically, 14 pollutants were found in the GCR at the highest levels of all waterbodies. These pollutants included metals, pesticides, cyanide, VOCs, nutrients, and oil and grease.

Table 4 - 14. Water Quality Monitoring Stations in the Grand Calumet River and the Indiana Harbor Ship Canal

Water Body	Station ID	Sec. ID	Name of Station
Grand Calumet River	170159	GCR 37	GRAND CALUMET R & KENNEDY AVE AT MI POINT 14.51
	174343	GCR 42	GRAND CALUMET-GARY BRIDGE STREET BR MI PT 42
	170162	GCR 34	GRAND CALUMET R. AT CALUMET AVE AT MILE PT 11.46
Indiana Harbor Ship Canal	4092750		INDIANA HARBOR CANAL AT EAST CHICAGO, IN
	170143	IHC 3W	LAKE GEORGE CANAL & INDPLS BLVD AT MI PT 3.2
	170147	IHC 3S	INDIANA HBR CANAL & COLUMBUS DR,AT MILE PT 3.2
	170204	IHC 0	IND HARBOR CANAL,MOUTH,LAKE MI,AT MILE POINT 0

Source: STORET, 1997

Table 4 - 15. Pollutant Levels in Grand Calumet River (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO MG/L	1990-1995	3	154	1.4	7.62	12.3
BOD 5 DAY MG/L	1990-1995	3	74	1	3.5	24
COD LOWLEVEL MG/L	1990-1995	3	204	5.2	25 11	390
RESIDUE TOT NFLT MG/L	1990-1995	3	172	4	17.54	223
OIL-GRSE FREON-GR MG/L	1990-1995	1	1	4	4	4
NH3+NH4- N TOTAL MG/L	1990-1995	3	202	0.1	1.37	25
TOT KJEL N MG/L	1990-1995	3	132	0.5	3 15	28
NO2&NO3 N-TOTAL MG/L	1990-1995	3	201	0 1	2.18	19
PHOS-TOT MG/L P	1990-1995	3	157	0.03	0.26	2.2
CYANIDE CN-TOT MG/L	1990-1995	3	100	0.01	0.01	0.17
ARSENIC AS,TOT UG/L	1990-1995	3	129	0.8	1.53	4
BARIUM BA,TOT UG/L	1990-1995	3	140	10	28.49	130
CADMIUM CD,TOT UG/L	1990-1995	2	5	2	2	2
CHROMIUM CR,TOT UG/L	1990-1995	3	28	4	7.46	20
COPPER CU,TOT UG/L	1990-1995	3	38	4	10.74	42
IRON FE,TOT UG/L	1990-1995	3	175	180	970.47	6800
LEAD PB,TOT UG/L	1990-1995	3	77	6	15.91	130
MANGNESE MN UG/L	1990,1994,1995	2	5	40	106.8	160
NICKEL NI,TOTAL UG/L	1990-1995	3	14	4	5 36	7
ZINC ZN,TOT UG/L	1990-1995	3	85	10	46.35	170
ANTIMONY SB,TOT UG/L	1990-1993	3	29	0 7	29.33	180
1,2-DICHLOROETHANE TOTUG/L	1990	1	1	5 9	5 9	5.9
BROMOFRM WHL-WTR UG/L	1990	1	1	2 8	2 8	2.8
PHENOLS TOTAL UG/L	1990-1995	2	17	5	9 35	23
METHYLENECHLORIDE TOTWUG/L	1992	3	3	15	16.33	19
DI-N-OCTYL PHTHALATE TOTUG/L	1992	1	1	36	36	36
BIS(2-ETHYLHEXYL) PHTHALATE UG	1991-1992	2	3	2 3	50 77	130
DI-N-BUTYL PHTHALATE TOTAL UG/	1992	2	2	1.4	1 5	1.6
ALDRIN TOT UG/L	1990	1	1	0.05	0 05	0.05
GAMMABHC LINDANE TOT UG/L	1990	1	1	0.02	0.02	0.02
MERCURY HG,TOTAL UG/L	1990-1995	3	32	0 1	0.13	0 3

Source STORET, 1997.

Table 4 - 16. Pollutant Levels in Indiana Harbor Ship Canal (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO MG/L	1990-1995	4	161	3 5	7.55	12.7
BOD 5 DAY MG/L	1990-1995	3	78	1	2.32	5.7
COD LOWLEVEL MG/L	1990-1995	3	202	5.9	14.16	40
RESIDUE TOT NFLT MG/L	1994,1995	4	406	1	10.25	46
RESIDUE VOL NFLT MG/L	1990	1	11	4	6	12
OIL-GRSE FREON-GR MG/L	1990-1995	3	3	1	4	7
NH3+NH4- N TOTAL MG/L	1990-1995	3	196	0 1	0.59	1.7
TOT KJEL N MG/L	1990-1995	4	213	0.3	1.19	5.2
NO2&NO3 N-TOTAL MG/L	1990-1995	3	201	0 3	1.39	2.2
PHOS-TOT MG/L P	1990-1995	4	207	0.03	0 06	0.16
PHOS-DIS ORTHO MG/L P	1990-1995	1	14	0.01	0.02	0.05
CYANIDE CN-TOT MG/L	1990-1995	3	111	0.01	0.01	0.06
ARSENIC AS,TOT UG/L	1990-1995	3	167	0 7	1 5	3
BARIUM BA,TOT UG/L	1990-1995	3	136	10	24.35	50
CADMIUM CD,TOT UG/L	1990-1995	1	2	2	2	2
CHROMIUM HEX-VAL UG/L	1990-1995	1	1	25	25	25
CHROMIUM CR,TOT UG/L	1990-1995	3	12	4	7.25	27
COPPER CU,TOT UG/L	1990-1995	1	38	4	5.26	10
IRON FE,TOT UG/L	1990-1995	3	166	53	735 47	3300
LEAD PB,TOT UG/L	1990-1995	1	25	6	9 56	20
MANGNESE MN UG/L	1990-1995	1	49	10	45.73	120
NICKEL NI,TOTAL UG/L	1993	1	1	5	5	5
ZINC ZN,TOT UG/L	1990-1995	1	50	10	36 4	170
PHENOLS TOTAL UG/L	1990-1995	2	10	5	8.6	15
RESIDUE DISS-180 C MG/L	1990-1995	1	54	180	274 76	403
MERCURY HG,TOTAL UG/L	1990-1992,1994	2	13	0.1	0 11	0.2

Source. STORET, 1997.

4.2.2 Water Quality of Lake Calumet and Associated Waterbodies

> **Lake Calumet and Tributaries**
>
> - Historic Problems Include Point Source Contamination and Physical Alterations
> - Current Sources Include Loadings from Tributaries and Runoff from Waste Disposal Sites

The Lake Calumet area shows signs of degradation from more than a century of industrial development and alteration of its physical features and hydrology. Some areas of Lake Calumet have been filled, other areas dredged; both exacerbate pollution problems (Ross et al., 1988). Concerns over sewage and industrial discharges of biological waste prompted efforts in the early 1900s to reverse the flow of the Calumet River away from Lake Michigan, a source of drinking water (Bhowmik and Fitzpatrick, 1988). Such early efforts included construction of the Chicago Sanitary and Ship Canal and the Cal-Sag Channel to carry polluted waters from the Chicago and Calumet Rivers away from Lake Michigan. Despite the history of severe contamination of Lake Calumet, the Calumet River, and related tributaries in the southern portion of Cook County, IL, evidence exists that conditions have improved in the second half of the century (Bhowmik and Fitzpatrick, 1988).

Past loadings to these waterbodies contaminated not only the surface water, but the associated sediments and biota. Studies in the 1960s and 1970s of the Lake Calumet area determined that all of the streams were contaminated to some degree. Major pollutants identified were PCBs, heavy metals, fecal coliform, ammonia, cyanide, phenolic compounds, and others (Fitzpatrick and Bhowmik, 1990). As shown in Figure 4-26, Lake Calumet is lined on the east with waste disposal sites, while its west side is bordered by industries and highways (Ross et al., 1988). Key factors that influence water quality include the dredging/use of Lake Calumet for navigation, the regulation of flow by the O'Brien Lock and Dam, and nearby industry/waste sites. While some point source discharges and leaching of contaminants from waste sites pose problems, CSOs also impact water quality in the Lake Calumet area. The combined sewer system in the Chicago area is operated by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). Flows in excess of capacity have traditionally been discharged into adjacent waterbodies through CSOs. In the mid-1970s, the City of Chicago indicated that 45 percent of the total pollutants to the rivers of the area

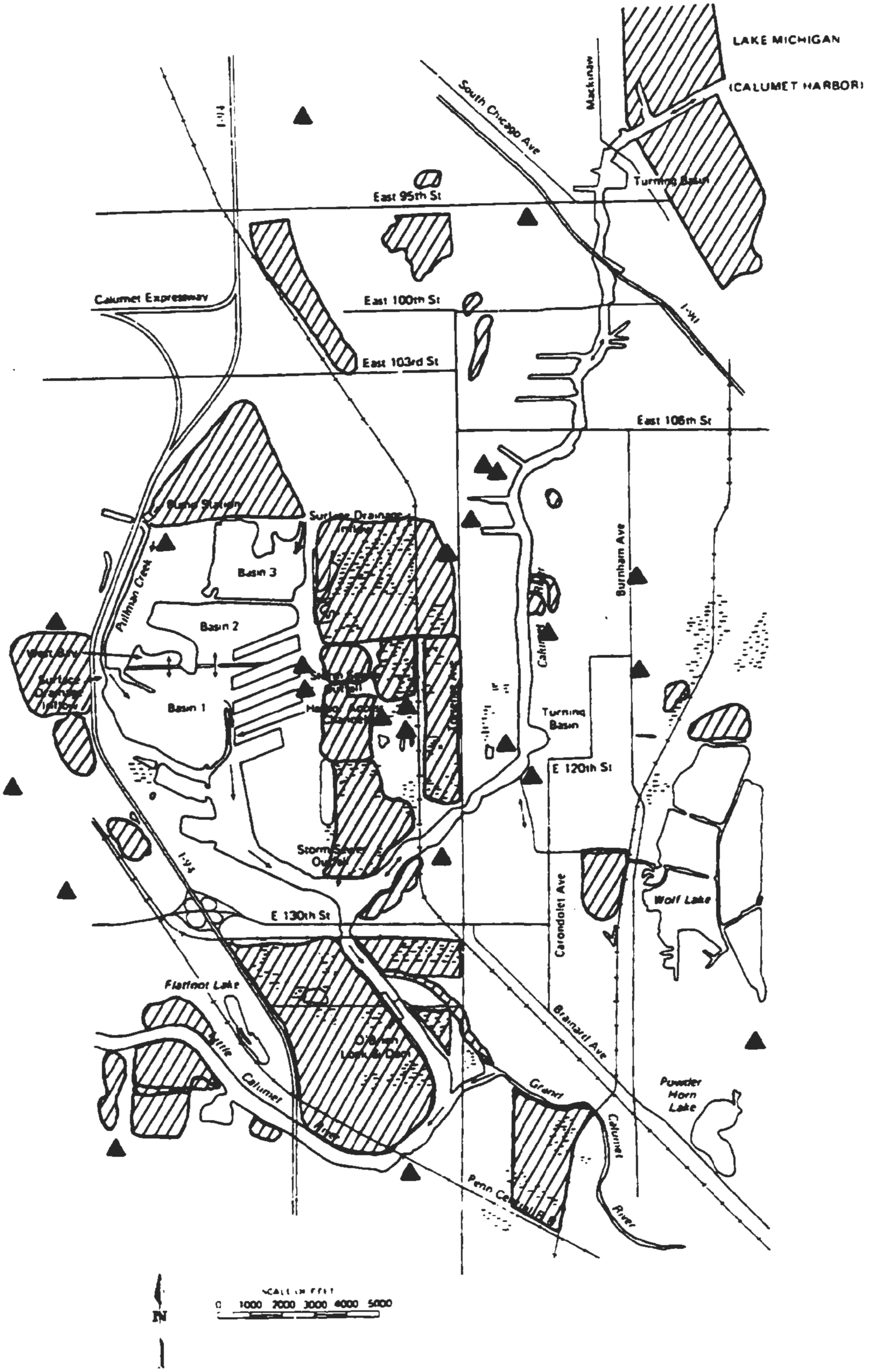


Figure 4-26. Landfills and Waste Disposal Sites in the Greater Lake Calument Area

Source: Bhowmik and Fitzpatrick, 1988.

were attributable to the estimated 100 overloads per year (Bhowmik and Fitzpatrick, 1988). The Tunnel and Reservoir Plan (TARP) system was implemented to prevent sewer overflows from polluting the rivers in Cook County and Lake Michigan (IEPA, 1994). TARP consists of a series of tunnels that provide an excess storage capacity of about 1-billion gallons to accommodate overflows from significant rain storms. Only during the most severe storms is this excess capacity of the TARP exceeded, resulting in discharge of untreated sewage into waterways. Bypasses to Lake Michigan at the Wilmette Pumping Station, Chicago River Controlling Works, and the O'Brien Lock and Dam occurred 12 times in the 1970s, 18 times in the 1980s, and only 3 times in the early 1990s (IEPA, 1994). Recent data from IEPA (1996c) indicate that bypasses of the locks/dams to Lake Michigan have not occurred since November 1990.

Monitoring conducted by the Illinois State Water Survey (ISWS) during 1987 and 1988 quantified levels of five metals and other contaminants in the water column in tributaries to Lake Calumet (Fitzpatrick and Bhowmik, 1990). Ten sampling sites in ditches, sewer outfalls, drainage from landfills, and runoff from sewage sludge drying beds were monitored (Figure 4-27), five for routine measurements and an additional five for comparison and special monitoring (Table 4-17). Concentrations of metals in water samples were identified at several locations, with maximums as high as 98 mg/L for zinc, 65 mg/L for chromium, 4.4 mg/L for cadmium, and 12.5 mg/L for lead. Table 4-18 summarizes the levels of contaminants measured by ISWS during 1987 and 1988 in Lake Calumet tributaries (Fitzpatrick and Bhowmik, 1990). Results from this monitoring included:

- **Arsenic** - More than half of the 30 samples from 6 locations were below the detection limit (0.007 mg/L). Concentrations detected for each of the six sites ranged from 0.008 to 0.17 mg/L, with the highest levels found in drainage from landfill areas east of Lake Calumet (Sewer F).

- **Cadmium** - Fifty-three samples from 10 locations were analyzed for cadmium. Only two samples had levels above the detection limits (0.06 to 0.008 mg/L) including 4.4 mg/L in drainage from the MWRDGC sludge drying beds and 0.010 mg/L from landfills east of the Lake (Sewer F).

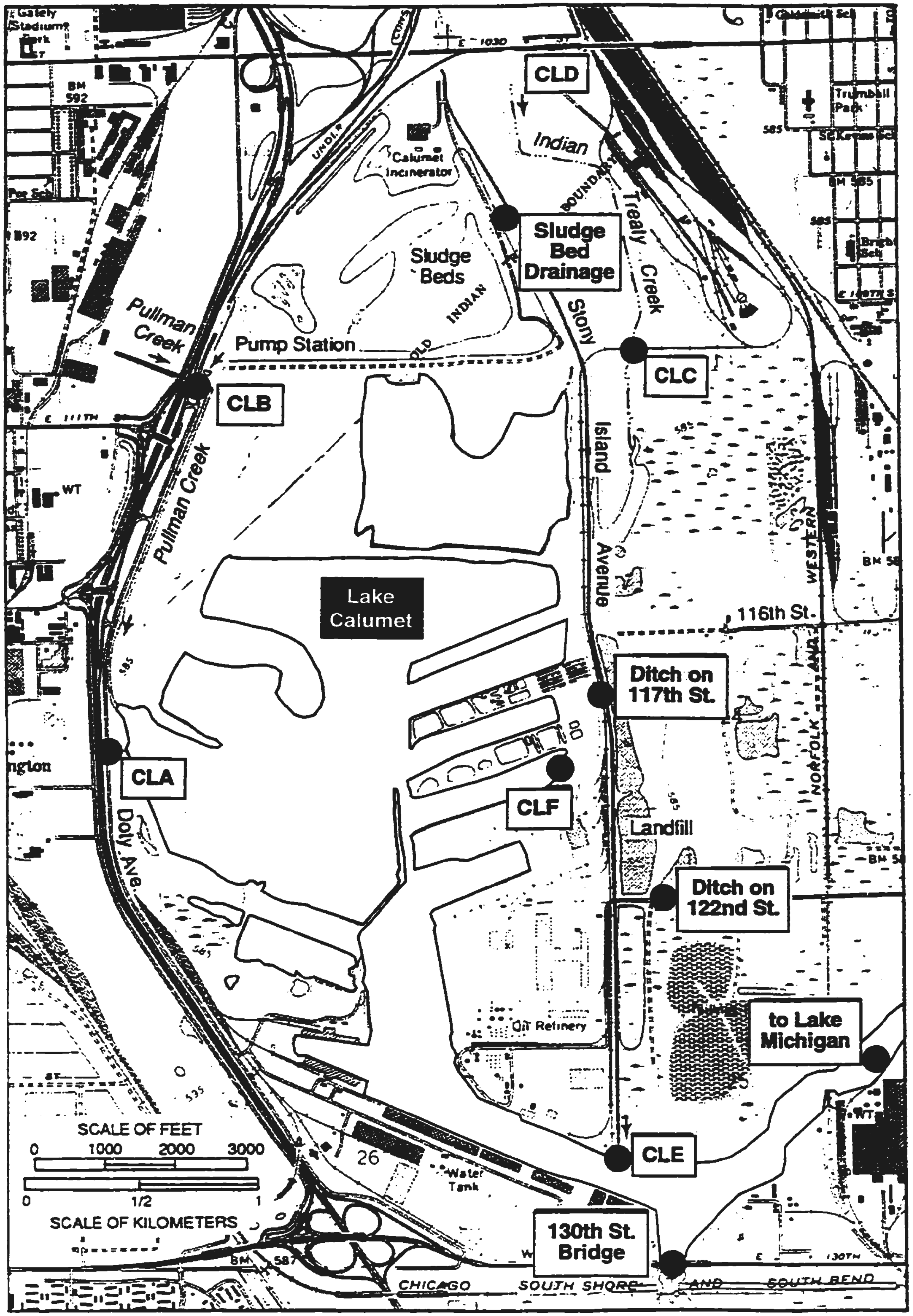


Figure 4-27. Surface Water Monitoring Sites Around Lake Calumet

Source: Bhowmik and Fitzpatrick, 1988.

Table 4-17. Monitoring Sites Used by the Illinois State Water Survey in Tributaries of Lake Calumet in 1987-88

Sample Name/Location/Description
CLA- Drainage from I-94, Doty Avenue, and fill areas west of the lake (± 35 acres)
Pullman Creek (CLB) - I-94, IDOT pump station and landfill areas west and north of the lake (± 150 acres)
Indian Treaty Creek (CLC) - Drainage from wetlands north and east of the lake (± 200 acres)
Sewer F (CLF) - Drainage from landfill areas east of the lake (± 60 acres)
Sewer E (CLE) - Drainage from holding pond/sludge drying beds south of lake
Additional Sites
Calumet River at 130th St.
Roadside ditch on 122nd Street near Stony Island Avenue receiving landfill area drainage
Roadside ditch on Stony Island Avenue at 107th Street receiving MWRDGC sludge bed drainage
Roadside ditch on Stony Island Avenue at 117th Street receiving landfill area drainage
Indian Treaty Creek (CLD)

Source: Fitzpatrick and Bhowmik, 1990.

Table 4-18. Contaminants Detected in Tributaries to Lake Calumet in 1987-1988

Contaminant	Frequency of Detection	Minimum Detected (mg/L)	Maximum Detected (mg/L)
Arsenic	12/29	0.008	0.17
Cadmium	2/53	0.010	4.4
Chromium	7/53	0.10	65
Lead	6/53	0.12	12.5
Zinc	44/53	0.014	98

Source: Fitzpatrick and Bhowmik, 1990.

- **Chromium** - Fifty-three samples were analyzed for chromium, from 10 locations. Seven samples had levels above the detection limits (0.08 to 0.10 mg/L), with a range from 0.10 to a maximum of 65 mg/L in drainage from the MWRDGC sludge drying beds.

- **Lead** - Lead was analyzed for in 53 samples from 10 locations, 6 of which had levels above the detection limits (0.06 to 0.08 mg/L). Lead levels detected ranged from 0.12 to 12.5 mg/L, with the highest in waters from the MWRDGC sludge drying beds.

- **Zinc** - Of 53 samples tested for zinc, 44 had levels above the detection limits. Zinc was detected ranging from 0.014 to 98 mg/L, with the maximum from a sample of runoff from the MWRDGC sludge drying beds.

Fitzpatrick and Bhowmik (1990) combined water concentration data with information collected on the flows of tributaries/sources to determine loadings to Lake Calumet. Drainage from the MWRDGC sludge drying beds (at 107th Street and Stony Island Avenue) was the largest measured source of pollutants to the wetland areas on the east side of Lake Calumet. Pullman Creek was determined to be the largest direct input of arsenic, lead, and chromium to Lake Calumet, with total loadings of toxic metals of more than 4 pounds per hour (Fitzpatrick and Bhowmik, 1990).

Ross et al. (1988) assessed water quality in Lake Calumet as part of a multimedia evaluation of the overall contamination problems in the area. It was concluded that Lake Calumet is a "severely disturbed system" that has been impacted by physical alteration, chemical contamination, and other anthropogenic insults (Ross et al., 1988). Problems with Lake Calumet were found to include the presence of industry, waste sites, and major highways. Drainage of Lake Calumet is controlled by Pullman Creek and the O'Brien Lock and Dam, and sediment contamination results in pollutants being released to the water column. Major pollutant loadings to Lake Calumet also come from CSOs, including an estimated 47 percent of the biological oxygen demand (BOD). Ross et al. (1988) estimated that the annual loadings of about 2,500 of 7,000 tons of BOD that enter the Little Calumet River system are from Indiana. Similarly, about one-third of the ammonia coming into the system is believed to have originated from the West Branch of the Grand Calumet River in Indiana and flowed toward Lake Calumet.

Ambient water quality monitoring data for the years 1990-1995 were obtained from STORET (1997) to characterize environmental levels in rivers and streams in the Lake Calumet area and southeast Cook County: (1) the Calumet and Little Calumet Rivers, (2) Thorn Creek, and (3) Calumet River Channel and Calumet Harbor. Monitoring was conducted from three, one, and seven monitoring stations, respectively. Table 4-19 presents the seven locations in Calumet River Channel and Calumet Harbor. Data on levels of contaminants detected are presented in Tables 4-20, 4-21, and Table 4-22 respectively. These data include minimum, maximum, and average concentrations for various metals and conventional parameters detected in the Calumet and Little Calumet Rivers in 1990. Monitoring results for the Calumet River Channel and Calumet Harbor are from 1994 and 1995. A fecal coliform measurement from 1992 in Thorn Creek was 127,000 per 100 mL, one of the highest reported in waterbodies in the study area.

4.2.3 Water Quality of Select Streams and Rivers in Cook County, IL

Recent water quality assessments of streams and rivers in this area by IEPA (1997a) were provided as part of the State water quality reporting (305(b)) program. These assessments classified water quality as "good," "fair," or "poor" based on a variety of chemical, physical, and biological parameters that are routinely monitored. Assessments of the Great Lakes/Calumet River watersheds (an area larger than Cook County) indicated that the streams and rivers were in "fair" condition. Specifically, of the 393 stream miles assessed, 9 percent were "good," 81 percent were "fair," and 10 percent were in "poor" condition (IEPA, 1997a). Figure 4-28 displays IEPA's (1996c) assessment of streams and rivers in Cook County, IL, for 1994-95; descriptions of the conditions of select waterbodies are summarized below:

Streams and Rivers in Cook County

- Many Major Waterbodies Assessed as Fair to Poor Condition
  - Chicago River
  - Little Calumet River
  - Cal-Sag Channel
  - Sanitary and Ship Canal
- Levels of Contaminants in Chicago River Among the Highest in Study Area

Table 4 - 19. Water Quality Monitoring Stations in the Calumet River Channel and Calumet Harbor

Water Body	Station ID	Sec. ID	Name of Station
Calumet River Channel and Calumet Harbor (including near CDF)	CHDF04A94		CALUMET RIVER CHANNEL
	CHDF04B94		CALUMET RIVER CHANNEL
	CHDF07		CALUMET HARBOR-ALONG CHICAGO AREA
	CHDF0594		CALUMET HARBOR
	CHDF06		CALUMET HARBOR-ALONG CHICAGO AREA
	CHDF8A94		CALUMET HARBOR
	CHDF8B94		CALUMET HARBOR

Source: STORET, 1997

Table 4 - 20. Pollutant Levels in Calumet River and Little Calumet River (1990)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO MG/L	1990,1994	3	38	3 4	5.49	14 3
NH3+NH4- N TOTAL MG/L	1990	2	2	0.29	1 35	2.4
KJELDL N DISS MG/L	1990	2	3	1	1.9	3.6
TOT KJEL N MG/L	1990	2	3	1 2	2.33	4 1
PHOS-TOT MG/L P	1990	2	3	1 2	1.63	2.2
PHOS-DIS MG/L P	1990	2	3	0.96	1.45	2 1
PHOS-DIS ORTHO MG/L P	1990	2	3	0.99	1.3	1.8
CHROMIUM CR,TOT UG/L	1990	2	2	3	3.5	4
IRON FE,TOT UG/L	1990	2	2	510	755	1000
LEAD PB,TOT UG/L	1990	2	2	5	7	9
MANGNESE MN UG/L	1990	2	2	110	125	140
NICKEL NI,TOTAL UG/L	1990	2	2	5	5 5	6
SILVER AG,TOT UG/L	1990	1	1	1	1	1
ZINC ZN,TOT UG/L	1990	2	2	30	60	90
ALUMINUM AL,TOT UG/L	1990	2	2	180	340	500
RESIDUE DISS-180 C MG/L	1990	2	2	561	671 5	782

Source: STORET, 1997.

Table 4 - 21. Pollutant Levels in Thorn Creek (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	1	55	5 2	8.3	12.3
DO MG/L	1990-1992	1	27	5.8	8.22	11.9
COD LOWLEVEL MG/L	1990-1993	2	64	15	31.02	57
RESIDUE TOT NFLT MG/L	1990-1995	2	81	3	41 48	176
RESIDUE VOL NFLT MG/L	1990-1995	2	81	1	9 74	54
OIL-GRSE FREON-GR MG/L	1990-1991,1994	2	9	1	2 67	6
NH3+NH4- N TOTAL MG/L	1990-1995	2	83	0.02	0.34	1.2
TOT KJEL N MG/L	1992	2	2	1.3	1.3	1.3
NO2&NO3 N-TOTAL MG/L	1990-1995	2	83	1.1	4.4	12.5
PHOS-TOT MG/L P	1990-1995	2	83	0.37	2 35	18.11
PHOS-DIS MG/L P	1990-1995	2	81	0.26	2.02	17.47
CYANIDE CN-TOT MG/L	990-1991,1994-1995	2	6	0.01	0.01	0.02
ARSENIC AS,TOT UG/L	1992	2	2	3	2.6	3
BARIUM BA,TOT UG/L	1990-1995	2	83	22	37.8	118
CADMIUM CD,TOT UG/L	1994-1995	1	3	3	3.33	4
CHROMIUM CR,TOT UG/L	1990-1993	2	36	5	13 61	86
COPPER CU,TOT UG/L	1990-1995	2	29	5	11 07	28
IRON FE,TOT UG/L	1990-1995	2	80	190	1354.18	8940
LEAD PB,TOT UG/L	1990-1994	2	24	5	8.94	25
MANGNESE MN UG/L	1990-1995	2	83	24	95.09	210
NICKEL NI,TOTAL UG/L	1990-1994	2	29	7	17 48	36
SILVER AG,TOT UG/L	1992, 1995	2	2	5	6.5	8
STRONTUM SR,TOT UG/L	1990-1995	2	83	113	340.79	541
VANADIUM V,TOT UG/L	1990-1994	2	8	6	8.75	12
ZINC ZN,TOT UG/L	1990-1995	2	26	51	109.81	250
ALUMINUM AL,TOT UG/L	1990-1995	2	76	140	959 67	6189
FECAL COLIFORM /100ML	1990-1995	2	18	180	26172.22	127000
PHENOLS TOTAL UG/L	1990	2	2	3	3	3
MERCURY HG,TOTAL UG/L	1992	2	2	0 2	0.16	0 2

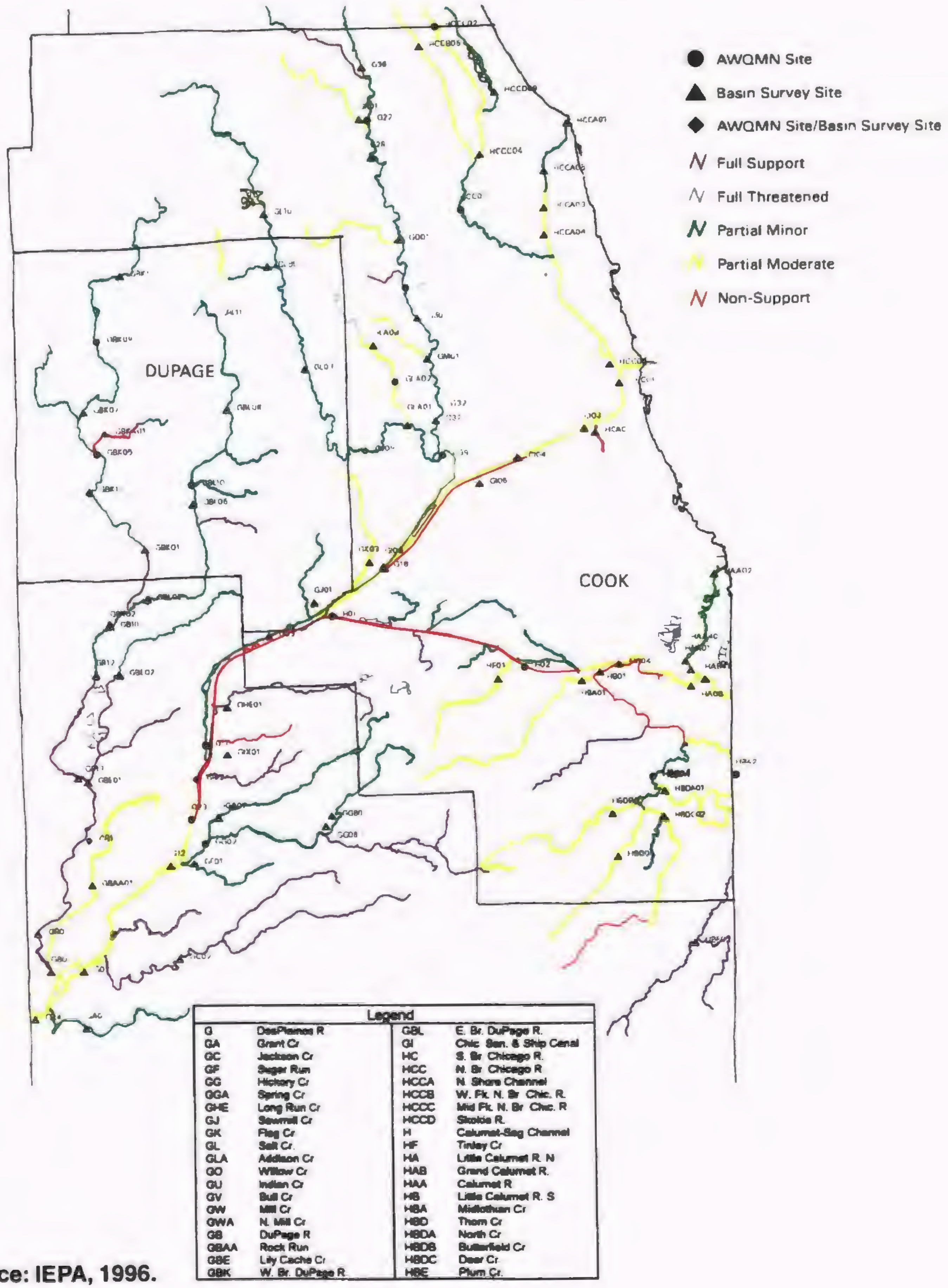
Source. STORET, 1997.

Table 4 - 22. Pollutant Levels in Calumet River Channel and Calumet Harbor (1994-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO MG/L	1994-1995	2	16	2 2	7 45	14.1
RESIDUE TOT NFLT MG/L	1994-1995	7	66	5	12.23	120
OIL-GRSE FREON-IR MG/L	1994	1	1	7.3	7 3	7.3
NH3+NH4- N TOTAL MG/L	1994-1995	5	24	0.2	0.41	0 89
TOT KJEL N MG/L	1994-1995	7	24	0.8	1 02	1.5
PHOS-TOT MG/L P	1994-1995	2	5	0.07	0.16	0.3
CYANIDE CN-TOT MG/L	1994	1	1	0.02	0 02	0 02
RESIDUE DISS-180 C MG/L	1994-1995	7	98	110	176.43	250
MERCURY HG,DISS UG/L	1994	2	2	0 3	0.46	0 6

Source: STORET, 1997

Figure 4-28. Water Quality Assessments of Streams and Rivers in the Cook County, IL Area for 1994-95



Source: IEPA, 1996.

- **North Branch Chicago River**: 21 stream miles assessed; 100 percent rated as having "fair" overall resource quality. Water quality problems were mainly a result of nutrients and pathogens from urban runoff.

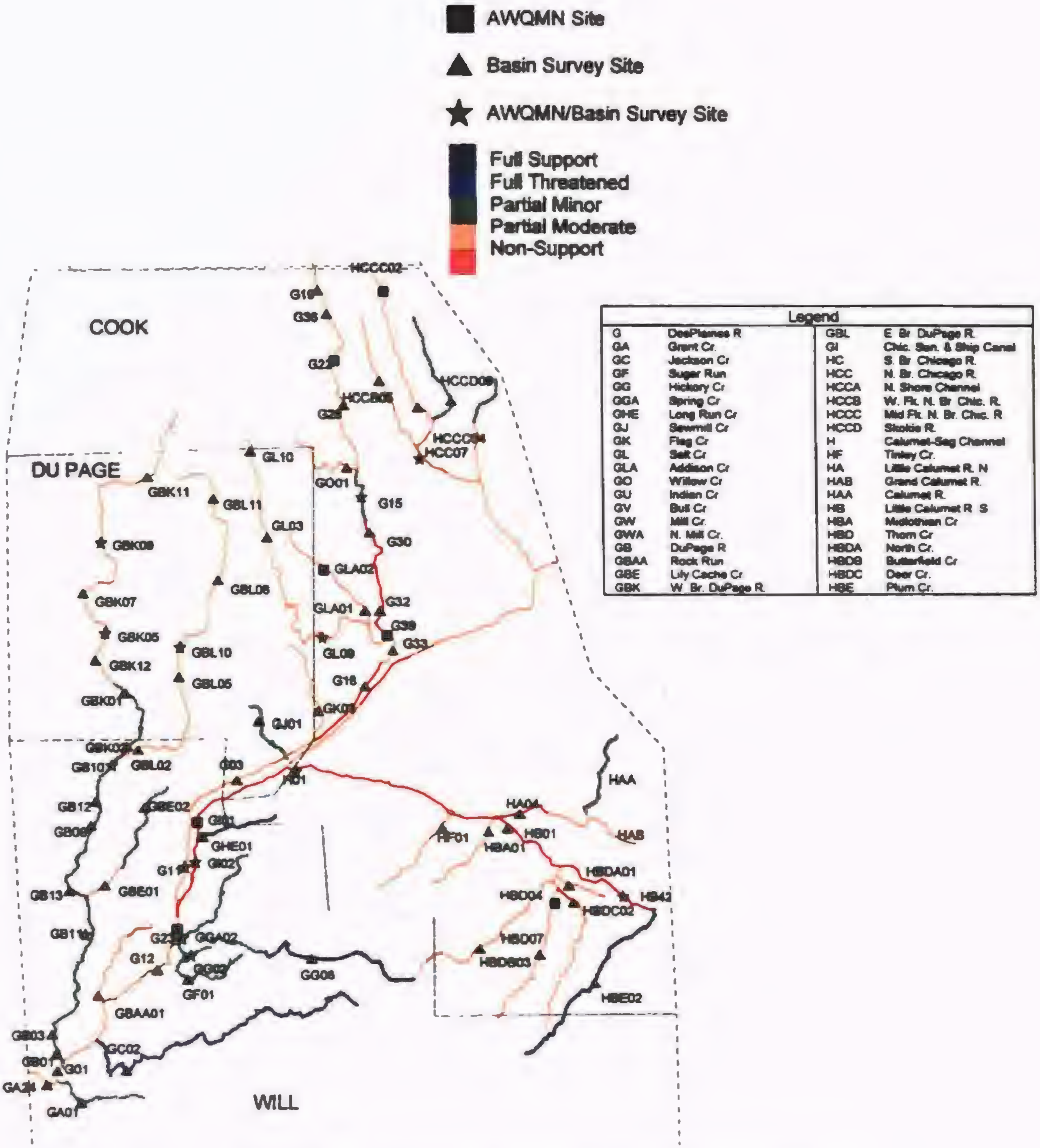
- **Little Calumet River - North**: 8 stream miles assessed; 6 miles rated as "fair," while the remaining 2 miles were rated as "poor." Nutrients, habitat alteration, metals, and organic enrichment (low-dissolved oxygen) from municipal and industrial point source pollution and hydrologic/habitat modifications have impacted the river.

- **Little Calumet River - South**: 16 stream miles assessed; 7 miles rated as "fair," and the remaining 9 miles as "poor." The river has been impacted by nutrients, pathogens, siltation, and organic enrichment (low-dissolved oxygen) from municipal point sources and urban runoff.

- **Thorn Creek**: 20 stream miles assessed; all 20 miles were rated as having "fair" overall resource quality. The creek was impacted by nutrients, siltation, and pathogens from construction and urban runoff.

Other waterbodies in Cook County, IL, assessed by IEPA (1997a) included the Cal-Sag Channel "poor," the Chicago Sanitary and Ship Canal "poor," and the Des Plaines River "fair." All 16.1 miles of the Cal-Sag Channel and 25 miles of the Chicago Sanitary and Ship Canal were rated as "nonsupport for aquatic life use support" (IEPA, 1996c). Most (80 percent) of the Des Plaines River were rated as "partial support with minor impairment," while 17 percent were "partial support/moderate impairment," and 3 percent were "full/threatened." The segment of the Des Plaines that was "full/threatened," however, was not located in Cook County, IL (IEPA, 1996c).

The previous IEPA water quality report for 1992-93 assessed water quality in several subbasins in the Cook County, IL, area (IEPA, 1994). These assessments used a five-level scale to indicate the quality of the waterbodies with respect to various chemical, physical, and biological attributes. Waterbodies assessed included the Chicago Sanitary and Ship Canal, the Chicago River system, the Cal-Sag Channel, and the Calumet River system. More than 60 percent of the stream miles of this highly-urbanized area were rated as "partial support/moderate impairment" (fourth lowest rating of five). Figure 4-29 displays the 1992-93 water quality assessment of select streams/rivers in the area. IEPA (1994) rated the entire length of the Chicago Sanitary and Ship



Source: IEPA, 1994.

Figure 4-29. Water Quality Assessments of Streams and Rivers in the Cook County, IL Area for 1992-93

Canal, a large portion of the Chicago River System, and most tributaries of the Little Calumet River and the Cal-Sag Channel as "partial support/moderate impairment."

The 1992-93 IEPA 305(b) report also assessed water quality of tributaries to Lake Michigan. While the Chicago and Calumet Rivers were historically tributaries of Lake Michigan, they were diverted to avoid contamination of the city's drinking water supply. Water is diverted away from Lake Michigan at the Wilmette Pumping Station, Chicago River Controlling Works, and the O'Brien Lock/Dam (IEPA, 1994). Bypasses have been occasionally necessary to avoid flooding during periods of heavy rain; however, there were no bypasses in 1991 and 1993 (IEPA, 1994). Of the Chicago River system (including in South Branch, North Branch, North Shore Channel, and the Middle Fork North Branch), 95 percent were rated as having "partial support/moderate impairment" water quality (IEPA, 1994). Furthermore, 67 percent of the Grand Calumet River, the Little Calumet River, and the Cal-Sag Channel were rated as "not supporting aquatic life use" (IEPA, 1994). This lowest rating, on a five-point scale, was found attributable to nutrients, ammonia, and low-dissolved oxygen.

U.S. EPA Region 5 sampled surface water contamination in 1983 in the South Deering section of Chicago (Sanders, 1983). Water samples from three locations were collected for total metals, mercury, arsenic, VOCs, and organics scan analyses. Sampling was conducted in ditches and ponds along the Norfolk and Western Railroad tracks west of Torrance Avenue. Metals identified in these samples at concentrations above IEPA Rule 203 General Water Quality Standards included boron, copper, manganese, and iron (Sanders, 1983). In addition to the metals, five VOCs were identified at low levels: 1,2-dichloroethane, chlorobenzene, chloroform, carbon tetrachloride, and 1,1-dichloroethane. Other organic compounds were also detected in the analyses. In general, some levels of pollutants were identified in all three sampling locations, with the northern sampling location having the highest concentrations (Sanders, 1983). Table 4-23 summarizes data for these metals, volatile organics, and other organic compounds detected in these waterbodies in the South Deering area of Southeast Chicago.

Ambient water quality monitoring data for 1990-1995 were obtained from STORET to characterize pollutant levels in the Cal-Sag Channel, the Chicago River, and the Des Plaines River

Table 4-23. Summary of Contaminants Detected in Select Waterbodies in South Deering, Chicago in 1983

Contaminant	Concentrations*
Boron	1.02 - 1.43 mg/L
Chromium	8.4 - 39.1 μg/L
Copper	25.4 μg/L
Manganese	1.4 mg/L
Iron	1.23 - 5.88 mg/L
1,2 Dichloroethane	1 - 16 μg/L
Chlorobenzene	3.5 μg/L
Chloroform	30 μg/L
Carbon Tetrachloride	0.7 μg/L
1,1 Dichloroethane	0.5 μg/L
Aniline	30 μg/L
Phenol	8.7 μg/L
4-methylphenol	73 μg/L
Isophorone	40 μg/L
Bis (2-ethylhexyl) phthalate	60 μg/L

* Concentrations presented for metals (except chromium) are those positive samples whose concentrations were determined by U.S. EPA Region 5 to exceed IEPA Rule 203 General Water Quality Standards.

mg/L = milligrams per liter

μg/L = micrograms per liter

Source: Sanders, 1983

(STORET, 1997). The monitoring stations used to represent these waterbodies are listed in Table 4-24. Available monitoring results from STORET for these waterbodies are presented in Tables 4-25, 4-26, and 4-27 as minimums, maximums, and average concentrations for parameters detected. The Cal-Sag Channel, Chicago River, and the Des Plaines River have concentrations of VOCs in addition to metals and conventional pollutants from monitoring conducted from 1990 to 1995. Specifically, 11 pollutants were found in the Chicago River at their highest concentrations in the study area. These pollutants included numerous VOCs such as chloroform, methylene chloride, tetrachloroethylene, and xylene. Levels of fecal coliform in these waterbodies include maximums of 32,000 per 100 mL in the Cal-Sag Channel, 46,000 per 100 mL in the Chicago River, and 55,000 per 100 mL in the Des Plaines River.

4.2.4 Water Quality of Streams and Rivers in Lake County, IN

Some of the major streams/rivers in Lake County, IN, (other than the GCR/IHSC) include the Kankakee and Little Calumet Rivers. The portion of the Kankakee River that borders Lake County was assessed by IDEM (1996a) in the 305(b) report as "fully supporting aquatic life use." The Little Calumet River was assessed as "nonsupporting for aquatic life and recreational uses," which could be associated with municipal point sources, CSOs, and other sources. The western portion of the Little Calumet, which flows into Illinois, has exceeded water quality standards for numerous parameters including DO and cyanide and also had high levels of bacteria. During 1994-95, DO violations were found in 42 percent of the samples; this was after several years of improvement in DO in the 1988-93 time period (IDEM, 1996a). High amounts of E. Coli bacteria were found in 75 percent of the samples taken in this portion of the Little Calumet and cyanide was also found at excessive levels in 33 percent of the samples in 1994-95 in this portion of the River (IDEM, 1996a).

Rivers in Lake County, IN

- Kankakee River - Fully Supporting Aquatic Life Use
- Little Calumet River - Nonsupporting for Aquatic Life and Recreational Uses
  - Low Dissolved Oxygen
  - Cyanide
  - Very High Bacteria Levels

Table 4 - 24. Water Quality Monitoring Stations in Select Streams and Rivers in Cook County, IL

Water Body	Station ID	Sec. ID	Name of Station
Cal-Sag Channel	5536700	H 01	CALUMET SAG CHANNEL AT SAG BRIDGE, IL
	46044	H 01	CAL-SAG CHANNEL AT RT 83 NE LEMONT
Chicago River	5536000	HCC 07	NORTH BRANCH CHICAGO RIVER AT NILES, IL
	48116	HCCC02	MD FK N BR CHICAGO R CO LN DEERFIELD RD
	48443	HCC07	N BR CHICAGO R TOUHY AV CHICAGO
Des Plaines River	5529000	G 22	DES PLAINES RIVER NEAR DES PLAINES, IL
	5530590	G 15	DES PLAINES RIVER NEAR SCHILLER PARK, IL
	5532500	G 39	DES PLAINES R BARRY PT RD RIVERSIDE
	47005	G 15	DES PLAINES R IRVING PK RD SCHLR PK

Source: STORET, 1997.

Table 4 - 25. Pollutant Levels in Cal-Sag Channel (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	1	56	0	5 72	10
DO MG/L	1990-1992	1	23	4	6 16	10
COD LOWLEVEL MG/L	1990-1993	2	60	17	31.92	64
RESIDUE TOT NFLT MG/L	1990-1995	2	77	4	42.23	236
RESIDUE VOL NFLT MG/L	1990-1995	2	76	1	9 96	34
OIL-GRSE FREON-GR MG/L	1990	2	2	2	2	2
NH3+NH4- N TOTAL MG/L	1990-1995	2	79	0 33	2.7	7.8
TOT KJEL N MG/L	1990-1995	2	78	0.5	4.14	9 8
NO2&NO3 N-TOTAL MG/L	1990-1995	2	78	0 8	2.34	7
PHOS-TOT MG/L P	1990-1995	2	78	0.36	1 33	4 1
PHOS-DIS MG/L P	1990-1995	2	71	0.21	1.11	3.53
CYANIDE CN-TOT MG/L	1990-1995	2	55	0.01	0.01	0.04
ARSENIC AS,TOT UG/L	1990-1995	2	53	1	2.59	5
BARIUM BA,TOT UG/L	1990-1995	2	79	7	32 86	68
CADMIUM CD,TOT UG/L	1990-1991,1995	1	3	4	4 33	5
CHROMIUM CR,TOT UG/L	1990-1995	2	29	7	8 97	20
COPPER CU,TOT UG/L	1990-1995	2	30	5	9.57	26
IRON FE,TOT UG/L	1990-1995	2	77	110	1222.49	6900
LEAD PB,TOT UG/L	1990-1995	2	63	5	11 45	53
MANGNESE MN UG/L	1990-1995	2	76	44	94.21	180
NICKEL NI,TOTAL UG/L	1990-1992	2	11	7	17.27	40
SILVER AG,TOT UG/L	1991,1995	2	4	3	5.75	8
STRONTUM SR,TOT UG/L	1990-1995	2	79	62	235.8	364
VANADIUM V,TOT UG/L	1990-1995	2	27	5	6 89	12
ZINC ZN,TOT UG/L	1990-1995	2	33	57	120 76	270
ALUMINUM AL,TOT UG/L	1990-1995	2	73	120	704 11	3097
FECAL COLIFORM /100ML	1990-1995	2	19	10	6059.48	32000
CHLRFORM TOTUG/L	1992	1	1	2 8	2.8	2 8
PHENOLS TOTAL UG/L	1990-1995	2	50	4	10.7	66
METHYLENECHLORIDE TOTWUG/L	1990-1992,1995	1	8	1	1 75	4
TETRACHLOROETHYLENE TOTWUG/	1990-1991,1994	1	7	1	1 57	4
111TRICHLOROETHANE TOTWUG/L	1990	1	3	1	1 67	2
12DICHLOROETHANE TOTWUG/L	1990-1992	1	3	1	1 33	2
MERCURY HG,TOTAL UG/L	1990-1992,1995	2	9	0.05	0 07	0 1

Source STORET, 1997

Table 4 - 26. Pollutant Levels in Chicago River (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	1	53	4.2	8 31	13.5
DO MG/L	1990-1992	1	23	4.4	8.51	13.1
COD LOWLEVEL MG/L	1990-1993	2	57	12	27	60
RESIDUE TOT NFLT MG/L	1990-1995	2	76	5	29 33	212
RESIDUE VOL NFLT MG/L	1990-1995	2	76	1	7.58	40
OIL-GRSE FREON-GR MG/L	1990	2	6	1	1.33	2
NH3+NH4- N TOTAL MG/L	1990-1995	2	75	0.06	0 26	1
TOT KJEL N MG/L	1990-1995	2	75	0.2	1 48	3.3
NO2&NO3 N-TOTAL MG/L	1990-1995	2	76	1 1	4 72	9.8
PHOS-TOT MG/L P	1990-1995	2	76	0 23	0 86	2.06
PHOS-DIS MG/L P	1990-1995	2	72	0.14	0 75	1 9
CYANIDE CN-TOT MG/L	1990,1993-1995	2	6	0.01	0.01	0.03
ARSENIC AS,TOT UG/L	1990-1992,1995	2	43	1	1 84	5
BARIUM BA,TOT UG/L	1990-1995	2	76	22	37.17	60
CADMIUM CD,TOT UG/L	1990	2	2	6	6	6
CHROMIUM CR,TOT UG/L	1990,1994-1995	2	11	5	6.82	10
COPPER CU,TOT UG/L	1990-1995	2	32	5	8.5	17
IRON FE,TOT UG/L	1990-1995	2	74	93	761 19	3200
LEAD PB,TOT UG/L	1990-1995	2	19	5	8.3	20
MANGNESE MN UG/L	1990-1995	2	76	14	67 58	140
NICKEL NI,TOTAL UG/L	1991	2	6	9	15 33	20
SILVER AG,TOT UG/L	1991	2	5	6	9.2	12
STRONTUM SR,TOT UG/L	1990-1995	2	76	130	322.78	435
VANADIUM V,TOT UG/L	1994	1	1	6	6	6
ZINC ZN,TOT UG/L	1991-1995	2	21	50	80.14	200
ALUMINUM AL,TOT UG/L	1990-1995	2	72	120	525 49	3200
FECAL COLIFORM /100ML	1990-1995	2	22	1	4740.72	46000
PHENOLS TOTAL UG/L	1990-1995	2	39	3	7 49	24
MERCURY HG,TOTAL UG/L	1990-1992	2	14	0.06	0 12	0 2
BROMODICHLOROMETHANE UG/L	1990-1993	2	8	1	2	8
DIBROMOCHLOROMETHANE UG/L	1991	1	2	1	1 5	2
BROMOFORM UG/L	1990	1	2	1	2.5	4
CHLOROFORM UG/L	1990-1994	2	25	1	3 88	52
METHYLENE CHLORIDE UG/L	1990-1992	1	2	1	3	5
TETRACHLOROETHYLENE UG/L	1991	1	2	6	205	404
111TRICHLOROETHANE UG/L	1990-1992	1	3	0.8	2 6	5
TRICHLOROETHYLENE UG/L	1990-1991	1	2	1	28.5	56
CIS-1,2-DICHLOROETHENE UG/L	1990-1991	1	2	1	19	37
XYLENE	1991	1	1	10	10	10

Source STORET, 1997

Table 4 - 27. Pollutant Levels in Des Plaines River (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	3	168	5.4	9.06	14.2
DO MG/L	1990-1992	2	47	5.5	8.86	12.2
COD LOWLEVEL MG/L	1990-1993	5	157	17	36.15	240
RESIDUE TOT NFLT MG/L	1990-1995	5	215	1	36.73	238
RESIDUE VOL NFLT MG/L	1990-1995	5	214	1	8.79	40
OIL-GRSE FREON-GR MG/L	1990	1	1	4	4	4
NH3+NH4- N TOTAL MG/L	1990-1995	5	213	0.01	0.29	3.2
TOT KJEL N MG/L	1990-1995	3	137	0 45	1 74	5 7
NO2&NO3 N-TOTAL MG/L	1990-1995	5	215	0.5	4 86	11
PHOS-TOT MG/L P	1990-1995	5	215	0.17	0.68	1 79
PHOS-DIS MG/L P	1990-1995	5	209	0.07	0 56	1.67
CYANIDE CN-TOT MG/L	990-1991,1994-1995	5	15	0.01	0 01	0.01
ARSENIC AS,TOT UG/L	1990-1992,1995	3	78	1	2 28	5
BARIUM BA,TOT UG/L	1990-1995	5	215	22	37.6	57
CADMIUM CD,TOT UG/L	1990-1992	3	26	0.1	0.52	3
CHROMIUM CR,TOT UG/L	1990-1995	5	74	5	13.04	122
COPPER CU,TOT UG/L	1990-1995	5	91	5	8 1	36
IRON FE,TOT UG/L	1990-1995	5	215	260	967.17	4705
LEAD PB,TOT UG/L	1990-1995	5	46	2	8.1	34
MANGNESE MN UG/L	1990-1995	5	215	24	79 18	178
NICKEL NI,TOTAL UG/L	1990-1994	5	45	5	11 84	26
SILVER AG,TOT UG/L	990-1991,1994-1995	4	10	3	6 1	11
STRONTUM SR,TOT UG/L	1990-1995	5	215	150	447.19	800
VANADIUM V,TOT UG/L	1990-1995	5	24	5	6.42	9
ZINC ZN,TOT UG/L	1990-1995	5	64	54	124.08	534
ALUMINUM AL,TOT UG/L	1990-1995	5	214	120	637.04	3100
FECAL COLIFORM /100ML	1990-1995	5	70	30	7800.2	55000
BROMOFRM WHL-WTR UG/L	1990-1991	1	3	2	2	2
CHLRFORM TOTUG/L	1992-1994	1	5	0.9	0.98	1
PHENOLS TOTAL UG/L	1990-1995	3	48	3	8.3	35
METHYLENECHLORIDE TOTWUG/L	1990-1991	1	2	2	2	2
PCP TOT UG/L	1990-1991	1	4	0.01	0.03	0.06
GAMMABHC LINDANE TOT.UG/L	1990	1	1	0.02	0 02	0 02
METOLACHLOR (DUAL) UG/L	1990	1	4	0 11	0 84	2 7
ATRAZINE WHL SMPL UG/L	1990-1991	1	5	0 21	0.87	2.7
RESIDUE DISS-180 C MG/L	1990-1992	1	27	453	707 71	1012
MERCURY HG,DISS UG/L	1992	1	1	0.05	0 05	0 05
MERCURY HG,TOTAL UG/L	1991-1992	2	9	0 05	0 09	0 2
ALACHLOR TOTAL UG/L	1990-1991	1	4	0 05	0 51	1.4
MTRBUZIN TOT UG/L	1990	1	1	0 2	0.2	0.2

Source STORET, 1997

Ambient water quality monitoring data for the years 1990-1995 were obtained from STORET to characterize environmental levels in streams and rivers in Lake County, IN. Other than the GCR/IHSC (discussed in Section 4.2.1) the streams/rivers for which STORET has data, include: (1) Little Calumet River, (2) Kankakee River, and (3) Wolf Lake Channel. The monitoring stations for these waterbodies are summarized on Table 4-28. Available monitoring results from STORET for (1) Little Calumet River, (2) Kankakee River, and (3) Wolf Lake Channel are presented in Tables 4-29, 4-30, and 4-31, respectively. The Kankakee River had the highest concentrations of several pollutants (alachlor, atrizine, and metolachlor) in the study area. Similarly, the Little Calumet River had the highest measures of certain nutrient parameters, as well as the highest fecal coliform level (163,000 per 100 mL) in the study area.

4.2.5 Water Quality of Lakes in Cook County, IL

IEPA (1997a) assessed water quality in 33 lakes, covering 2,777 acres, in the Great Lakes/Calumet River watershed (an area larger than Cook County, IL). Overall resource quality is "good" on 819 acres (29%), "fair" on 1,916 acres (69%), and "poor" on 42 acres (2%) (IEPA, 1997a). Figure 4-30 displays the assessed lakes for 1994-95. The primary causes of water quality problems in these lakes are siltation, suspended solids, priority organics, metals, and habitat alterations attributed to land disposal and contaminated sediments. IEPA's (1997a) assessments of select lakes in the Great Lakes/Calumet River watershed are presented below:

- **Wolf Lake:** Created during the 1920s by filling a quarry. The surface area (419 acres) receives water from its 500-acre watershed and from groundwater infiltration. Water input also comes from American Maize and Lever Brothers Company, which draw and use Lake Michigan water for cooling water purposes and then discharge it into Wolf Lake. The overall resource quality is rated as "good." Pollutants to the lake include nutrients, suspended solids, siltation, organic enrichment (low-dissolved oxygen), and noxious aquatic plants. Primary pollution sources include urban runoff, shoreline erosion, and contaminated sediments.

- **Skokie Lagoons:** Chain of inter-connecting lagoons in Cook County, IL, that were built in the late 1930s by damming the Skokie River. Total surface area is 225 acres, and water is received from a 14,722-acre watershed. The overall resource quality of Skokie Lagoons is considered "fair." Causes of pollution include nutrients, organic

Table 4 - 28. Water Quality Monitoring Stations in Stream/Rivers in Lake County, IN

Water Body	Station ID	Sec. ID	Name of Station
Kankakee River	5518000		KANKAKEE RIVER AT SHELBY, IN
Little Calumet River	5536195	HB 42	LITTLE CALUMET RIVER AT MUNSTER, IND.
	5536195	HB 42	L CALUMET R S HOLMAN AV IND ST LINE MUNSTER IN
	170155	LCR 13	LITTLE CALUMET R & HOHMAN AVE AT MI POINT 13.34
Wolf Lake	160189	WL SL	WOLF LAKE AT STATE LINE CULVERT

Source: STORET, 1997.

Table 4 - 29. Pollutant Levels in Little Calumet River (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	1	56	1.6	7.27	13
DO MG/L	1990-1995	2	76	2 4	8.01	13
BOD 5 DAY MG/L	1990-1995	1	25	1	2 65	4.6
COD LOWLEVEL MG/L	1990-1995	3	134	12	34 24	70
RESIDUE TOT NFLT MG/L	1990-1995	3	147	7	54.78	256
RESIDUE VOL NFLT MG/L	1990-1995	2	80	2	13.15	42
OIL-GRSE FREON-GR MG/L	1990	1	1	1	1	1
NH3+NH4- N TOTAL MG/L	1990-1995	3	148	0 1	0.44	1.9
TOT KJEL N MG/L	1990-1995	2	82	0 7	1.84	3.9
NO2&NO3 N-TOTAL MG/L	1990-1995	3	152	0 8	2.99	9.3
PHOS-TOT MG/L P	1990-1995	3	153	0 05	0.44	1 8
PHOS-DIS MG/L P	1990-1995	2	81	0.06	0.28	0.98
CYANIDE CN-TOT MG/L	1990-1995	3	105	0 01	0 01	0.08
ARSENIC AS,TOT UG/L	1990-1995	3	107	0 7	1.77	6
BARIUM BA,TOT UG/L	1990-1995	2	82	27	47.2	94
CADMIUM CD,TOT UG/L	1990,1995	2	3	4	4	4
CHROMIUM CR,TOT UG/L	1990-1995	3	38	5	14.26	82
COPPER CU,TOT UG/L	1990-1995	2	40	5	9.17	21
IRON FE,TOT UG/L	1990-1995	2	82	420	2105 03	6295
LEAD PB,TOT UG/L	1990-1995	2	27	5	7.64	15
MANGNESE MN UG/L	1990-1995	2	82	66	156.71	370
NICKEL NI,TOTAL UG/L	1990-1992	2	26	7	16.5	30
SILVER AG,TOT UG/L	1992-1993,1995	2	3	4	5	7
STRONTUM SR,TOT UG/L	1990-1995	2	82	130	420.39	920
VANADIUM V,TOT UG/L	990-1991,1993-1994	2	14	6	6.86	8
ZINC ZN,TOT UG/L	1990-1995	2	27	50	96.82	150
ALUMINUM AL,TOT UG/L	1990-1995	2	77	160	1219 84	4200
FECAL COLIFORM /100ML	990-1991,1993-1995	2	17	190	45748.76	163000
CHLRFORM TOTUG/L	1990,1992,1994	1	3	1	1	1
PHENOLS TOTAL UG/L	1990-1994	3	45	2	9.82	45
TETRACHLOROETHYLENE UG/L	1994	1	1	5	5	5
PCP TOT UG/L	1990	1	1	0.01	0 01	0.01
TRICHLOR ETHYLENE TOT UG/L	1994	1	1	2	2	2
MERCURY HG,TOTAL UG/L	1990-1995	3	14	0.07	0.1	0 1
C-1,2DCE TOTAL UG/L	1994	1	1	1	1	1

Source STORET, 1997

Table 4 - 30. Pollutant Levels in Kankakee River (1990)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
NO2&NO3 N-TOTAL MG/L	1990	1	4	1.9	3	4.1
METLCHLR WTR DISS UG/L	1990	1	3	0.3	0 59	1.1
ATRAZINE WHL SMPL UG/L	1990	1	1	5 6	5.6	5.6
ATRAZINE DISS. PPB	1990	1	3	0.77	2.31	4.4
ALACHLOR WTR DISS UG/L	1990	1	3	0.3	1 09	2.8
ALACHLOR TOTAL UG/L	1990	1	1	3.2	3.2	3.2

Source· STORET, 1997.

Table 4 - 31. Pollutant Levels in Wolf Lake Channel for 1990-1995

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO MG/L	1990-1995	1	42	7.5	10.6	14.9
BOD 5 DAY MG/L	1990-1995	1	18	1.3	2 21	4.6
COD LOWLEVEL MG/L	1990-1995	1	56	4	20 18	39
RESIDUE TOT NFLT MG/L	1990-1995	1	45	2	11 56	36
OIL-GRSE FREON-GR MG/L	1990	1	1	2	2	2
NH3+NH4- N TOTAL MG/L	1990-1995	1	20	0 1	0 22	0.3
NO2&NO3 N-TOTAL MG/L	1990-1995	1	27	0 1	0 27	0.7
PHOS-TOT MG/L P	1990-1995	1	35	0.03	0.04	0.07
CYANIDE CN-TOT MG/L	1992-1993,1995	1	5	0.01	0 01	0.02
ARSENIC AS,TOT UG/L	1990-1991	1	4	1	2.4	4
COPPER CU,TOT UG/L	1990-1991	1	3	5	7	11
LEAD PB,TOT UG/L	1990	1	1	12	12	12
ZINC ZN,TOT UG/L	1990-1991	1	3	10	20	30
ANTIMONY SB,TOT UG/L	1991	1	1	2	2	2
METHYLENECHLORIDE TOTWUG/L	1991-1992	1	2	5 4	10.7	16
111TRICHLOROETHANE TOTWUG/L	1991	1	1	1.5	1.5	1.5
BIS2ETHYLHEXYLPHTHALATE UG/L	1990-1991	1	3	20	193.33	340

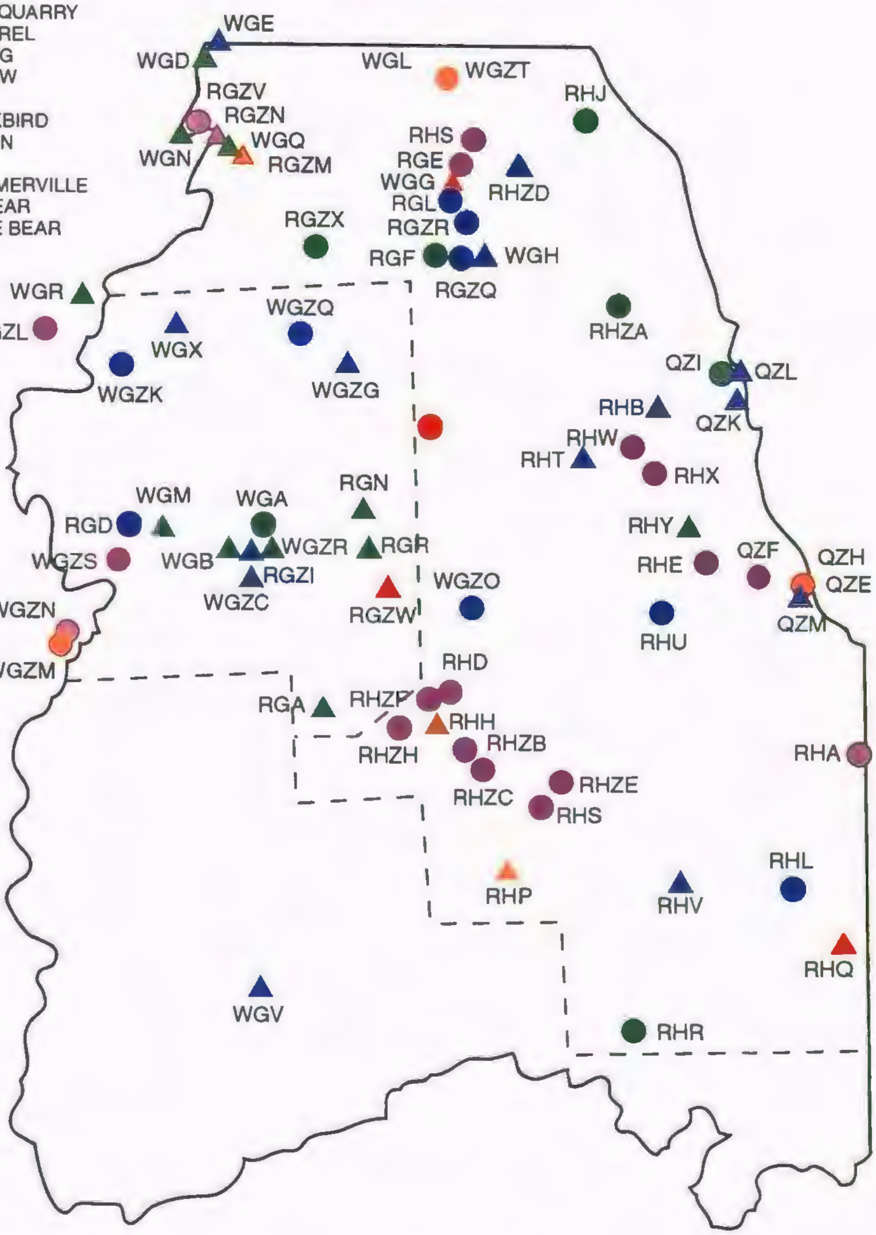
Source. STORET, 1997

Legend

QZE	JACKSON PK LGN EAST	WGA	MEADOW
QZF	WASHINGTON PK LGN	WGB	MARMO
QZH	JACKSON PK LGN WEST	WGC	STERLING POND
QZI	DIVERSY HARBOR	WGD	ACORN
QZK	LINCOLN PK NORTH PND	WGE	HIDDEN VALLEY
QZL	LINCOLN PK SOUTH PND	WGF	MEADOWLAKE W.
QZM	JACKSON PK SOUTH LGN	WGG	OAKTON
QZV	SAND POND	WGH	PARK
RGA	BRUCE	WGK	SALEM-REED
RGB	DIAMOND	WGL	MEADOWLAKE E.
RGC	LINDEN	WGM	HERRICK
RGD	SILVER	WGN	WESTBURY
RGE	BECK	WGQ	HARPER
RGF	OPEKA	WGR	LOST ISLAND
RGG	CHURCHILL LAGOON	WGS	WATERFORD (WALDEN)
RGI	GAGES	WGU	OLD MILL
RGJ	BUTLER	WGX	MALLARD
RGK	GRAYS	WGZC	CRABAPPLE
RGL	BIG BEND	WGZG	GROVE
RGM	SAND	WGZI	OLD SCHOOL
RGN	BRIARWOOD CENTRAL	WGZJ	STERLING
RGP	MINEAR	WGZK	DEEP QUARRY
RGR	CHARLES	WGZL	PICKEREL
RGT	LIBERTY	WGZM	SPRING
RGV	DRUCE	WGZN	WILLOW
RGW	THIRD	WGZO	IDA
RGX	DEER	WGZQ	BLACKBIRD
RGZA	CROOKED	WGZR	HIDDEN
RGZB	HASTINGS	WGZS	MUD
RGZD	MILTMORE	WGZT	SHERMERVILLE
RGZE	SLOUGH	WGZU	BIG BEAR
RGZF	SYLVAN	WGZV	LITTLE BEAR
RGZG	FOREST		
RGZI	ARBOR		
RGZK	POTOMAC		
RGZM	VALLEY		
RGZN	INVERNESS (PHEASANT)		
RGZO	TAMPIER LAKE		
RGZQ	AXEHEAD		
RGZR	BELLEAU		
RGZS	ELLYN		
RGZV	S. RIDGE (WESTBURY)		
RGZW	JOHNSON SLOUGH		
RGZX	BUSSE WOODS		
RGZY	BROWNS		
RHA	WOLF		
RHB	HUMBOLDT PARK LAGOON		
RHD	MAPLE		
RHE	MARQUETTE PARK LAG.		
RHG	POWDERHORN		
RHH	SANGANSHKEE SL		
RHI	SAUK TRAIL		
RHJ	SKOKIE LAGOONS		
RHK	ELEANOR		
RHL	WAUMPUM		
RHO	CALUMET		
RHP	LORIN		
RHQ	LYNWOOD		
RHR	GEORGE		
RHS	TURTLEHEAD		
RHT	COLUMBUS PARK LAG.		
RHU	SHERMAN PARK LAGOONS		
RHV	CRESTVIEW		
RHW	GARFIELD PK. LAGOON		
RHX	DOUGLAS PARK LAGOON		
RHY	MC KINLEY PK. LAGOON		
RHZA	GOMPERS PARK LAGOON		
RHZB	HORSETAIL		
RHZC	PAPOOSE		
RHZD	PARK LAKE		
RHZE	ARROWHEAD		
RHZF	BULLFROG		
RHZH	SAG QUARRY WEST		

Key

- Monitored
- Evaluated
- Full Support
- Full/Threatened
- Partial/Minor
- Partial/Moderate
- Non Support



Source: IEPA, 1996.

Figure 4-30. Water Quality Assessments of Lakes in the Cook County, IL, Area for 1994-95

enrichment (low-dissolved oxygen), suspended solids, and siltation. Primary sources of pollution include urban runoff, construction, combined sewer overflows, and shoreline erosion. The quality of Skokie Lagoons is improving.

- **Douglas Park Lagoon:** Located in Cook County, IL, this 19-acre lake was built in the late 1800s for the 1902 World's Fair, by excavating a lowland area near Lake Michigan. The overall resource quality of the lagoon is considered "good." Causes of pollution to the lake include nutrients, organic enrichment (low-dissolved oxygen), siltation, and suspended solids. The primary source of pollution is urban runoff.

In the previous water quality report for 1992-93, 105 lakes in the Des Plaines/Lake Michigan River Basin were assessed by IEPA (1994) as part of its 305(b) program (Figure 4-31). While about 60 lakes had "fully supported" or "full/threatened" water quality ratings, several had lower water quality assessments, including:

- Tampier Lake - "non supporting";
- Jackson Park Lagoons - "partial/moderate";
- Lynwood Lake - "partial/moderate";
- Lake George - "partial/moderate"; and
- Lorin Lake - "partial/moderate."

STORET data for surface water quality were examined for select lakes in Cook County, IL (STORET, 1997). Table 4-32 displays the sampling stations for select lakes. In general, the lakes characterized had more complete data sets and higher levels of contaminants as reported in STORET than other lakes in Cook County. (Wolf Lake, which lies on the border between Illinois and Indiana, is discussed further under Section 4.2.6.) Pollutant levels for detected parameters from monitoring conducted between 1990 and 1995 are presented on Tables 4-33 through 4-38 for Garfield Lagoon, Lincoln North Pond, Sherman Park Lagoon, Skokie Lagoons, Tampier Lake, and Washington Lagoon. All of these systems had detectable levels of metals. Lincoln North Pond and Washington Lagoon had low levels (0.06 μg/L) of pentachlorophenol found in 1991. Finally, Sherman Park Lagoon and Skokie Lagoons had fecal coliform levels of 4,200 and 22,000 per 100 mL, respectively.

Legend

QZE	JACKSON PK LGN EAST	WGA	MEADOW
QZF	WASHINGTON PK LGN	WGB	MARMO
QZH	JACKSON PK LGN WEST	WGC	STERLING POND
QZI	DIVERSY HARBOR	WGD	ACORN
QZK	LINCOLN PK NORTH PND	WGE	HIDDEN VALLEY
QZL	LINCOLN PK SOUTH PND	WGF	MEADOWLAKE W.
QZM	JACKSON PK SOUTH LGN	WGG	OAKTON
QZV	SAND POND	WGH	PARK
RGA	BRUCE	WGK	SALEM-REED
RGB	DIAMOND	WGL	MEADOWLAKE E.
RGC	LINDEN	WGM	HERRICK
RGD	SILVER	WGN	WESTBURY
RGE	BECK	WGQ	HARPER
RGF	OPEKA	WGR	LOST ISLAND
RGG	CHURCHILL LAGOON	WGS	WATERFORD (WALDEN)
RGI	GAGES	WGU	OLD MILL
RGJ	BUTLER	WGX	MALLARD
RGK	GRAYS	WGZC	CRABAPPLE
RGL	BIG BEND	WGZG	GROVE
RGM	SAND	WGZI	OLD SCHOOL
RGN	BRIARWOOD CENTRAL	WGZJ	STERLING
RGP	MINEAR	WGZK	DEEP QUARRY
RGR	CHARLES	WGZL	PICKEREL
RGT	LIBERTY	WGZM	SPRING
RGV	DRUCE	WGZN	WILLOW
RGW	THIRD	WGZO	IDA
RGX	DEER	WGZQ	BLACKBIRD
RGZA	CROOKED	WGZR	HIDDEN
RGZB	HASTINGS	WGZS	MUD
RGZD	MILTMORE	WGZT	SHERMERVILLE
RGZE	SLOUGH	WGZU	BIG BEAR
RGZF	SYLVAN	WGZV	LITTLE BEAR
RGZG	FOREST		
RGZI	ARBOR		
RGZK	POTOMAC		
RGZM	VALLEY		
RGZN	INVERNESS (PHEASANT)		
RGZO	TAMPIER LAKE		
RGZQ	AXEHEAD		
RGZR	BELLEAU		
RGZS	ELLYN		
RGZV	S. RIDGE (WESTBURY)		
RGZW	JOHNSON SLOUGH		
RGZX	BUSSE WOODS		
RGZY	BROWNS		
RHA	WOLF		
RHB	HUMBOLDT PARK LAGOON		
RHD	MAPLE		
RHE	MARQUETTE PARK LAG.		
RHG	POWDERHORN		
RHH	SANGANSHKEE SL		
RHI	SAUK TRAIL		
RHJ	SKOKIE LAGOONS		
RHK	ELEANOR		
RHL	WAUMPUM		
RHO	CALUMET		
RHP	LORIN		
RHQ	LYNWOOD		
RHR	GEORGE		
RHS	TURTLEHEAD		
RHT	COLUMBUS PARK LAG.		
RHU	SHERMAN PARK LAGOONS		
RHV	CRESTVIEW		
RHW	GARFIELD PK. LAGOON		
RHX	DOUGLAS PARK LAGOON		
RHY	MC KINLEY PK. LAGOON		
RHZA	GOMPERS PARK LAGOON		
RHZB	HORSETAIL		
RHZC	PAPOOSE		
RHZD	PARK LAKE		
RHZE	ARROWHEAD		
RHZF	BULLFROG		
RHZH	SAG QUARRY WEST		

Source: IEPA, 1994.

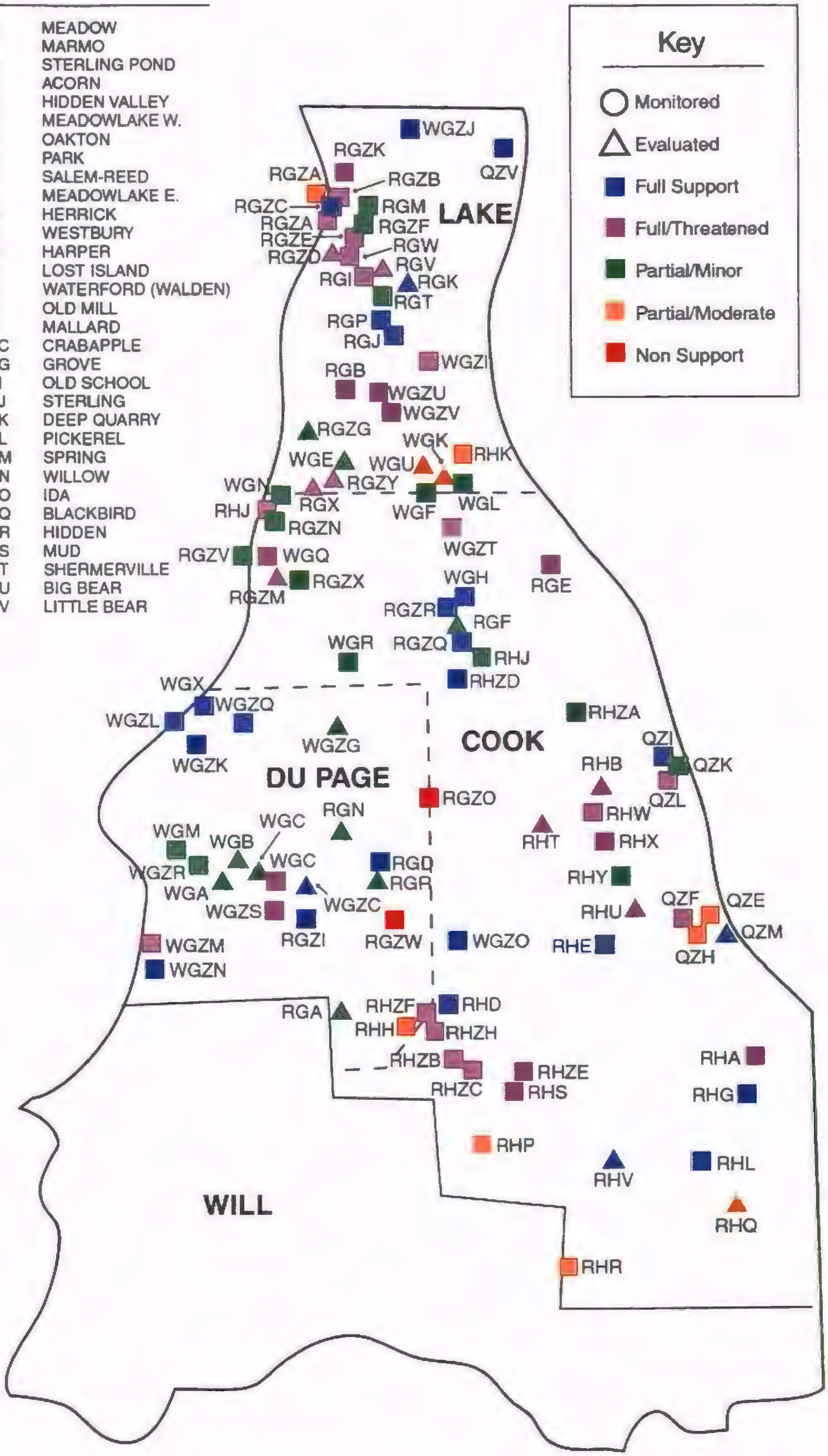


Figure 4-31. Water Quality Assessments of Lakes in the Cook County, IL, Area for 1992-93

Table 4 - 32. Water Quality Monitoring Stations in Lakes in Cook County, IL

Water Body	Station ID	Sec. ID	Name of Station
Garfield Lagoon	RH-A04-W-2	RHW-2	GARFIELD PK NW END OF LAKE
	RH-A04-W-3	RHW-3	GARFIELD PK SITE 3 MID-EAST POOL
Lincoln North Pond	QZ-A02-K-1	QZK-1	LINCOLN NORTH POND MID N END
Sherman Park Lagoon	RH-A04-U-1	RHU-1	SHERMAN PARK LAGOON SITE 1
	RH-A04-U-2	RHU-2	SHERMAN PARK LAGOON SITE 2
Skokie Lagoons	RH-A03-J-3	RHJ-3	SKOKIE LAGOONS SITE 3 SE VOLTZ RD DAM BY IS. PT
	RH-A03-J-1	RHJ-1	SKOKIE LAGOONS SITE 1 NEAR DAM
	RH-A03-J-2	RHJ-2	SKOKIE LAGOONS ST 2 N LG IS. S TOWER RD DAM
Tampier Lake	RG-B03ZO-1	RGZO-1	TAMPIER L SITE 1 100 YD E DAM
Washington Lagoon	QZ-A04-F-1	QZF-1	WASHINGTON LAGOON SITE 1 MID W SIDE
	QZ-A04-F-2	QZF-2	WASHINGTON PK SE CORNER OF LAKE

Source: STORET, 1997

Table 4 - 33. Pollutant Levels in Garfield Lagoon (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1991	3	91	5 9	10 37	13 4
COD LOWLEVEL MG/L	1991	3	15	9	13	26
RESIDUE TOT NFLT MG/L	1991	3	15	1	2.93	9
RESIDUE VOL NFLT MG/L	1991	3	15	1	2 6	5
NH3 + NH4- N TOTAL MG/L	1991	3	14	0.01	0.02	0.07
TOT KJEL N MG/L	1991	3	15	0.3	0.49	0 9
PHOS-TOT MG/L P	1991	3	15	0.01	0 02	0 05
PHOS-DIS MG/L P	1991	3	14	0	0 01	0 02
ARSENIC AS,TOT UG/L	1991	1	1	20	20	20
BARIUM BA,TOT UG/L	1991	1	1	22	22	22
MANGNESE MN UG/L	1991	1	1	7	7	7
STRONTUM SR,TOT UG/L	1991	1	1	110	110	110
ALUMINUM AL,TOT UG/L	1991	1	1	54	54	54
FECAL COLIFORM /100ML	1991	2	7	10	112.86	610
PCP TOT UG/L	1991	1	1	0.01	0.01	0.01

Source. STORET, 1997.

Table 4 - 34. Pollutant Levels in Lincoln North Pond (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1991	1	35	5 2	8.48	13.7
COD LOWLEVEL MG/L	1991	1	11	13	36.46	73
RESIDUE TOT NFLT MG/L	1991	1	11	7	32.09	61
RESIDUE VOL NFLT MG/L	1991	1	11	6	17.64	35
NH3+NH4- N TOTAL MG/L	1991	1	10	0.01	0.04	0.11
TOT KJEL N MG/L	1991	1	11	0.6	1.03	2
NO2&NO3 N-TOTAL MG/L	1991	1	2	0 1	0.15	0.2
PHOS-TOT MG/L P	1991	1	11	0 03	0.09	0.17
PHOS-DIS MG/L P	1991	1	11	0.01	0.01	0.02
ARSENIC AS,TOT UG/L	1991	1	1	36	36	36
BARIUM BA,TOT UG/L	1991	1	1	37	37	37
CHROMIUM CR,TOT UG/L	1991	1	1	6	6	6
COPPER CU,TOT UG/L	1991	1	1	12	12	12
IRON FE,TOT UG/L	1991	1	1	1257	1257	1257
MANGNESE MN UG/L	1991	1	1	45	45	45
NICKEL NI,TOTAL UG/L	1991	1	1	8	8	8
STRONTUM SR,TOT UG/L	1991	1	1	121	121	121
VANADIUM V,TOT UG/L	1991	1	1	6	6	6
ALUMINUM AL,TOT UG/L	1991	1	1	831	831	831
FECAL COLIFORM /100ML	1991	1	7	4	82.71	220
PCP TOT UG/L	1991	1	1	0.06	0.06	0.06

Source: STORET, 1997

Table 4 - 35. Pollutant Levels in Sherman Park Lagoon (1994-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1994-1995	2	111	1.8	10 46	15.6
RESIDUE TOT NFLT MG/L	1994-1995	2	17	1	3 41	9
RESIDUE VOL NFLT MG/L	1994-1995	2	14	1	3.14	8
NH3+NH4- N TOTAL MG/L	1994-1995	2	16	0.01	0.02	0.1
TOT KJEL N MG/L	1994-1995	2	21	0.1	0.43	1.2
NO2&NO3 N-TOTAL MG/L	1994-1995	1	1	0.1	0.1	0.1
PHOS-TOT MG/L P	1994-1995	2	22	0.01	0 03	0.08
PHOS-DIS MG/L P	1994-1995	2	22	0	0.02	0.07
FECAL COLIFORM /100ML	1994-1995	2	4	200	1280	4200

Source. STORET, 1997.

Table 4 - 36. Pollutant Levels in Skokie Lagoons (1990-1995)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1990-1995	3	1206	0	8.08	17.9
BOD 5 DAY MG/L	1990-1994	3	219	1	5.39	20
COD LOWLEVEL MG/L	1990-1993	3	192	18	36.37	255
RESIDUE TOT NFLT MG/L	1990-1995	3	248	1	22.42	98
RESIDUE VOL NFLT MG/L	1990-1995	3	246	1	8.2	33
NH3+NH4- N TOTAL MG/L	1990-1995	3	244	0 01	0.19	2 1
KJELDL N DISS MG/L	1993	3	3	0.7	0.8	0.9
TOT KJEL N MG/L	1990-1995	3	245	0.7	1.52	4.4
NO2&NO3 N-TOTAL MG/L	1990-1995	3	116	0.01	0 59	5.4
PHOS-TOT MG/L P	1990-1995	3	248	0.02	0 18	0.92
PHOS-DIS MG/L P	1990-1995	3	242	0.01	0 09	0 65
FECAL COLIFORM /100ML	1990-1994	3	31	10	1164 03	22000
RESIDUE DISS-180 C MG/L	1993	1	1	592	592	592

Source: STORET, 1997.

Table 4 - 37. Pollutant Levels in Tampier Lake (1992)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1992	1	9	4 4	5.29	5.8
COD LOWLEVEL MG/L	1992	1	1	48	48	48
RESIDUE TOT NFLT MG/L	1992	1	1	36	36	36
RESIDUE VOL NFLT MG/L	1992	1	1	10	10	10
NH3+NH4- N TOTAL MG/L	1992	1	1	0 12	0.12	0.12
TOT KJEL N MG/L	1992	1	1	1.6	1 6	1.6
PHOS-TOT MG/L P	1992	1	1	0.11	0.11	0.11
PHOS-DIS MG/L P	1992	1	1	0 01	0.01	0.01

Source· STORET, 1997

Table 4 - 38. Pollutant Levels in Washington Lagoon (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1991	1	64	2 5	7 66	12.6
COD LOWLEVEL MG/L	1991	2	11	12	25.45	35
RESIDUE TOT NFLT MG/L	1991	2	11	3	9.55	17
RESIDUE VOL NFLT MG/L	1991	2	11	3	7.55	13
OIL-GRSE FREON-GR MG/L	1991	1	1	1	1	1
NH3+NH4- N TOTAL MG/L	1991	2	9	0.02	0 16	0 78
TOT KJEL N MG/L	1991	2	11	0.5	0 71	1.2
NO2&NO3 N-TOTAL MG/L	1991	1	2	0 1	0.15	0.2
PHOS-TOT MG/L P	1991	2	11	0.01	0 03	0 05
PHOS-DIS MG/L P	1991	2	11	0	0 01	0.01
ARSENIC AS,TOT UG/L	1991	1	1	24	24	24
BARIUM BA,TOT UG/L	1991	1	1	44	44	44
CADMIUM CD,TOT UG/L	1991	1	1	7	7	7
IRON FE,TOT UG/L	1991	1	1	243	243	243
MANGNESE MN UG/L	1991	1	1	90	90	90
NICKEL NI,TOTAL UG/L	1991	1	1	6	6	6
STRONTUM SR,TOT UG/L	1991	1	1	143	143	143
ALUMINUM AL,TOT UG/L	1991	1	1	83	83	83
FECAL COLIFORM /100ML	1991	1	6	20	63 33	130
PCP TOT UG/L	1991	1	1	0 06	0 06	0 06

Source STORET, 1997

4.2.6 Water Quality of Lakes in Lake County, IN

Wolf Lake

- Located on Border of Illinois and Indiana
- Phosphorus Levels Higher on the Indiana Side of Lake
- Levels of Barium, PCP, DDT, and PCBs Highest of Waterbodies Evaluated

Wolf Lake is located on the border between Illinois and Indiana. IDEM (1997b) recently completed a diagnostic and feasibility study on Wolf Lake. This study was initiated in 1992 and included water quality monitoring for various pollutants in Wolf Lake's water column, as well as sediment, fish, and other surveys of the lake and its tributaries. The concentrations of contaminants identified are included in the analyses below of STORET data for Wolf Lake. IDEM (1997b) found that chemical contaminants were generally "well within stipulated limits." Some water quality parameters of note include DO, which met general use standards of 5.0 mg/L or above throughout the lake. However, DO levels were below 5.0 mg/L in 4 of 17 samples in the Wolf Lake Channel. Similarly, Wolf Lake Channel had higher bacteria levels than the Lake, which could be attributed to two stormwater pumping stations from the Hammond Sanitary District that discharge to the channel (IDEM, 1997b). Total phosphorus was found to be significantly higher in the Indiana side of Wolf Lake. Concentrations of organic compounds were below detection limits and no metals exceeded general use standards (IDEM, 1997b).

STORET data from 24 monitoring stations in Wolf Lake were obtained. These monitoring stations are listed on Table 4-39. Monitoring data from 1992 and 1993 are presented in Table 4-40 as minimums detected, maximums, and average concentrations for various parameters. More than 10 pollutants were identified in Wolf Lake at their highest concentrations in the two-county study area. Elevated levels of lead, barium, pentachlorophenol, DDT, and PCBs were detected in Wolf Lake from samples collected in 1993.

Table 4 - 39. Water Quality Monitoring Stations in Wolf Lake (IL&IN)

Water Body	Station ID	Sec. ID	Name of Station
Wolf Lake	RH-A06-A-1	RHA-1	WOLF L SITE 1 MID OF N SECTION W OF TRACKS
	RH-A06-A-2	RHA-2	WOLF L SITE 2 CENTER OF MID SECTION W OF RR
	RH-A06-A-3	RHA-3	WOLF L SITE 3 CENTER OF S SECTION W OF RR
	RH-A06-A-4	RHA-4	WOLF L ST4 3600 FT E ST2 MIDLAKE
	RH-A06-A-5	RHA-5	WOLF SITE 5
	RH-A06-A-6	RHA-6	WOLF SITE 6
	RH-A06-A-7	RHA-7	WOLF SITE 7
	RH-A06-A-8	RHA-8	WOLF SITE 8
	RH-A06-A-9	RHA-9	WOLF SITE 9
	RHA 01		WOLF LAKE TRIB SITE 01
	RHA 02		WOLF LAKE TRIB SITE 02
	RHA 03		WOLF LAKE TRIB SITE 03
	RHA 04		WOLF LAKE TRIB SITE 04
	RHA 05		WOLF LAKE TRIB SITE 05
	RHA 06		WOLF LAKE TRIB SITE 06
	RHA 07		WOLF LAKE TRIB SITE 07
	RHA 08		WOLF LAKE TRIB SITE 08
	RHA 09		WOLF LAKE TRIB SITE 09
	RHA 10		WOLF LAKE TRIB SITE 10
	RHA11		WOLF LAKE TRIB SITE 11
	RHA13		WOLF LAKE TRIB SITE 13
	RHA14		WOLF LAKE TRIB SITE 14
	RHA 71		WOLF LAKE TRIB SITE 71
	RHA 72		WOLF LAKE TRIB SITE 72

Source. STORET, 1997

Table 4 - 40. Pollutant Levels in Wolf Lake (IL&IN) for 1991-1994

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
DO PROBE MG/L	1991-1994	11	2060	0 1	9 73	17 5
COD LOWLEVEL MG/L	1991-1993	24	386	5	20.26	295
RESIDUE TOT NFLT MG/L	1991-1994	24	394	1	20.11	575
RESIDUE VOL NFLT MG/L	1991-1994	24	352	1	9 05	175
OIL-GRSE FREON-GR MG/L	1993	4	4	1	2	3
NH3+NH4- N TOTAL MG/L	1991-1994	24	327	0.01	0.24	2.8
TOT KJEL N MG/L	1991-1994	24	398	0 14	0.75	6.19
NO2&NO3 N-TOTAL MG/L	1991-1994	24	275	0.01	0.29	2.1
PHOS-TOT MG/L P	1991-1994	24	401	0	0 04	0.34
PHOS-DIS MG/L P	1991-1994	11	187	0	0	0.04
ARSENIC AS,TOT UG/L	1993	2	3	2	4.83	6
BARIUM BA,TOT UG/L	1993	11	13	11	55.46	180
BERYLIUM BE,TOT UG/L	1993	6	6	2	2.5	3
CADMIUM CD,TOT UG/L	1993	2	2	3	4.5	6
CHROMIUM CR,TOT UG/L	1993	4	4	8	39.5	56
COPPER CU,TOT UG/L	1993	2	2	6	6.5	7
IRON FE,TOT UG/L	1993	11	13	120	2769	12000
LEAD PB,TOT UG/L	1993	4	4	100	200	400
MANGNESE MN UG/L	1993	11	13	24	401 6	1400
STRONTUM SR,TOT UG/L	1993	11	13	45	188.23	580
VANADIUM V,TOT UG/L	1993	4	5	6	19.4	41
ZINC ZN,TOT UG/L	1993	5	7	65	226 4	550
ALUMINUM AL,TOT UG/L	1993	7	7	280	1433	3700
PCP TOT UG/L	1993	8	8	0 02	0.11	0.27
P,P'DDT TOT UG/L	1993	2	2	0 01	0 01	0.01
PCBS WHL SMPL UG/L	1993	1	1	2	2	2

Source. STORET, 1997

4.2.7 Water Quality in Lake Michigan

This section describes water quality in the portions of Lake Michigan in Cook County, IL, and Lake County, IN. Data are included from 305(b) reports, STORET, and other sources on the overall condition of the lake, as well as levels of contaminants. In general, the water quality of Lake Michigan is very good, with few contaminants detected in the water column. Much of the efforts over the last 20 years to reduce the impacts of point source discharges to the lake have been effective. However, contaminated sediments remain from years of pollution and fish advisories are in effect Lake-wide for PCBs, mercury, and other contaminants present in fish tissue.

Lake Michigan

- Water Quality is Generally Good
- Low/Nondetectable Levels of Contaminants in Water Column
- Some Concerns Related to Sediments and Fish Tissue Contamination
- Improvement in Water Quality in Recent Years

4.2.7.1 *Illinois Portion of Lake Michigan*

Assessment of water quality of the 63 miles of Illinois Lake Michigan shoreline was performed by IEPA (1996c) for the State water quality monitornng report. Water quality on the Illinois shorelines of Lake Michigan has improved since the 1970s (IEPA, 1996c). All 63 miles were assessed as "full supporting/ threatened" for overall use because of sport fishing advisories. While the entire Lake Michigan shoreline in Illinois was "fully supporting" for drinking water use, it was rated as "nonsupport" for fish consumption (IEPA,

Water Quality in Illinois Portion of Lake Michigan

- "Full Support/Threatened" Condition - Sport Fish Consumption Advisory
- All 63 Miles "Fully Supporting" for Drinking Water Use
- 50 of 63 Miles Rated as "Fully Supporting" for Swimming

1996c). The presence of PCBs, chlordane, other organics, and metals (lead, zinc, and copper) are of concern in sediments, especially in five harbors (including Chicago and Calumet) along the Lake Michigan shoreline. To a degree, IEPA (1996c) found that CSOs no longer pose a severe threat to Lake Michigan because of improvements due to the TARP. More than 63 miles of tunnels (of the eventual 131 miles) have been constructed to reduce bypasses of CSOs to Lake Michigan (IEPA, 1996c).

Fecal coliform measurements from 1993 were also presented in IEPA (1996c) for 32 Lake Michigan beaches in the Chicago Park District. The geometric means for fecal coliform ranged from 6 to 76 per 100 mL, with the higher measurements located at Montrose (76), Jackson Park (73), South Shore (43), North Avenue (43), and Rainbow South (42) locations. All locations were assessed "full support," except Jackson Park, which was "partial/minor support" due to the presence of pathogens (IEPA, 1996c). Jackson Park had more than 15 percent of fecal coliform measurements of levels above 400 per 100 mL, while the other beaches ranged from 0.0 to 8.2 percent of the fecal coliform measurements above 400 per 100 mL.

The Illinois shoreline areas of Lake Michigan are considered to have low levels of toxics in the water column (IEPA, 1994). IEPA's (1994) 305(b) report assessed 63 miles of Lake Michigan shoreline, which were rated "full support/threatened" for overall use because of fish consumption advisories. Organic compounds, primarily PCBs and chlordane, are of concern in fish, though they are rarely detected in the water column. Similarly, organics and metals tend to be found in sediments in harbor areas. Since 1979, only three organochlorine compounds (pentachlorophenol, dieldrin, and chlordane) were detected in Lake Michigan water (IEPA, 1994). These compounds were all identified at levels well below applicable water quality standards. Metals were rarely detected or were found at levels below the water quality standards.

Monitoring of water quality of the southwestern portion of Lake Michigan was conducted jointly by IEPA and the City of Chicago (IEPA, 1993b). Eighty stations in the Illinois and Indiana areas of Lake Michigan were monitored during 1989 through 1991 to assess water quality for use of the resource for drinking water consumption, fishing, and other purposes. Monitoring of bacteria (fecal coliform and total coliform), conventional parameters (nutrients), and toxics (metals, pesticides, etc.) was conducted to assess current levels, as well as to evaluate trends in water quality (IEPA, 1993b). Table 4-41 summarizes data for 1989, 1990, and 1991 for the levels of contaminants that have water quality standards. Results for conventional parameters reflect measures for approximately 300 samples per year while metals were analyzed in about 21 samples in 1989, 19 samples in 1990, and 15 samples in 1991 (IEPA, 1993b). Pesticides were monitored in about 21, 16, and 6 samples over the 3 years only at the North Shore and South Shore monitoring stations. Similarly, organochlorine and other organic compounds are measured at relatively few sites.

Pentachlorophenol was the only organochlorine detected from water column monitoring during 1989 to 1991 and was found at two locations in 1989 at 0.002 μg/L (IEPA, 1993b). Since the inception of organochlorine monitoring in 1979, the only compounds detected in the water column in the Illinois portion of Lake Michigan were pentachlorophenol (13 of 76 samples), dieldrin (5 of 89 samples), and total chlordane (3 of 84 samples). IEPA (1993b) and the City of Chicago concluded that most water quality parameters indicated that this resource was in good to excellent condition. Furthermore, water quality in this portion of Lake Michigan has improved since the 1960s and 1970s due to efforts to reduce municipal, industrial, and CSO discharges to the Lake. With respect to total coliform, levels have dropped from maximums of 1,200 per 100 mL during the 1970s (1973, 1977, and 1980) to maximums less than 140 per 100 mL during the 1980s and early 1990s (IEPA, 1993b). For fecal coliform, maximum levels from 1970 to 1979 ranged from 194 to 1,700 per 100 mL to much lower levels of 10 to 410 per 100 mL from 1981 to 1991. Similarly, levels of nutrients (ammonia nitrogen and total phosphate) have dropped substantially, which also indicate improving water quality during the 1980s and early 1990s (IEPA, 1993b).

Monitoring water quality at one location in Lake Michigan, at the Calumet Park boat launch, was conducted by ISWS as part of a study of contaminant flow in the Lake Calumet area (Fitzpatrick and Bhowmik, 1990). Sampling was conducted on March 1 and/or March 31, 1988, with analyses for total organic carbon (TOC), total organic halide (TOX), arsenic, cadmium, chromium, lead, and zinc. In general, contaminant levels were below the detection limits; however, the pollutants identified were: TOC (2.6 mg/L), TOX (1.7 to 4.9 mg/L), and lead (0.14 mg/L).

Table 4-41. Summary of Lake Michigan Water Quality Data for 1989-91

Pollutant	Mean Concentration		
	1989	1990	1991
Ammonia Nitrogen	0.02 mg/L	0.01 mg/L	0.01 mg/L
Total Phosphate	0.018 mg/L	0.018 mg/L	0.014 mg/L
Fecal Coliform	<1 / 100 mL	<1 / 100 mL	< 1 / 100 mL
Arsenic	1 μg/L	1 μg/L	1 μg/L
Barium	21 μg/L	18 μg/L	19 μg/L
Cadmium	< 3 μg/L	< 4 μg/L	< 4 μg/L
Chromium	5 μg/L	5 μg/L	< 5 μg/L
Copper	< 6 μg/L	< 6 μg/L	< 6 μg/L
Lead	< 50 μg/L	< 52 μg/L	< 50 μg/L
Manganese	6 μg/L	5 μg/L	10 μg/L
Mercury	< 0.05 μg/L	< 0.06 μg/L	0.05 μg/L
Nickel	6 μg/L	9 μg/L	8 μg/L
Silver	< 3 μg/L	< 4 μg/L	4 μg/L
Zinc	< 60 μg/L	< 55 μg/L	68 μg/L

mg/L - milligrams per liter
μg/L = micrograms per liter

Source IEPA, 1993b.

Lake Michigan water quality monitoring, conducted by the City of Chicago Department of Water (in conjunction with IEPA) in southern areas of the Lake during May and October 1988, identified low levels of select metals (Fitzpatrick and Bhowmik, 1990). Arsenic was detected at an average concentration of 0.002 mg/L and a maximum of 0.011 mg/L. Cadmium was detected at levels as high as 0.003 mg/L while chromium had an average concentration of 0.011 mg/L and a maximum of 0.032 mg/L (Fitzpatrick and Bhowmik, 1990).

4.2.7.2 *Indiana Portion of Lake Michigan*

IDEM (1996a) evaluated water quality and contaminant levels in its portion of Lake Michigan. All 43 miles of Indiana's Lake Michigan shoreline were assessed as "fully supporting" recreational and aquatic life uses; however, these waters were only "partially supporting" for fish consumption use. All of Indiana's portion of the Lake are considered to be impacted by PCBs and mercury and are under the Lake-wide fish consumption advisory (IDEM, 1996a).

4.3 SEDIMENTS

Sediments are a repository for a variety of nutrients and contaminants, mostly a result of over 100 years of industrial and municipal pollution. More stringent pollution control measures have generally reduced point sources of contamination during the past 20 years; however, contaminated sediments remain. Nonpoint sources such as agricultural runoff, groundwater contamination, atmospheric deposition, and permit violations of effluent discharges remain the main sources of pollution. In some areas, contaminated sediments are the primary source of anthropogenic chemicals to the aquatic

Sediment Contamination

- Sediments Contain Elevated Levels of PCBs, Metals, Pesticides, PAHs, and Other Contaminants
- Highest Levels of Pollutants in Waterbodies:
  - GCR/IHSC
  - Cal-Sag Channel
  - Chicago River
  - Wolf Lake
- Sediments Are Source of Pollution to Fish and the Water Column

environment (U.S. EPA, 1994a). Human exposure to contaminants in sediments can occur directly from swimming and wading or indirectly from fish consumption or consumption of drinking water taken from waters containing contaminated sediments.

This section presents available data regarding sediment contamination in Cook County, IL, and Lake County, IN. Figure 4-32 shows the streams, lakes, and drainage patterns in this area. Much of the data are summarized to provide an overall sense of contamination in these regions. Sources are provided to aid in assessment of the data. This discussion is organized by major waterbodies in the area and includes data from numerous reports as well as data from STORET. Included are summaries of results from monitoring conducted from the 1980s to the mid-1990s.

Sediments in Cook County, IL, and Lake County, IN, are for the most part contaminated with heavy metals (e.g., zinc, chromium, lead, copper), PAHs, PCBs, and pesticides. Metal contamination of sediments has been found in association with municipal wastewater operations, coal-fired power plants, landfill leachate, urban runoff, highway runoff, mining and metal-working operations, airborne particulates, and industrial waters. Previous studies of sediments indicate that PAHs are generally of anthropogenic origin, primarily from combustion of fossil fuels (especially coal) and petroleum spills (Ross et al., 1988). Sources of PAHs include discharges from coke production in the iron and steel industry; catalytic cracking in

Concentrations of Total PAHs in Select U.S. Sediments

Location	Concentrations (μg/g)
Cayuga Lake, Ithaca, NY (Deepwater)	1.26-2.50[1]
Penobscot Bay, Maine	0.29-8.80[1]
Casco Bay, Maine	0.21-14.43[1]
Lake Erie	0.53-3.75[1]
Adirondack Lakes	4.07-12.81[1]
Alaska	0.005-1.13[1]
Lake Calumet	0.34-9.64[2]
Pullman Creek	0.5-12[3]
GCR-IHC	11-3,300[4]
Indiana Harbor	3,229[4]

[1]Ross et al., 1989
[2]Ross et al., 1988
[3]IDEM, 1991
[4]U.S. EPA, 1991a

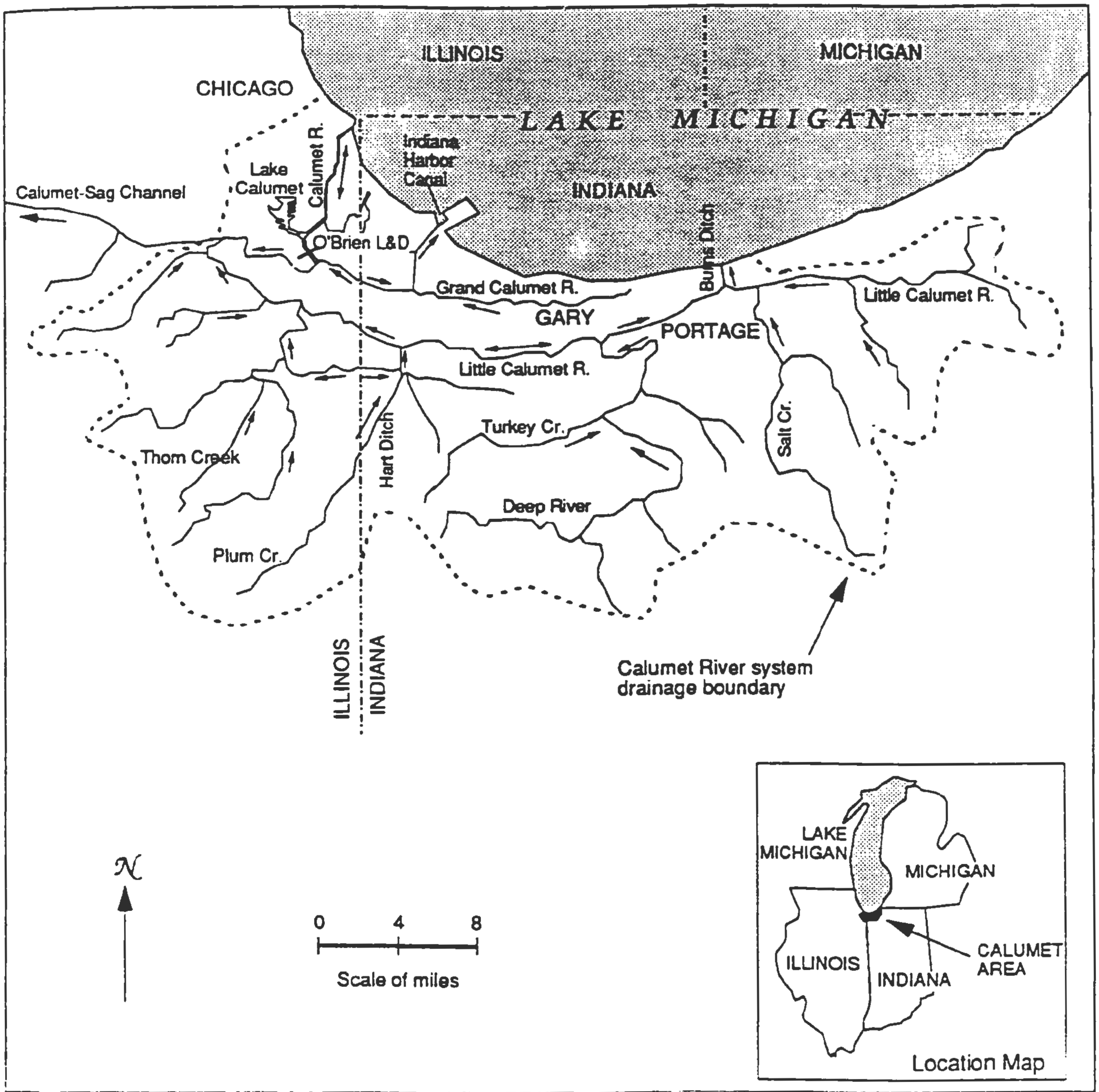


Figure 4-32. Streams and Drainage Pattern in the Calumet Area Watershed
(Source: Fitzpatrick and Bhowmik, 1990)

the petroleum industry; the manufacture of carbon black, coal tar pitch, and asphalt; heating and power generation; controlled refuse incineration; and open burning (Ross et al., 1988). A list of total PAHs found in select U.S. sediments is provided as a point of reference.

While some levels of chemicals in sediments are expected, when the levels are elevated they may adversely impact biota (fish, benthic organisms, etc.) and ultimately human health. The overall impact will be functions of the toxicity of the chemical and its concentration in the sediments. Various groups have established sediment guidelines/levels and criterion based on short- (acute) and long-term (chronic) impacts on aquatic life. Such benchmarks are necessary in order to estimate potential effects for a given concentration of sediment concentration. Long and MacDonald's (L&M) effects range and Ontario's Provincial Sediment Quality Guidelines are utilized as benchmarks in this section (Table 4-42). Long and MacDonald updated and utilized the biological effects data base for sediments (BEDS), which was initially developed by Long and Morgan (1990). Two guideline values were determined:

- The Effects Range-Low (ER-L), which corresponds to the lower 10th percentile of the effects data for each chemical; and
- The Effects Range-Median (ER-M), which corresponds to the median, or 50th percentile of the effects data for each chemical.

Concentrations that fall below the ER-L are believed to rarely cause effects. Concentrations that are greater than the ER-L, but less than the ER-M, represent a possible-effects range where effects would occasionally occur; concentrations above the ER-M represent a probable-effects range where effects would frequently occur (U.S. EPA, 1996d).

The Ontario Ministry of the Environment developed three levels of Provincial Sediment Quality Guidelines to provide guidance for making freshwater sediment-related decisions (U.S. EPA, 1996c). These guidelines replace the Open Water Disposal Guidelines published by the Ministry in 1976. Equilibrium partitioning and the Screening Level Concentration (SLC) approaches were used by the Ministry to derive the guidelines. The SLC approach, as developed by Neff et al. (1986), is an effects-based approach, using field data on the co-occurrence of benthic infaunal species in

Table 4-42. Analytes and Sediment Quality Guidelines

	Chemical	Sediment Quality Guidelines		
		L&M (ER-L)	L&M (ER-M)	Ontario (SEL)
PAHs	Benz(a)anthracene	261 ng/g	1,600 ng/g	1,480 µg/g OC
	Benzo(a)pyrene	430 ng/g	1,600 ng/g	1,440 µg/g OC
	Benzo(k)fluoranthene			1,340 µg/g OC
	Naphthalene	160 ng/g	2,100 ng/g	
	2-Methylnaphthalene	70 ng/g	670 ng/g	
	Fluorene	19 ng/g	540 ng/g	160 µg/g OC
	Phenanthrene	240 ng/g	1,500 ng/g	950 µg/g OC
	Anthracene	85 3 ng/g	1,100 ng/g	370 µg/g OC
	Fluoranthene	600 ng/g	5,100 ng/g	1,020 µg/g OC
	Pyrene	665 ng/g	2,600 ng/g	850 µg/g OC
	Chrysene	384 ng/g	2,800 ng/g	460 µg/g OC
	Indeno(1,2,3)pyrene			320 µg/g OC
	Benzo(g,h,i)perylene			320 µg/g OC
	Total PAH	4,022 ng/g	44,792 ng/g	10,000 µg/g OC
Pesticides	4,4 DDE	2 2 ng/g	27 ng/g	19 µg/g OC
	Dieldrin			91 µg/g OC
	Aldrin			8 µg/g OC
	Endrin			130 µg/g OC
	a-BHC			10 µg/g OC
	b-BHC			21 µg/g OC
	c-BHC			1 µg/g OC
	Heptachlor Epoxide			5 µg/g OC
PCBs	Total PCBs	22 7 ng/g	180 ng/g	530 µg/g OC
METALS	Cadmium	1 2 µg/g	9 6 µg/g	10 µg/g
	Chromium	81 µg/g	370 µg/g	110 µg/g
	Copper	34 µg/g	270 µg/g	110 µg/g
	Iron			4%
	Nickel	20 9 µg/g	51 6 µg/g	75 µg/g
	Lead	46 7 µg/g	218 µg/g	250 µg/g
	Zinc	150 µg/g	410 µg/g	820 µg/g
	Silver	1 0 µg/g	3 7 µg/g	
	Arsenic	8 2 µg/g	70 µg/g	33 µg/g
	Mercury	0 15 µg/g	0 71 µg/g	2 µg/g
	Manganese			1,100 µg/g

ng/g = nanograms per gram
µg/g = microgram per gram
Source U S EPA, 1996c

sediments and different concentrations of contaminants. The three guidelines are entitled as the No Effect Level (NEL), Lowest Effect Level (LEL), and the Severe Effect Level (SEL). SEL is the level at which pronounced disturbance of the sediment dwelling community can be expected. A compound found at, or above, this concentration would be considered to be detrimental to the majority of benthic species. SEL is based on the 95th percentile of the SLC. Concentrations of contaminants in this report are compared to SEL values only.

4.3.1 Waterbodies in Cook County, IL

Cook County, IL, contains many lakes, streams, and rivers. Figure 4-33 displays the location of major waterbodies. The main waterbodies in Cook County include: Lake Calumet, Des Plaines River, Pullman Creek, Cal Sag Channel, Chicago River, Chicago Harbor, Calumet River, Calumet Harbor, and parts of Lake Michigan and Wolf Lake, which is located on the border of Cook County, IL, and Lake County, IN. Extensive sediment contamination studies, however, have been conducted for only a few of these waterbodies. A few studies have been conducted in these areas, and the conclusions and results of these are reported in this section.

Major Waterbodies in Cook County, IL

- Cal Sag Channel
- Chicago Harbor
- Chicago River
- Des Plaines River
- Lake Calumet
- Lake Michigan (Parts of)
- Pullman Creek
- Wolf Lake
- Calumet River
- Calumet Harbor

4.3.1.1 *Lake Calumet and Pullman Creek*

Lake Calumet, located 15 miles south of downtown Chicago, was formed 13,500 years ago as a result of retreating glaciers. The location of this lake, which once covered the entire present-day Chicago area, can be seen in

Lake Calumet and Pullman Creek

The Lake Calumet system has been threatened by continued industrial activity such as waste landfills, major highways, refineries, scrap metal operations, and residues from previous disposal practices.

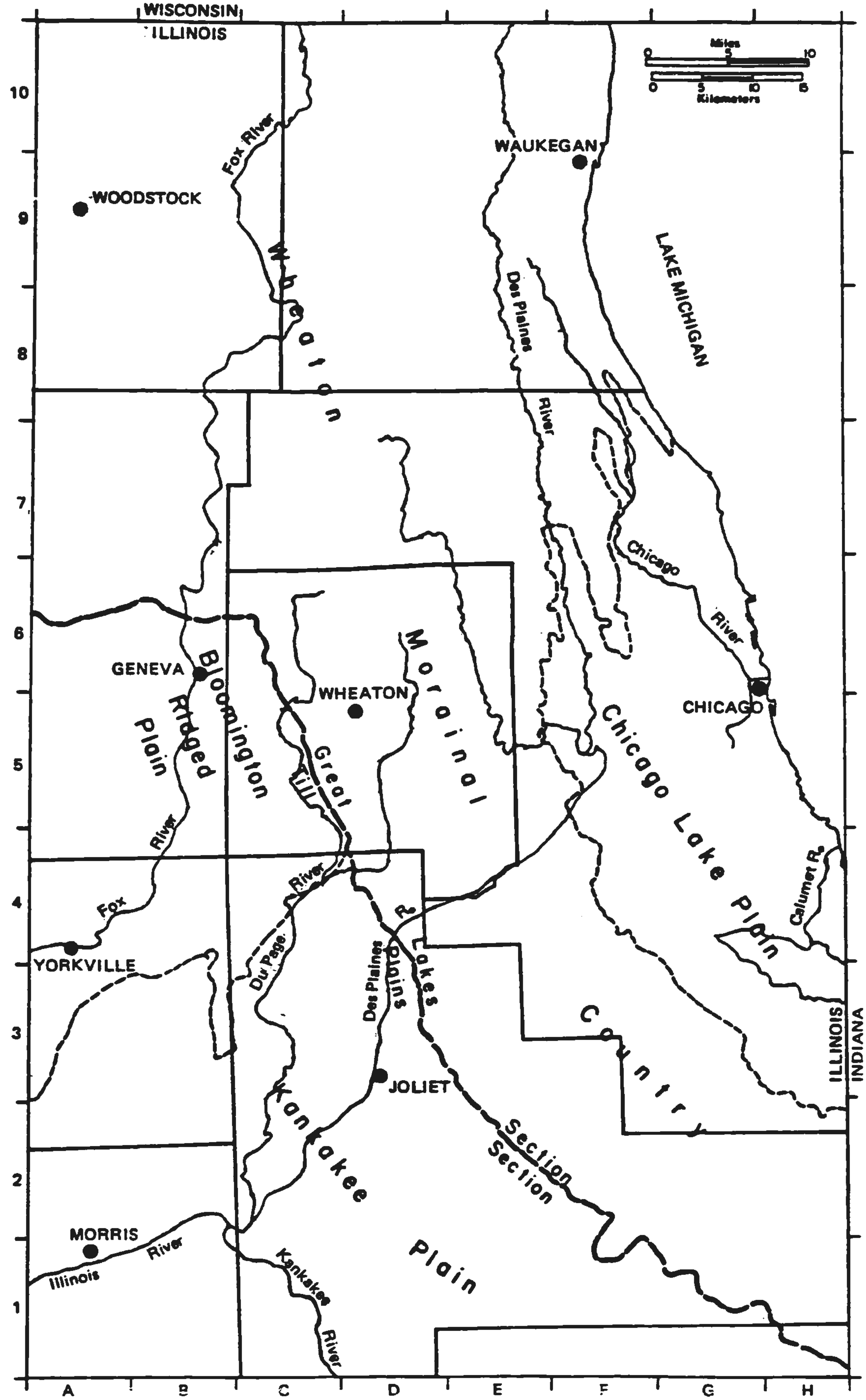


Figure 4-33. Map Showing Location of Illinois Waterbodies (Source: IEPA, 1986)

Figure 4-32. A map showing the flow into and out of Lake Calumet is presented in Figure 4-34 Today, disposal facilities line the east side of the lake, and the Calumet Expressway borders the west. Pullman Creek, a ditch filled with runoff from the Calumet Expressway and nearby industries, also borders Lake Calumet on the west (Ross et al., 1988).

Following more than 100 years of exposure to industrial contaminants and nonpoint sources, the Lake Calumet system continues to be threatened by continued industrial activity (e.g., waste landfills, major highways, refineries, scrap metal operations) and residues from previous disposal practices (Ross et al., 1988). Sampling and analyses have indicated that Lake Calumet sediments contain high concentrations of anthropogenic metals and PAHs (Fowler et al., 1993). Zinc, chromium, and copper were the most common metals reported in these sediments. Table 4-43 compares concentrations of contaminants detected in Lake Calumet sediments with sediments in surrounding water systems. Among these waterbodies (Figure 4-35), Lake Calumet had the highest concentrations of arsenic, silver, and antimony, and the second highest level of chromium (Ross et al., 1988). Ross et al. (1988) divided Lake Calumet into five sampling regions (Figure 4-36) and took 89 samples from November 1986 through April 1988. The study found high concentrations of anthropogenic metals and PAHs in the Lake Calumet sediments. These concentrations were found to be higher than those from nearby waters.

According to the study by Ross et al. (1988), the eastern wetlands and the western ditch regions of Lake Calumet had the highest concentrations of priority pollutant metals. Most metals in Lake Calumet sediments were present at levels many times greater than average concentrations found in other Illinois lakes. Zinc, chromium, and copper were the dominant priority pollutant metals in the study samples. Zinc concentrations from the four sampling areas in this study ranged from 19 ppm to 4,800 ppm. The average zinc concentration in Lake Calumet sediments was 479 ppm, and the area with highest concentration was the western ditches. Chromium concentrations ranged from 20 to 1,470 ppm. The average chromium concentration in the lake was 114.5 ppm, with the highest concentration in the eastern wetland. Copper concentrations ranged from 13 to 1,150 ppm. The average copper concentration in Lake Calumet was 89 ppm, with the highest copper concentration in the eastern wetlands. Only one of 15 samples taken from the eastern wetland was below the detection limit; this was excluded from the calculation of the average copper concentration. The average zinc concentration was greater than L&M's ER-M, and the average

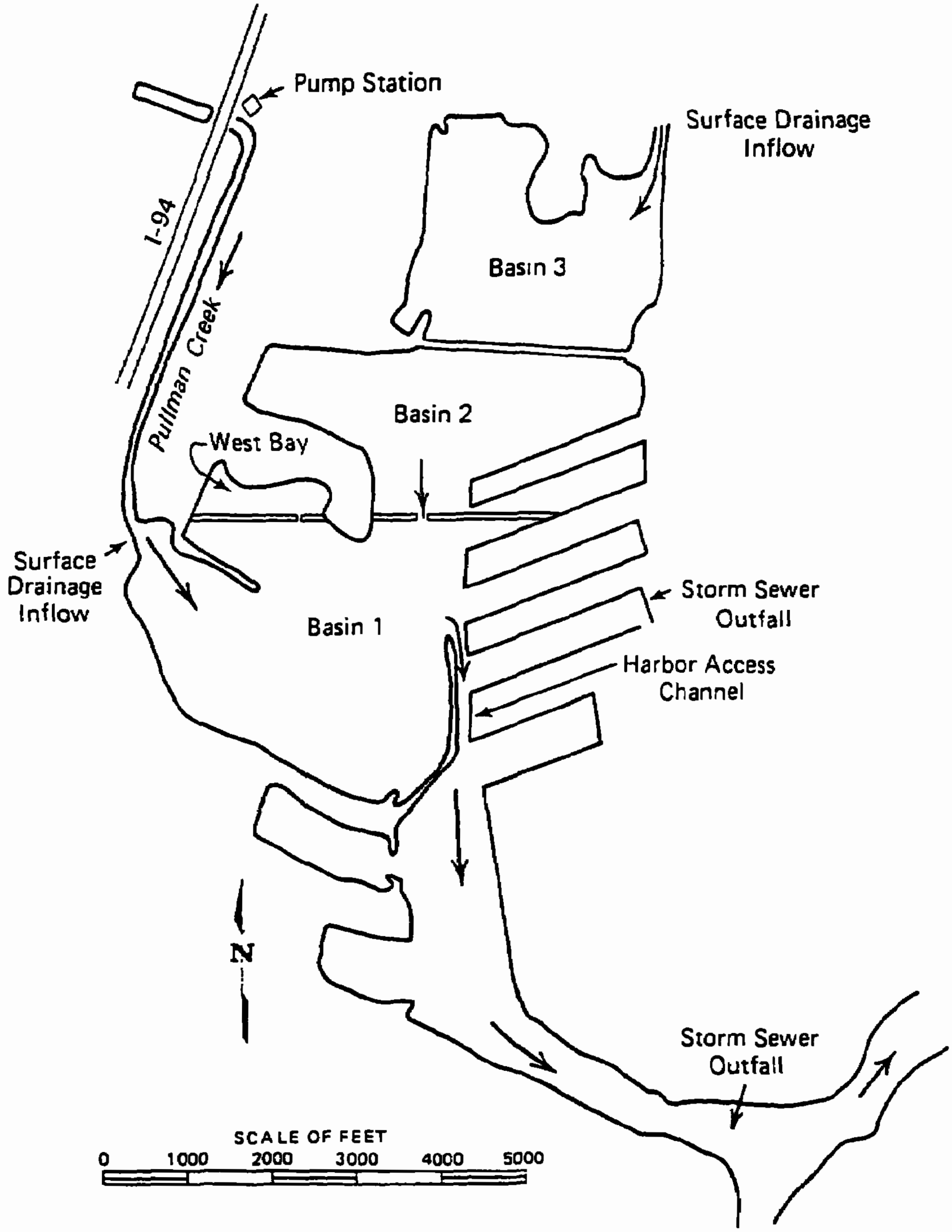


Figure 4-34. Flow Into and Out of Lake Calumet (Source: Ross et al., 1988)

Table 4-43. Average Concentrations of Contaminants in Sediments of Select Indiana and Illinois Water Systems

Elements	Lake Calumet[a] ($\mu g/g$)	Calumet Harbor[b] ($\mu g/g$)	Little Cal. River[c] ($\mu g/g$)	Lake Michigan[d] ($\mu g/g$)	Cal-Sag Channel[e] ($\mu g/g$)	Wolf Lake[e] ($\mu g/g$)
Antimony (Sb)	2.4	--	--	1.1	--	--
Arsenic (As)	29.8	6.2	5.5	10.5	15	21
Bromine (Br)	4.2	--	--	33.0	--	--
Cadmium (Cd)	1.8	3.2	2.5	0.9	8.5	2.0
Chromium (Cr)	76.7	46.0	66	46.0	105.0	18.0
Copper (Cu)	57.5	44	88	22.0	125.0	27.0
Iron (Fe)	2.7%	--	2.9%	2.2%	3.4%	1.5%
Lead (Pb)	187.0	144	190.0	40	370.0	110.0
Nickel (Ni)	23.6	--	--	24	--	--
Phosphorus (P)	20.0	20.6	130.0	70.0	300.0	36.0
Selenium (Se)	0.7	--	--	1.2	--	--
Silver (Ag)	561.0	--		460.0	--	
Sodium (Na)	470.0	--	--	458.0	--	--
Thallium (Th)	6.2	--	--	--	--	--
Zinc (Zn)	341.0	268.0	375.0	97.0	1100.0	255.0

[a] = Ross et al, 1988
[b] = USACE, 1985
[c] = IEPA, 1984
[d] = Cahill and Shimp, 1984
[e] = Kelly and Hite, 1979

Units are expressed in $\mu g/g$ (micrograms per gram) unless otherwise noted

Source: Ross et al., 1988.

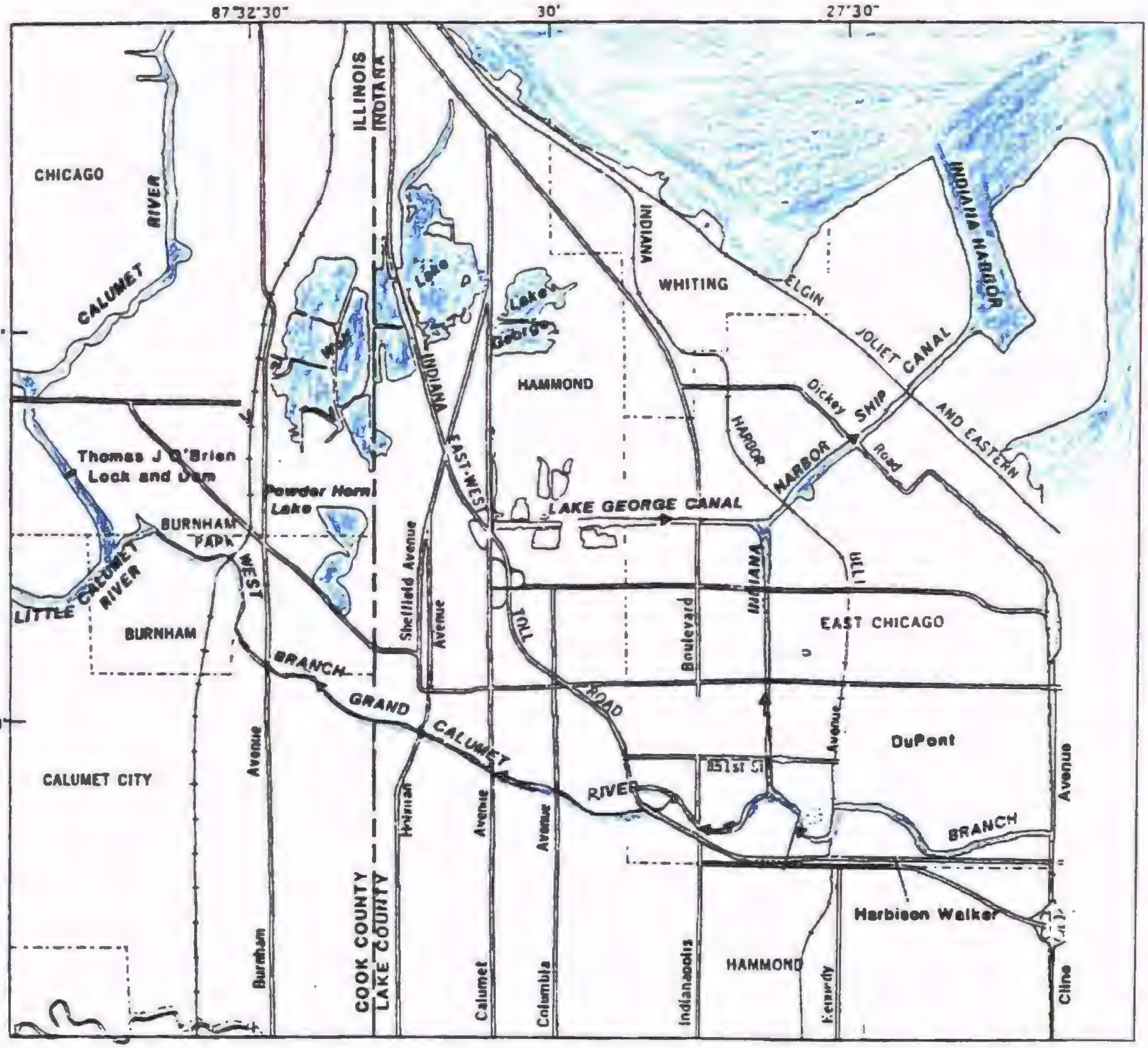


Figure 4-35. Detailed Map of the Calumet Region (Source: U.S. EPA, 1991)

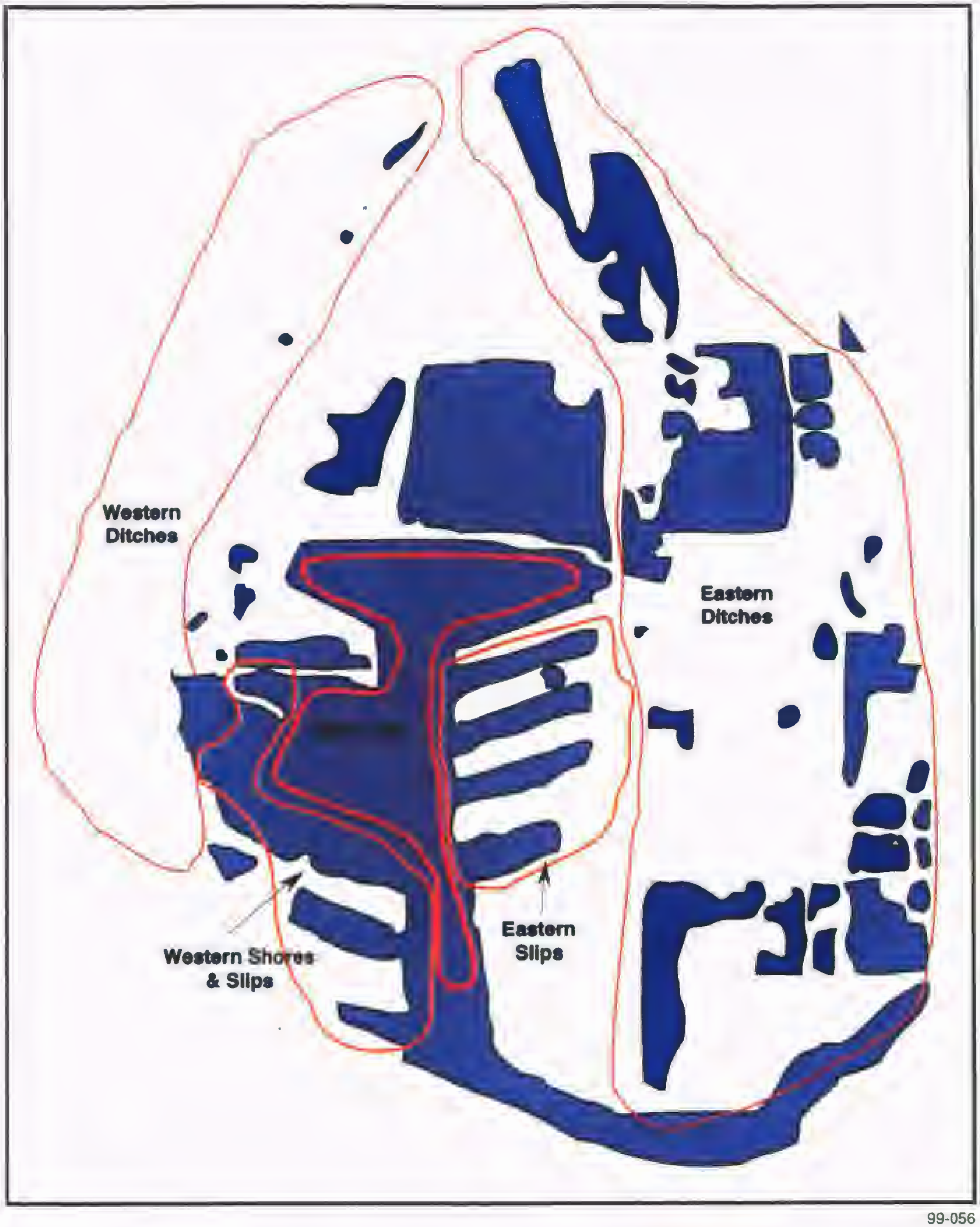


Figure 4-36. Map Showing the 5 Regions of Study on Lake Calumet
Source: Ross et al., 1988.

values of chromium and copper fell between L&M's ER-L and ER-M. Table 4-44 reports the average sediment concentrations of chromium, copper, and zinc. Average lead concentrations in the Lake Calumet area exceeded the L&M ER-L. Ross et al. (1988) reported PAH concentrations of 340 to 9,640 ppb in Lake Calumet.

PCB concentration in the Lake Calumet sediments and the sediments of the surrounding drainage ditches ranged from 0.24 μg/g to 3.6 μg/g (Fowler et al., 1993). Results from preliminary assessments showed that total sediment PAH concentrations in Lake Calumet ranged from 0.3 to 9.2 miligrams per kilogram (mg/kg).

In June 1983, sediment samples were collected at 18 sampling sites in Lake Calumet by EPA Region 5 (Sanders, 1983). Samples were taken from the wetlands near the active landfills and the proposed landfills and drainage ditches along side of the Norfolk and Western railroad track. Samples from 116th Street and the river at the Metropolitan Sanitary District (MSD) site showed the lowest overall metal concentrations. Samples from the east side of the Burnham site and the tar pit at the Interlake Steel site detected the highest metal concentrations. Arsenic was detected in all but one sample, taken from the northeast corner of 122nd Street and the railroad tracks. The highest concentrations were found in the samples from the ditch on the west side of the MSD site (31 μg/g) and both samples from the Burnham site (26 μg/g and 20 μg/g) (Sanders, 1983).

The highest cadmium concentrations were found at the east side of the Burnham site (14 μg/g) and the tar pit at the Interlake site (20 μg/g) (IEPA, 1986). Chromium, copper, lead, nickel, and zinc were detected in all samples. The sample from the east location at the Burnham site had the highest concentration for chromium (210 μg/g), copper (250 μg/g), and nickel (73 μg/g). The highest lead concentration was in the sample from the tar pit at the Interlake site (4.4 mg/g). The highest zinc concentrations were in samples from the east side of the Burnham site (1.8 mg/g) and the tar pit at the Interlake site (12 mg/g). The highest mercury concentrations were in the two samples taken from the Burnham site (2.8 μg/g and 2.0 μg/g) and from the northwest location at the Interlake site (2.3 μg/g) (Sanders, 1983).

Three chlorinated ethanes, chloroethane (480 μg/kg), 1,1-dichloroethane (38 μg/kg), and 1,1,1-trichloroethane (900 μg/kg), were detected in the samples from the south side of 122nd Street.

Table 4-44. Mean Sediment Concentrations of Priority Pollutants in Sediment Samples from Lake Calumet

Location on Lake Calumet	Cr (μg/g)	Cu (μg/g)	Zn (μg/g)
Eastern Wetlands	209	175	578
Open Lake	75	44	184
Western Ditches	118	85	851
Western Shores and Slips	74	45	247

μg/g - micrograms per gram
Source: Ross et al., 1988.

Toluene was also detected in the sample (9.0 μg/kg) (IEPA, 1986). A significant number of PAHs were detected at 116th Street, on both the north and south sides of 122nd Street, the three samples from 122nd Street and the railroad tracks, the east location of the Burnham site and the tar pit, and the northwest location of the Interlake site (IEPA, 1986). PCBs were detected at the east side of the Burnham site (Aroclor 1254, 33 μg/g) and the tar pit at the Interlake site (Aroclor 1242, 8.0 μg/g, and Aroclor 1254, 3.0 μg/g). Pesticides were detected at four locations; however, they were in the low range of 0.1 to 0.6 μg/g (IEPA, 1986).

To summarize, the highest metal concentrations in this area were in samples from the east location of the Burnham site and the tar pit on the Interlake site (Sanders, 1983). The highest concentrations of organic compounds were at 116th Street, both sides of 122nd Street, the three locations at 122nd Street and the railroad tracks, the east location of the Burnham site, and the tar pit and the northwest location of the Interlake site. Sanders (1983) concluded that because the tar pit (S21) was used by Interlake Steel for waste disposal, high concentrations of pollutants would be expected. The high levels of pollutants at the Burnham site can be associated with the flood plain of the Calumet River. Most organic compounds detected were PAHs, which are residues of coal tar. It is, therefore, not usual for this class of compounds to be detected in the sediment samples from this area (Sanders, 1983).

Lake Calumet and Pullman Creek

Over a 9-day period, 2,500 cubic feet of sediment was deposited on the beds of Pullman Creek indicating that Pullman Creek is a source of in-flowing water, sediment, and pollutants.

Pullman Creek (Figure 4-34), a drainage ditch that receives the runoff from the Calumet Expressway, is not only a source of in-flowing water, but also of sediment (Ross et al., 1988). During a 9-day period, Ross et al. (1988) documented the deposition of 2,500 cubic feet of sediment, equivalent to 44 tons of sediment, on the beds of Pullman Creek, indicating that the drainage delivered to Lake Calumet from Pullman Creek is a significant source of sediments and pollutants. Elevated concentrations of trace elements/metals (cadmium, bromine, lead, tin, chromium, zinc, arsenic, and nickel) were reported at the mouth of Pullman Creek (Ross et al., 1988). These sediments were reported to contain over 50 ppm of total PAH compounds. A major PAH source is emissions from internal combustion engines used in transportation. This may explain the high levels near the expressway. The remaining samples measured by Ross et al. (1988) for PAHs had levels ranging from 0.5 to 12.0 ppm. Levels exceeding 1 ppm indicate elevated PAH contamination relative to levels in "clean areas."

4.3.1.2 *Des Plaines River*

Sediment samples taken during 1984-1993 from the Des Plaines River basin displayed high levels of heavy metal contamination (IEPA, 1994) (Figure 4-33), including arsenic, chromium, lead, mercury, zinc, cadmium, chlordane, DDT, PCBs, and heptachlor epoxide. Municipal and industrial point source discharges and urban runoff are believed to be the sources of contamination in the Des Plaines River basin.

Des Plaines River: Sediment Contamination

Arsenic	Chlordane
Chromium	DDT
Lead	PCBs
Mercury	Heptachlor Epoxide
Zinc	Cadmium

4.3.1.3 *Chicago River and Harbor and Calumet River and Harbor*

U.S. ACOE (1980) monitored the Chicago River and Harbor, as well as the Calumet River. All samples taken from the North Branch of the Chicago River were classified as heavily polluted with lead, zinc, chromium, and copper; 98 percent of the samples were heavily polluted by cadmium, 19 percent by manganese, and 12 percent by arsenic. The degree of heavy metal pollution decreased from the North Branch of the Chicago River to the

Chicago River and Harbor

The degree of pollution decreases from Chicago River to the harbor reach. Of the sediments, 98% are heavily polluted by cadmium, 50% by lead, 19% by manganese and 12% by arsenic. 27% of the samples contained mercury in concentrations exceeding 1μg/g.

Harbor reach, and from the Calumet River to the Harbor reach (Figures 4-33, 4-37). In the Chicago River and Harbor, lead was the only contaminant found to be in the heavily polluted category for more than 50 percent of the samples. Mercury, in excess of 1 $\mu g/g$, was found in 3 of the 11 samples (a finding of >1 $\mu g/g$ constitutes a polluted sample as cited by U.S. EPA Region 5 1977 Guidelines for the Pollution Classification of Great Lakes Harbor Sediment) (U.S. ACOE, 1980). In general, sediments from all three reaches show high levels of lead. Widespread copper and zinc contamination was also reported. High mercury levels were present in the North Branch sediments, with some evidence of mercury contamination at generally lower levels in the Chicago River and Harbor reach. All grab samples taken from the Calumet River and Harbor portions of the sampled areas contained less than 10 ppm PCBs. PCB contamination in the North Branch was confined to the mid-depths to lower portions of the sediments (U.S. ACOE, 1980).

Elevated levels of various heavy metals were reported in sediment samples taken during January 1981 at all sampling locations at Chicago River and Harbor sites, and Calumet River and Harbor sites (U.S. ACOE, 1981) (Table 4-45). Lead, arsenic, and chromium were present in elevated levels. The average lead and chromium concentrations from the Chicago River were 465 $\mu g/g$ and 107.5 $\mu g/g$, respectively. Silver levels in the sediment from Chicago River (North Clark Street), were found to be 128 $\mu g/g$ (US. ACOE, 1981).

Calumet River and Harbor

The degree of pollution decreases from Calumet River to the Harbor reach. Grab samples from this area are reported to contain less than 10 ppm PCBs. Lead concentrations in the Calumet River turning basin and in the harbor exceeded the L&M ER-M. The Harbor also has elevated levels of zinc.

Elevated lead concentrations (656 $\mu g/g$) were found in the Calumet River turning basin; this level exceeds the L&M ER-M of 218 $\mu g/g$. The average lead concentration was 363 $\mu g/g$, which also exceeds the L&M ER-M (218 $\mu g/g$). PCBs were not found above the reported detection limits of 1 ppm (U.S. ACOE, 1981). One Chicago River sample was reported to contain a PCB concentration greater than 10 ppm. Under classification categories of U.S. EPA Region 5 1977 Guidelines for the Pollution Classification of Great Lakes Harbor Sediment, this sample would qualify as "polluted" (U.S. ACOE, 1981).

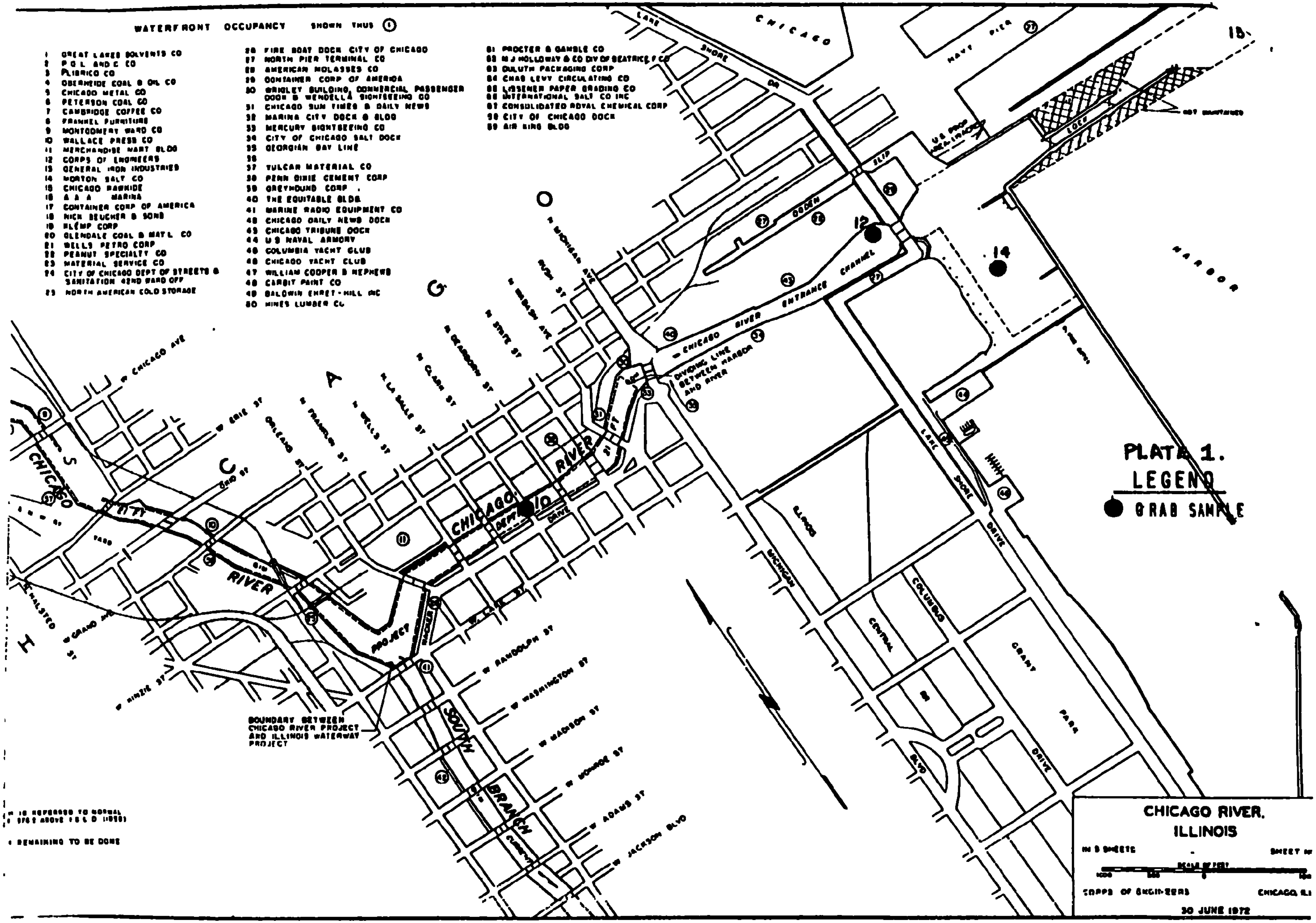


Figure 4-37. Detailed Map Showing Location of Chicago River and Harbor
(Source: USACE, 1981)

Table 4-45. Analysis of Sediment Samples from Chicago River and Harbor and Calumet River and Harbor Collected April 27-28, 1981

Location	CN	AS	BA	CD	CR	PB	AG	HG
Calumet Harbor - Near N. break wall	0.48	21	168	17	117	255	<5	<0.1
Calumet Harbor - N. line of CDF, 500' of PL	0.5	18	53	16	133	276	<5	<0.1
Calumet Harbor - E. line of CDF on fence line	0.19	23	112	13	133	242	<5	<0.1
Calumet River - Division between Harbor/River	1.16	18	185	23	152	393	<5	<0.1
Calumet River - 106th St.	1.72	24	99	28	88	400	<5	0.2
Calumet River - Turning Basin #3	1.44	46	64	<5	136	656	<5	0.2
Chicago Harbor - Outer Harbor	<.13	33	91	18	155	254	<5	<0.1
Chicago Harbor - Inner Harbor	<.13	29	57	<5	72	222	<5	0.3
Chicago River - Lake Shore Drive	0.27	30	56	31	101	457	<5	<0.1
Chicago River - N. Clark St.	0.17	14	106	40	114	473	128	<0.1

All units expressed as mg/g dry weight except as noted otherwise.

Source. U.S. ACOE, 1981.

One sediment sample was reported from the Chicago River in 1996. A summary of these data can be found in Table 4-46. Analysis of that sample indicates the presence of metals and pesticides. No contaminants in the sample showed concentrations greater than the Ontario SEL guidelines. However, among the compounds detected are chlordane-trans isomer (26,000 μg/kg), for which no SEL has been set, and p,p'DDE (120 μg/kg detected, 27 μg/kg ER-M) (STORET, 1997).

U.S. ACOE (1981) reported results of sediment samples from the Chicago Harbor (Figure 4-33). Sediment lead concentrations in Chicago Harbor and Calumet Harbor exceeded the L&M ER-M (218 μg/g). Concentrations in the outer Chicago Harbor also exceeded the Ontario SEL of 250 μg/g. L&M ER-M (9.6 μg/g) and the Ontario SEL (10 μg/g) for arsenic concentrations fell between the L&M ER-L and ER-M. The Calumet Harbor had elevated levels of lead and zinc (IEPA 1994). The average lead and chromium concentrations from the Chicago Harbor were 238 μg/g and 113.5 μg/g, respectively (U.S. ACOE, 1981).

4.3.1.4 *Cal-Sag Channel*

Table 4-43 reports the average concentrations of pollutants in sediments of Lake Calumet and surrounding waterbodies. As is evidenced from the table, the Cal-Sag Channel (Figure 4-32) is the most contaminated of the six waterbodies for all metals tested, except for arsenic. The Cal-Sag Channel has an average zinc concentration of 1,100 μg/g, which exceeds the L&M ERM and Ontario SEL (Ross et al., 1988). It also exceeded both the L&M's ER-M of 218 μg/g and the Ontario SEL of 250 μg/g. The mean lead concentration of Cal-Sag Channel sediments was 370 μg/g (Ross et al., 1988).

> **Cal-Sag Channel**
>
> The Cal Sag Channel, as shown in Table 4-43, is one of the most contaminated waterbodies in Cook County, IL and Lake County IN.

Table 4 - 46. Pollutant Levels in Chicago River Sediment (1996)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
TOTAL KJELDAHL N MG/KG	1996	1	1	5063	5063	5063
PHOSPHOROUS MG/KG	1996	1	1	1576	1576	1576
POTASSIUM MG/KG	1996	1	1	2900	2900	2900
ARSENIC MG/KG	1996	1	1	6.3	6.3	6.3
BARIUM MG/KG	1996	1	1	110	110	110
CADMIUM MG/KG	1996	1	1	1	1	1
CHROMIUM MG/KG	1996	1	1	44	44	44
COPPER MG/KG	1996	1	1	90	90	90
LEAD MG/KG	1996	1	1	130	130	130
MANGANESE MG/KG	1996	1	1	610	610	610
NICKEL MG/KG	1996	1	1	31	31	31
ZINC MG/KG	1996	1	1	240	240	240
CHLORDANE-TRANS ISOMER UG/KG	1996	1	1	26000	26000	26000
IRON MG/KG	1996	1	1	18	18	18
P,P'DDT UG/KG	1996	1	1	260	260	260
P,P'DDD UG/KG	1996	1	1	620	620	620
P,P'DDE UG/KG	1996	1	1	120	120	120
ALDRIN UG/KG	1996	1	1	5.8	5 8	5 8
CHLORDANE UG/KG	1996	1	1	18	18	18
DDT SUM ANALOGS UG/KG	1996	1	1	1000	1000	1000
DIELDRIN UG/KG	1996	1	1	7	7	7
ENDRIN UG/KG	1996	1	1	26	26	26
METHOXYCHLOR UG/KG	1996	1	1	53	53	53
HEXACHLOROBENZENE UG/KG	1996	1	1	2 4	2.4	2.4
TOTAL VOLATILE RESIDUE, PERCENT	1996	1	1	7.9	7.9	7.9
MERCURY MG/KG	1996	1	1	0 7	0 7	0.7

Source STORET, 1997

4.3.1.5 *Skokie Lagoons and Wolf Lake*

IEPA monitored surficial sediments from 63 Illinois lakes. The mean zinc sediment concentrations in the majority of Illinois lakes were between 60-160 μg/g, with the exception of Skokie Lagoons, which had average zinc concentrations of 403 μg/g (IEPA, 1981). Wolf Lake (Figure 4-35) had a mean lake zinc concentration of 205 μg/g. Both of these levels fall between the L&M ER- and L&M ER-M.

> **Skokie Lagoons**
>
> Zinc and lead levels in Skokie Lagoons fall between the L&M ER-L and ER-M. Lead concentrations range from 70-250 μg/g. PCBs were detected in 11% of the 63 waterbodies monitored by IEPA. Among these, Skokie Lagoons was found to have the largest number of detected samples of PCBs, with a mean of 235 μg/g, which far exceeds the L&M ER-M.

Of 63 Illinois lakes sampled, PCBs were detected in 11 percent. Skokie Lagoons had the largest number of detected concentrations, with a mean concentration of 235 μg/g sediment dry weight (IEPA, 1981). Skokie Lagoons also had an exceptionally high phosphorous concentration of 4,930 μg/g out of the 63 Illinois lakes under analyses (IEPA, 1981). This concentration exceeded by a factor of 2, the next highest concentration encountered in any other lake. Lead concentrations ranged from 70-250 μg/g for Skokie Lagoons, with a mean of 152 μg/g.

Wolf Lake lead concentrations ranged from 40-140 μg/g, with a mean of 100 μg/g. Both these values fall between the L&M ER-L and L&M ER-M. IEPA (1981) concluded that the increased contaminant levels in Wolf Lake and Skokie Lagoons may be due to the closeness of these lakes to Chicago. IEPA (1981) further expounded that the elevated levels of lead are anthropogenic rather than natural. In the absence of significant atmospheric precipitation and urban street runoff containing lead, a sediment lead content in the range of 20 to 50 μg/g appeared typical of Illinois lakes (IEPA, 1981).

> **Wolf Lake**
>
> Zinc and lead levels in Wolf Lake fall between the L&M ER-L and ER-M. A number of compounds in Wolf Lake exceeded their respective SELs, including copper, lead, manganese, zinc, iron, and p,p'DDE.

Sediment samples from Wolf Lake collected between 1991 and 1993. A summary of these data can be found in Table 4-47. Analyses of those samples indicated the presence of metals and pesticides. The samples contained a few compounds with concentrations exceeding their respective SELs, including: copper (247 mg/kg detected, 110 mg/kg SEL), lead (454 mg/kg detected, 250 mg/kg SEL), manganese (3,300 mg/kg detected, 1,100 mg/kg SEL), zinc (1,100 mg/kg detected, 820 mg/kg SEL), iron (11.3% detected, 4% SEL), and p,p'DDE (28 μg/kg detected, 27 μg/kg ER-M) (STORET, 1997).

4.3.1.6 *Other Lakes and Lagoons*

Douglas Lagoon

Two sediment samples are reported for Douglas Lagoon from 1991. A summary of these data can be found in Table 4-48. Analyses of these samples indicated the presence of a few pesticides. With the exception of DDT, all pesticides found in Douglas Lagoon sediment samples have Ontario SEL guidelines. No contaminants in the samples surpass any of these guidelines; however, 30 μg/kg of p,p'DDE were found in one sample--a concentration surpassing L&M ER-M level of 27 μg/kg (STORET, 1997).

Comparison of Certain Waterbodies Using STORET Data

Among the Chicago River, Douglas Lagoon, Garfield Lagoon, Lincoln North Pond, Marquette Park Lagoon, SAG Quarry, Washington Lagoon, and Wolf Lake, the Chicago River has 48% of the highest concentrations of pollutants, Wolf Lake has 35%, and Garfield Lagoon has 2%.

Garfield Lagoon

One sediment sample was taken from Garfield Lagoon in 1991. A summary of these data can be found in Table 4-49. Analysis of the sample indicated the presence of metals and pesticides. The sample contained a few compounds with concentrations exceeding the respective Ontario SEL. Among the compounds detected were arsenic (67 mg/kg detected, 33 mg/kg Ontario SEL), copper (133 mg/kg detected, 110 mg/kg Ontario SEL), p,p'DDE (68 μg/kg detected, 27 μg/kg L&M ER-M), and mercury (0.4 mg/kg detected, 0.15 mg/kg L&M ER-L) (STORET, 1997).

Table 4 - 47. Pollutant Levels in Wolf Lake Sediment (1991-1993)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
ARSENIC SEDMG/KG DRY WGT	1991,1993-1994	9	34	1 6	12 65	29.1
BA MUD DRY WGT MG/KG-BA	1991,1993-1994	9	34	5	77.24	320
CD MUD DRY WGT MG/KG-CD	1991,1993-1994	8	22	1	2.19	6
CHROMIUM SEDMG/KG	1991,1993-1994	9	34	2	37.02	97
COPPER SEDMG/KG DRY WGT	1991,1993-1994	9	33	4	64.16	247
LEAD SEDMG/KG DRY WGT	1991,1993-1994	9	33	13	147 5	454
MN MUD DRY WGT MG/KG-MN	1991,1993-1994	9	34	126	890.2	3300
NICKEL SEDMG/KG DRY WGT	1991,1993-1994	9	33	5	19.1	50
SILVER SEDMG/KG DRY WGT	1993	2	2	1	1	1
ZINC SEDMG/KG DRY WGT	1991,1993-1994	9	34	11	323 7	1100
FE MUD DRY WGT MG/KG-FE	1991,1993-1994	9	34	2700	23941	113000
P,P'DDT SEDUG/KG DRY WGT	1993	5	13	1 8	6.06	18
P,P'DDD SEDUG/KG DRY WGT	1993	9	20	1 4	8.3	26
P,P'DDE SEDUG/KG DRY WGT	1991,1993	9	21	1.9	8.18	28
ALDRIN SEDUG/KG DRY WGT	1993	2	2	1.8	1.85	1 9
CDANEDRY TECH&MET UG/KG	1993	2	2	4 6	6.2	7.8
DDT SUM ANALOGS MUDUG/KG	1993	5	13	11	26.84	58
DIELDRIN SEDUG/KG DRY WGT	1993	4	5	1 3	2.24	3.8
ENDRIN SEDUG/KG DRY WGT	1993	1	1	1.8	1 8	1 8
HPCHLREP SEDUG/KG DRY WGT	1993	1	1	1.3	1.3	1.3
PCBS MUD UG/KG	1993	9	33	21	502.5	4000
HCB SEDUG/KG DRY WGT	1993	1	2	4 5	5.2	5.9
TOTAL ORGANIC CARBON %	1994	2	2	2.73	3 21	3 68
MERCURY SEDMG/KG	1991,1993	8	19	0 1	0.308	1

Source STORET, 1997

Table 4 - 48. Pollutant Levels in Douglas Lagoon Sediment (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
ALPHABHC SEDUG/KG DRY WGT	1991	2	2	3.6	6 45	9 3
P,P'DDD SEDUG/KG DRY WGT	1991	2	2	2.7	23.85	45
P,P'DDE SEDUG/KG DRY WGT	1991	2	2	19	24.5	30
DDT SUM ANALOGS MUDUG/KG	1991	2	2	22	48.5	75
DIELDRIN SEDUG/KG DRY WGT	1991	2	2	3.4	30 7	58

Source. STORET, 1997.

Table 4 - 49. Pollutant Levels in Garfield Lagoon Sediment (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
ARSENIC SEDMG/KG DRY WGT	1991	1	2	63	65	67
BA MUD DRY WGT MG/KG-BA	1991	1	2	101	101	101
CD MUD DRY WGT MG/KG-CD	1991	1	2	2	2.5	3
CHROMIUM SEDMG/KG DRY WGT	1991	1	2	32	33	34
COPPER SEDMG/KG DRY WGT	1991	1	2	128	130.5	133
LEAD SEDMG/KG DRY WGT	1991	1	2	322	330.5	339
MN MUD DRY WGT MG/KG-MN	1991	1	2	371	371	371
NICKEL SEDMG/KG DRY WGT	1991	1	2	43	44	45
ZINC SEDMG/KG DRY WGT	1991	1	2	385	390 5	396
FE MUD DRY WGT MG/KG-FE	1991	1	2	27000	27500	28000
ALPHABHC SEDUG/KG DRY WGT	1991	2	2	1.9	4.55	7 2
P,P'DDD SEDUG/KG DRY WGT	1991	2	2	4.1	72 05	140
P,P'DDE SEDUG/KG DRY WGT	1991	2	2	17	42 5	68
DDT SUM ANALOGS MUDUG/KG	1991	1	1	210	210	210
DIELDRIN SEDUG/KG DRY WGT	1991	2	2	2	15	28
MERCURY SEDMG/KG DRY WGT	1991	1	2	0.3	0 36	0.4

Source· STORET, 1997.

Lincoln North Pond

One sediment sample was taken from Lincoln North Pond in 1991. A summary of these data can be found in Table 4-50. Analysis of that sample indicated the presence of a few pesticides; with the exception of DDT, all pesticides found in the sample have Ontario SEL guidelines. No contaminants in the sample surpass any of these guidelines; however, the 32 μg/kg of p,p'DDE found in the sample surpasses the respective ER-M level (27 μg/kg) (STORET, 1997).

Marquette Park Lagoon

One sediment sample was taken from Marquette Park Lagoon in 1992. A summary of these data can be found in Table 4-51. Analysis of that sample indicated the presence of metals and pesticides; however, no contaminants in the sample had concentrations stronger than the Ontario SEL guidelines (STORET, 1997).

SAG Quarry

Two sediment samples were taken from SAG Quarry in 1993. A summary of these data can be found in Table 4-52. Analyses of those samples indicated the presence of metals. The samples contained two compounds with concentrations exceeding their respective SELs: copper (150 mg/kg detected, 110 mg/kg SEL) and total organic carbon (10.3% detected, 10% SEL) (STORET, 1997).

Washington Lagoon

Two sediment samples were taken from Washington Lagoon in 1991. A summary of these data can be found in Table 4-53. Analyses of those samples indicate the presence of a few pesticides. With the exception of DDT, all pesticides found in the sample have Ontario SEL guidelines. No contaminants in the samples surpass any of these guidelines; however, the 21 μg/kg of p,p'DDE found in one sample surpasses the respective ER-L level (2.2 μg/kg).

4.3.2 Waterbodies in Lake County, IN

Many lakes, streams, and rivers are located in Lake County, IN. Figure 4-32 displays the location of the major waterbodies. The Grand Calumet River (GCR), Indiana Harbor Canal (IHC), and Indiana Harbor (IH) have been the focus of extensive sediment contamination studies, somewhat because it is a Great Lakes Area of Concern (AOC). Many of these studies have concentrated on all

Table 4 - 50. Pollutant Levels in Lincoln North Pond Sediment (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
P,P'DDD SEDUG/KG DRY WGT	1991	1	1	53	53	53
P,P'DDE SEDUG/KG DRY WGT	1991	1	1	32	32	32
DDT SUM ANALOGS UG/KG	1991	1	1	85	85	85
DIELDRIN SEDUG/KG	1991	1	1	8.7	8.7	8.7

Source: STORET, 1997.

Table 4 - 51. Pollutant Levels in Marquette Park Lagoon Sediment (1992)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
ARSENIC SEDMG/KG DRY WGT	1992	1	1	19	19	19
BA MUD DRY WGT MG/KG-BA	1992	1	1	120	120	120
CD MUD DRY WGT MG/KG-CD	1992	1	1	2	2	2
CHROMIUM SEDMG/KG	1992	1	1	32	32	32
COPPER SEDMG/KG DRY WGT	1992	1	1	47	47	47
LEAD SEDMG/KG DRY WGT	1992	1	1	53	53	53
MN MUD DRY WGT MG/KG-MN	1992	1	1	552	552	552
NICKEL SEDMG/KG DRY WGT	1992	1	1	38	38	38
ZINC SEDMG/KG DRY WGT	1992	1	1	130	130	130
FE MUD DRY WGT MG/KG-FE	1992	1	1	33000	33000	33000
P,P'DDD SEDUG/KG DRY WGT	1992	1	1	3 6	3.6	3 6
P,P'DDE SEDUG/KG DRY WGT	1992	1	1	2	2	2
MERCURY SEDMG/KG	1992	1	1	0.1	0 1	0.1

Source. STORET, 1997

Table 4 - 52. Pollutant Levels in SAG Quarry Sediment (1993)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
ARSENIC SEDMG/KG DRY WGT	1993	2	2	7.95	10 05	12.15
BA MUD DRY WGT MG/KG-BA	1993	2	2	98 5	116.25	134
CD MUD DRY WGT MG/KG-CD	1993	1	1	2	2	2
CHROMIUM SEDMG/KG	1993	2	2	20	21.38	22.75
COPPER SEDMG/KG DRY WGT	1993	2	2	67 5	108.75	150
LEAD SEDMG/KG DRY WGT	1993	2	2	67.75	109.38	151
MN MUD DRY WGT MG/KG-MN	1993	2	2	530	549	568
NICKEL SEDMG/KG DRY WGT	1993	2	2	30.5	31 63	32 75
ZINC SEDMG/KG DRY WGT	1993	2	2	187	201 5	216
FE MUD DRY WGT MG/KG-FE	1993	2	2	20850	24550	28250
TOTAL ORGANIC CARBON %	1993	2	2	8.7	9.5	10.3
MERCURY SEDMG/KG	1993	2	2	0.1	0 13	0.2

Source. STORET, 1997.

Table 4 - 53. Pollutant Levels in Washington Lagoon Sediment (1991)

Pollutant and Units	Years Sampled	No. of Stations	Total Samples	Minimum Detected	Mean Detected	Maximum Detected
P,P'DDD SEDUG/KG DRY WGT	1991	2	2	18	19.5	21
P,P'DDE SEDUG/KG DRY WGT	1991	2	2	20	20 5	21
DDT SUM ANALOGS UG/KG	1991	1	1	41	41	41
DIELDRIN SEDUG/KG	1991	2	2	3.1	4 05	5

Source: STORET, 1997.

three waterbodies. This section, therefore, first presents the joint studies, followed by studies that concentrate on individual waterbodies. Other waterbodies that fall within Lake County, IN, include parts of Lake Michigan and parts of Wolf Lake, and Little Calumet River.

4.3.2.1 *IHC/GCR/IH*

The Grand Calumet River and Indiana Harbor Canal (GCR/IHC) (Figure 4-38) have a combined length of 34 kilometers (km) or 21 miles. This area has been the focus of attention since 1965 by the Federal Government, including the EPA and Alliance for Clear Energy (ACE). In 1987, EPA was directed under Section 118 of the Clean Water Act, as amended in 1987, to ensure that Remedial Action Plans were developed for this area (Holowaty et al., 1991).

Listing of Facilities in the Grand Calumet River and Indiana Harbor Canal Area

- 5 Superfund Sites
- 56 CERCLIS Sites
- 425 RCRA Sites
- 23 Facilities Dealing with Hazardous Waste
- 9 Hazardous Waste Landfills or Surface Impoundments
- 150 Leaking Underground Storage Tanks

GCR/IHC is located in a heavily-industrialized region of northwestern Indiana, approximately 32 km southeast of Chicago, IL. From its headwaters (near Marquette Park Lagoon), the East Branch of the Grand Calumet River flows westward (approximately 21 km) before joining the IHC and the West Branch of the Grand Calumet River. Waters entering IHC flow about 8 km to the north and then northeast, exiting into Indiana Harbor (IH) and southern Lake Michigan. U.S. EPA (1994a) reported that 5 Superfund sites, 56 CERCLA sites, 425 RCRA sites, 23 facilities that treat, store, or dispose (TSD) of hazardous waste, 9 hazardous waste landfills or surface impoundments, and approximately 150 leaking underground storage tanks (LUSTs) lie within GCR/IHC Area of Concern.

EPA (1994a) concluded that contamination problems within the GCR/IHC have resulted in the Indiana Harbor becoming one of the most highly contaminated harbors in the Great Lakes. The major contaminant transport mechanism is believed to be the resuspension of contaminated

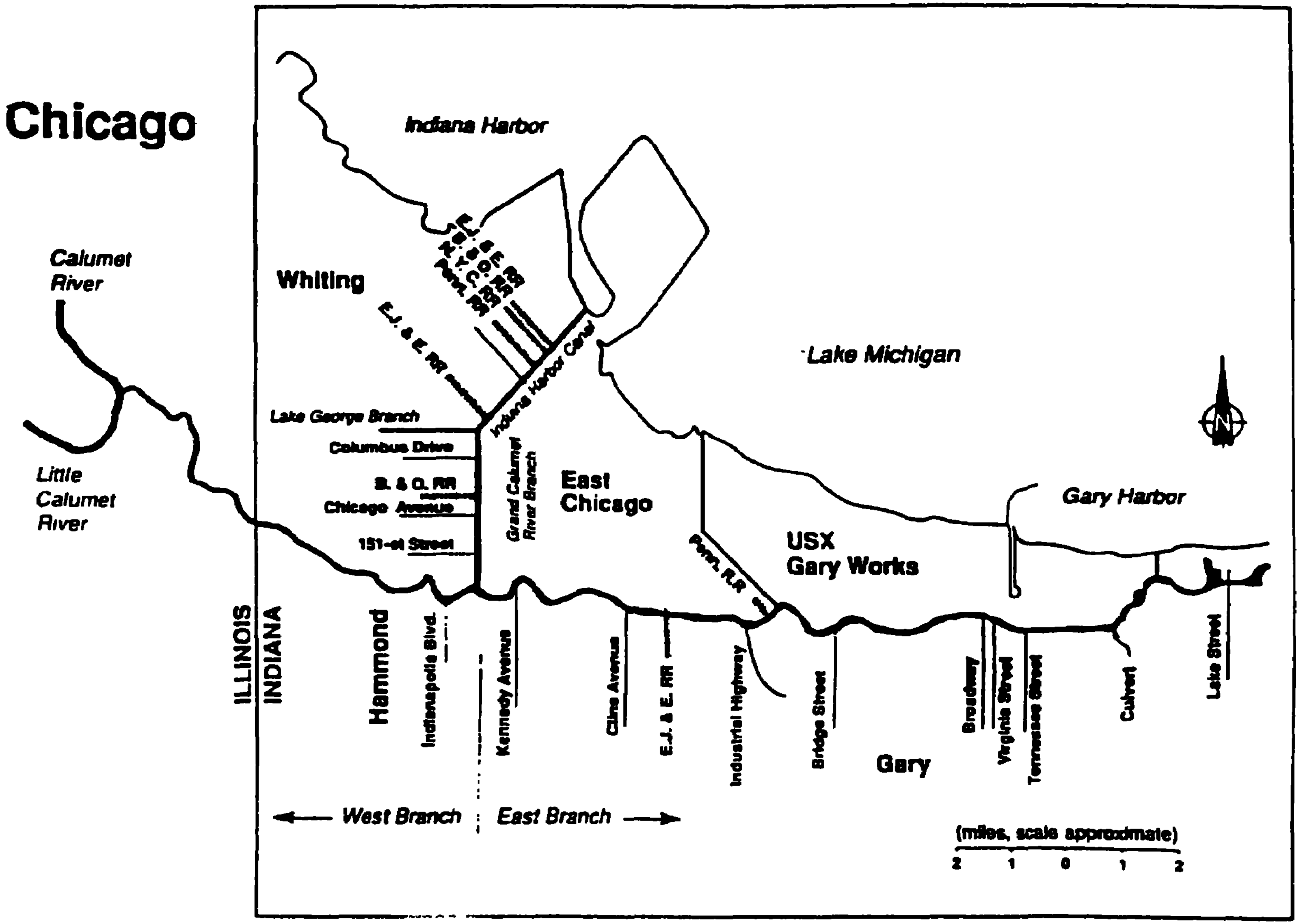


Figure 4-38. Grand Calumet River / Indiana Harbor Canal Area of Concern
(Source: IDEM, 1991)

sediments followed by partitioning to the water column (U.S. EPA, 1994a). Comparison of arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc to Ontario's SELs indicate all parameters are of concern in some location, if not throughout the IHC area (U.S. EPA, 1996c). The highest concentrations of contaminants found in the GCR/IHC AOC sediments are listed in Table 4-54.

U.S. ACOE has maintained a Federal navigation project at IHC since 1910. Harbor depths are authorized by statute and range from 6.7 meters (22 feet) in the turning basin and IHC, to 8.8 meters (29 feet) in the outer harbor for navigation purposes. Periodic dredging of the canal is necessary to maintain the authorized depths and eliminate shoals in the outer harbor and accumulated sediments in remaining areas. The canal has not been dredged since 1972, which has resulted in restricting the flow of traffic on the canal. Under the present conditions, the shipping capacity in the harbor and canal has been reduced by 15 percent and has resulted in a substantial increase in shipping costs (IDEM, 1991). Although it is more difficult for boat traffic to get through the canal, some boats are able to power their way through the soft sediments. This frequent churning up of sediments from both ship traffic and storm events results in the resuspension, transport, and deposition of contaminated sediments (U.S. EPA, 1994a). The reason the canal has not been dredged since 1972 is because of the lack of disposal sites for the dredged spoils, which are classified as heavily polluted or toxic according to EPA guidelines (Holowaty et al., 1991). As a result, the navigation channel in the Calumet River Branch of IHC is impassible to commercial traffic. Prior to 1968, dredged material from the Indiana Harbor deep-draft navigation project, as authorized by the River and Harbor Act of 1910, was placed in the open waters of Lake Michigan. After 1968, the Federal Government prohibited the unconfined disposal of contaminated dredged material (U.S. EPA, 1994a). Data from bathymetric surveys from 1972, 1976, 1980, and 1984 indicated that incoming sediment was equal to outgoing sediment in the Canal (U.S. EPA, 1994a). Because the incoming sediments are probably contaminated sediments from the Grand Calumet River, this area may be receiving a continuous load of contaminants throughout the year (U.S. EPA, 1994a).

Municipal and industrial point discharges, combined sewer overflows, and urban runoff, are the major sources of contamination to sediments entering GCR/IHC. Thirty-nine point sources on the GCR/IHC serve municipal sewage treatment plants, semi-integrated steel manufacturing, chemical producers, and others (HydroQual, 1985). In addition to these permitted outfalls, the

Table 4-54. Maximum Concentrations of Contaminants in GC/IHC Sediments

Contaminant	Highest Concentration ($\mu g/g$)
Ammonia	545.0
Arsenic	29.5
Cadmium	45.0
Chromium	1,680.0
Copper	600.0
Cyanide	4.4
Iron	326,000
Lead	1,430
Manganese	382,00
Mercury	2.20
Nickel	140.0
Zinc	4,630
PCBs (total) Aroclor 1248 Aroclor 1254 Aroclor 1260 Aroclor 1242	102.3 27.0 6.9 8.56 89.08
P-cresol	4.5
Chlorophenyl-phenylether	3.2
Dibenzofuran	160.0
Phenol	0.278
Di-methylphenol	3.2
Di-chlorophenol	3.3
Napthalene	2,033.333+/-57.735
Acenapthylene	27.0
Acenapthene	105.333+/-8.083

Table 4-54. Maximum Concentrations of Contaminants in GC/IHC Sediments (continued)

Contaminant	Highest Concentration ($\mu g/g$)
Fluorene	160.0
Benzo(a)pyrene	105.667+/-16.921
Fluoranthene	160.000+/-10.000
Phenanthrene	206.667+/-11.547
Anthracene	170.0
Pyrene	3,300.0
Benzo(a)anthracene	140.0
Chrysene	130.0
Benzo(b)-fluoranthene	200.0
Benzo(k)-fluoranthene	140.0
Benzo(g,h,i)-perylene	39.667+/-4.163
Dibenzo(a,h)anthracene	11.0
Indeno(1,2,3-c,d)-pyrene	57.000+/-10.440
Di-N-octyl phthalate	47.0
Bis(2-ethylhexyl)phthalate	26.0
Butyl benzyl pthalate	0.6
Di-N-butyl pthalate	0.8
Heptachlor epoxide	<1.0
Endosulfan I	<0.05
Endosulfan II	<0.02
Endrin	<0.02
Aldrin	<1.0
Isodrin	<1.3
Dieldrin	<0.02

Table 4-54. Maximum Concentrations of Contaminants in GC/IHC Sediments (continued)

Contaminant	Highest Concentration (μg/g)
Chlorodane	<0.2
DDT	<1.0
DDD	<0.4
DDE	<0.3
Mirex	<0.2
Methoxychlor	<2.0
2,4-D	<0.5
DCPA	<0.03
1,2-DCB	0.04
1,4-DCB	0.14
HCB	

μg/g = microgram per gram

Source U.S. EPA, 1991a.

sanitary districts of Gary, Hammond, and East Chicago maintain combined sewer systems that overflow to the GCR/IHC during even light storm events (U.S. ACOE, 1996). CSO loadings have been estimated to exceed 11-billion gallons per year (IDEM, 1991). A number of industries are located in the GCR/IHC area, and the hydrology of the river system has been altered due to channeling and dredging activities (U.S. EPA, 1994a). This river system has been used primarily for two functions: (1) for ship transportation in the canal, and (2) as a conduit for effluent discharges from industries and sewage treatment plants (STPs) in Gary, Hammond, East Chicago, and Whiting, IN. Of the 39 permitted outfalls on the GCR/IHC, 28 are accounted for by three companies: US Steel-Gary Works, Inland Steel, and LTV Steel (formerly Jones & Laughlin Steel). These companies are reported to discharge greater than 95 percent of the industrial effluent volume (U.S. EPA, 1994a). Improvement in manufacturing practices and heightened stringency for regulating discharges have improved water quality of the river (U.S. ACOE, 1996).

The lack of industrial pretreatment and the small size of the upstream drainage basin has increased the contaminant problems (U.S. EPA, 1993a). As the flow from this system enters Lake Michigan, the level of pollutants has been of particular concern. Over the past two decades, source control has improved water quality; however, sediments and groundwater in the area have continued to be a repository for many contaminants including PCBs, PAHs, polychlorinated dioxins and furans, chlorinated pesticides, heavy metals, and many other pollutants (U.S. EPA, 1993a). Fifty EPA CERCLIS sites have been identified and listed in the GCR/IHC AOC (U.S. EPA, 1993a). Table 4-55 displays selected potentially hazardous substances found in the GCR/IHC system.

Volume of Contaminated Sediments in IHC/GCR

In its Comprehensive Management Plan for dredging the IHC, the U.S. ACOE (1996) estimates the total annual loading of sediments to GCR/IHC to be 152,000 cubic yards. The Grand Calumet Task Force estimates the annual loading to be from 15,000 to 26,000 cubic yards. U.S. ACOE (1996) has concluded that different methodologies employed could be a possible

Annual Sediment Load from GCR/IHC to Lake Michigan

The GCR/IHC has reached a state of balance of sediment deposition and scour/transport. Annual loading of 152,000 cubic yards of sediment containing 100,000 pounds of lead, 67,000 pounds of chromium, and 420 pounds of PCBs enter Lake Michigan from GCR/IHC.

Table 4-55. Selected Potentially Hazardous Substances Found in the GCR/IHC System

Chemical	Sediment Concentration (μg/g)
I. Metals	
Carcinogenic:	
Arsenic (As)	29.5
Cadmium (Cd)	45.0
Chromium (Cr)	1,680.0
Nickel (Ni)	140.0
Noncarcinogenic:	
Copper (Cu)	600.0
Iron (Fe)	326,000.0
Lead (Pb)	1,430.0
Manganese (Mn)	382,000.0
Mercury (Hg)	2.2
Zinc (Zn)	4,630.0
II. Inorganic Compounds:	
Carcinogenic:	
PAHs (11 Potential carcinogens)	11 - 3,300.0
PCBs (Total)	102.3
Aroclors	132.0
CDFs	160.0
DEHP (Bis(2-ethylhexyl)phathalate	26.0

μg/g = microgram per gram

Source: IDEM, 1991.

explanation for the difference in values. Another reason could be that the original U.S. ACOE study was conducted in the early 1980s, and the reduction in total loadings is a reflection of better management practices (U.S. ACOE, 1996).

U.S. ACOE (1996) estimates that the sediment quantity for the Calumet River and lagoons (excluding the Federal Navigation Channel and the proposed US Steel sediment cleanup project) totaled 1,754,000 cubic yards. Table 4-56 lists the estimated sediment volume for each GCR-IHC reach and the total sediment volume estimate for the project area. U.S. ACOE (1996) reports that a steel rod was used to estimate the depth of unconsolidated sediment. As seen in Table 4-56, the estimated volume of sediment in the hot spot area of the West Lagoon was about 50,000 cubic yards. The volume of penetrable sediment in the remaining portion of the West Lagoon was estimated to be about 100,000 cubic yards. Holowaty et al. (1991) reported that sediments reached depths of 5 meters (17 feet) in GCR/IHC. U.S. ACOE has estimated that this small river system may contain over 3.6-million cubic meters (4-million cubic yards) of contaminated sediments (U.S. ACOE, 1986).

Results from the sedimentation analyses indicate 8,294 tons of sediments are delivered to the GCR lagoons per year. This equates to a volume of approximately 8,003 cubic yards, of which 5,995 cubic yards are deposited in the West Lagoon and 2,008 in the East Lagoon. Sediment transport between the lagoons has not been considered in these calculations. Sediment transport off the surrounding lands has been the main factor (U.S. ACOE, 1996).

The volume of contaminated sediments in the GCR/IHC has been estimated to be 1.4-million cubic yards in the East Branch of the GCR and 700,000 cubic yards of the West Branch and IHC upstream of the navigation project. The authorized navigation project contains 1-million cubic yards, and the Chicago District U.S. ACOE has estimated between 500,000 and 1-million cubic yards of soft sediments adjacent to the authorized channel. It is, therefore, estimated that 3.5- to 4-million cubic yards of contaminated sediments exist in GCR/IHC AOC (U.S. ACOE, 1996).

U.S. ACOE states that most of the GCR/IHC system has reached a state of balance of sediment deposition and scour/transport. The result of this steady-state condition is an annual loading of 100,000 to 200,000 cubic yards of sediment to Lake Michigan from the mouth of the

Table 4-56. Sediment Volume Estimates for the Grand Calumet River Reaches

REACH	VOLUME (yd^3)	SOFT-SIDES (yd^3)	OVERDREDGE (yd^3)	TOTAL (yd^3)
Grand Cal Lagoons:				
East Lagoon	150,000	a	a	150,000
West Lagoon				
Western portion	46,000	a	a	46,000
Eastern portion	97,000	a	a	97,000
Gary Sanitary District	340,000	100,000	30,000	470,000
DuPont	270,000	78,000	29,000	377,000
East Chicago Sanitary District	130,000	38,000	6,300	174,000
Roxana Marsh	220,000	b	20,000	240,000
Hammond San District	130,000	b	7,500	138,000
Culverts	290,000	b	17,000	307,000
Canal	72,000	21,000	19.000	112,000
Lake George				
TOTAL	**1,745,000**	**237,000**	**129,000**	**2,111,000**

yd^3 = cubic yards.
[a] Nor considered in this phase of study.
[b] Included in volume estimate under column 2.

Source U S ACOE, 1996

Indiana Harbor. The annual sediment load to the lake contains an estimated 67,000 pounds of chromium, 100,000 pounds of lead, and 420 pounds of PCBs (U.S. ACOE, 1997).

Concentrations of Sediment Contaminants in IHC/GCR

Compounds exhibiting the greatest sediment concentrations in the GCR/IHC were the various PAHs, total PCBs, pp'-DDE, toxaphene, p-Chlorotoluene, ethylbenzene, and p-dichlorobenzene (Hoke et al., 1993). These compounds are reported to have been present in the 2-20 μg/g range, with the exception of several PAHs, which were present at concentrations as great as 100 μg/kg in the sediments. The percentage of oil and grease ranged from 1.6 to 13.5 percent. Detectable concentrations of most analyzed metals were present in all study site sediments. Iron, magnesium, and manganese were generally present in high mg/kg to low μm/kg concentrations in solid phase sediments. Of the metals of toxicological concern in aquatic systems, zinc, lead, and chromium were present at concentrations as great as 5.23, 3.94, and 1.22 μm/kg, respectively. Copper, nickel, and cadmium concentrations were generally below 500 μg/g.

Compounds Exhibiting the Greatest Sediment Concentrations in the GCR/IHC

- PCBs,
- PAHs,
- p,p'-DDE,
- Toxaphene
- p-Chlorotoluene
- Ethylbenzene
- p-diclorobenzene
- Heavy Metals

Table 4-57 displays sediment data presented by EPA (1991a). These data were from six sampling locations in the GCR/IHC as displayed on Figure 4-38 (U.S. EPA, 1991a). Zinc concentration in IHC sediments ranged from 550 to 4,500 μg/g. The average concentration was 2,475 μg/g, which exceeded the Ontario SEL of 820 μg/g. The Indianapolis Road

GCR/IHC

Zinc, chromium, copper, lead, cadmium, iron, manganese, mercury, nickel, silver, zinc, concentrations in the GCR/IHC exceeded the SEL. PCB concentrations were 90 times the ER-M benchmark, and PAHs, such as anthracene and phenanthrene, were 25 times greater than the ERM.

Table 4-57. GCR-IHC Sediment Data for 1986[1]

Sampling Site	1	2	3	4	5	6
Location	**Bridge St.**	**Cline Ave.**	**Kennedy Ave.**	**Indianapolis Blvd.**	**Lake George Branch**	**Dickey Rd.**
% Volatile Solids	24 (12)	11 (15)	7 (13)	26 (30)	18 (39)	11 (20)
Antimony	3 9 (3.6)	3.8 (7 6)	1.9 (5.4)	13 (13)	6 3 (0.5)	7.0 (6.1)
Arsenic	25 (26)	21 (67)	9.3 (25)	210 (68)	36 (6.0)	44 (60)
Beryllium	1 2 (1 4)	<2 2 (1.2)	<2 2 (<2.1)	<2 4 (1.3)	<2 3 (<1.2)	<2.3 (1.2)
Cadmium	2 1 (2 9)	1 8 (6.2)	1.3 (7.7)	27 (22)	4.6 (0.68)	10 (11)
Chromium	220 (180)	280 (540)	75 (330)	990 (570)	930 (46)	730 (610)
Copper	150 (180)	120 (300)	70 (220)	450 (440)	600 (17)	360 (360)
Cyanide	4.4 (3.4)	1.5 (1 3)	0.13 (0.23)	1.0 (3.5)	0.13 (<0.13)	3.3 (1.4)
Lead	500 (730)	350 (790)	360 (870)	1,100 (1,200)	1,100 (100)	960 (1,200)
Mercury	0 61 (0 90)	0.19 (0 78)	0.18 (1.1)	1.2 (0.89)	0 37 (0 041)	0 99 (0 65)
Nickel	42 (*47)	44 (69)	18 (40)	120 (180)	90 (2 3)	81 (72)
Selenium	1.4 (1.4)	1 6 (1.8)	0 67 (1.4)	17 (42)	8 1 (0 77)	3.8 (3.0)
Silver	<1 7 (3)	<1 4 (4.6)	<1 9 (2.7)	26 (15)	1.7 (<0.44)	6.0 (<1.8)
Thallium	<19 (<20)	<22 (<24)	<22 (<21)	<24 (<26)	<12 (<12)	<23 (<24)
Zinc	2,000 (2,700)	1,600 (2,900)	550 (2,100)	4,500 (3,700)	2,000 (210)	4,200 (4,300)
PCB-1248	14 (1.9)	6 1 (1.1)	1 1 (1.4)	1.5 (0.35)	2 0 (ND)	4.1 (3.1)
BHC	ND (ND)	0.02 (ND)	ND (ND)	0 01 (ND)	ND (ND)	ND (ND)
Pentachlorophenol	ND (ND)	ND (ND)	ND(51)	ND (ND)	ND (ND)	17 (ND)
Pentachloroanisole	ND (ND)	ND (ND)	ND (ND)	ND (3 9)	ND (ND)	ND (ND)
Napthalene	220 (11)	6 5 (3.8)	ND (ND)	2.5 (ND)	ND (ND)	ND (ND)

Table 4-57. GCR-IHC Sediment Data for 1986[1] (continued)

Sampling Site	1	2	3	4	5	6
Location	**Bridge St.**	**Cline Ave.**	**Kennedy Ave.**	**Indianapolis Blvd.**	**Lake George Branch**	**Dickey Rd.**
Bis (2-ethylhexyl) phthalate	21 (ND)	ND (ND)	ND (ND)	11 (ND)	ND (ND)	27 (ND)
Methylnaphthalene	ND (11)	4.2 (3.7)	ND (ND)	3 0 (ND)	ND (ND)	ND (ND)
Dierhylphthalate	ND (ND)	ND (62)	ND (ND)	5.8 (ND)	ND (ND)	ND (ND)
Fluorene	160 (ND)	5 9 (ND)	ND (ND)	ND (ND)	12 (ND)	ND (ND)
Fluoranthene	ND (24)	44 (8.6)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Pyiene	3,300 (22)	49 (6.7)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Dibenzofuran	160 (5.1)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Acenapthene	ND (4 5)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
1-2 Dichlorobenzene	ND (1 5)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Chloronaphthalene	6.5 (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Benzoanthracene	47 (ND)	ND (ND)	ND (ND)	17 (ND)	ND (ND)	ND (ND)
Benzofluoranthene	ND (ND)	ND (ND)	ND (11)	ND (ND)	ND (ND)	ND (4.0)
4-Nitroaniline	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
Chlorophenyl-phenylether	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	4.0 (ND)
p-Cresol	ND (ND)	ND (ND)	ND (ND)	4.5 (ND)	ND (ND)	ND (ND)
Dimethylphenol	ND (ND)	ND (ND)	3.2 (2.0)	ND (ND)	ND (ND)	ND (ND)
Dichlorophenol	ND (ND)	ND (ND)	3.3 (2.8)	ND (ND)	ND (ND)	ND (ND)

[1] Measurements represent
$\mu g/g$ = microgram per gram.
ND = Not Detected

Source U S EPA, 1991a.

site had the greatest zinc concentrations in this study. Chromium, copper, and lead were also present in elevated concentrations. The mean concentrations for these metals are presented in Table 4-58. U.S. EPA (1991a) presented data on PCB concentrations in sediments at 13 IHC and IH locations. PCB concentrations ranged from 0.09 to 31.74 μg/g with an average of 11.45 μg/g. High PCB concentrations reported from this study were found on the IHC at Dickey Road. Table 4-57 displays the results of this study conducted in September 1987. The average concentration of PCBs in the Harbor and Canal was found to be 1.55 μg/g and 17 μg/g, respectively (U.S. EPA, 1991a). Table 4-59 displays data from U.S. EPA (1991a) showing the concentration of metals and PCBs at the IHC and IH (Figures 4-38 and 4-39). Lead and zinc concentrations are highest in the IHC between Conrail and Dickey Road. PCB concentrations are greatest in the Lake George branch of the IHC (U.S. EPA, 1991a).

A 1979 U.S. ACOE study analyzed 34 sediment samples from 13 sites in IHC and IH. Contaminant concentrations were compared to "U.S. EPA Region 5 classification of sediment quality," and it was concluded that most Indiana Harbor sediments were heavily polluted (U.S. ACOE, 1986). The two lakeward sites in this study were found to contain more moderately polluted sediments. Sediments in the upstream branches of the canal and turning basin were more heavily polluted.

Sediment core sampling of nutrient organics and metals showed that contaminant concentrations varied with depth. Trends of decreasing or increasing concentrations of individual parameters with sediment depth were not observed for the IHC as a whole. However, trends for a few specific contaminants at specific locations were observed. Concentrations of contaminants in the deepest sediment composite samples were lower than those observed closer to the sediment surface (U.S. ACOE, 1986).

EPA's Great Lakes National Program Office (GLNPO) conducted two sediment sampling surveys in August 1989 and November 1990 at the Indiana Harbor AOC, which included IH and IHC. Contaminants found at elevated levels included heavy metals, PCBs, PAHs, oil, and grease. The summary statistics in Table 4-60 display the range of concentrations present for each chemical (U.S. EPA, 1996c). L&M's effects ranges and Ontario's Provincial Sediment Quality Guidelines were utilized as benchmarks against which levels of contaminants could be compared

Table 4-58. Summary Statistics for Specific Metals in GCR-IHC

Pollutant	Concentration Range (μg/g)	Mean Concentration (μg/g)	Ontario SEL (μg/g)
Zinc	550 - 450	2,475	820
Chromium	75 - 990	534	110
Copper	70 - 600	292	110
Lead	350 - 1,100	728	250

μg/g = microgram per gram.

Source: U.S. EPA, 1991a.

Table 4-59. Pollutant Concentrations From Sediments Collected Along the Indiana Harbor Canal and Indiana Harbor

Constituent*	Harbor Reach		IHC (Between Conrail and Dickey Rd.)		
	Closest to Lake Michigan	Closest to Canal	IHC (Between Conrail and Dickey Road)	Midway on Grand Calumet Branch of IHC	Lake George Branch of IHC
Arsenic (μg/g)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (μg/g)	108.0	150.0	576.0	478.0	602.0
Iron (μg/g)	24,000	43,100	45,000	59,900	60,900
Lead (μg/g)	255.0	439.0	963.0	940.0	153.0
Manganese (μg/g)	978.0	1,118.0	996.0	1,207.0	1,207.0
Nickel (μg/g)	30.0	50.0	120.0	70.0	90.0
Zinc (μg/g)	930.0	1,920.0	4,280.0	3,250.0	4,120.0
Total PCBs (μg/g)	1.45	2.23	10.14	8.06	17.30

μg/g = microgram per gram.
*Expressed on a dry weight basis.

Source: U.S. EPA, 1991a

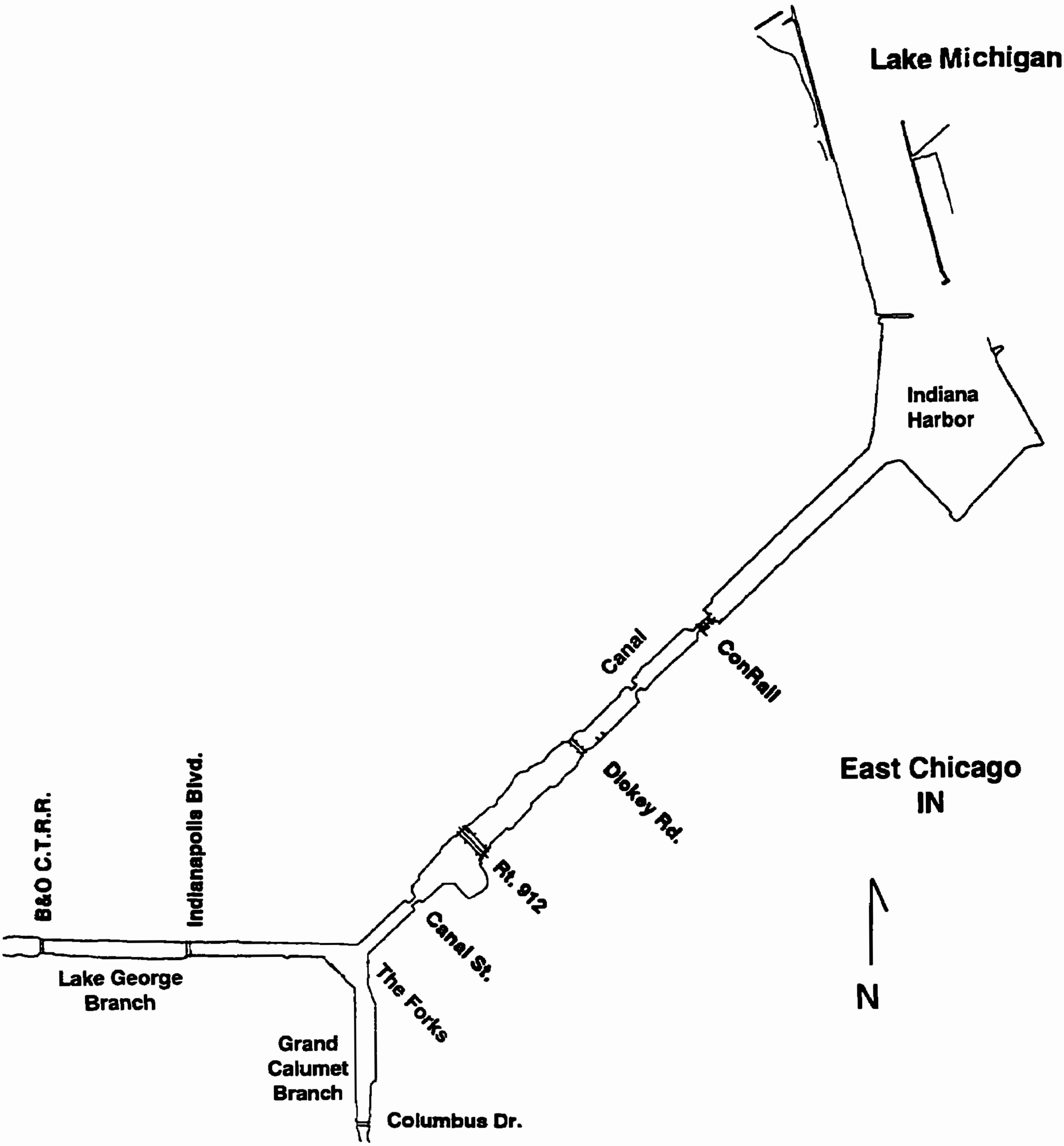


Figure 4-39. Indiana Harbor and Indiana Harbor Canal (Source: USEPA, 1996)

Table 4-60. Summary Statistics from Indiana Harbor Canal Including the Applicable Sediment Quality Criteria/Benchmarks

Chemical Parameter	Survey	Minimum	Median	Maximum	L&M ER-L	L&M ER-M	SEL
Arsenic (μg/g)	1	32	56	93	8.2	70	33
	2	N/A	N/A	N/A			
Cadmium (μg/g)	1	5 2	11.7	24 2	1.2	9.6	10
	2	0 0 PNQ	9.3	45			
Chromium (μg/g)	1	407	780	2,610	81	370	110
	2	3.4 LLS	345	1,800			
Copper (μg/g)	1	182	284	379	34	270	110
	2	4 5 LLS	275	880			
Iron (μg/g)	1	12 1	19.7	28 8	N/A	N/A	4
	2	N/A	N/A	N/A			
Lead (μg/g)	1	396	791	1,354	46 7	218	250
	2	1.5 LDL	695	3,700			
Manganese (μg/g)	1	1,674	2,420	2,280	N/A	N/A	1,100
	2	N/A	N/A	N/A			
Silver (μg/g)	1	0 023	4 67	7.08	1	3.7	N/A
	2	N/A	N/A	N/A			
Zinc (μg/g)	1	2,250	3,540	7,960	150	410	820
	2	20 LLS	3,150	10,000			
Anthracene (μg/g)	1	1,400	3,450	300,000	85.3	1,100	370 μg/g OC
	2	N/A	N/A	N/A			

Table 4-60. Summary Statistics from Indiana Harbor Canal Including the Applicable Sediment Quality Criteria/benchmarks (continued)

Chemical Parameter	Survey	Minimum	Median	Maximum	L&M ER-L	L&M ER-M	SEL
Benz(a)anthracene (μg/g)	1	4,200	11,650	39,000	261	1,600	1,480 μg/g OC
	2	N/A	N/A	N/A			
Benzo(a)pyrene (μg/g)	1	5,700	15,500	41,000	430	1,600	1,440 μg/g OC
	2	N/A	N/A	N/A			
Benzo(g,h,i)perylene (μg/g)	1	76	125	310	N/A	N/A	320
	2	N/A	N/A	N/A			
Benzo(k)fluoranthene (μg/g)	1	51	131	230	N/A	N/A	1,340
	2	N/A	N/A	N/A			
Chrysene (μg/g)	1	5,200	16,700	39,000	384	2,800	460 μg/g OC
	2	N/A	N/A	N/A			
Fluoranthene (μg/g)	1	4,800	11,800	120,000	600	5,100	1,020 μg/g OC
	2	N/A	N/A	N/A			
Fluorene (μg/g)	1	<61	3,200	61,000	19	540	160 μg/g OC
	2	N/A	N/A	N/A			
Indeno[1,2,3-cd]chrysene (μg/g)	1	58	95	220	N/A	N/A	320 μg/g OC
	2	N/A	N/A	N/A			
2-Methylnaphthalene (μg/g)	1	<31	2,600	42,000	70	670	N/A
	2	N/A	N/A	N/A			
Naphthalene (μg/g)	1	3,600	6,200	24,000	160	2,100	N/A
	2	N/A	N/A	N/A			

Table 4-60. Summary Statistics from Indiana Harbor Canal Including the Applicable Sediment Quality Criteria/benchmarks (continued)

Chemical Parameter	Survey	Minimum	Median	Maximum	L&M ER-L	L&M ER-M	SEL
Phenanthrene (μg/g)	1	3,400	11,450	270,000	240	1,500	950 μg/g OC
	2	N/A	N/A	N/A			
Pyrene (μg/g)	1	5,500	27,000	55,000	665	2,600	850 μg/g OC
	2	N/A	N/A	N/A			
Total PAH (μg/g)	1	67,971	304,045	941,340	4,022	44,792	10,000 μg/g OC
	2	N/A	N/A	N/A			
Total PCBs (μg/g)	1	4,000 PD	12,000 D	43,000 PD	22.7	180	530 μg/g OC
	2	N/A	N/A	N/A			

Source: U S EPA, 1996c.

(U.S. EPA, 1996c). Metal concentrations for all 10 parameters (cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc) sampled exceeded either the L&M effects ranges or Ontario's SELs, and all parameters could be considered to be contaminants of concern in both surficial as well as deeper sediments. Comparison of bulk sediment concentrations in the Indiana Harbor to L&Ms ER-M indicated that zinc and lead pose the highest potential risk for biota (U.S. EPA, 1996c).

Based on the L&M guidelines, this study found that the organic pollutants that pose the greatest risk in contaminated sediment in the Indiana Harbor area of concern (AOC) are total PCBs. On average, total PCB concentration was almost 90 times higher than the ER-M benchmark (U.S. EPA, 1993b). PAHs, such as anthracene and phenanthrene, had mean exceedances greater than 25 times the ER-M (U.S. EPA, 1996c). In general, U.S. EPA (1996c) found the highest concentration of organics were found at the fork of the Lake George Branch and in the IHC or by Indianapolis Boulevard in the Lake George Branch. When compared to Ontario's SELs, only two organics (anthracene and fluorene) exceeded the SEL at the fork of the Lake George Branch and the IHC.

4.3.2.2 *Indiana Harbor*

Indiana Harbor

Zinc, chromium, copper, lead, and manganese and zinc concentrations in IH exceeded the SEL. Mean fluorcne, phenanthrene, total PAHs, and PCB concentrations exceeded the L&M ER-M.

U.S. EPA (1993b) analyzed sediment samples from IHC and Indiana Harbor (Figure 4-40). Concentrations of metals in whole sediment samples from Indiana Harbor can be found in Table 4-61. This study found that samples from the fork of IHC had the highest concentrations of chromium, manganese, lead, and zinc. Maximum copper concentrations were found at the midway sampling point, which was on the IHC. Chromium concentrations ranged from 407 to 2,610 μg/g, with an average concentration of 1,070 μg/g. The measured levels were all above the L&M ER-M (370 μg/g) and the Ontario SEL (110 μg/g). Manganese concentrations ranged from 1,674 to 3,280 μg/g with an average concentration of 2,420 μg/g. The reported levels of manganese greatly exceeded the Ontario SEL of 1,100 μg/g. L&M benchmarks do not exist for manganese. Lead concentrations ranged from 415 to 1,354 μg/g, with an average concentration of 807 μg/g. The reported levels

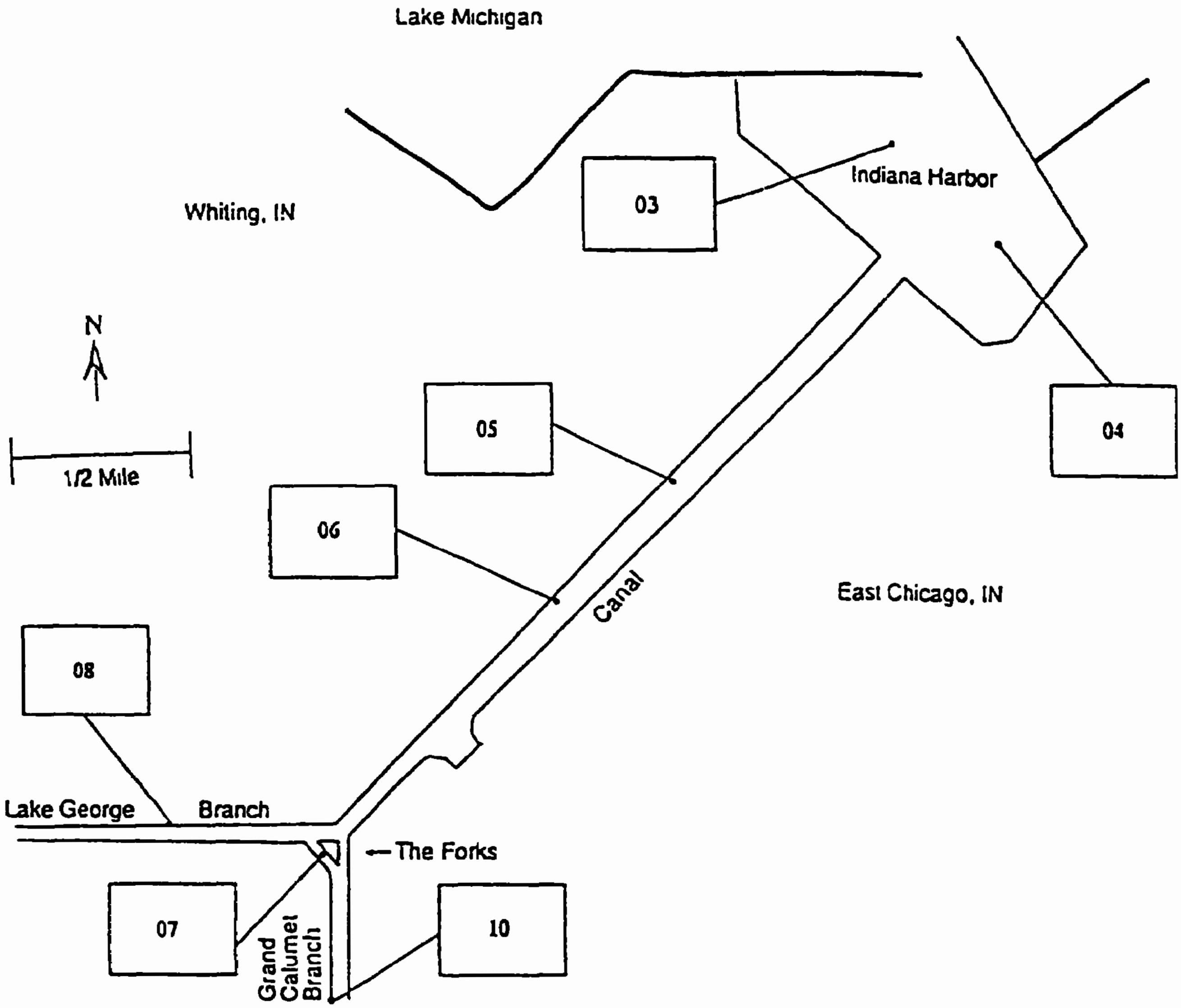


Figure 4-40. Sediment Sampling Stations in Indiana Harbor Canal and Indiana Harbor (Source: U.S. EPA, 1993)

Table 4-61. Concentrations of Metals in Whole Sediment Samples from Indiana Harbor, IN.

Sample	Metal Concentrations ($\mu g/g$)[1]											
	Ag	As	Cd	Cr	Cu	Fe (%)	Hg	Mn	Ni	Pb	Se	Zn
IH-01-03	0.2	60	9.1	572	226	19.7	0.9	2,420	50	589	2 6	3,250
IH-01-04	0 04	32	5 2	407	182	14 4	0.7	1,970	50	396	2 3	2,250
IH-01-05	0.02	45	10.4	580	219	23.4	0.9	2,740	<50	415	2.0	2,290
IH-01-06	6 0	52	11.7	1,132	379	7.9	1 9	2,410	103	878	3.8	4,460
IH-01-07	7 1	93	24.2	2,610	287	28.8	2.1	3,280	<58	1,354	3.1	7,960
IH-01-08	4.7	56	12 4	780	284	12.1	1.8	1,674	95	1,223	3.9	3,540
IH-01-10	5.2	63	18.4	1,412	354	21.4	1 8	2,450	88	791	3.3	4,080

[1] $\mu g/g$ = microgram per gram
< Indicates compound not detected at detection limit shown

Source: U S EPA, 1993b.

exceeded the L&M ER-M (218 μg/g) and the Ontario SEL (250 μg/g). Zinc concentrations ranged from 2,250-7,960 μg/g, with an average concentration of 3,976 μg/g. The reported levels greatly exceeded the L&M ER-M (410 μg/g) and Ontario SEL (820 μg/g). Copper concentrations ranged from 182 to 379 μg/g, with an average concentration of 276 μg/g. All reported levels exceeds the Ontario SEL (100 μg/g), and 70 percent of the reported measurements exceeded the L&M ER-M (270 μg/g). Total PAH compound concentration was 2,197 ng/g. Fluorene concentrations ranged from 790 to 12,000 ng/g with an average of 7,645 ng/g. These levels exceeded the L&M ER-M (540 ng/g) and fell below the Ontario SEL (160 μg/g). Phenanthrene concentrations ranged from 3,400 to 270,000 ng/g, with an average concentration of 38,414 ng/g. These levels exceeded the L&M ER-M (1,500 ng/g) and fell below the Ontario SEL (950 μg/g) (U.S. EPA, 1993b).

Sediments from Indiana Harbor contained PAH and semivolatile compound concentrations that ranged from less than 25 ng/g for dimethyl phthalate to 290,000 ng/g for 2-methylnaphthalene. Station IH-01-07 contained fluorene, phenanthrene, anthracene, fluoranthene, and pyrene (Table 4-62). Polychlorinated dibenzo-dioxins and -furans in the Indiana Harbor samples ranged from 3.8 picograms per gram (pg/g) for 1,2,3,7,8-pentachlorodibenzofuran to 43,000 pg/g for octachloro-dibenzodioxin. Anthracene concentrations ranged from 1,400 to 300,000 ng/g, with an average of 36,271 ng/g. These levels exceeded the L&M ER-M (1,100 ng/g) and fell below the Ontario SEL (370 μg/g) (U.S. EPA, 1993b).

PCBs concentrations in the sediment from Indiana Harbor for Aroclor 1242 ranged from 3,000 to 43,000 ng/g. Table 4-63 displays concentrations of dioxin and furans in sediment samples taken from Indiana Harbor. In addition, Aroclor 1254 was detected at one sampling site (1,000 ng/g). Pesticides in the Indiana Harbor sediments were below analytical detection limits (U.S. EPA, 1993b).

In an effort to confirm the quality of sediments in the outer harbor and entrance channel, the U.S. ACOE conducted sediment quality studies in 1984. Eighteen samples were collected from six sites from depths at and below authorized analysis depths. The results showed that the lakeward sediments contained low levels of nearly all parameters analyzed. Organic compounds, including PCBs, were not detected at routine detection limits (U.S. ACOE, 1986).

Table 4-62. Concentrations of Polynuclear Aromatic and Other Semivolatile Compounds in Whole Sediment Samples From Indiana Harbor, IN.

Sample	Polynuclear Aromatic Hydrocarbon[1]									
	1,4 DCB	Naph	2-M Naph	DMPh	DBF	Fluore	Phen	Anth	Fluora	Pyrene
IH-01-03	82	7300	2000	<68	2300	2400	7000	2400	8600	16000
IH-01-04	31	3600	930	<43	920	790	3400	1400	4800	5500
IH-01-05	45	6300	1200	<25	1200	1400	5100	2200	7200	10000
IH-01-06	380	8500	5400	<95	5700	3200	9900	3400	14000	40000
IH-01-07	125 (110-140)	4550 (4100-5000)	21015 (<31-42000)	<52 (<37-<68)	26530 (<61-53000)	30530 (<61-61000)	151500 (33000-270000)	215000 (130000-300000)	80000 (40000-120000)	46500 (38000-55000)
IH-01-08	160	6100	20000	<110	6900	12000	79000	26000	56000	43000
IH-01-10	930	24000	4200	<95	2400	3200	13000	3500	9600	16000
Sample	**BBPh**	**BaAnth**	**BisPh**	**Chrys**	**DnOPh**	**BbFluor**	**BkFluor**	**BaPyr**	**IndPyr**	**BghiPer**
IH-01-03	<160	7300	10000	8600	1900	7800	10000	10000	7300	9600
IH-01-04	<100	4200	4700	5200	4100	5600	4200	7000	5300	6300
IH-01-05	<58	5800	3800	7200	430	6300	5100	5700	6600	8800
IH-01-06	16000	16000	290000	26000	37000	24000	23000	25000	2000	28000
IH-01-07	<122 (<85-<160)	32000 (25000-39000)	7150 (5900-8400)	31500 (24000-39000)	<130 (<90-<170)	20500 (19000-22000)	13500 (12000-15000)	31000 (21000-41000)	10100 (9200-11000)	17500 (14000-21000)
IH-01-08	<240	30000	18000	33000	2600	26000	21000	29000	19000	31000
IH-01-10	<220	6900	15000	9400	<240	8900	9700	9200	5800	7600

[1] ng/g = nanogram per gram.
< Indicates that compound was not detected at detection limit shown
Ranges For Samples Analyzed in Replicate are Shown In Parentheses
Source U.S EPA, 1993b

Table 4-62. Concentrations of Polynuclear Aromatic and Other Semivolatile Compounds in Whole Sediment Samples From Indiana Harbor, IN. (continued)

Abbreviations

1,4 DCB	1,4-Dichlorobenzene
Naph	Naphthalene
2-M-Naph	2-methylnaphthalene
Acnaph	Acenapthene
DMPh	Dimethylphthalate
DBF	Dibenzofuran
Fluore	Fluorene
Phen	Phenanthrene
Anth	Anthracene
Fluora	Fluoranthene
Pyrene	Pyrene
BBPh	Butyl Benzyl Phthalate
BaAnth	Benzo(a)anthracene
BisPh	Bis(2-Ethylhexyl)Phthalate
Chrys	Chrysene
DnOPh	Di-n-octylphalate
BbFluor	Benzo(b)Fluoranthene
BkFluor	Benzo(k)Fluoranthene
BaPyr	Benzo(a)Pyrene
IndPyr	Indeno (1,2,3-cd)Pyrene
BghiPer	Benzo(g,h,i)perylene

Table 4-63. Concentrations of Dioxins and Furans Whole Sediment Samples from Indiana Harbor, IN.

Sample	Polychlorinated-dibenzo-dioxins or Polychlorinated-dibenzofurans												
	2378-TCDF	Total TCDF	2378-TCDD	Total TCDD	12378-PeCDF	23478-PeCDF	Total PeCDF	12378-PeCDD	Total PeCDD	123-478-HxCDF	123-678-HxCDF	123-789-HxCDF	234-678-HxCDF
IH-01-03	290	860	130	190	27	29	340	<52	ND	41	<66	32	<5.6
IH-01-04	27	400	ND	37	12	21	190	ND	22	16	12	10	ND
IH-01-05	11	170	ND	32	3 8	7.8	76	ND	35	15	6.8	5.2	ND
IH-01-06	600	3700	<59	490	56	120	1300	42	510	130	76	55	13
IH-01-07	610 (480-740)	3450 (2400-4500)	73 5 (<37-<110)	195 (160-230)	104 (28-<180)	106 (82-130)	1350 (1300-1400)	80 (<76-84)	1900	225 (210-240)	98 (86-110)	77.5 (56-<99)	85.5 (<31-<140)
IH-01-08	320	2200	<39	230	27	89	680	29	140	95	<45	32	<13
IH-01-10	310	1700	<18	110	30	68	720	20	66	86	43	30	<18

Table 4-63 Concentrations of Dioxins and Furans in Whole Sediment Samples from Indiana Harbor, IN. (continued)

Sample	Polychlorinated-dibenzo-dioxins or Polychlorinated-dibenzo-furans											
	Total HxCDF	123-478-HxCDD	123-678-HxCDD	123-789-HxCDD	Total HxCDD	1234-678-HpCDF	1234-789-HpCDF	Total HpCDF	1234-678-HpCDD	Total HpCDD	OCDF	OCDD
IH-01-03	700	53	73	97	950	<38	660	660	1400	3300	1600	6700
IH-01-04	250	13	23	14	350	180	ND	380	410	980	180	2300
IH-01-05	220	17	31	19	420	220	8.8	510	580	1200	250	2900
IH-01-06	1900	130	210	380	2500	1600	81	4200	5100	9300	6900	43000
IH-01-07	3600 (3500-3700)	390 (220-560)	420 (360-480)	660 (520-<800)	6800 (4600-9000)	3150 (3000-3300)	96 (72-120)	7700 (6600-8800)	10750 (6500-15000)	23000 (15000-31000)	17300 (2600-32000)	43500 (41000-46000)
IH-01-08	2100	<47	230	290	2600	340	700	8200	4700	5300	12000	25000
IH-01-10	920	32	99	260	1700	810	36	1500	1600	3100	2500	12000

pg/g = picogram per dry gram.
Ranges for samples analyzed in replicate are shown in parentheses.
< Indicates that compound was not detected at detection limit.
ND = Not detected.

Source U.S. EPA, 1993b.

Sediments of the outer harbor and entrance channel were found to contain elevated levels of PCBs, lead, copper, arsenic, chromium, and oil and grease. PCBs (Aroclor 1242) ranged from 0.31 to 17 μg/g, with only one sample exceeding 10 μg/g. Sixteen PAH compounds were detected at relatively low levels (0.004-13 μg/g). Chlorinated pesticides were not detected from the harbor sediments. The 1984 study confirmed EPA and U.S. ACOE studies that sediments closest to Lake Michigan are generally classified as nonpolluted, while those within the outer harbor and entrance channel being moderate to heavily polluted for nutrients and metals (U.S. ACOE, 1986).

4.3.2.3 *Indiana Harbor Canal*

> **Indiana Harbor Canal**
>
> The pollutant levels were found to be high from the upstream reach of the canal and lower towards the lakeward sites. Concentrations exceeding 1,800 μg/g for naphthalene were found in the turning basin and benzo(a)pyrene was reported at 50 μg/g. The mean total PAH concentrations were found to exceed the L&M ER-M. PCB concentrations exceeded the SEL.

During 1977 and 1980, 19 samples were collected in the IHC on two sampling occasions (U.S. ACOE, 1986). Sediments from the upstream project limits (Lake George Branch, Calumet River Branch, and turning basin) of IHC to the middle of the east breakwater consisted of black or dark brown oily silt with a petroleum odor and visible oil. Sediments lakeward of the east breakwater were composed of brown or gray sand and gravel. The bulk sediment concentrations compared to EPA Region 5 "Guidelines for the Pollution Classification of Great Lakes Harbor Sediments" indicated that all sampling sites, with the exception of the two closest to Lake Michigan, were heavily polluted with respect to nearly every parameter measured. The pollutant level of the sediments was generally high from the upstream reach of the canal. Samples from the two most lakeward sites contained moderate levels of zinc (150-160 μg/g), manganese (320 μg/g), and arsenic (4-9 μg/g); levels of other constituents were lower.

Elevated PCB levels, ranging from 5.6 to 15.7 μg/g, were found in the canal sediment. PCB Aroclor 1242 was the predominant isomer present. PCB concentrations also indicated a trend of declining concentrations lakeward through the canal. A wide variety of PAH compounds were present in sediments in the upstream reach of the canal, the turning basin, and the canal branches, with concentrations exceeding 1,800 μg/g for naphthalene. The greatest number of PAHs present in this study were found in the turning basin and branches, while the highest concentrations were reported from Canal Street sediments. A known carcinogen, benzo(a)pyrene, was reported from the Calumet River branch sediments at 50μg/g. Pesticide compounds were reported below detectable limits in the IHC sediments (U.S. ACOE, 1986).

A 1980 EPA sediment quality study sampled sediments from six sites: three in the upstream reach of the canal and three in the harbor (U.S. ACOE, 1986). Parameters analyzed included metals and organic compounds (PCBs and PAHs). High metal concentrations were reported from the sediments at each sampling site. Almost all metal concentrations were found to exceed the EPA sediment classification of heavily polluted. Sediments from the upstream portion of the canal (Lake George Branch) showed higher concentrations of metals than those of the outer harbor.

U.S. ACOE (1986) reported variable distribution of PCB concentrations (Aroclor 1242 and 1260) were found throughout the IHC. Total PCB levels ranged from below detectable limits to 89.2 μg/g, with most sampling sites showing concentrations exceeding the classification of polluted (≥10 μg/g). The only nonpolluted samples were from the Lake George Branch and the most lakeward sample (<0.02 - 2.25 μg/g), which were considered nonpolluted. The reach between the Pennsylvania (CONRAIL) and the Elgin, Joliet, and Eastern (EJ&E) railroad bridges (Figure 4-41) was found to contain the greatest PCB content in this study. PCB concentrations at these sites exceeded 50 μg/g in selected sediment strata. Sediment core sampling and analysis showed PCB concentrations to be highly variable by depth (Table 4-64); most sampling locations in the canal showed a decrease in PCB concentration from the deepest composite sample to the surface sample. Higher PCB concentrations were found with sediment depth at the two locations with PCB concentrations greater than 50 μg/g (U.S. ACOE, 1986).

The Calumet River Branch of the Canal, about midway between the turning basin and the upper limit of the Federal deep-draft navigation project, has also been found to be contaminated with PCBs. The conclusion reached is that PCB-contaminated sediments, especially those greater than 50 μg/g, are site-specific within the canal. Dredged materials with PCB concentrations of over 50 μg/g are subject to the requirements of the Toxic Substances Control Act (TSCA) (U.S. ACOE, 1986).

Table 4-64. Results of PCB Analysis of Indiana Harbor Canal Sediment Samples Collected in 1983

Sampling Location	Sample Depth (feet)	Total PCBs (μg/g)
Calumet River Branch	-17.9 to -19.9 -19.9 to -21.9 -21.9 to -23.9 -23.9 to -25.4	14.9 17.5 23.6 35.1
West side of Main Canal, between the Turning Basin and Dickey Road	-17.9 to -19.9 -19.9 to -21.9 -21.9 to -24.1	11.7 22.2/24.4 19.4
East side of Main Canal, between the Turning Basin and Dickey Road	-18.8 to -20.8 -20.8 to -22.8 -22.8 to -23.3	16.0 26.2 30.6
Same as above	-18.8 to -20.8 -20.8 to -22.8 -22.8 to -25.0	14.0 24.7 24.3
West side of Main Canal, between Canal Street and Dickey Road	-12.8 to 14.8 -14.8 to -16.8 -16.8 to -17.8 -17.8 to -18.8	14.3/18.5 15.4 26.9 <0.3
East side of Main Canal between Dickey Road and Conrail Bridge	-20.7 to -22.7 -22.7 to -23.9	18.1 22.5
West side of Main Canal between Dickey Road and Conrail Bridge	-21.1 to -23.1 -23.1 to -24.4	<0.3/<0.3 <0.3
East side of Main Canal between Conrail and EJ&E Bridges	-18.9 to -20.9 -20.9 to -22.9 -22.9 to -24.1	<0.3 6.4 9.3
West side of Main Canal between Conrail and EJ&E Bridges	-19.9 to -21.9 -21.9 to -23.9 -23.0 to -25.0	23.1 69.9 115.0

μg/g = micrograms per gram

Source: U.S ACOE, 1986.

In 1983, U.S. ACOE conducted sediment testing in the IHC to study the distribution of PCBs. Twenty-seven composite samples were taken from eight sampling locations in the canal. High PCBs levels were found, with concentrations ranging from <0.3 to 115 μg/g dry weight. Sediments from the north side of the IHC, between the CONRAIL and EJ&E railroad bridges, had PCB concentrations exceeding 50 μg/g. Samples from upstream, downstream, and the opposite side of the channel had lower concentrations. This led U.S. ACOE (1986) to conclude that this area has localized PCB contamination. Higher PCBs levels were also found in the deeper sediments (U.S. ACOE, 1986).

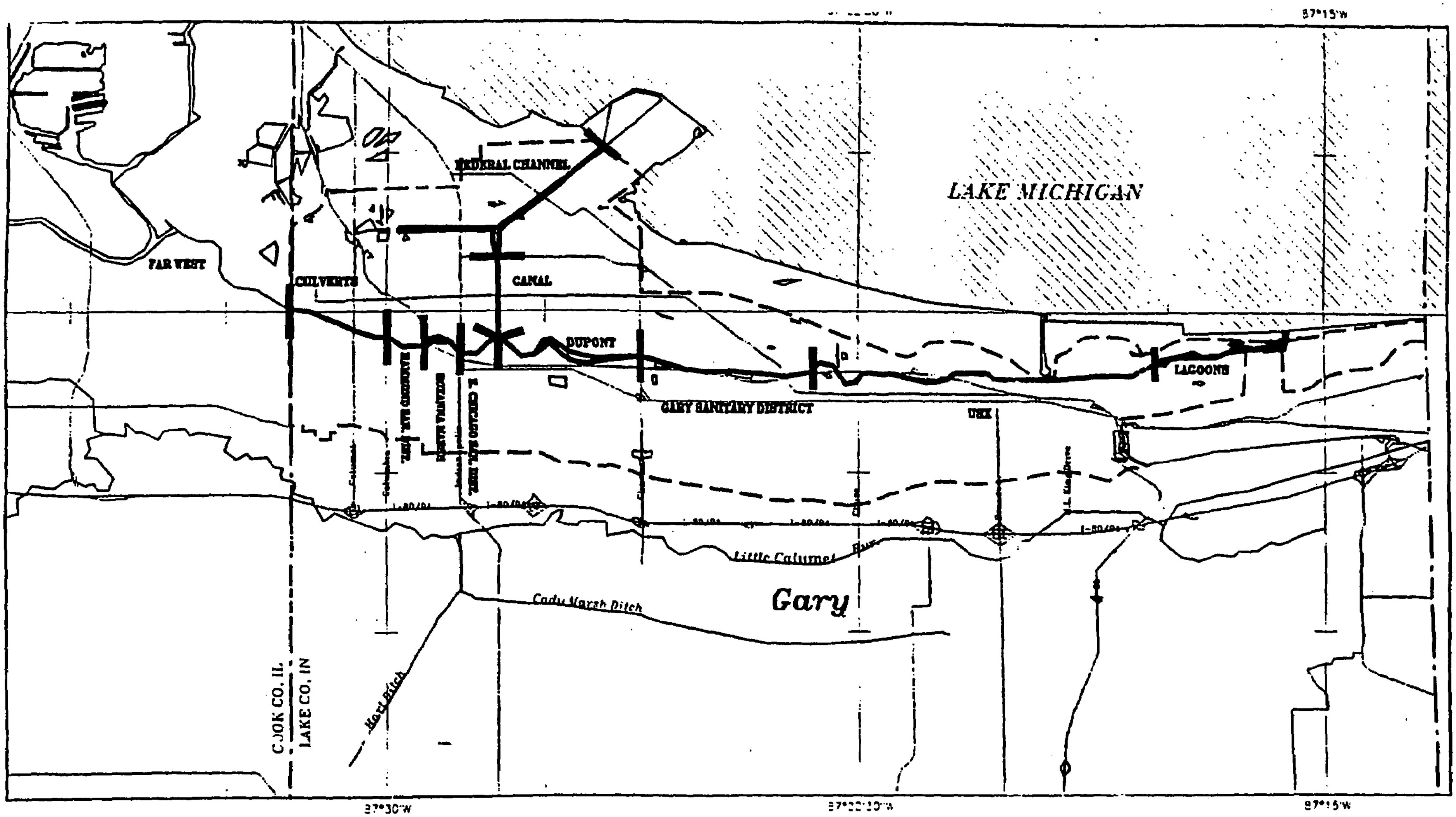
Total PAH concentrations from IHC displayed a range of 107 to 935 ppb (U.S. EPA, 1991a). The average total PAH concentration was 343 ppb, with the highest total PAH concentration found at site on Lake George branch of IHC. Total PAH concentrations range at the Indiana Harbor was reported at 24 to 134 ppb, and the concentration was 81.96 ppb. Total PAH concentration in Lake Michigan ranged from 0.91 to 13.45 ppb, with an average of 6.2 ppb. PCB concentrations in sediments from IHC ranged from 4 to 102 ppb. PCB concentrations in Indiana Harbor were below detection levels (U.S. EPA, 1991a).

Grand Calumet River

U.S. ACOE (1996) conducted a study of GCR/IHC, with the study area extending west from the Grand Calumet Lagoons to the Calumet River and north to the Indiana Harbor Canal. Figure 4-41 displays the study area with the 10 subdivisions employed. Tables 4-65 and 4-66 show pollutant concentrations in sediment samples from this study.

> **Grand Calumet River**
>
> Lead and zinc concentrations decreased by 65% between 1980 and 1984, but still exceed their respective SEL benchmark. In general, sampling points closest to the IHC exhibit higher pollutant concentration. One primary contaminant in the system is reported to be oil and grease. Total PCB concentration, benzo(b)fluoranthene, benzo(a)pyrene, and phenanthrene exceeded L&M's ER-M.

EPA (1991) presented data from the Water Division of EPA, Region 5 (1985) that ranked priority pollutant organics found in the Grand Calumet River sediments based on a comparison of sediment concentrations and EPA Water Quality



Source: USACE, 1996.

Figure 4-41. Grand Calument Sediment Remediation Plan: Study Reaches

Table 4-65. Pollutant Concentrations in Sediment Samples from the Grand Calumet River Lagoons

	East Lagoon		W. Lagoon Pond	West Lagoon		
Ammonia-Nitrogen	490	770	220	380	220	970
Antimony	--	--	60	--	--	--
Arsenic	100	75	36	87	39	110
Cadmium	--	--	18	--	--	--
Chromium	--	4.4	31	6.5	10	25
Chemical Oxygen Demand (g/kg)	33	--	50	52	31	130
Copper	14	--	2400	11	--	32
Lead	120	42	1300	39	32	77
Mercury	--	--	4	--	--	1.5
Nickel	--	--	23	--	--	--
pH (std. units)	7.4	7.5	7.3	7.6	7 5	7.4
Phenol	24	10	2.8	7.9	3 8	35
Phosphorus	170	56	54	38	95	55
Selenium	--	--	--	4 8	4.2	20
Total Kjeldahl Nitrogen	2800	3000	2700	2700	2300	4500
Total Organic Carbon (g/kg)	66.5	104	91 1	88 7	108	381
Total Hydrocarbons	55	20	2300	62	57	3400
Zinc	150	--	1200	00	00	380

(--) - Below Detection Limits)
All Units micrograms per gram ($\mu g/g$) parts per million (ppm) except as noted

Source. U.S ACOE, 1996

Table 4-66. Semivolatile Organic Contaminants Detected in Sediment Samples From the Grand Calumet Lagoon Area.

Compound	East Lagoon		W. Lagoon Pond	West Lagoon		
Acenaphthene	--	--	--	--	--	4,300
Anthracene	--	--	--	--	--	2,600
Benzo(a)anthracene	--	--	--	--	--	5,000
Benzo(b)fluoranthene	--	--	--	--	--	690
Benzo(k)fluoranthene	--	--	--	--	--	380
Benzo(a)pyrene	--	--	--	--	--	470
Chrysene	--	--	--	--	--	5,500
Dibenzofuran	--	--	--	--	--	3,900
Di-N-butyl phthalate*	--	5.5	10	10	--	--
Fluorene	--	--	--	--	--	6,600
Phenanthrene	--	--	--	--	--	18,000
Pyrene	--	--	--	--	--	4,800

All Units are migrograms per gram ($\mu g/g$) parts per million (ppm)

* = Sampling Artifact.

Source: U.S. ACOE, 1996

Criteria for the Protection of Aquatic Life. Aroclor 1248, naphthalene, fluorene, acenapthene, and phenol were the top five ranking pollutants based on acute toxicity. Based on chronic toxicity, arochlor 1248, aroclor 1254, bis(2-ethylhexyl)phthalate, phenol, and di-n-butyl phthalate were the five most toxic pollutants.

Table 4-67 presents concentrations of priority pollutants in sediments of the Grand Calumet River system. Total PCB concentration was 23.9 μg/g, which exceeded the L&Ms ER-M (180 ng/g). The total PAH concentration was 1,659.4 μg/g. Benzo(b)fluoranthene, benzo(a)pyrene, and phenanthrene were present at concentrations of 200 μg/g, above the L&Ms ER-M of 44,792 ng/g (U.S. EPA, 1991). Table 4-68 and Figure 4-42 compare metal concentrations in GCR sediment samples from 1980 and 1984. The trend of decreased concentrations can be seen, with the exception of chromium concentrations. Lead and zinc concentrations decreased 65 percent, but both concentrations still exceeded the Ontario SEL benchmarks of 250 μg/g and 820 μg/g, respectively.

Hoke et al. (1993) collected sediments at 10 GCR locations from October 1988 through May 1990. For all sampling sites, the sampling point that was closest to the Cook County, IL, border had the highest levels of organic chemicals. The greatest concentrations of metals (Table 4-69) were found in the GCR before the IHC (Hoke et al., 1993). A wide variety of organic chemicals and metals were present in the sediments from a number of sites in the GCR system of northwest Indiana. Hoke et al. (1993) reported that by simple visual inspection of the sediments, it was observed that one of the primary contaminants in the system was oil and grease. The concentrations of this broad category of petroleum hydrocarbons ranged from 1.6 to 13.5 percent on a sediment dry weight basis (Hoke et al., 1993).

4.3.3 Lake Michigan

Each year, over 180-million pounds of sediments enter Lake Michigan from the IHC and GCR (IDEM, 1991). This sediment contains 420 pounds of PCBs, 2,300 pounds of cadmium, and 110,000 pounds of lead

Lake Michigan

420 pounds of PCBs, 2,300 pounds of cadmium, and 110,000 pounds of lead enter Lake Michigan from GCR/IHC. Concentrations of cadmium, lead, and zinc in Indiana Harbor sediments were 200, 80, and 80 times those in Lake Michigan. Mean PCB concentrations in Lake Michigan were below the L&M ERM.

Table 4-67. Concentrations of Priority Pollutants in Sediments of the Grand Calumet River System

Pollutant	Sediment Concentration (μg/g)
PCBs	
Aroclor 1248	17
Aroclor 1254	6.9
Monocyclic aromatic chemicals	
1,2-Dichlorobenzene	0.04
1,4-Dichlorobenzene	0.14
Phthalate esters	
Di-N-octyl phthalate	47
Bis(2-ethylhexyl)phthalate	26.0
Butyl benzyl phthalate	0.6
Di-N-butyl phthalate	0.8
PAHs	
Acenaphthene	100.0
Acenaphthylene	27.0
Anthracene	170.0
Benzo(a)anthracene	140.0
Benzo(b)fluoranthene	200.0
Benzo(k)fluoranthene	120.0
Benzo(g,h,i)perylene	38.0
Benzo(a)pyrene	200.0
Chrysene	130.0
Dibenzo(a,h)anthracene	11.0
Fluoranthene	120.0
Fluorene	98.0
Indeno(1,2,3-cd)pyrene	6.8
Naphthalene	33.0
Phenanthrene	200.6
Pyrene	65.0

μg/g = microgram per gram

Source U S. EPA, 1991a

Table 4-68. Comparison of Metal Concentrations from the GCR Sediment Samples During 1980 and 1984

	Concentrations (μg/g)	
Metal	**January 1984**	**October 1980**
Mercury (Hg)	0.68	0.73
Cadmium (Cd)	7	8
Arsenic (As)	18	27
Nickel (Ni)	140	98
Copper (Cu)	214	182
Chromium (Cr)	561	408
Lead (Pb)	414	1192
Zinc (Zn)	955	2687

μg/g = microgram per gram.

Source: U.S. EPA, 1991a.

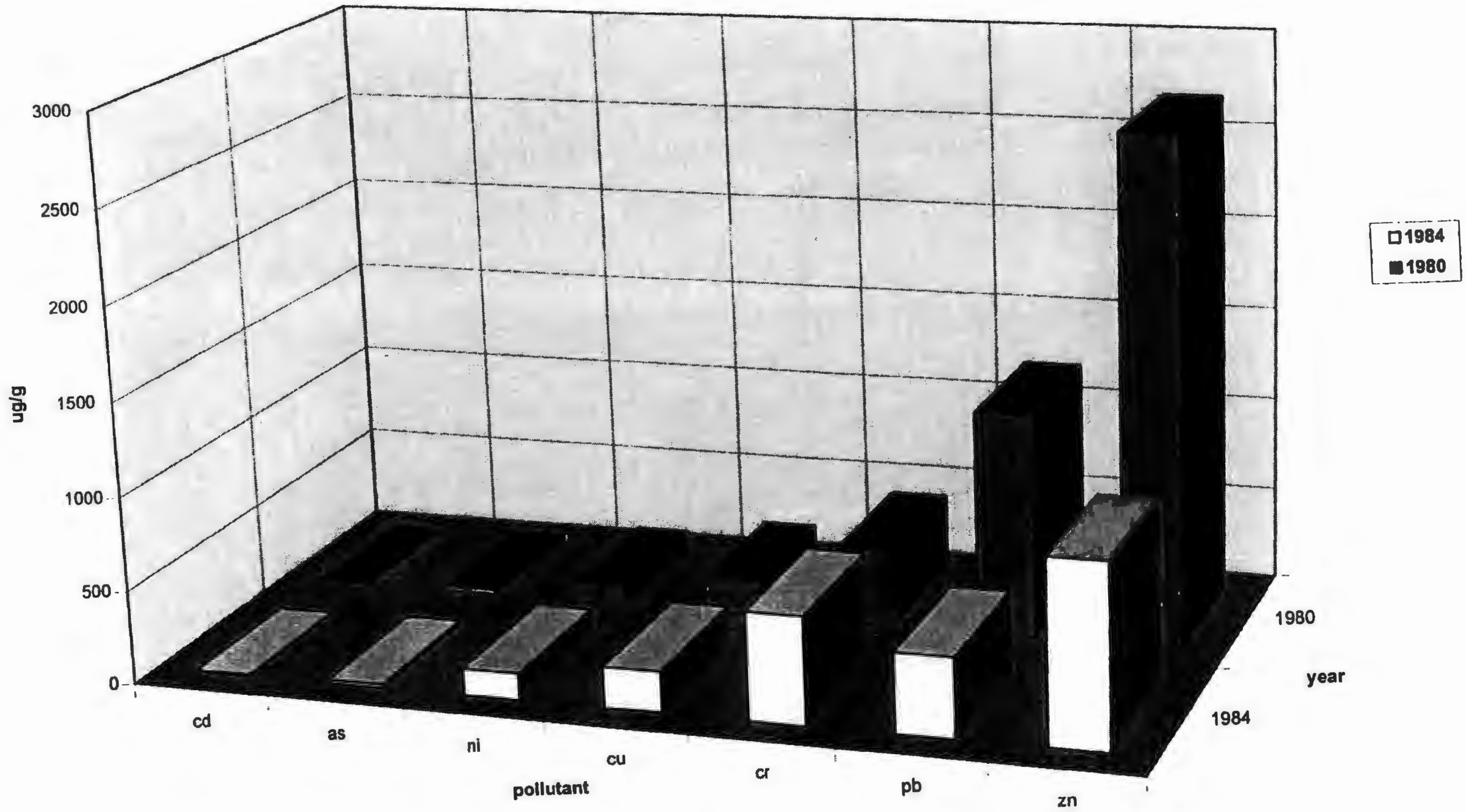


Figure 4-42. Comparison of Mean Metal Concentrations from the Grand Calumet River from 1980 and 1984 Sediment Samples

Table 4-69. Concentrations of Metals in Sediments From the Grand Calumet River, Indiana

Parameter	UG-1 µg/g	UG-2 µg/g	UG-3 µg/g	UG-4 µg/g	UG-5 µg/g	UG-6 µg/g	UG-7 µg/g	UG-8 µg/g	UG-9 µg/g	UG-10 µg/g
Cadmium	0.010	0.079	0.032	0.042	0.012	0.069	0.049	0.089	0.052	0.018
Chromium	0 009	0.327	0.393	0.344	0.438	0.923	0.814	1.225	0.904	0.097
Copper	0.007	0.226	0.153	0.099	0.242	0 241	0.271	0.387	0 544	0.257
Lead	0.017	0.912	0.403	0.538	0.803	1.526	1.815	3.940	1.916	1.306
Nickel	0.030	0.047	0.188	0.391	0.166	0.033	0.160	0.337	0.361	0.055
Zinc	0.108	2.834	0.069	1.542	0.218	0.486	5.230	0.793	0.450	0.125
Manganese	0.051	3.896	0.982	1.492	2.234	3.261	2.585	2.419	1.679	0.614
Magnesium	2.506	3.616	1.648	3.242	6.532	3.831	2.695	5.268	4.930	7.239
Iron	1.71	19.19	17.15	21.65	9.52	17.68	27.10	6.33	6.94	2.31

µg/g = microgram per gram

Source· Hoke et al., 1993.

that are transported to the lake. According to the U.S. Army Corps of Engineers (1986), PCBs are the contaminant of most concern in Indiana Harbor sediments. Approximately 190 kg of PCBs, 1,000 kg of cadmium, and 50,000 kg of lead are transported to Lake Michigan annually along with approximately 8 x 10^7 kg of sediment from the harbor and canal (U.S. EPA, 1994a).

U.S. ACOE (1986) reported results from bulk analyses of surface sediment samples from Indiana Harbor in 1977. Sediments throughout the canal were found to be heavily polluted, with the exception of two sites closest to Lake Michigan. Sediments at the harbor mouth and entrance had lower concentrations than the canal and branches, and were generally categorized as nonpolluted to moderately polluted. Arsenic (5-13 μg/g), copper (29 μg/g), manganese (29 μg/g), and zinc (118-135 μg/g) were found in the moderately polluted levels. As in other bulk analyses studies, the more heavily polluted sediments were found in the upstream portion of the IHC.

Table 4-70 displays the levels of contamination in Indiana Harbor and Lake Michigan sediment (U.S. ACOE, 1986; U.S. EPA, 1991a). Sediments in the harbor area are much more contaminated than in Lake Michigan (U.S. EPA, 1994a). Concentrations of cadmium, lead, and zinc in Indiana Harbor sediments were nearly 200, 80, and 80 times, respectively, than those in Lake Michigan sediments. Organic chemical concentrations ranged from more than 30 times for aroclor 1248 to several orders of magnitude higher for aldrin in Indiana Harbor sediments (U.S. EPA, 1994a).

EPA (1991a) presented data on PCB concentrations in sediments from Indiana Harbor and adjacent Lake Michigan. PCB concentrations in the IHC ranged from 4.55 to 102.52 ppb. The average concentration was 59 ppb. PCB concentrations in the Indiana Harbor were below detection limits, and PCB concentrations in Lake Michigan ranged from 17.69 to 494.60 ppb. The average concentration was 131 ppb. It should be noted that the sediment sampling sites in Lake Michigan were located close to the shoreline.

Table 4-70. Comparison of Chemical Composition of Indiana Harbor and Lake Michigan Sediments

Parameter	Concentration in Sediment, μg/g Dry Weight	
	Indiana Harbor	Lake Michigan
Metals		
Arsenic	29.5	10.1
Cadmium	20 0	0 1
Chromium	650.0	4.4
Lead	879.0	11.9
Mercury	0 5	BD*
Zinc	4,125.0	54.1
Pesticides		
Aldrin	2.55	0 0006
PAHs		
Acenaphthene	96	BD
Acenaphthylene	22	BD
Anthracene	62	BD
Benzo(a)anthracene	86	BD
Benzo(b)fluoranthene	140	BD
Benzo(a)pyrene	87	BD
Benzo(g, h, I)perylene	35	BD
Chrysene	92	BD
Fluoranthene	150	BD
Fluorene	69	BD
Indeno(1,2,3-c d)pyrene	50	BE
Naphthalene	2,000	0.46
Phenanthrene	200	BD
Pyrene	140	BD
PCBs		
PCB-1248	33.4	BD
PCB-1254	BD	0.013

BD = Below Detection
μg/g = microgram per gram.

Source: U.S. EPA, 1991a.

4.4 FISH TISSUE

> **Fish Tissue**
>
> - Potentially Major Source of Human Exposure to PCBs, Pesticides, and Other Chemicals
> - Elevated Levels of Metals, PCBs, Pesticides, and Other Chemicals
> - Levels of Some Chemicals Are Increasing
> - Fish Consumption Advisories in Several Waterbodies in the Study Area

This section describes levels of contaminants found in fish tissue from monitoring conducted in the waterbodies of Cook County, IL, and Lake County, IN. Fish tissue analysis is very important because studies conducted in the Great Lakes basin have shown that 80-90 percent of human exposure to organochlorine compounds, such as PCBs and pesticides, come from the food supply (Hicks, 1996). EPA (1994a) indicated that one "primary" route of exposure to sediment-derived contaminants comes from consumption of contaminated fish. The average person in the United States eats 6.6 grams of fish per day; recreational anglers can consume more (U.S. EPA, 1997a). Included in this subsection are descriptions of the potential exposures from consumption of fish from waterbodies in this area, especially for recreational/sport anglers. Also characterized are the types and levels of contaminants identified in fish tissues sampled in streams, rivers, and lakes in Cook County, IL, and Lake County, IN.

The Consortium for the Health Assessment of Great Lakes Fish Consumption (1996) compared blood serum levels of PCBs and dichlorodiphenyldichloroethene (DDE) between sport fish consumers and individuals who do not eat or eat very little (Comparison Group) Great Lakes fish (Falk, 1997). The ongoing study was conducted with residents from Illinois, Indiana, Michigan, Ohio, and Wisconsin. Mean blood serum levels of PCBs and DDE for sport fish consumers were 4.67 and 5.37 ppb, respectively. The comparison group's mean levels were 1.18 and 2.87 ppb, showing a difference of 4 times and 2 times for PCBs and DDE, respectively. Results from this study for residents in area codes 219, 312, and 708 were obtained to examine increased exposure from fish consumption (Falk, 1997). These results were only for sport fish consumers. Indiana, area code 219, men showed mean PCB and DDE serum levels of 3.1 and 5.6 ppb, while women showed mean levels of 2.3 and 2.6 ppb, respectively. For Illinois area codes 312 and 708, men's mean PCB and DDE serum levels were 7.4 and 6.2, while the women's levels were 2.3 and 3.2, respectively (Falk, 1997). No explanation was given for the gender differences. Consumption patterns for the two genders appear to be very similar.

4.4.1 Study Area

Fish tissue monitoring data were obtained from both Illinois and Indiana. Data for Illinois were obtained from STORET, and data for Indiana were obtained from IDEM (Stahl, 1997). Cook County, IL, data included 21 different waterbodies for the years 1985 thru 1995. The STORET data did not indicate the species of fish or type of sample (whole or fillet). Lake County, IN, data included 17 sites from 8 different waterbodies from 1984 to 1994. The largest number of samples were obtained from the Indiana Harbor Canal, Grand Calumet River, and Kankakee River. Carp was the most commonly sampled species was Carp. Types of samples included whole fish, skin-on fillets, and skin-off fillets. Table 4-71 shows the waterbodies sampled, the number of sampling stations on each waterbody, and the number of chemicals positively detected in fish tissue within each waterbody.

4.4.2 Chemicals Monitored in Fish Tissue

Both Illinois and Indiana regularly test fish tissue for a wide range of chemicals, such as metals, organochlorine pesticides, PCBs, and other contaminants. Illinois regularly performs 20 pesticide/PCB analyses on all samples (IEPA, 1994). Gas chromatography/mass spectrometry analyses are also performed to test for volatile and semi-volatile organics. Dioxins and mercury may also be tested when needed (IEPA, 1994).

Indiana tests for 23 metals, 30 pesticides/PCBs, and 99 other organic chemicals including volatile and semi-volatile compounds and PAHs (Stahl, 1997). Several metals were analyzed but were not considered for this study because they are normally thought to be human nutrients (calcium, iron, potassium, and sodium) (Stahl, 1997). All reported PCB results are for total PCBs.

Table 4-71. Fish Tissue Sampling Sites

Waterbody	No. of Sampling Sites	No. of Chemicals Detected
Lake Calumet, IL	1	8
Lake George, IL	1	5
Lake Michigan, IL	1	10
Wolf Lake, IL	1	2
Columbus Park Lagoon, IL	1	2
Douglas Park Lagoon, IL	1	5
Garfield Park Lagoon, IL	1	2
Humbolt Park Lagoon, IL	1	4
Lincoln Park South Lagoon, IL	1	5
Marquette Park Lagoon, IL	1	5
McKinley Park Lagoon, IL	1	5
Sherman Park Lagoon, IL	1	4
Washington Park Lagoon, IL	1	4
Cal-Sag Channel, IL	1	4
North Shore Channel, IL	1	14
Chicago San & Ship Canal, IL	1	5
Calumet River, IL	1	5
Des Planes River, IL	1	5
Lake Calumet River, IL	1	5
North Branch Chicago River, IL	1	5
Salt Creek, IL	1	7
Cedar Lake, IN	1	21
Lake George, IN	3	32
Wolf Lake, IN	3	13
Marquette Park Lagoon, IN	3	22
Indiana Harbor Canal, IN	1	58
Grand Calumet River, IN	4	46
Kankakee River, IN	1	33
Little Calumet River, IN	1	5

Source STORET, 1997

4.4.3 Fish Tissue Analyses Results

> **Chemicals in Fish Tissue**
>
> - 77 Chemicals Detected in Waterbodies From 1984-1995
> - Most Frequently Detected Chemicals Included:
>   - DDT (and analogs)
>   - PCBs
>   - Chlordane
>   - Dieldrin
>   - Lead
>   - Mercury
>   - Zinc
> - Highest Concentrations of Chemicals Most Often Found in GCR/IHSC

The results are reported for only those chemicals that could be clearly identified by the analyst. Chemicals with unresolved peaks, possible contaminated blanks, or any other reported analysis problems were not considered to be detected. Fish tissues from waterbodies in Cook County, IL, and Lake County, IN, (including Lake Michigan) showed 77 individual compounds, including isomers of some chemicals. The most commonly reported chemicals were DDT and its analogs, PCBs, chlordane, and dieldrin. Lead, mercury, and zinc were the most commonly reported metals. Table 4-71 illustrates that the Indiana Harbor Canal, Grand Calumet River, Kankakee River, and Lake George had the highest numbers of chemicals detected. The North Shore Channel and Lake Michigan were the two waterbodies in Illinois from which the most detected chemicals were reported. The higher number of detected chemicals in Indiana waters may be attributed to the fact that they regularly test for more chemicals. (See Section 4.4.2.)

When a chemical appeared in two or more waterbodies, the waterbody with highest level of that chemical was noted. Table 4-72 shows that 53 chemicals were detected in two or more waterbodies. This table also gives the concentration ranges and means of chemicals detected in the waterbodies. It also shows which waterbody contained the highest level of each chemical and the year the highest level was detected. Twelve organic chemicals, including pesticides and PCBs, were reported at levels above 1 ppm, and PCBs, detected at 27 ppm, were the highest recorded organic chemical. Nineteen metals were discovered in fish tissue; 10 were detected at, or above, 1 ppm, and magnesium, detected at 610 ppm, was the highest recorded metal. Nine chemicals had concentration means above 1 ppm; seven of the nine were metals, including lead, which had a mean concentration

Table 4-72. Chemicals Detected in Fish Tissue in Two or More Locations

Chemical	Concentration Range mg/kg	Concentration Mean mg/kg	Location of Maximum Concentration	Maximum Concentration Year
1,1,1-Trichloroethane	ND-0 022	0 01	Wolf Lake, IN	86
2-Butanone	ND-0 41	0 0709	Wolf Lake, IN	86
2-Methylnaphthalene	ND-5 2	0 6563	Grand Calumet River, IN	86
Acenaphthene	ND-4 3	0 6544	Grand Calumet River, IN	86
Acenaphthylene	ND-2 8	1 3167	Kankakee River, IN	94
Aldrin	ND-0 22	0 0619	Indiana Harbor Canal, IN	90
Aluminum	ND-122	38 2	Grand Calumet River, IN	87
Anthracene	ND-0 059	0 0193	Indiana Harbor Canal, IN	94
Arsenic	ND-0 25	0 0804	Lake George, IN	86
Benzene	ND-0 12	0 0133	Grand Calumet River, IN	86
alpha-BHC	ND-0 053	0 0052	Lake Michigan, IL	85-87
gamma-BHC	ND-0 013	0 0033	Grand Calumet River, IN	94
Cadmium	0 01-0 039	0 0211	Kankakee River, IN	86
Carbon Disulfide	ND-0 068	0 0125	Wolf Lake, IN	86
Chlordane[1]	ND-0 58	0 0584	Lake Michigan, IL	86
Chromium	ND-1 8	0 4656	Cedar Lake, IN	87
Chrysene	ND-0.068	0.0465	Kankakee River, IN	90
Copper	ND-6 55	1 435	Indiana Harbor Canal, IN	90

Table 4-72. Chemicals Detected in Fish Tissue in Two or More Locations (continued)

Chemical	Concentration Range mg/kg	Concentration Mean mg/kg	Location of Maximum Concentration	Maximum Concentration Year
DDT (total)[2]	0 02-31	0 3848	Lake Michigan, IL	86-95
DDD[3]	ND-0 46	0 0649	Grand Calumet River, IN	86
DDE[3]	ND-2 6	0 1873	Grand Calumet River, IN	86
DDT[3]	ND-0 221	0 0207	Grand Calumet River, IN	86
Dibenzofuran	ND-1 7	0 52	Grand Calumet River, IN	86
Dieldrin	ND-0 4	0 053	Douglas Park Lagoon, IL	86
Endrin	ND-0.041	0 0193	Grand Calumet River, In	86
Ethylbenzene	ND-0 064	0 0163	Indiana Harbor Canal, IN	86
Fluoranthene	0 015-0 21	0 0613	Indiana Harbor Canal, IN	94
Fluorene	ND-1 41	0 2346	Indiana Harbor Canal, IN	92
Heptachlor	ND-0 013	0 0075	Indiana Harbor Canal, IN	92
Heptachlorepoxide	ND-0 051	0.0168	North Branch Chicago River, IL	85
Hexachlorobenzene	ND-0 02	0 0056	Lake Calumet, IL	90
Lead	ND-8 9	1 3994	Grand Calumet River, IN	87
Magnesium	162-610	342	Kankakee River, IN	86
Manganese	ND-35 1	6 54	Lake George, IN	86
Mercury	ND-1 4	0 1257	Sherman Park Lagoon, IL	88-90
Methoxychlor	0 018-0 05	0 034	North Shore Channel, IL	85
Mirex	0 01-0 02	0 015	Lake Michigan, IL	90

Table 4-72. Chemicals Detected in Fish Tissue in Two or More Locations (continued)

Chemical	Concentration Range mg/kg	Concentration Mean mg/kg	Location of Maximum Concentration	Maximum Concentration Year
Nickel	ND-5 9	1 8	Lake George, IN	86
cis-Nonachlor	ND-0 057	0 0154	Grand Calumet River, IN	86
trans-Nonachlor	ND-0 1	0 0277	Kankakee River, IN	84
Oxychlordane	ND-0 027	0 0114	Grand Calumet River, IN	86
PCBs	0 002-27 0	1.7553	Grand Calumet River, IN	94
Pentachloroanisole	ND-0 018	0 0053	Grand Calumet River, IN	84
Phenanthrene	ND-0 76	0 1599	Indiana Harbor Canal, IN	92
Pyrene	0.014-0 16	0 0531	Indiana Harbor Canal, IN	94
Selenium	ND-2 0	0 7222	Indiana Harbor Canal, IN	86
Silver	ND-1 8	0 5667	Lake George, IN	86
Tetrachloroethylene	ND-0 099	0 0229	Lake George, IN	86
Toluene	0 016-0 037	0 0265	Grand Calumet River, IN	87
Trichloroethylene (total)	ND-0 048	0 0177	Lake George, IN	86
Trichloromethane	ND-1.1	0 08	Lake George, IN	86
Xylene (total)	0 048-0 25	0 1274	Indiana Harbor Canal, IN	86
Zinc	6 1-122	38 2	Grand Calumet River, IN	87

[1] Illinois and Indiana reported chlordane as "alpha-chlordane," "chlordane," and "gamma-chlordane" The values here are all three reported values

[2] Illinois only reported DDT as total DDT The FDA action level for DDT is for total DDT (5 ppm) Total DDT is all the isomers of DDT and its metabolites DDD and DDE

[3] Indiana reported DDT and its metabolites as separate isomers The values here are combined isomer values The total DDT value for Indiana never exceeded the FDA action level

Source STORET, 1997

of 1.4 ppm. PCBs and acenaphthylene had mean concentrations of 1.8 and 1.3 ppm, respectively. None of the pesticides had mean concentrations above 1 ppm. The highest mean concentration for any of the pesticides was DDT (total) at 0.38 ppm. DDT (total) and DDE were the only pesticides reported with concentrations above 1 ppm; the highest levels were reported as 31 and 2.6 ppm, respectively.

Of the chemicals detected, 70 percent had their highest concentrations between the years 1984-1987. PCBs had their highest concentrations in 1994. Indiana performed a trend analysis for Kankakee River and Indiana Harbor Canal for four chemicals between 1979 and 1994 (IDEM, 1994b). On the Kankakee River, all four chemicals (total DDT, dieldrin, total PCB, and total chlordane) showed decreasing levels between 1979 and 1994. The Indiana Harbor Canal, on the other hand, showed increasing levels of total DDT, dieldrin, and total PCBs over this time period. Only total chlordane showed decreasing levels. Figure 4-43 shows trends for two chemicals in the Indiana Harbor Canal (IDEM, 1994b).

Dioxins and furans are not regularly analyzed for in fish tissue, but some studies have been conducted. One such study (U.S. EPA, 1994a) was conducted in 1987 on the Indiana Harbor Canal. The results showed a dioxin toxic equivalence (TEQ) concentration of 15.16 picograms per gram (pg/g). Of the TEQ for dioxins and furans, 78 percent of the TEQ were attributed to 2,3,7,8-TCDF; 2,3,7,8-TCDD; and 1,2,3,7,8-PeCDD. These are the three most toxic dioxin/furan congeners (U.S. EPA, 1989b).

Illinois sampled fish in Lake Calumet in 1983 (IEPA, 1986) and in 1990 (STORET, 1997). Six chemicals (chlordane, total DDT, dieldrin, heptachlor epoxide, hexachlorobenzene, and PCBs) were detected in both time periods. All six chemicals showed increasing levels between 1983 and 1990. The most notable change was for chlordane; in 1983, the concentration was well below the U.S. Food and Drug Administration (FDA) action level. (See Section 4.4.4.) In 1990, the concentration, 0.358 ppm, exceeded the action level of 0.3 ppm.

Nine chemicals (chlordane, DDT, dieldrin, endrin, gamma-BHC, heptachlorepoxide, mercury, methoxychlor, and PCBs) were found in both Illinois and Indiana. In Indiana, endrin, gamma-BHC, and PCBs were reported at their highest levels at the Grand Calumet River. Seven

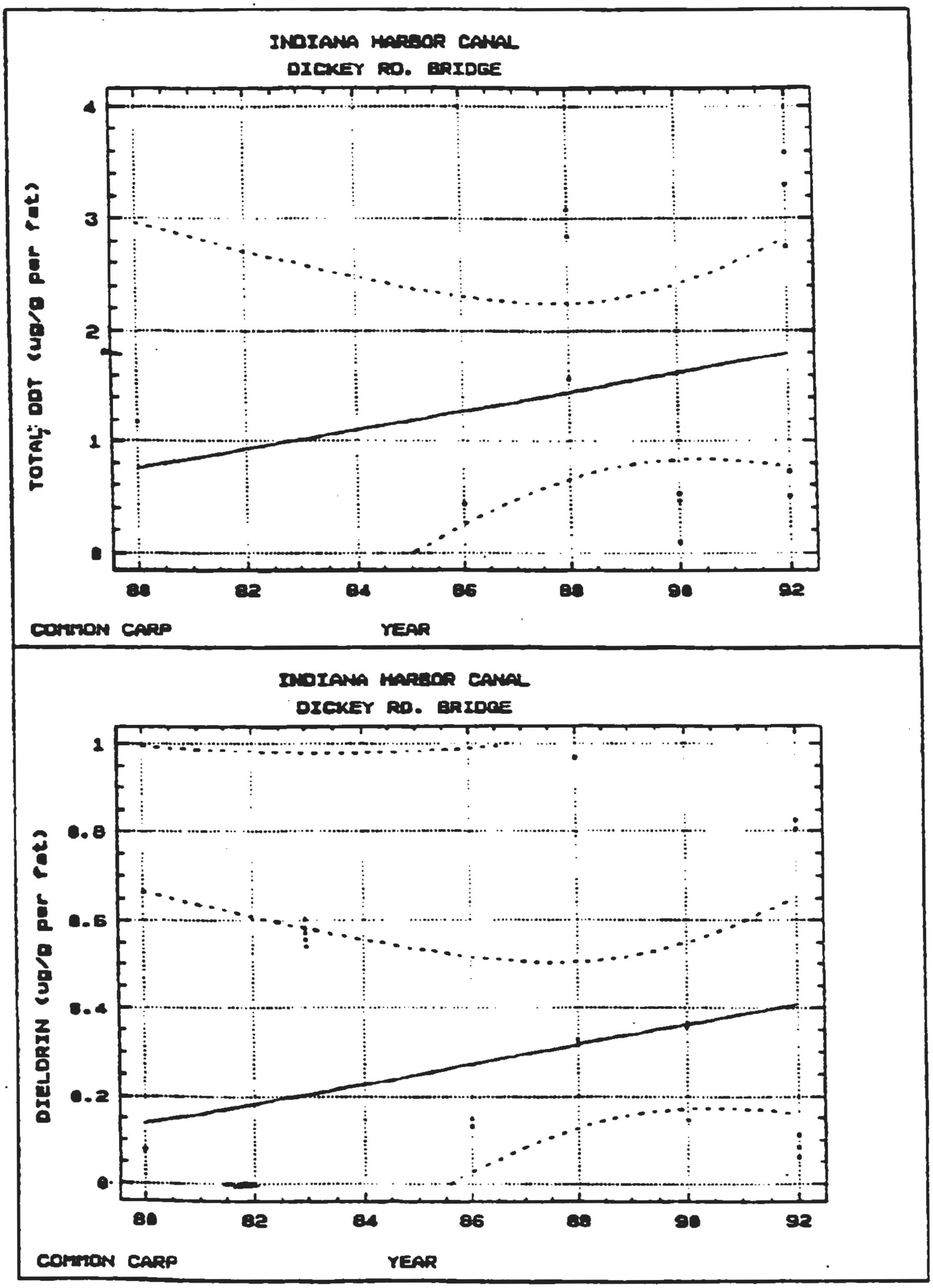


Figure 4-43. Trends in Levels of DDT and Dieldrin in Carp from the Indiana Harbor Canal (1980 - 1992)

Source: IDEM, 1994b.

of these chemicals had their highest levels reported in Illinois. The seven chemicals reported at their highest levels were found at six different Illinois locations.

Table 4-73 summarizes which waterbodies had the highest detected levels of chemicals, and the types of chemicals in these waterbodies. The waterbody showing the most number of chemicals at their highest levels (17) was the Grand Calumet River in Indiana. The Indiana Harbor Canal had the second highest number with 11 chemicals, Lake George had 7 chemicals at their hightest levels, and the Kankakee River in Indiana had 5 chemicals at their highest levels. Seven waterbodies had fewer than four chemicals detected at their highest values. Organics, excluding pesticides, and metals appeared to predominate in Indiana. Caution should be used in interpreting these data, because Indiana tests for more metals and organics than does Illinois.

4.4.4 Potential Effects of Fish Tissue Contamination

FDA publishes action levels for chemicals in various media including fish tissue DHHS, 1994. These action levels can be used as a general benchmark; however, they do not directly indicate the risks associated with consuming fish containing these chemicals. Five chemicals (chlordane, DDT, dieldrin, mercury, and PCBs) exceeded these actions levels on at least one occasion, with PCBs exceeding the FDA action level 29 times. Both chlordane and dieldrin exceeded the FDA action levels four times. The highest PCB level was reported at 27 ppm in the Grand Calumet River. PCBs were the only chemicals that exceeded the action level in both Illinois and Indiana; the other four chemicals exceeded the action levels only in Illinois. FDA action levels are developed only for single chemical exposures; they do not take into account exposure to multiple chemicals. The fish tissue data indicate that consuming even one fish exposes an individual to multiple chemicals. The effects of multiple chemical exposure are not clearly understood at this time. Even though lead does not have an FDA action level, a great deal of concern exists about lead,

FDA Fish Tissue Action Levels

- Five Chemicals Were Detected Above FDA Action Levels
- PCBs Exceeded the FDA Action Level in 29 Fish Samples in Illinois and Indiana
- Chlordane, DDT, Dieldrin, and Mercury Exceeded the FDA Action Levels in Illinois

Table 4-73. Waterbodies with Highest Levels of Chemicals in Fish Tissue

Waterbody	No. of Metals	No. of Organics	No. of Pesticides	Total
Douglas Park Lagoon, IL	-	-	1	1
Lake Calumet, IL	-	-	1	1
Lake Michigan, IL	-	-	4	4
North Branch Chicago River, IL	-	-	1	1
North Shore Channel, IL	-	-	1	1
Sherman Park Lagoon, IL	1	-	-	1
Cedar Lake, IN	1	-	-	1
Grand Calumet River, IN	3	6	8	17
Indiana Harbor Canal, IN	2	7	2	11
Kankakee River, IN	2	3	-	5
Lake George, IN	4	3	-	7
Wolf Lake, IN	-	3	-	3
Totals	13	22	18	53

Source: STORET, 1997.

especially for children. Lead was found in fish tissue 14 times at levels above 1 ppm, with the highest level reported at 8.9 ppm in the Grand Calumet River.

PCB contamination of fish tissue has resulted in fish consumption advisories for both Illinois (IEPA, 1996c) and Indiana (IDEM, 1997a). Illinois rated the 63 shoreline miles of Lake Michigan as "full support/threatened" for overall and aquatic life uses. The threatened rating is in place because of sport fish consumption advisories, which are the result of PCB and chlordane contamination (IEPA, 1996c). High PCB levels in the Grand Calumet River/Indiana Harbor Canal system have resulted in a Group 5 fish consumption advisory. This is the highest level of fish advisory, and is defined as no consumption (do not eat) for all persons (IDEM, 1997a). This river system is considered to have the most contaminated fish in the State of Indiana with 95 percent of the fish tissue samples exceeding the FDA action level (i.e., 2 ppm for PCBs) (IDEM, 1997a).

4.5 SOILS

Levels of contaminants in soils are important indicators of environmental conditions because human exposure to can occur through direct ingestion, inhalation of volatiles and fugitive dusts, and dermal absorption. Furthermore, contaminated soils can contribute to risks through ingestion of contaminated groundwater caused by migration of chemicals through soils to waterbodies. The mean soil ingestion rate for children is 100 mg/day compared to adults, which is 50 mg/day (U.S. EPA, 1997a). For acute exposure (a "pica" child), the mean ingestion rate is 10 g/day (U.S. EPA, 1997a).

Contaminants in Soil

- Human Exposure Through Ingestion, Inhalation, and Dermal Absorption
- Levels of Contaminants Characterized in Soils:
  - In Southeast Chicago
  - Near Highways, Playgrounds, Schools, and Homes
  - At Hazardous Waste Sites

This section describes: (1) levels of contaminants in Southeast Chicago; (2) lead levels in soil near highways, schools, and residences; and (3) levels of contaminants in soil at hazardous waste sites. Most data presented in this section are from documents/reports that provide measured soil levels, as well as specific studies at contaminated waste sites.

4.5.1 Levels of Contaminants in Soil in Southeast Chicago

In a multimedia study of Southeast Chicago, specifically, the Lake Calumet area, IEPA (1986) placed special emphasis on waste disposal practices. This region has a long history of being a disposal area for a wide variety of industrial, commercial, and residential wastes. IEPA took soil borings in 1983, and the Division of Land Pollution conducted a detailed soil sampling program. The Southeast Chicago area was divided into 25 grids of approximately equal areas (Figure 4-44). Soil samples were taken at 22 locations in the area, from three depths, ranging from 0 to 6 inches, 6 inches to 2 feet, and 2 feet to 10 feet (IEPA, 1986).

The ranges of soil metal concentrations from these samples are presented in Table 4-74. Mean concentrations at depths between 0 to 6 inches, 6 inches to 2 feet, and 2 feet to 10 feet, are presented in Table 4-75. IEPA (1986) compared the concentrations of contaminants found in the Southeast Chicago soils to ranges of these compounds normally found in soils by the U.S. Geological Survey (USGS) (IEPA, 1986). Contaminants found by IEPA (1986) to be present in concentrations above the normal range in soil included:

- **Chromium:** Concentrations were reported from nondetect to 2,500 ppm, which was detected at Grid #14 (Republic Steel).

- **Cadmium:** Concentrations ranged from nondetect to 13.2 ppm, with the highest concentration detected at Grid #15 (Wolf Lake Conservation Area).

- **Manganese:** Concentrations ranged from 42.5 to 9,250 ppm in surface soil and 32,600 ppm in slag. The 6-inch to 2-foot depth sample collected at Grid #10 (Addams Elementary School) showed manganese concentrations of 9,250 ppm; according to the report, this is 2,500 ppm above the highest surface concentrations found by the USGS.

- **Selenium:** Concentrations ranged from nondetect to 5.2 ppm. Four samples were detected above the normal range at Grid #3 (Luella Playground School), Grid #8

Figure 4-44. Sampling Grid for Soil in South Chicago Study Area

Table 4-74. Ranges of Soil Concentrations of Metals in Southeast Chicago for Samples Taken from Depths Ranging from 0 to10 feet

Contaminant	Concentration Range in ppm
Arsenic	0.7 to 80
Barium	<2.5 to 462
Cadmium	<2.5 to 13.2
Chromium	<2.5 to 2,500
Copper	<2.5 to 95
Iron	3,919 to 174,518
Lead	<7.5 to 657
Manganese	42.5 to 32,600
Mercury	0.01 to 0.29
Nickel	<25 to 162.5
Selenium	<0.1 to 5.2
Silver	<2.5 to 5
Zinc	2.5 to 550

Source: IEPA, 1986.

Table 4-75. Mean Soil Concentrations of Metals in Southeast Chicago at Various Depths

Contaminant	Mean Concentrations in ppm at 0-6 inches	Mean Concentrations in ppm at 6 inches - 2 feet	Mean Concentrations in ppm at 2 feet - 10 feet
Arsenic	8.3	11.2	5.4
Barium	86	82.5	58.9
Cadmium	<3	<2.5	<2.5
Chromium	19.5	14	7.6
Copper	31.4	18.8	11.9
Iron	18,902	17,688	10,923
Lead	114.4	52.5	44
Manganese	657	1,323.2	424.4
Mercury	0.08	0.07	0.03
Nickel	25.6	28.9	26.2
Selenium	0.58	0.55	0.47
Silver	<2.5	2.7	<2.5
Zinc	186.1	73.1	56.7

Source: IEPA, 1986.

(Bright School), Grid #10 (Addams Elementary School Playground), and Grid #14 (Republic Steel).

- **Zinc:** Concentrations ranged from 2.5 to 550 ppm. Levels at Grid #14 (Republic Steel) and Grid #15 (Wolf Lake Conservation Area) were high, because the borings were in areas where slag had been deposited. Concentrations found in Grid #3 (Luella Playground School) and Grid #4 (Veterans Memorial Park) were also above normal range.

- **Lead**: Concentrations ranged from nondetect to 576 ppm in soil, and 657 ppm in surface slag.

- **Organics:** No significant amounts of organic compounds were detected in any of the soil samples tested (IEPA, 1986).

Initial test results from the sampling study indicated five sampling sites where levels were of concern to IEPA (1986). These five sites were re-sampled by the Division of Land Management in 1984:

1. Luella Playground/School (Grid #3).
2. Bright School (Grid #8).
3. Addams Elementary School Playground (Grid #10).
4. Republic Steel (Grid #14).
5. Wolf Lake Conservation Area (Grid #15).

The sampling grid approach used by IEPA was also applied to the 1984 supplemental study. The resampling efforts confirmed that the five sites, previously identified as potential problem sites, were potentially hazardous due to the surface concentrations of specific heavy metals, including selenium, chromium, and cadmium. In general, total metals content in soils indicated concentrations of specific metals to be slightly above normal soil concentrations, and metal acid digest results were above the common range for the metals (IEPA, 1986).

4.5.2 Lead Levels in Soil Near Highways, Playgrounds, Schools, and Residences

A 1985 study analyzed lead levels in soils from play areas near Illinois roads (LaBelle et al., 1987). This study was a cooperative efforts between Argonne National Laboratory, the Public Health Department of the City of Chicago, and the Health Departments of Cook and other Illinois counties. Soils were analyzed for lead content, and the surface-soil lead content was compared to local traffic activity to determine the contribution of motor vehicles to lead levels in soils near highways. Also, the data were assessed to determine if lead levels were higher in urban or suburban and rural areas, as well as to determine how lead levels changed according to soil depth (LaBelle et al., 1987).

4.5.2.1 *Design of Soil Sampling Survey*

Three regions chosen for the comparative study were: (1) City of Chicago; (2) suburban areas in the six counties surrounding Chicago (Cook, DuPage, Kane, Lake, McHenry, and Will counties); and (3) the rest of Illinois (downstate). Sampling locations in the City of Chicago are shown in Figure 4-45, and sampling locations in the six-county, suburban region (outside Chicago) are presented in Figure 4-46. The selection of soil sampling locations was based on the following criteria:

1. The location was in the property of a park, playground, school, or day-care center.
2. The location was near a well-traveled road.
3. The location had a play area for small children (< 7 years of age)
4. The play area had a soil surface.

Criterion No. 3, however, was not always met. The study group selected 158 locations for sampling, and collected over 800 soil samples from surface (0-5 centimeters [cm]) and subsurface (25-30 centimeters [cm]) soil (LaBelle et al., 1987). Most sampling locations (68 of 158) were near base roads that carried less than 10,000 vehicles per day, and 17 sampling locations were near roads with over 50,000 vehicles per day. Of the 158 sampling locations, 81 (51.2 percent) were in Cook County, IL, 50 of which were located in the City of Chicago. More than one-third of the samples were collected from areas of disturbed soil (which was expected near play equipment [either bare

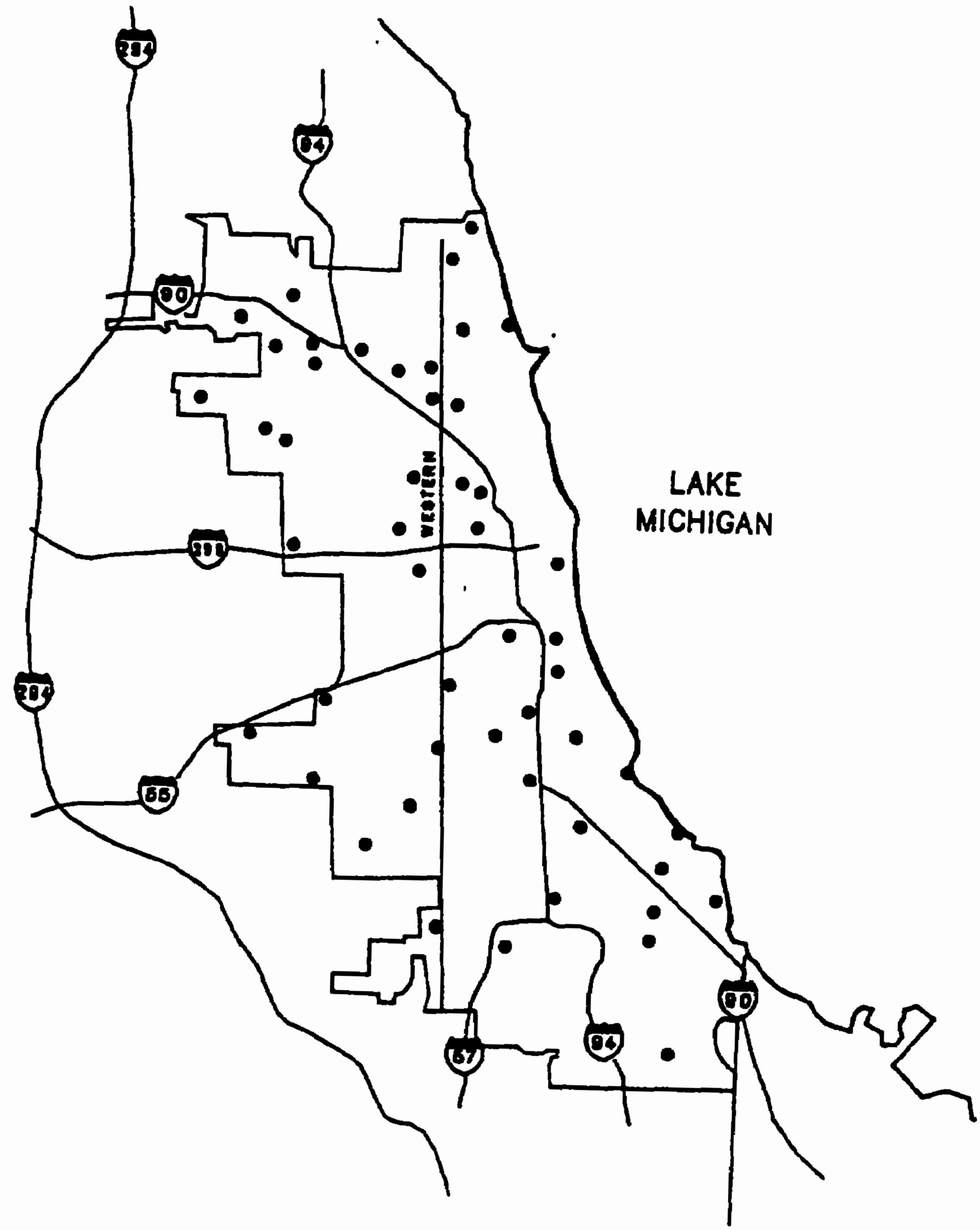


Figure 4-45. Soil Sampling Locations in the City of Chicago

Source: LaBelle et al., 1987.

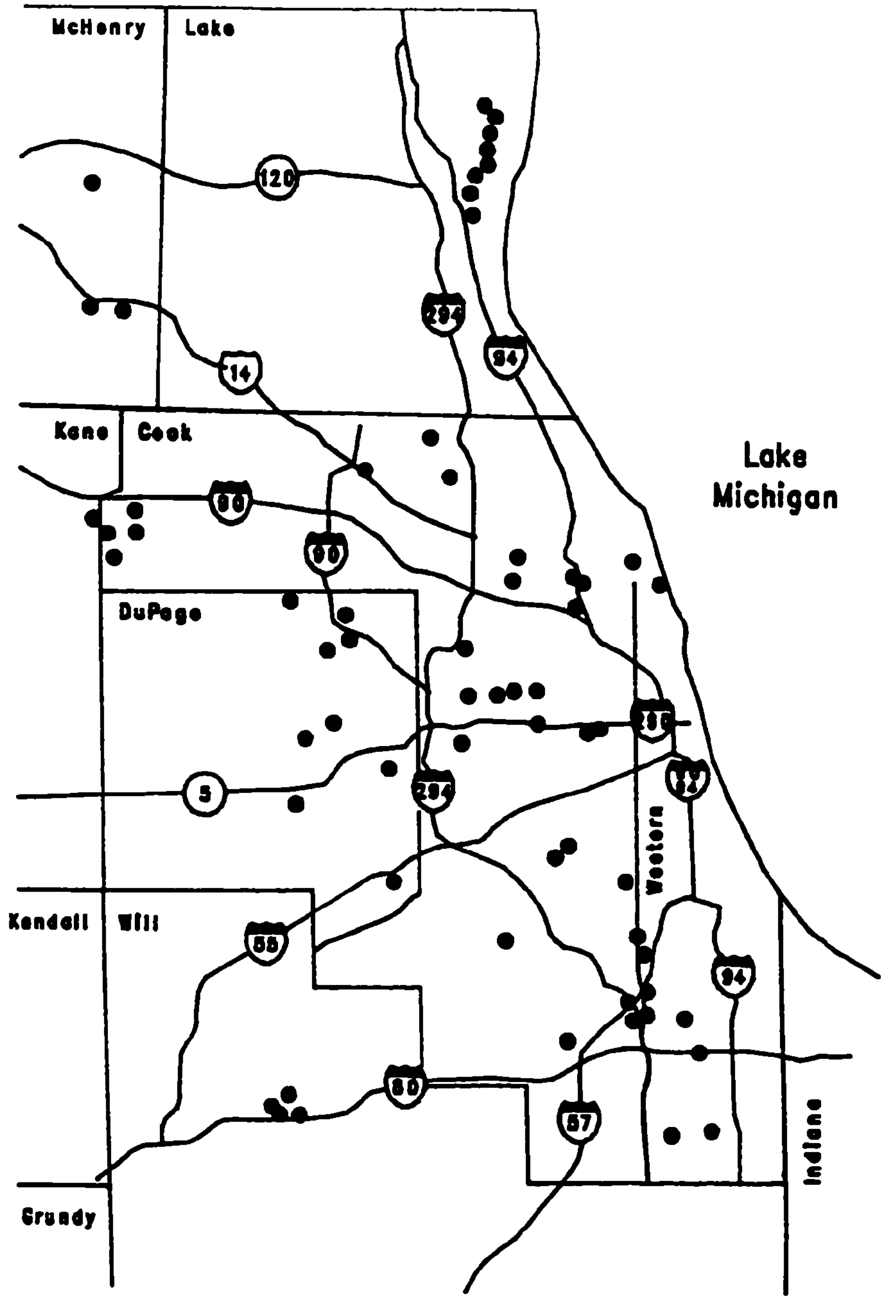


Figure 4-46. Soil Sampling Locations in Six-County Suburban Region (Outside Chicago)

Source: LaBelle et al., 1987.

or vegetated]). Samples collected near play equipment, but away from buildings, were believed to be potentially exposed to a small amount of lead paint from the equipment (LaBelle, et al., 1987). Painted play equipment or fencing were observed near 85 samples taken from 29 locations. Industrial sources of lead were systematically avoided in site selection; sites were required not be within 1 mile of a smelter or other lead processing plant (LaBelle et al., 1987).

Soil samples were collected during the summer and fall of 1985. This period was just prior to the January 1, 1986, Federal-mandated, 90 percent reduction of leaded gasoline concentration, from 1.1 to 0.1 gram per leaded gallon. However, lead already in soil, including lead from vehicle exhaust, would be expected to remain in the soil for hundreds of years because of its relative immobility in soil (LaBelle et al., 1987).

4.5.2.2 *Lead Levels in Soils Near Highways and Playgrounds*

LaBelle et al. (1987) showed that lead levels in soils from Chicago and its surroundings suburban counties were higher than those in downstate soils. The greater traffic density in Chicago, compared to the suburbs, appeared the most likely cause of the higher lead level in soil near highways (LaBelle et al., 1987). Geometric-mean surface-soil lead values in Chicago and suburban surface soil samples were 157 and 83 ppm, respectively, as compared to 44 ppm downstate. The same pattern held for the subsurface-soil lead levels of 118 and 49 ppm versus 27 ppm downstate (LaBelle et al., 1987).

Soil Lead Levels Near Highways and Playgrounds

- Levels Higher in Chicago Than in Suburban and Rural Areas
- Levels Near Play Equipment Lower Than Other Areas
- Higher Levels Near Highways

Lead levels exceeding 250 ppm were reported for 35 locations in the City of Chicago, 27 suburban locations, and 6 downstate locations. Only 21 of these 68 locations had samples taken near play equipment; most higher values were very close to a roadway (play equipment is typically not located immediately next to a road). Table 4-76 compares values of surface-soil lead levels near play equipment to other samples. In general, lead levels were lower near play equipment than in other areas sampled (LaBelle et al., 1987). Table 4-77 compares lead concentrations according to soil conditions (disturbed versus undisturbed) in Chicago, suburbs, and downstate. The mean concentrations in undisturbed soils were slightly higher than disturbed soils. Furthermore, levels in Chicago were higher than those in suburban areas and downstate (LaBelle et al., 1987). Table 4-78 displays mean lead levels in surface and subsurface soils which suggest that surface soil levels of lead are higher than those of subsurface soils (LaBelle et al., 1987).

In conclusion, a link was indicated to exist between surface-soil lead concentration and traffic variables. Elevated soil lead levels were noted in most sampled locations. However, the lead levels measured in those areas (generally from 25-300 ppm) were considerably lower than those typically found in soils surrounding industrial lead sources or houses painted with lead paint (up to 10,000 ppm) (LaBelle et al., 1987). Also, lead levels were considerably lower than the >1,000 ppm soil lead level guideline used to indicate general needs for blood-lead screening or soil cleanup (LaBelle et al., 1987).

4.5.2.3 *Lead Levels in Soils of West Town*

Loyola University, the National Science Foundation, community-based organizations, and students from Rudy Lozano Middle School collaborated on a research program to study soil lead levels in the West Town of Chicago (Fitch, 1993). Soil samples were collected from a public park (Pulaski Field House Park), located adjacent to Rudy Lozano Middle School in Chicago's West Town neighborhood, to determine lead content. Sampling results were compared to samples analyzed by commercial laboratory, thus verifying the accuracy of the result. The study found that the soil in the park had higher lead levels (± 300 ppm) than desired by EPA (± 50 ppm). The study also indicated that high lead levels were likely the result of the park's close proximity to Interstate 94 (Fitch, 1993).

Anecdotal evidence from the preliminary findings indicate pockets of very high lead concentrations in soils around housing in the West Town area of Chicago. These findings will be reported by the Neighborhood Based Childhood Lead Primary Prevention Project (West Town,

Table 4-76. Surface Soil Lead Levels Near Play Equipment

Traffic Volume (vehicles/day)	Samples Near Play Equipment		All Other Samples	
	No. of Samples	Lead Conc. (ppm)[a]	No. of Samples	Lead Conc. (ppm)[a]
< 5,000	83	86 ± 9	96	90 ± 13
5,000 - 9,999	26	99 ± 29	30	141 ± 33
10,000 - 19,999	66	111 ± 17	77	187 ± 23
20,000 - 49,999	92	142 ± 12	87	265 ± 26
≥ 50,000	47	108 ± 21	63	236 ± 41

[a] - Arithmetic mean ± standard error

Source: LaBelle et.al., 1987

Table 4-77. Comparison of Lead Concentrations by Surface Soil Conditions in Chicago, Suburbs, and Downstate

Region	Lead Conc. (ppm) Disturbed Soil		Lead Conc. (ppm) Undisturbed Soil	
	Mean[a]	Standard Error	Mean [a]	Standard Error
City of Chicago	201	15	226	21
Suburbs	103	23	150	15
Downstate	64 .	25	74	10

[a] - Arithmetic mean

Source LaBelle et.al., 1987.

Table 4-78. Mean Lead Levels of Surface and Subsurface Soils in Chicago, Suburbs, and Downstate

Region	Surface Soil		Subsurface Soil	
	No. of Samples	Lead Conc. (ppm)[a]	No. of Samples	Lead Conc. (ppm)[a]
City of Chicago	256	157	50	118
Suburbs	244	83	61	49
Downstate	167	44	48	27

[a] - Geometric mean antilog (mean ln x).

Source: LaBelle et.al., 1987.

Chicago- Lead Project, 1995-1997) in the near future. (For blood lead level monitoring in the West Town area, see Section 4.8.)

4.5.2.4 *Lead Levels in Soils of Austin*

Another study was undertaken near a municipal solid waste incinerator in Austin, an older Chicago neighborhood that was once the center of industry and is currently ranked among the poorest neighborhoods (Fitch, 1993). Fitch (1993) reported that the government estimated that the incinerator emitted 5.7 pounds of lead per hour. The Austin Community Council wanted to determine if these emissions resulted in elevated lead levels in surrounding area soil. In 1994, a Loyola University chemistry class sampled three homes in the Austin community, following protocols developed by the Chicago Department of Health. Soil samples gathered during the study near the incinerator had elevated lead content (similar to the Pulaski Field House Park) (Fitch et al., 1996).

The senior chemistry class from Loyola University presented a paper on soil sampled for lead in the Austin neighborhood, Rogers Park, and near the Northwest Incinerator in Chicago (Fitch, 1993). This study was a cooperative effort between 20, fifth grade elementary students from a local school, who sampled soil for lead levels in spring of 1994, and Loyola University students. In the fall of 1994, Loyola University students sampled soil from residential yards and analyzed the samples for lead levels. The soil sampling results in Austin indicated lead levels from 150 ppm to 1,850 ppm. Soil samples from Rogers Park, an industrial facility, indicated lead levels from 439 ppm to 3,067 ppm. The lead levels in soils at a radius of 500 meters from the Northwest Incinerator were estimated to be >1,000 ppm (Fitch et al., 1996).

4.5.3 Levels of Contaminants in Soil at Hazardous Waste Sites

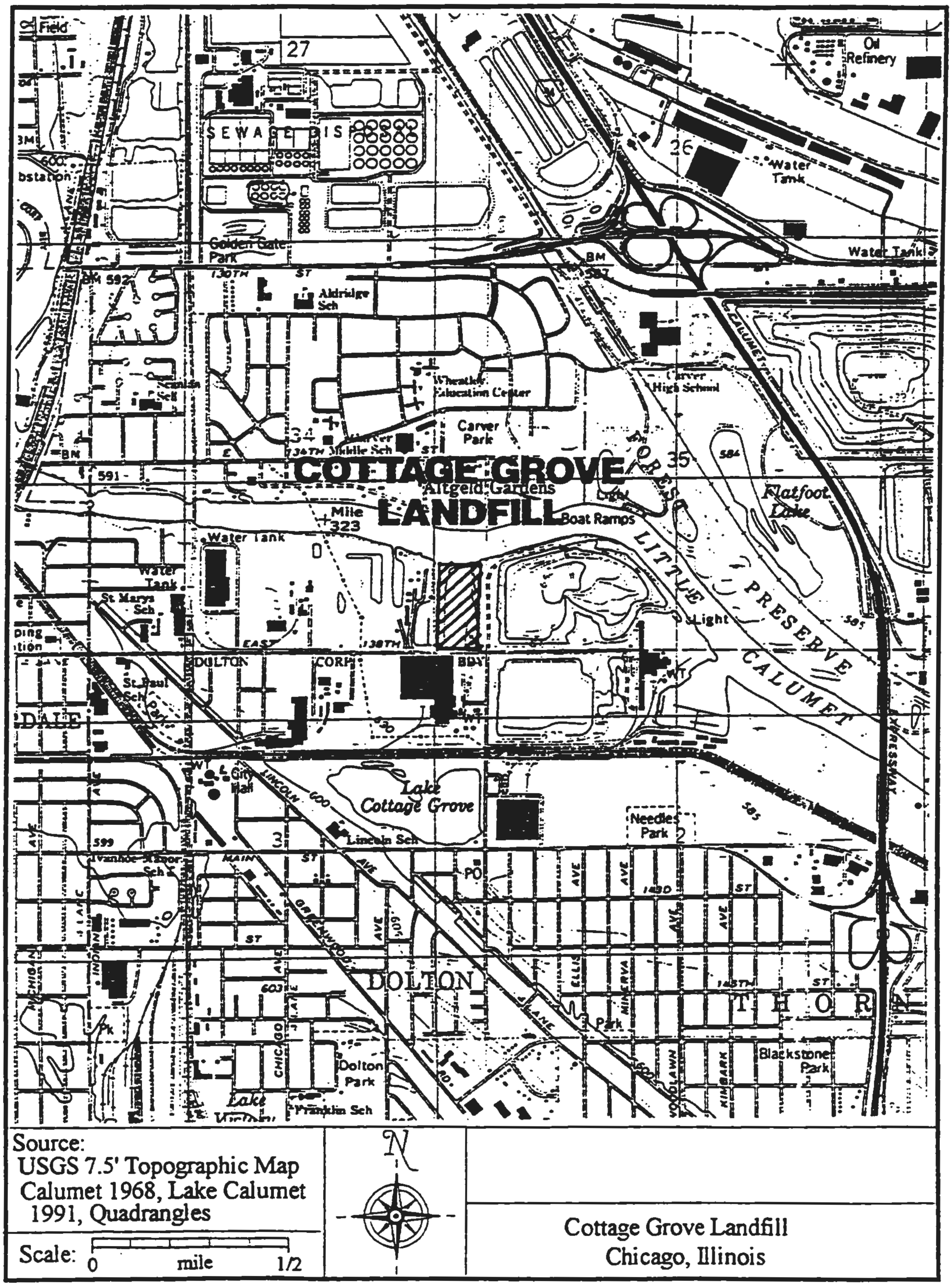
This section describes levels of contaminants in soils at select hazardous waste sites in Cook County, IL, and Lake County, IN. Most of these data were taken from environmental site investigation (ESI) reports for the sites.

4.5.3.1 *Cottage Grove Landfill*

EPA conducted an ESI of Cottage Grove Landfill site in the Southeastern Chicago, IL, south of the Little Calumet River, approximately 1-mile west of the Calumet Expressway I-94 (Figure 4-47). The site is bordered by the Little Calumet River to the north, the Land and Lakes #2 landfill to the east, an industrial complex to the south, and a harbor with a marina used for recreational boating to the west. Areas surrounding the site are primarily industrial and not heavily populated; however, a private residence is onsite. Over 5,000 people are estimated as living within 1 mile of the site, and over 160,000 people are within 4 miles (U.S. EPA, 1994d). This facility operated from 1976 to 1982, accepting hazardous waste. In addition to the landfill contents and leachate production, sludge containing heavy metals was spread over a large site area (approximately 8 acres) from 1980 to 1983 (U.S. EPA, 1994d). The facility had a history of poor operating practices and was sited for violations on numerous occasions by IEPA; it was not authorized to accept industrial wastes (U.S. EPA, 1994d).

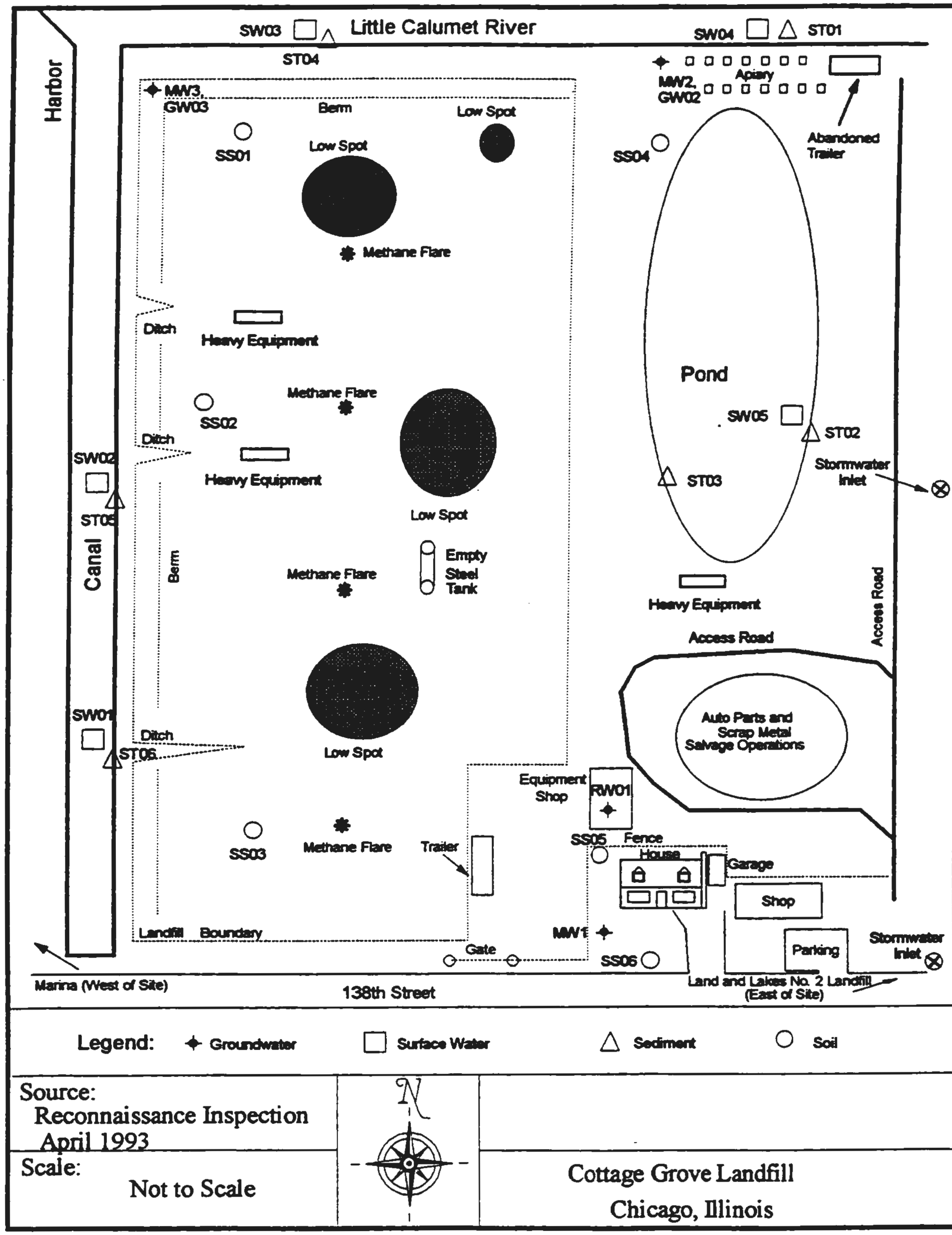
On August 17, 1993, the ESI field team collected eight soil samples from locations (Figures 4-48 and 4-49) that were selected to identify possible contamination resulting from landfill activities and to address exposure concerns to on-site residents (U.S. EPA, 1994d). Three soil samples (SS01, SS02, SS03) were collected from the top of the fill area, and an additional soil sample (SS04) was collected from the northern section of an on-site wetland pond. Soil samples SS05 and SS06 were collected from the back and the front yards of the residence, respectively. Two background soil samples (SS07 and SS08) were collected from two undeveloped lots, south of the site. All eight soil samples were collected at depths of less than 1 foot (U.S. EPA, 1994d).

Soil analyses indicated levels of xylene (0.041 mg/kg), chromium (12.4 mg/kg to 66.1 mg/kg), copper (18.1 mg/kg to 65.5 mg/kg), manganese (232 to 1,070 mg/kg), mercury (0.23 mg/kg), nickel (16.4 to 46.1 mg/kg), potassium (1,960 to 3,310 mg/kg), vanadium (13.7 to 41.6 mg/kg), and cyanide (0.83 mg/kg). The sample locations and concentrations of contaminants are presented in Table 4-79 (U.S. EPA, 1994d). In general, location SS06, which was collected from the front yard of the on-site residence, contained the highest concentration of contaminants was found in (Figure 4-48). The results indicated that several wastestreams may have affected site soils. Soil sampling confirmed an observed release to the soil exposure pathway.



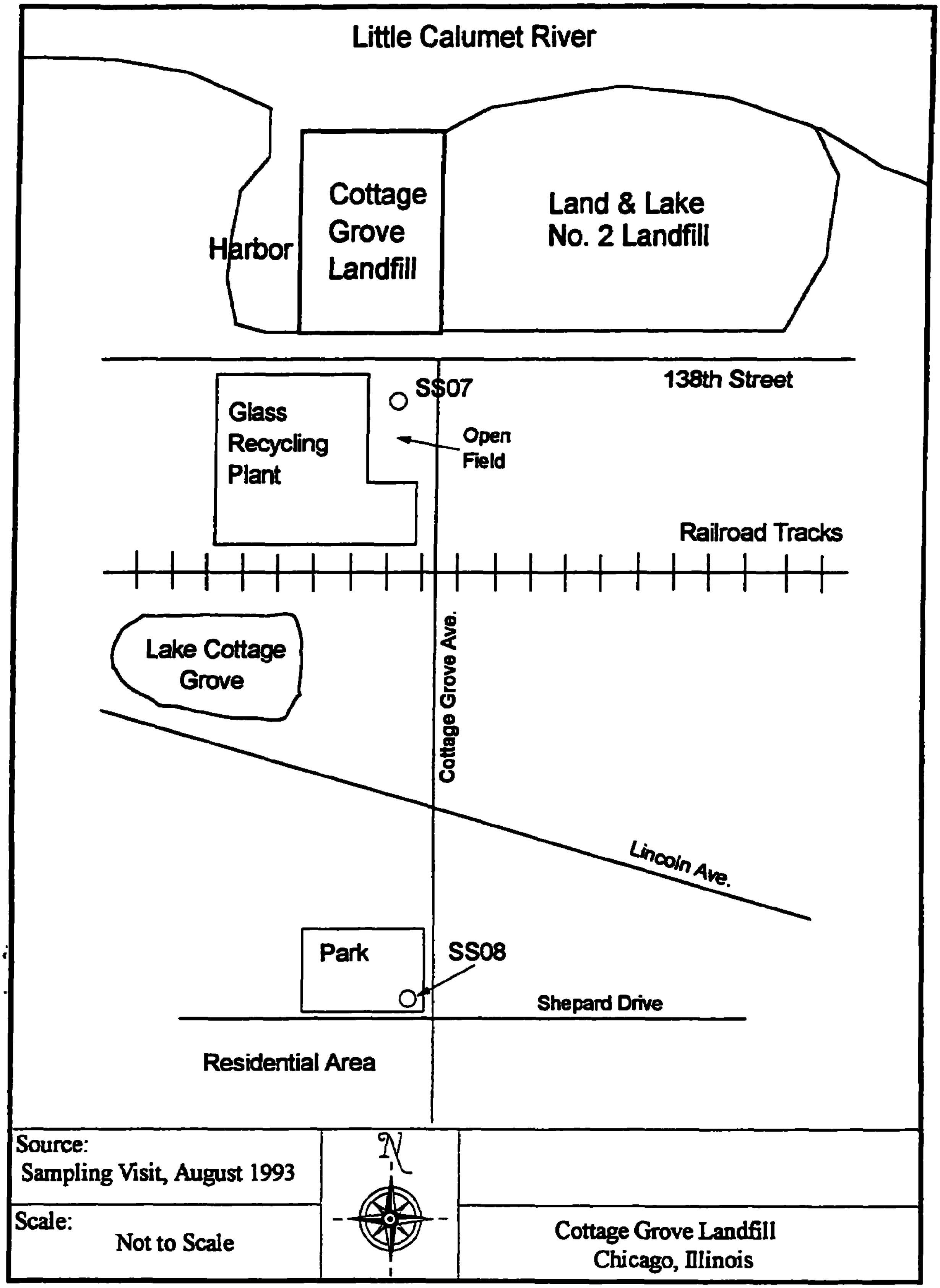
Source: U.S. EPA, 1994d.

Figure 4-47. Site Location Map of Cottage Grove Landfill



urce: U.S. EPA, 1994d.

Figure 4-48. Soil Sample Locations (SS01 to SS06) at Cottage Grove Landfill



Source: U.S. EPA, 1994d.

Figure 4-49. Background Soil Sample Locations (SS07 to SS08) at Cottage Grove Landfill

Table 4-79. Concentrations of Soil Contaminants at Cottage Grove Landfill

Substance	Soil Sample Location & Concentrations (mg/kg)							
	SS01	SS02	SS03	SS04	SS05	SS06	SS07	SS08
Acetone	0 025 BE						0 012 UJB	0 012 UJB
Xylene (total)	0 041						0 012 UJ	0 012 UJ
Bis(2-ethylhexyl)phthalate	12 BD	11 BD	5 3 BD		1 8 B	8 2 BD	4 BD	0 38 UJB
Dieldrin						0 46 J	0 04 U	0 0038 U
4,4'-DDD	0 082						0 04 U	0 0038 U
Beryllium	0 69 B	0 86 B	0 94 B	0 69 B	0 24 B	0 69 B	0 45 B	0 23 U
Chromium	52 6					66 1	27 2	12.4
Copper						65 5	27 1	18 1
Manganese		940			855	1070	453	232
Mercury						0 23	0 12 U	0 11 U
Nickel	46 1		24 2	22	21 9	30 5	16 4	7 3 B
Potassium			2,800	3,310		3.200	1,960	865 B
Vanadium						41 6	29 4	13 7
Cyanide						0 83	0 59 U	0 56 U

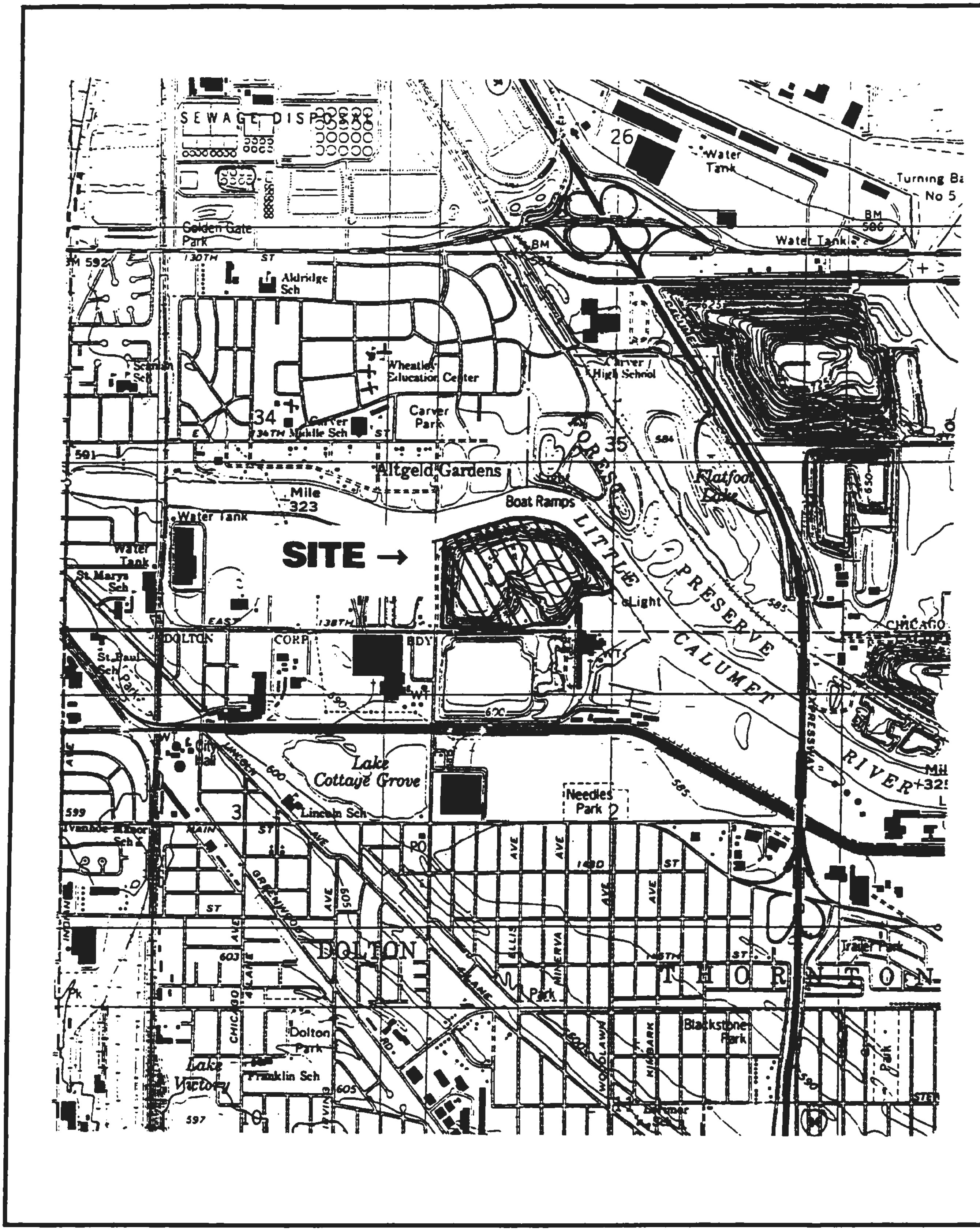
J - Reported value is estimated; U - Substance is undetected The reported value is the contract required quantification limit, B - Reported value less than the contract required detection limit, but greater than instrument detection limit; P - Greater than 25% difference for detected concentrations; S - Reported value determined by method of standards additions; W - Post-digestion spike for furnace AA analysis is out of control limits, X - Indistinguishable coeluting isomers; Y - Compound reported from peak response exceeding range of standard calibration; * - Duplicate analysis was not within control limits; C - Identification confirmed by GC/MS.

Source U.S. EPA, 1994d.

4.5.3.2 *Land and Lakes #2*

EPA conducted an ESI of Land and Lakes #2, which is located in the southeastern sector of Chicago, along the southern bank of the Little Calumet River, covering approximately 73 acres (Figure 4-50) (U.S. EPA, 1994e). The site initially operated as the old Cottage Grove landfill from the mid 1950s to early 1970s, and is believed to have accepted municipal refuse. The old landfill was filled to approximately 10 feet above grade when the Land and Lakes Company purchased the site and began operation. The Land and Lakes Company bought the property before 1974. IEPA issued a permit for land filling in 1976, and during the next 10 years, the facility received approximately 9-million cubic yards of waste. Wastes accepted included solids, sludges, gasoline-contaminated soils, and liquid from municipal, industrial, and commercial sources, including sludge from the MSDGC, and river bottom dredging from the Indiana Harbor Canal. The landfill operated under a permit issued by the City of Chicago and IEPA, and was removed from the RCRA system in 1987. In July of 1993, the City of Chicago closed the landfill (U.S. EPA, 1994e).

In October 1993, the field team collected four soil samples (SS01 to SS04) from representative of natural soil conditions in the area (U.S. EPA, 1994e) (Figure 4-51). Analyses of soil samples collected from several leachate seeps indicated the presence of several semivolatile organic compounds, PCBs, and inorganic compounds (U.S. EPA, 1994e). Table 4-80 presents the sample locations and contaminant concentrations. Sample SS01 contained the maximum value for the SVOC anthracene (640 μg/kg) and PCBs Aroclor-1248 (700 μg/kg). Sample SS02 contained the maximum values for several SVOCs, including naphthalene (720 μg/kg), phenanthrene (2,700 μg/kg), fluoranthene (3,000 μg/kg), pyrene (2,700 μg/kg), benzo(a)anthracene (1,800 μg/kg), chrysene (1,900 μg/kg), benzo(b)fluoranthene (2,800 μg/kg), benzo(k)fluoranthene (2,800 μg/kg), benzo(a)pyrene (1,800 μg/kg), indeno(1,2,3-cd)pyrene (1,600 μg/kg), and benzo(g,h,i)prylene (1,700 μg/kg). Sample SS02 also contained the maximum value for one pesticide, methoxychlor (77 μg/kg), and several inorganic compounds, including cadmium (71.8 mg/kg), chromium (702 mg/kg), copper (626 mg/kg), lead (572 mg/kg), nickel (110 mg/kg), selenium (1.1 mg/kg), silver (23.6 mg/kg), zinc (1,630 mg/kg), and cyanide (25.2 mg/kg). Sample SS03 contained the maximum value for bis(2-ethylhexyl)phthalate (2,300 μg/kg) (U.S. EPA, 1994e).



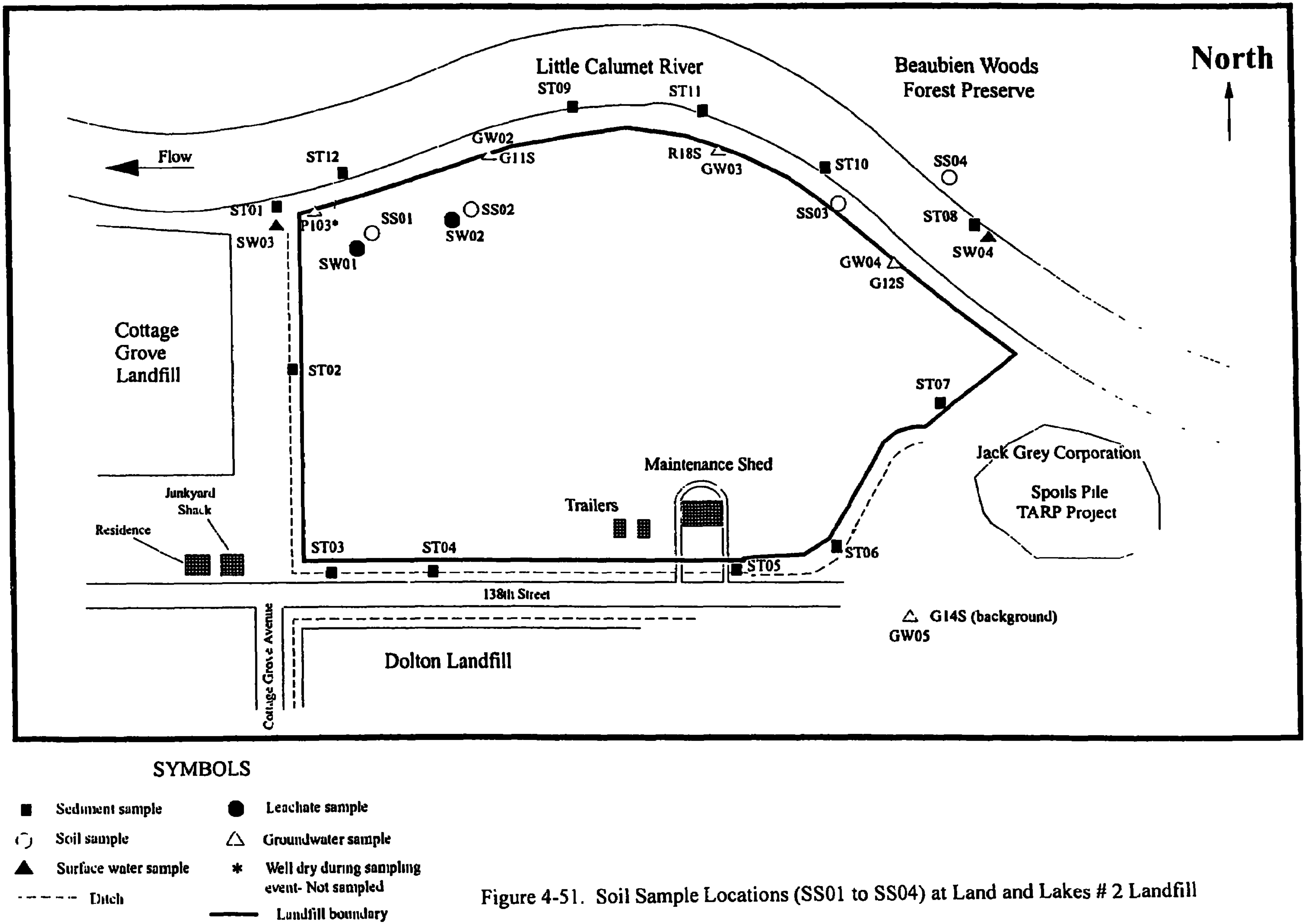
Source: U.S. EPA, 1994e.

North

USGS 7.5' Topographic Map
Lake Calumet quad (1991)

Not to Scale

Figure 4-50. Site Location Map of Land and Lakes # 2 Landfill



Source: U.S. EPA, 1994e.

Figure 4-51. Soil Sample Locations (SS01 to SS04) at Land and Lakes # 2 Landfill

Table 4-80. Concentrations of Soil Contaminants at Land and Lakes #2

Substance		Soil Sample Location and Concentrations			
		SS01	SS02	SS03	SS04
Organics (µg/kg)	Naphthalene		720		450 U
	Phenanthrene	2,100	2,700	2,000	290 J
	Anthracene	640	620	580	62 J
	Fluoranthene	1,900	3,000	2,200	550
	Pyrene		2,700		410 J
	Benzo(a)anthracene	1,500	1,800	1,400	240 J
	Chrysene		1,900		270 J
	bis(2-Ethylhexyl)phthalate	1,100		2,300	100 J
	Benzo(b)fluoranthene		2,800 X	2,000 X	390 JX
	Benzo(k)fluoranthene		2,800 X	2,000 X	390 JX
	Benzo(a)pyrene	850	1,800	1,100	180 J
	Indeno(1,2,3-cd)pyrene	760	1,600	600	110 J
	Benzo(g,h,i)perylene	740	1,700	560	86 J
	Methoxychlor		77 JP		1 2 JP
	PCB - Aroclor-1248	700 JPY			46 U
	PCB - Aroclor-1254		1,300 JPY		46 U
	PCB - Aroclor-1260		640 JC		46 U
Inorganics (mg/kg)	Cadmium	9 3	71 8		0 77 U
	Chromium	128	702		17 7
	Coppper	129	626		34 5
	Lead		572 J		38 8 US*
	Nickel		110		23 6
	Selenium		1 1 B		0 26 U
	Silver	6 2	23 6	2 1 B	1 U
	Zinc		1,630		124
	Cyanide		25 2 J		0 64 UJ

J - Reported value is estimated, U - Substance is undetected The reported value is the contract required quantification limit, B - Reported value less than the contract required detection limit, but greater than instrument detection limit, P - Greater than 25% difference for detected concentrations; S - Reported value determined by method of standards additions, W - Post-digestion spike for furnace AA analysis is out of control limits; X - Indistinguishable coeluting isomers; Y - Compound reported from peak response exceeding range of standard calibration; * - Duplicate analysis was not within control limits; C - Identification confirmed by GC/MS

Source: U S. EPA, 1994f.

EPA (1994e) reported an observed release to the soil pathway. The source of inorganic analytes was possibly from heavy metals contained within dried municipal sewage sludge, which was tilled into cover material under an IEPA permit. Nearby targets included 11 workers employed at the site and the residents, who lived in a house located within 200 feet of the landfill on the landfill property. No schools or day-care facilities are located within 200 feet of the site (U.S. EPA, 1994).

4.5.3.3 *U.S. Drum II*

EPA conducted an ESI of U.S. Drum Disposal Corporation, referred to as U.S. Drum II (U.S. EPA, 1995d). The site is located in Southeast Chicago approximately 4-miles northwest of Calumet City (Figure 4-52), near the Paxton Landfill site. Since 1940, the site was used as a dump for municipal and industrial wastes. During the mid to late 1970s, the site was used as a hazardous waste transfer and petroleum recovery facility. IEPA conducted an initial site inspection in March 1979, and found an estimated 6,000, 55-gallon drums in poor condition; 4 open dump lagoons; assorted sludge and liquid hazardous waste; 3 bulk liquid trucks; and approximately 25 semi-trailers. The drums were believed to contain solvents, paint wastes, tar wastes, PCB-contaminated sludge, resins, corrosives, and cyanide compounds (U.S. EPA, 1995d). This site was shut down in 1979. Fire occurred in 1985. This site, which was never permitted under RCRA, conducted on-site hazardous waste management activities and was sited for numerous violations of State and RCRA laws. Corrective action was implemented in 1979, when liquid and semi-solid wastes were removed from site and, supposedly, disposed. In 1980s, IEPA implemented removal action, in which contaminated areas were leveled, capped with clay, covered with soil, graded, and sealed (U.S. EPA, 1995d).

Between December 1983 and Apnl 1984, IEPA collected seven soil samples (identified as SS01 to SS07) at the U.S. Drum II site (Figure 4-53). To a limited extent, soil sample locations were selected based on information in EPA files regarding drum storage locations (U.S. EPA, 1995d). Soil samples were collected to identify possible contamination resulting from prior waste transfer, leaking drums, and lagoon dumping activities. During the ESI, three on-site soil samples were collected: one from the northwestern portion of the site, west of the concrete platform (former loadıng dock); one from the northeastern portion of the site; and one from the southeastern portion of the sıte. On-site soil samples were collected at depths of approximately 10 to 16 inches below

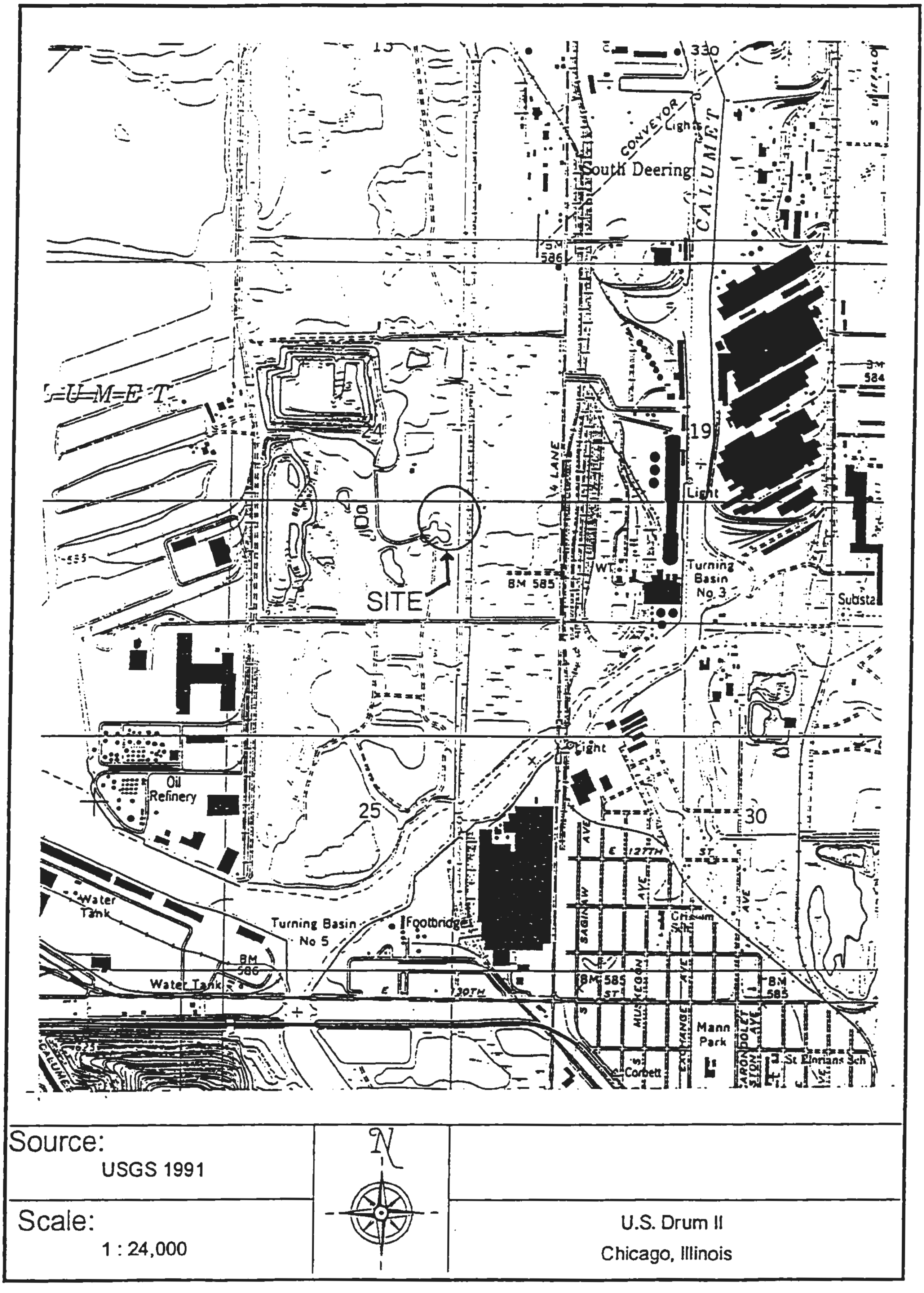


Figure 4-52. Site Location Map of U.S. Drum II

Source: U.S. EPA, 1995d.

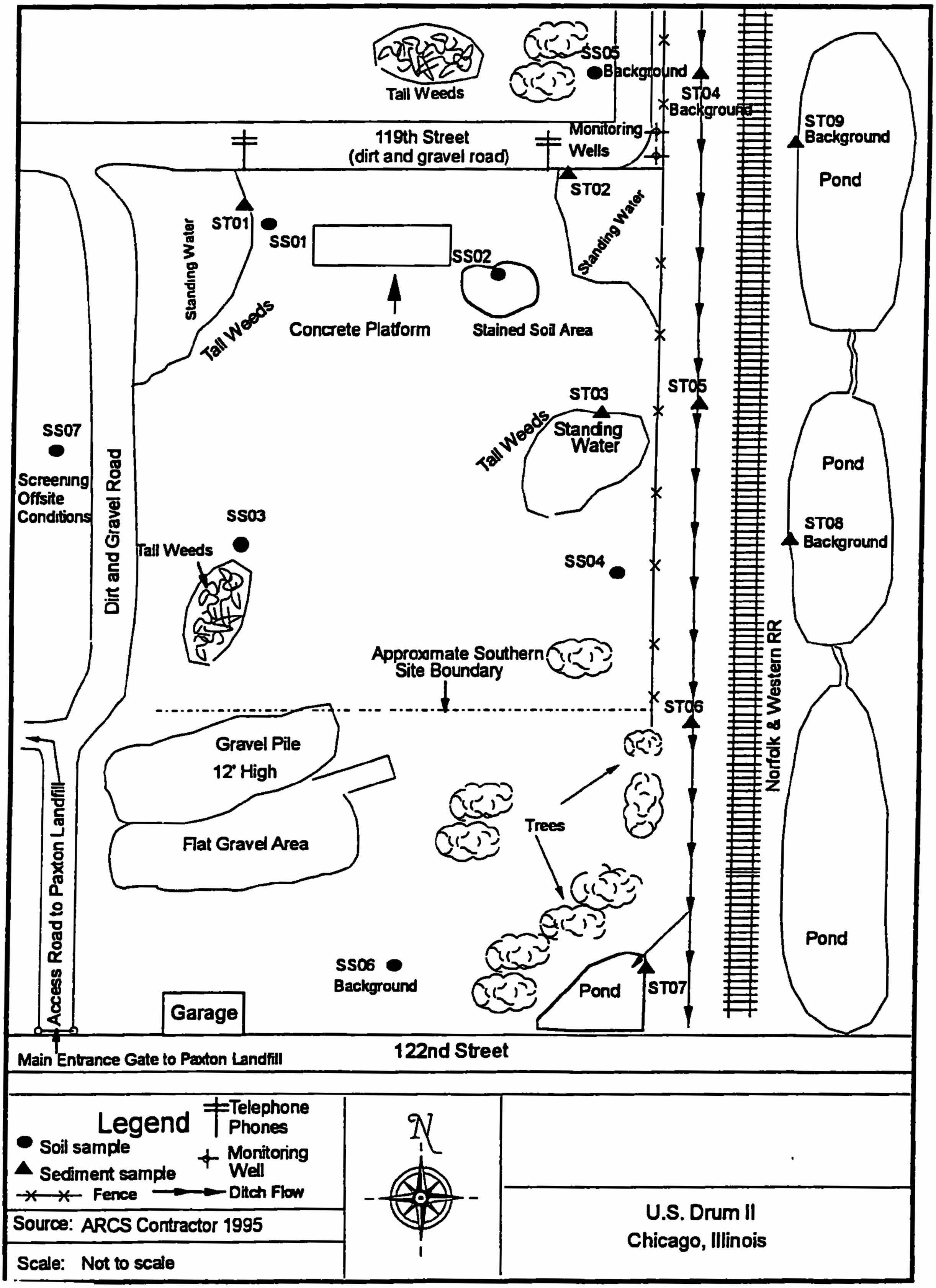


Figure 4-53. Soil Sample Locations (SS01 to SS07) at U.S. Drum II

Source: U.S. EPA, 1995d.

ground surface. An off-site composite soil sample and two background samples were collected in the open field, located west of the site's dirt access road, in an area between the site and the Alburn Incinerator property (U.S. EPA, 1995d).

Analyses detected several pesticides, PCBs, volatile organics, semi-volatile organics, and heavy metals. The sample locations and contaminant concentrations are presented in Table 4-81. Analysis of the four on-site soil samples (SS01 to SS04) confirmed an observed release of hazardous substances to site soils. SS01 contained PCB Aroclor-1248 at 0.54 mg/kg. Soil sample SS02, collected from a dark stained area without vegetation southeast of the on-site concrete platform, exhibited the widest range of hazardous contaminants in on-site soil samples. SS02 detected nine SVOCs between the range of 0.5 to 310 mg/kg, and six inorganics between the range of 1.4 to 632 mg/kg. SS03 detected seven SVOC between the range of 0.58 to 2.7 mg/kg, and SS04 detected vanadium at 75.6 mg/kg (U.S. EPA, 1995d).

This site is inactive and is not accessible to the public. No on-site workers, residences, schools, or day-care facilities within 200 feet of the site. The residential population within 1 mile of the site is estimated at 280 people (U.S. EPA, 1995d).

4.5.3.4 *MSD #4 Sludge and Barrel Dump*

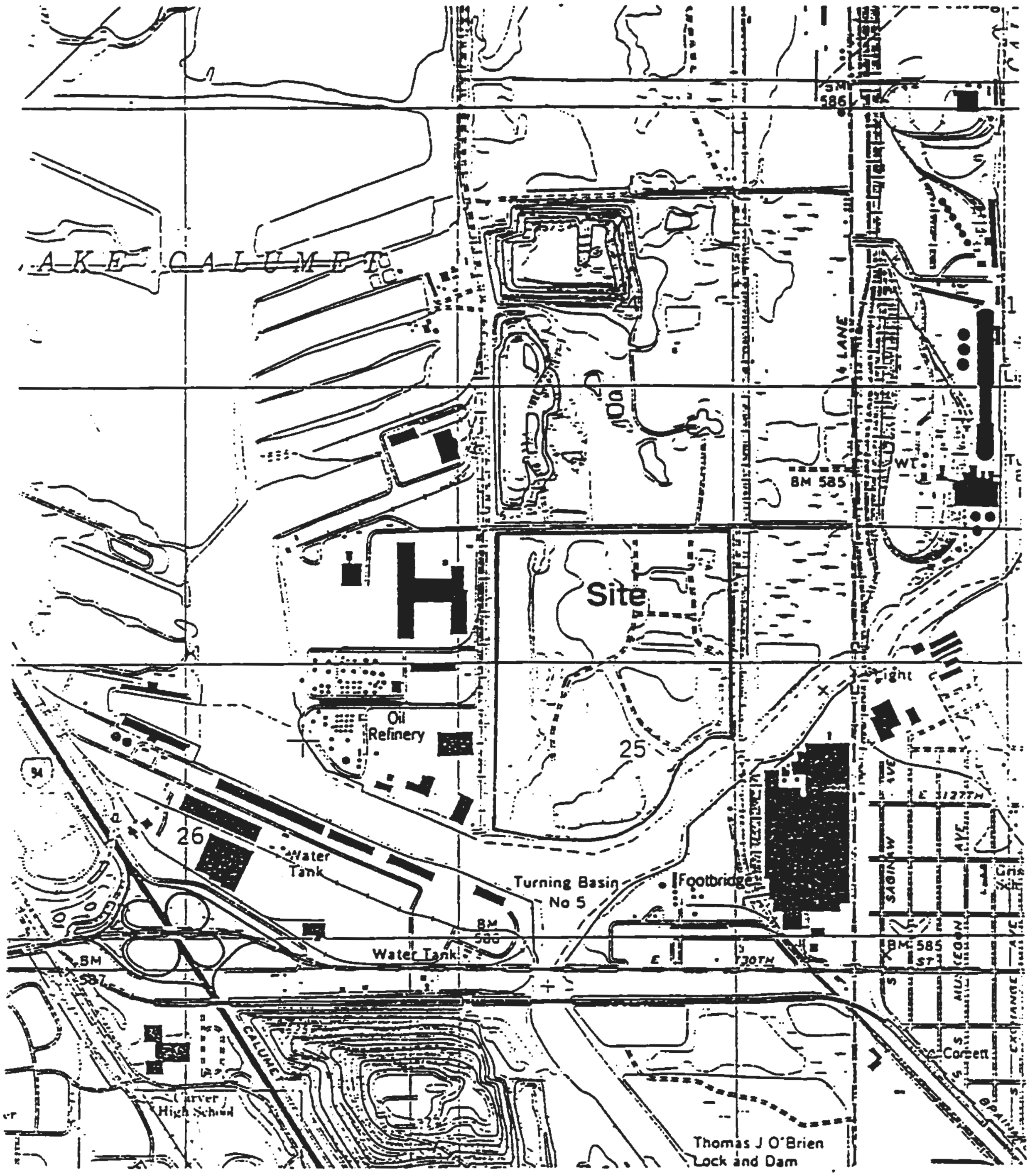
EPA conducted an ESI of the MSD #4 Sludge and Barrel Dump, located in Southeast Chicago near Lake Calumet and bordered on the south by the Calumet River (Figure 4-54) (U.S. EPA, 1995e). The vicinity around the MSD #4 site is industrial; much of the area is occupied by landfills. Within a 1-mile radius of the site are Land and Lakes #3 Landfill, Paxton I & II Landfills, U.S. Drum II site, and Alburn Incinerator site. The site is divided into two parcels: the northeastern parcel is operated as a gun club; the other parcel is owned by MWRDGC and is operated by Stony Island Avenue Biosolids Processing (Stony) facility. The Stony facility is an active facility, operating under permit issued by IEPA and NPDES. It receives municipal sludge generated by MWRDGC, dries the sludge, and transports it to the CID Landfill. Before 1980, the Stony facility was used for the disposal of dredged material from the Calumet River. In 1983, EPA collected sediment samples. In 1991, an EPA Preliminary Assessment and various improvements were made at the Stony facility (U.S. EPA, 1995e).

Table 4-81. Concentrations of Soil Contaminant at U.S. Drum II

Substance	Soil Sample Location & Concentrations (mg/kg)						
	SS01	SS02	SS03	SS04	SS05	SS06	SS07
Chloroform		4 2 E			0 016 UJ	0 003 J	
1,2-Dichloroethane		5 8 E			0 016 UJ	0 004 J	
1,1,1-Trichloroethane		0 5 J			0 016 UJ	0 012 UJ	
Trichloroethane		1 8 JE			0 016 UJ	0.012 UJ	
Benzene		1 7 JE			0 016 UJ	0 012 UJ	
Tetrachloroethene		1 5 JE			0 016 UJ	0 012 UJ	
Toluene		33 D			0 016 UJ	0.012 UJ	
Ethylbenzene		62 D			0 016 UJ	0 012 UJ	
Xylene (Total)		310 D			0 016 UJ	0 012 UJ	
Naphthalene		9.6 JD			0 23 J	0 4 U	
Hexachlorobutadiene		13 JD			1 U	0 4 U	
Fluoranthene			2 7		0 31 J	0 4 U	
Pyrene			2		0 27 J	0 4 U	
Benzo(a)anthracene			1 2		0 2 J	0 4 U	
Chrysene			0 96		0 17 J	0 4 U	
bis(2-Ethylhexyl)phthalate		58 JD			1 UJ	0 4 UJ	
Benzo(a)fluoranthene			1 3		0 22 J	0 4 U	
Benzo(a)pyrene			0 7		0 12 J	0 4 U	
Indeno(1,2,3-cd)pyrene			0.58		0 08 J	0 4 U	
4,4'-DDE					0 0052 UJ	0 0040 UJ	0 015 JP
4,4'-DDD					0 0052 UJ	0 0040 UJ	0 042 JP
PCB - Aroclor-1248	0 54 JP				0 0052 UJ	0 0040 UJ	
Barium		391			111	53 2	
Mercury		1 4			0 21	0 11 U	
Silver		1 7 B			0 93 U	0.78 U	
Vanadium		162		75 6	19 7	21 7	
Zinc		632*			174*	89 7*	
Cyanide		7 7			3 6 U	3 U	

J - Reported value is estimated, U - Substance is undetected The reported value is the contract required quantification limit; B - Reported value less than the contract required detection limit, but greater than instrument detection limit; P - Greater than 25% difference for detected concentrations; S - Reported value determined by method of standards additions; W - Post-digestion spike for furnace AA analysis is out of control limits; X - Indistinguishable coeluting isomers, Y - Compound reported from peak response exceeding range of standard calibration, * - Duplicate analysis was not within control limits; C - Identification confirmed by GC/MS.

Source: U S. EPA, 1996d.



Sources:
USGS Lake Calumet Quadrangle, 1991

Not to Scale

N

MSD #4 Sludge and Barrel Dump
Chicago, Illinois

Figure 4-54. Site Location Map of MSD # 4 Sludge and Barrel Dump

Source: U.S. EPA, 1995e.

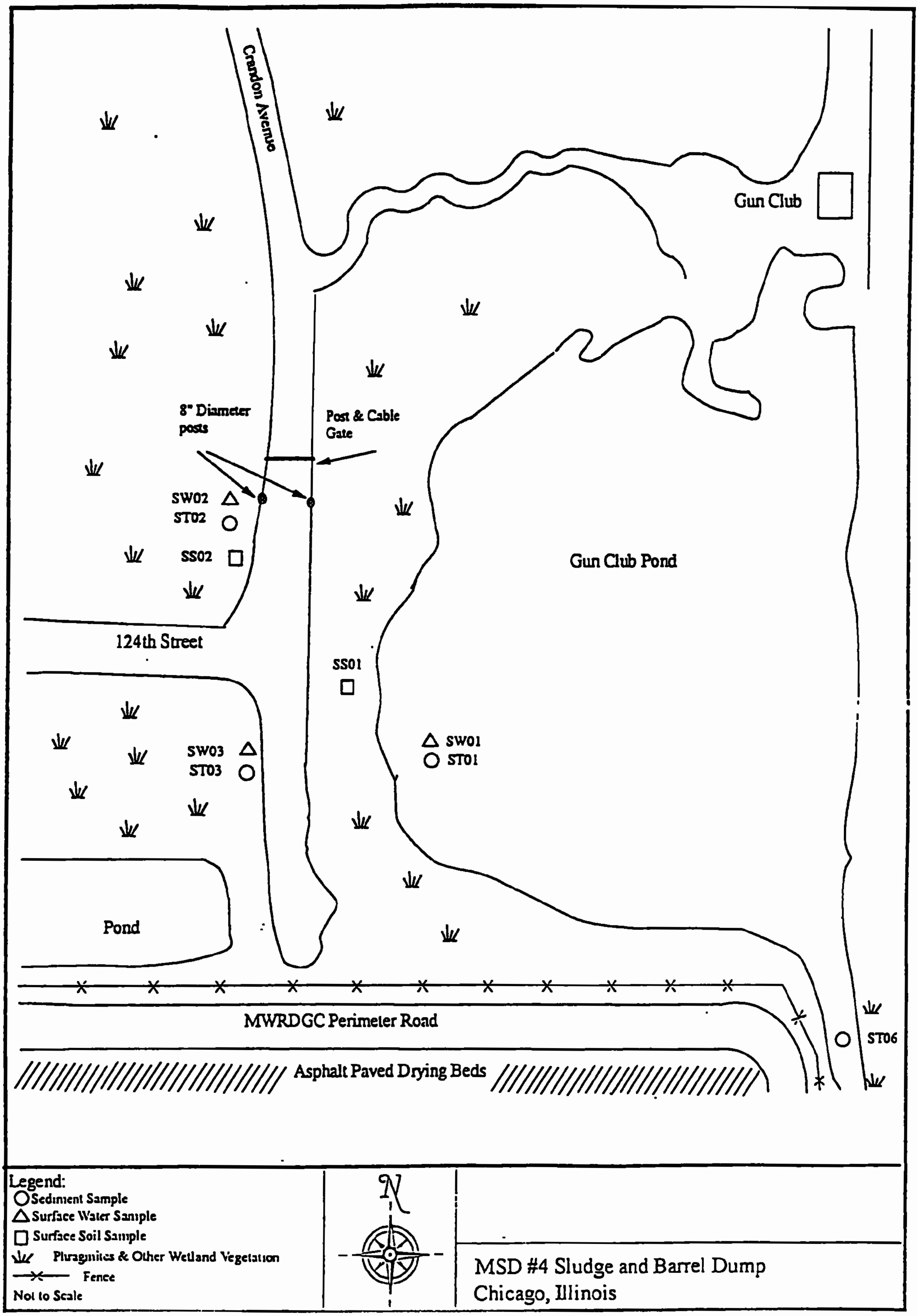
The sampling portion of the ESI was conducted in 1993, when a field team collected three soil samples (SS01, SS02, SS03) (Figures 4-55 and 4-56). Each sample was collected from a depth of 0 to 6 inches. A background soil sample (SS03) was collected northeast of the site. This location was representative of natural soil conditions in the area; however, the background soil sample contained high concentrations of contaminants. Because analytical results were skewed, the sample was rejected (U.S. EPA, 1995d). Two soil samples were collected in the area where drums were thought to have been released. One inorganic compound (silver) was identified at sample location SS01 at 3.1 mg/kg (U.S. EPA, 1995e). The sample locations and concentrations of the contaminants are presented in Table 4-82.

The nearby populations include people using the gun club property for hunting or other purposes, people residing within 1-mile of the site, and sensitive environments within 200 feet of the site. Approximately 3,540 people live within 1 mile of the gun club. The only sensitive area within 200 feet of the site is the Lake Calumet Natural Area, which encompasses the whole site.

4.5.3.5 *Cosden Oil & Chemical Company*

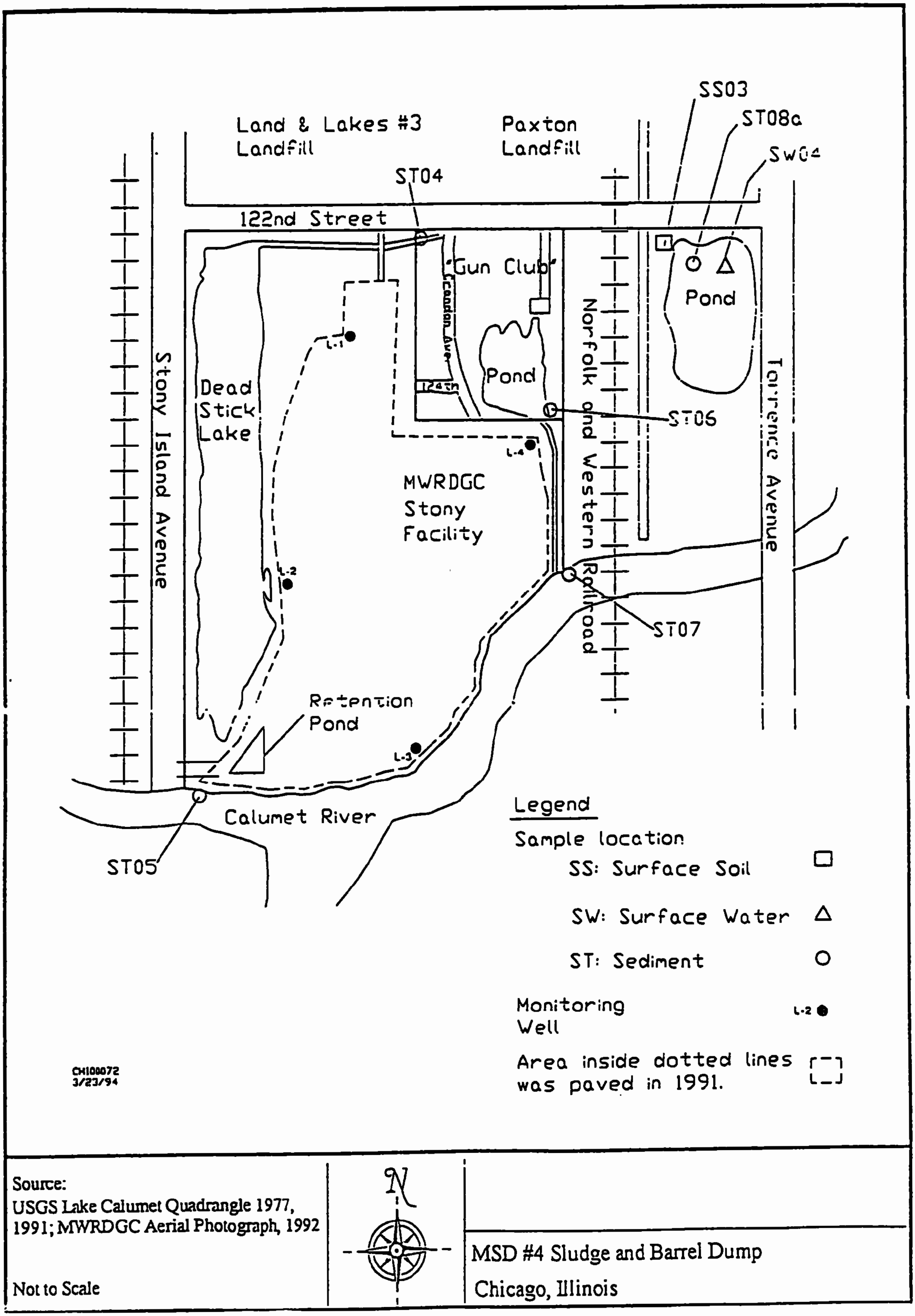
EPA conducted an ESI of Cosden Oil & Chemical Company, located in Calumet City in southeastern Illinois (U.S. EPA, 1995f) (Figure 4-57). The site is bordered on the west by Calumet Expressway I-94, on the north by the Little Calumet River, and on the south and east by Ashland Chemical facility. CID landfill is located north of the Little Calumet River. From 1949 to 1990, the facility manufactured a variety of products including formaldehyde, aqua ammonia, hexamethylenetetramine (hexamine), polyethylene emulsions, and polystyrene plastic. Several steel aboveground storage tanks were used to store products and wastes from about 1978 until 1992. The site was shut down in 1990; dismantling and hazardous waste removal actions continued from 1990 to 1992 (U.S. EPA, 1995f).

In 1993, five soil samples (SS01-SS05) were collected from depths of less than 2 feet during the ESI sampling. SS01 was collected within the bermed area surrounding three 850,000-gallon styrene tanks in the northwestern portion in the site. SS02 was collected from the likely location of the gravel-lined drum storage area. Sample SS03 was collected from beneath aboveground product piping north of the bermed area that surrounded the three 850,000-gallon styrene tanks. SS04 was



Source: U PA, 1995e.

Figure 4-55. Soil Sample Locations (SS01 to SS02) at # 4 Sludge and Barrel Dump



Source: U.S. EPA, 1995e.

Figure 4-56. Background Soil Sample Location (SS03) at # 4 Sludge and Barrel Dump

Table 4-82. Concentrations of Soil Contaminants at MSD # 4 Sludge and Barrel Dump

Substance	Soil Sample Location & Concentrations (μg/kg)		
	SS01	SS02 Background	SS03
Phenanthrene	300 J	100J	1.600
Carbazole	83 J		450
Fluoranthrene	430	170 J	2.400
Pyrene	610 B		3,300 B
Benzo(a)anthracene	360 J	130 J	2.000
Chrysene	300 J	130 J	1,500
Benzo(b)fluoranthene	500	230 J	2,900
Benzo(a)pyrene	230 J	110 J	1.400
Indeno(1.2.3-cd)pyrene	230 J	110 J	690 JD
Benzo(g.h,i)perylene	240 J	110 J	1400
PCB - Aroclor-1254	400 P	170 P	160 P
Metals Concentrations (mg/kg)			
Aluminum	10,700	7.200	14.900
Arsenic	9 9 S*	13 9*	15 3*
Barium	147 J	81 6 J	200 J
Beryllium		0 59 B	2 7
Cadmium	8	5	
Chromium	204 JN	113 JN	232 JN
Lead	70 3	57 7	47 1
Manganese	1.380	1,180	4,160
Nickel	32 7	22 9	26 1
Selenium	0 68 JBW	0 51 JBW	0 31 JBW
Silver	3 1 JN		1 7 JN
Vanadium	43 5	35 7	65 2
Zinc	320 JN	221 JN	214 JN

J - Reported value is estimated; U - Substance is undetected. The reported value is the contract required quantification limit, B - Reported value less than the contract required detection limit, but greater than instrument detection limit; P - Greater than 25% difference for detected concentrations; S - Reported value determined by method of standards additions, W - Post-digestion spike for furnace AA analysis is out of control limits; X - Indistinguishable coeluting isomers; Y - Compound reported from peak response exceeding range of standard calibration, * - Duplicate analysis was not within control limits, C - Identification confirmed by GC/MS.

Source: U.S EPA, 1995e

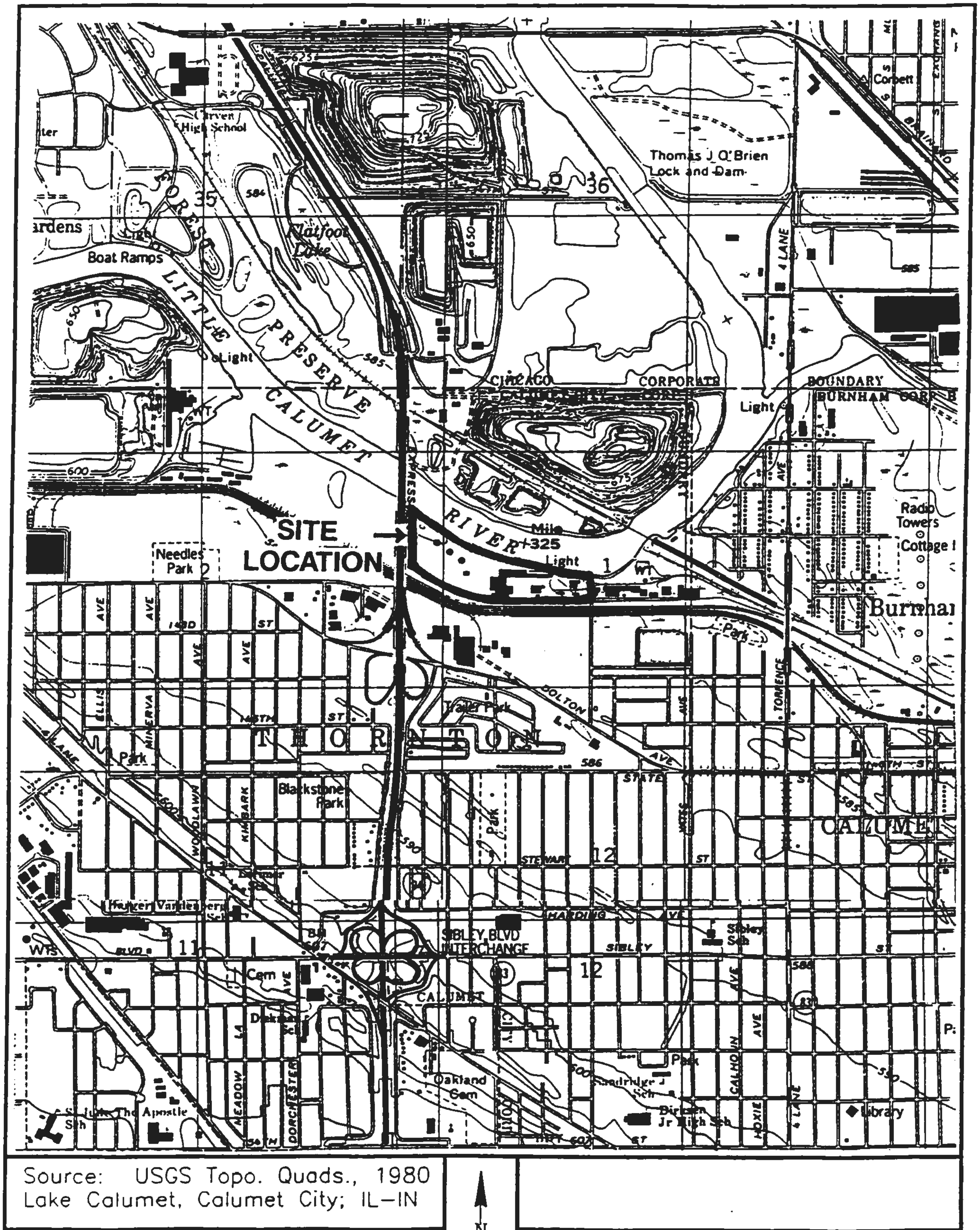


Figure 4-57. Site Location Map of Cosden Oil and Chemical Co.

Source: U.S. EPA, 1995f.

collected just south of the polystyrene process building, in the location of the former earthen blow-down pit. SS05, the background soil sample, was collected in the wooded area south of the site (Figure 4-58).

Analyses of the four on-site soil samples (SS01-SS04) identified 3 VOCs, 1 PCB, and 14 inorganic contaminants (U.S. EPA, 1995f). Sample locations and concentrations of contaminants are presented in Table 4-83. SS01 detected chloromethane (120 μg/kg), acetone (1,200 μg/kg), styrene (820 μg/kg), cadmium (66.4 mg/kg), chromium (182 mg/kg), copper (2,440 mg/kg), lead (1,240 mg/kg), manganese (829 mg/kg), nickel (135 mg/kg), and zinc (212,000 mg/kg). Sample SS02 detected aluminum (21.8 mg/kg), chromium (78.6 mg/kg), manganese (4,130 mg/kg), silver (2.2 mg/kg), and vanadium (58.4 mg/kg). SS03 detected PCB-Aroclor-1260 (600 μg/kg), barium (209 mg/kg), calcium (148,000 mg/kg), magnesium (96,000 mg/kg), and silver (6.5 mg/kg). SS04 detected barium (216 mg/kg), cadmium (14.5 mg/kg), chromium (455 mg/kg), iron (51,700 mg/kg), and nickel (116 mg/kg) (U.S. EPA, 1995e). In general, the highest concentrations of contaminants were found in sampling location SS01, which was collected within the bermed area surrounding the three 850,000-gallon styrene tanks at the northwestern portion of the site (Figure 4-58).

No workers or other persons are routinely on-site, and the nearest residences are located about 1,000-feet south of the site in Calumet City. The estimated population within 1 mile of the site is 21,595 persons; no sensitive environments are located on site (U.S. EPA, 1995f).

4.5.3.6 *Land and Lakes #3 Landfill*

EPA conducted an ESI of the Land and Lakes #3 Landfill, located in an industrial area on Chicago's far southside (Figure 4-59). The landfill is bordered on the north and northeast by Paxton Landfill and Lagoon (U.S. EPA, 1996d). Land and Lakes #3, an active landfill permitted to accept municipal and nonhazardous special wastes, began operations in 1978 (accepted solid, liquid, and industrial wastewater treatment sludge wastes) and operates a wastewater treatment facility, which treats leachates from other landfills. Treated effluents are discharged to the sanitary sewer system. The facility has no leachate collection system. IEPA collected soil, sediment, and groundwater samples in 1994, which showed elevated levels of various organics, inorganics, pesticides, and PCBs (U.S. EPA, 1996d).

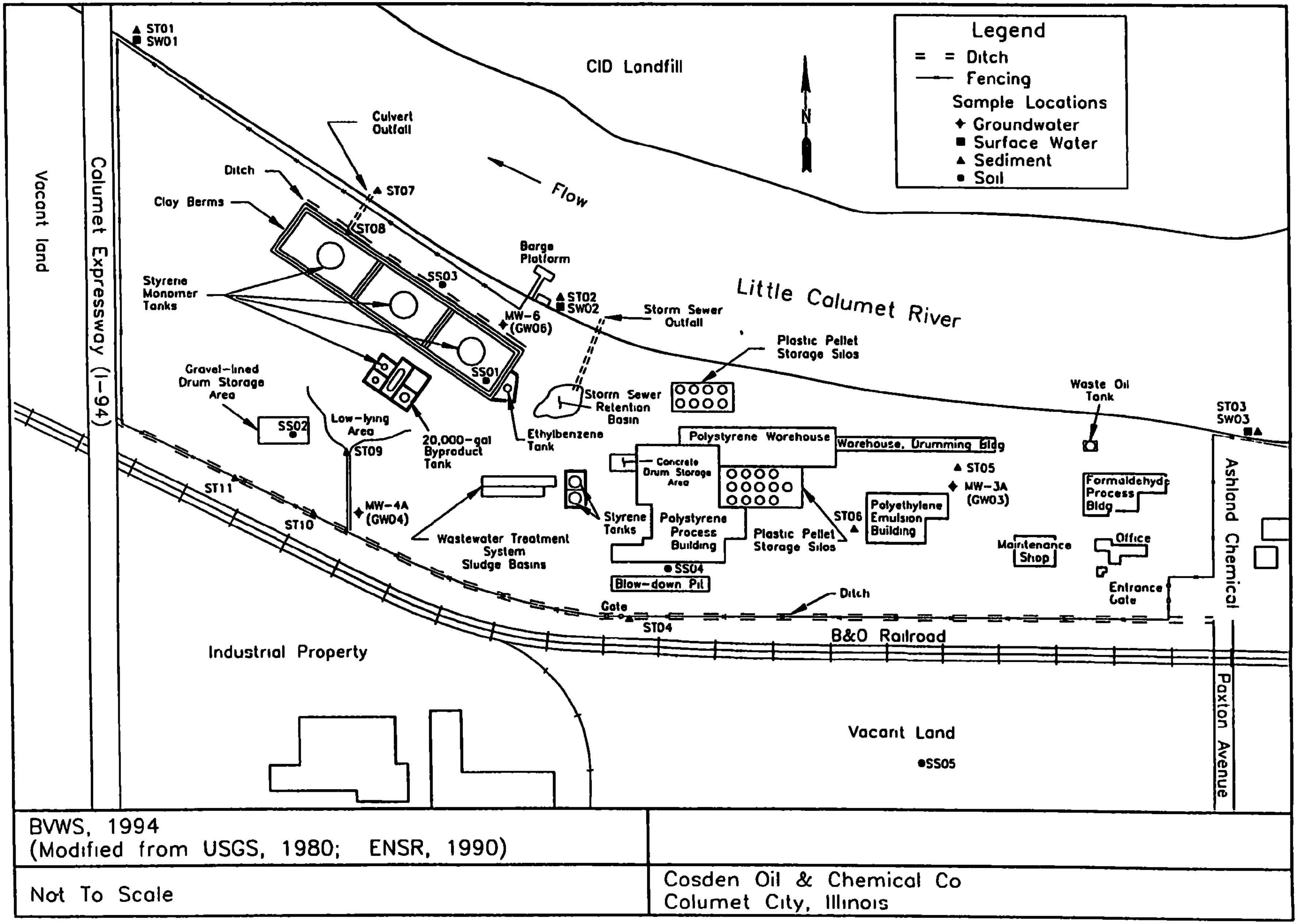


Figure 4-58. Soil Sample Locations (SS01 to SS05) at Cosden Oil and Chemical Co.

Source: U.S. EPA, 1995f.

Table 4-83. Concentrations of Soil Contaminants at Cosden Oil & Chemical Company

Substance	Soil Sample Location and Concentrations ($\mu g/kg$)				
	SS01	SS02	SS03	SS04	SS05 Background
Chloromethane	120				15 UJ
Acetone	1,200 J				15 UJ
Styrene	820				15 UJ
PCB-Aroclor-1260			600 P		51 UJ
Metals Concentration (mg/kg)					
Aluminium		21.8			10 U
Barium			209	216	66.5
Cadmium	66.4			14.5	0.83 U
Calcium			148,000 J		4400 J
Chromium	182	78.6		455	14.2
Copper	2,440 JE				33 UJE
Iron				51,700	16,800
Lead	1,240				47.5
Magnesium			96,000 J		1,980 J
Manganese	829	4,130			255
Nickel	135			116	14.4
Silver		2.2	6.5		1.7 U
Vanadium		58.4			18.4
Zinc	212,000 JE				461 JE

U-compound analyzed for but not detected, P-pesticide Aroclor target analyte where greater than 25% difference exist between the two GC columns for detected concentrations The lower of the two values is reported and flagged with a "P", J-Estimated value, B-reported value is less than the contract required detection limit, but greater than or equal to the instrument detection limit, E-Estimated because of interference, N-spiked sample recovery not within control limits

Source. U.S. EPA, 1995f.

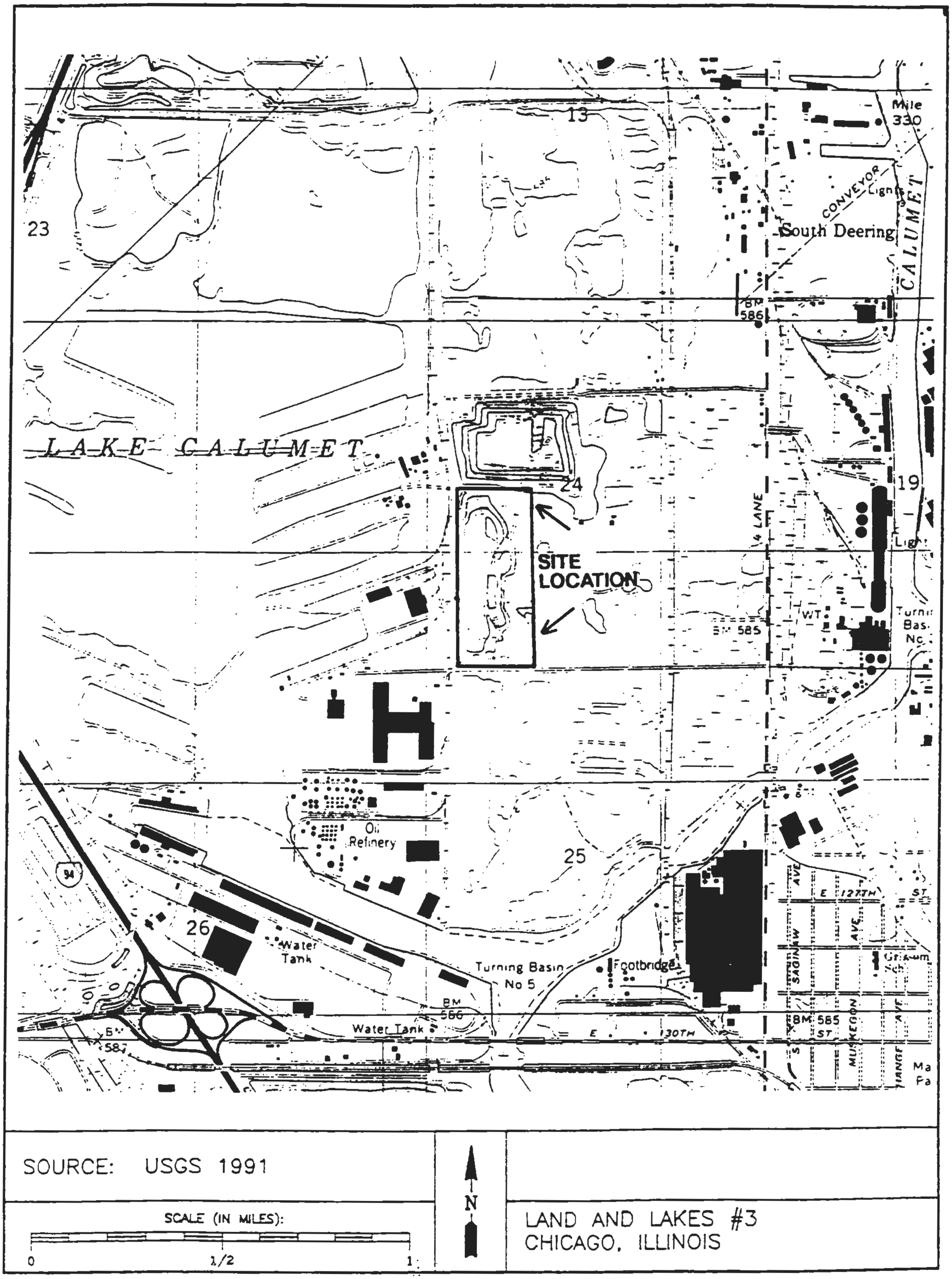


Figure 4-59. Site Location Map of Land and Lakes # 3

Source: U.S. EPA, 1996d.

The site investigation field team collected six soil samples in January 1994, including four investigative soil samples and two background soil samples. Samples SS01 to SS04 were collected near the perimeter (northwest, northeast, southeast, and southwest site quadrants respectively) of the landfill area to assess general soil conditions. Background samples (SS05 and SS06) were collected from off-site locations, northwest and southeast of the site, to establish background soil conditions (Figure 4-60).

Table 4-84 presents sample locations and contaminant concentrations. The analytical results identified SVOCs in concentrations ranging from 2.1 to 130,000 μg/kg; pesticides, ranging from 2.1 to 6.1 μg/kg; PCBs, ranging from 40 to 610 μg/kg; arsenic, ranging from 6.7 to 20.7 mg/kg; barium, ranging from 54.7 to 610 mg/kg; cadmium, ranging from 1.2 to 24.7 mg/kg; silver, ranging from <0.94 to 5 mg/kg; lead, ranging from 47.1 to 463 mg/kg; and cyanide, ranging from <0.62 to 22.2 mg/kg (U.S. EPA, 1996d). In general, the highest concentration of contaminants was identified in sampling location SS04, which was in the southwest site quadrant.

Samples indicated that approximately 30 acres of soil contain an observed release. Approximately 10 workers were potentially threatened by soil exposure. The site is fenced, and on-site soils are unlikely to affect residential areas, located 1-mile southeast of the site. An estimated 274 people reside within 1 mile of the site (U.S. EPA, 1996d).

4.5.3.7 *Alburn Inc.*

EPA conducted an ESI of the Alburn Inc., an abandoned hazardous waste landfill/incinerator site located in Lake Calumet area of Southeast Chicago (U.S. EPA, 1995g) (Figure 4-61). Alburn, which accepted hazardous solid and liquid waste for more than 20 years, was ordered closed by IEPA in 1982, due to several violations and detection of several organics, inorganics, metals, and pesticides at elevated levels in soils and water samples (U.S. EPA, 1995g). In addition to its incinerator, the site had a 175,000-gallon surface impoundment, more than 6,000 55-gallon drums (several were leaking to the ground), and 2 USTs. Several emergency removal actions were initiated by EPA in the 1980s, partially in response to a drum explosion in July 1983. Following these removal actions, which included clay capping of specific areas due to high levels of PCBs, the site remains inactive (U.S. EPA, 1995g).

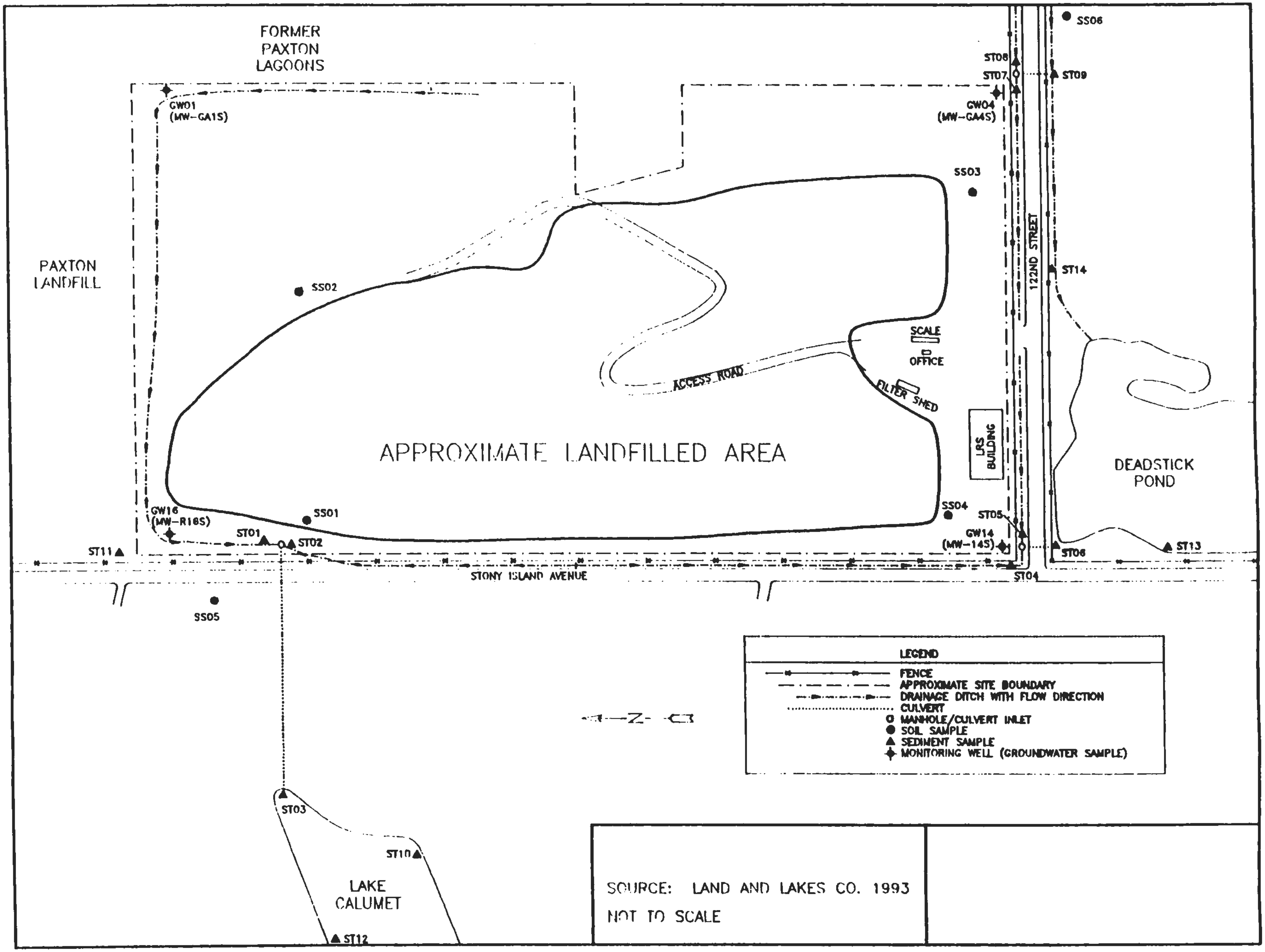


Figure 4-60. Soil Sample Locations (SS01 to SS06) at Land and Lakes # 3

Source: U.S. EPA, 1996d.

Table 4-84. Concentrations of Soil Contaminants at Land and Lakes #3

Substance	Soil Sample Location & Concentrations (μg/kg)					
	SS01	SS02	SS03	SS04	SS05 (Background)	SS06 (Background)
Bis(2-Ethylhexyl)phthalate				130.000 BD	1.200 UJBD	1,400 UJB
Delta-BHC				7 8 JPX	2 1 U	2 4 U
Gamma-BHC				6 2 JPX	2 1 U	2 4 U
Heptachlor Epoxide				12 J	2 1 U	2 4 U
Dieldrin	7 3 J			28 JPX	4 0 U	4 6 U
4.4'-DDE				24	4 4 PX	8 P
4,4'-DDD				25 J	4 6 PX	4 6 U
Endosulfan Sulfate		6 1 JP			4 0 U	4 6 U
Alpha-Chlordane	5 6 JPX				2 1 U	2 4 U
Gamma-Chlordane	5 1 JPX				2 1 U	2 4 U
PCB - Aroclor-1242	180 J		490 J		40 U	46 U
PCB - Aroclor-1254	140 J	59 J		610 J	40 U	46 U
Metals Concentrations (mg/kg)						
Aluminum	9.400	12,600	9.830	12.000	8.010	9,530
Arsenic	9 1	7	8 6	20 7	6 7	17 3
Barium	82 2	89 7	54 7	610	75 1	114
Cadmium	2 4	1 2 U	0 91 U	24 7	1 2	2 8
Chromium	113 JN*	35 5 JN*	24 7 JN*	248 JN*	37 6 JN*	74 5 JN*
Iron	22.100	21.300	24.100	28,900	19.700	57,500
Lead	70 3	57 7	47 1	463	153	215
Magnesium	33.800	29.900	29.100	24,100	23,300	20,900
Manganese	1.740 J*	672 J*	522 J*	589 J*	614 J*	1,230 J*
Nickel	30 9	39	37 9	44 1	24 5	50 4
Selenium	0 68 JBW	0 51 JBW	0 31 JBW	3 2 S	0 57 JB	0 87 JB
Silver	1 1 U	1 1 U	0 87 U	5	0 94 U	1 1 U
Vanadium	43 4	25 9	20 1	35 2	25 4	36 9
Zinc	164	116	246	711	240	472
Cyanide	0 89	0 63 U	0 67 U	22 2	0 62 U	0 95

J - Reported value is estimated; U - Substance is undetected. The reported value is the contract required quantification limit, B - Reported value less than the contract required detection limit, but greater than instrument detection limit; P - Greater than 25% difference for detected concentrations, S - Reported value determined by method of standards additions; W - Post-digestion spike for furnace AA analysis is out of control limits, X - Indistinguishable coeluting isomers, Y - Compound reported from peak response exceeding range of standard calibration, * - Duplicate analysis was not within control limits; C - Identification confirmed by GC/MS.

Source: U.S EPA, 1996d

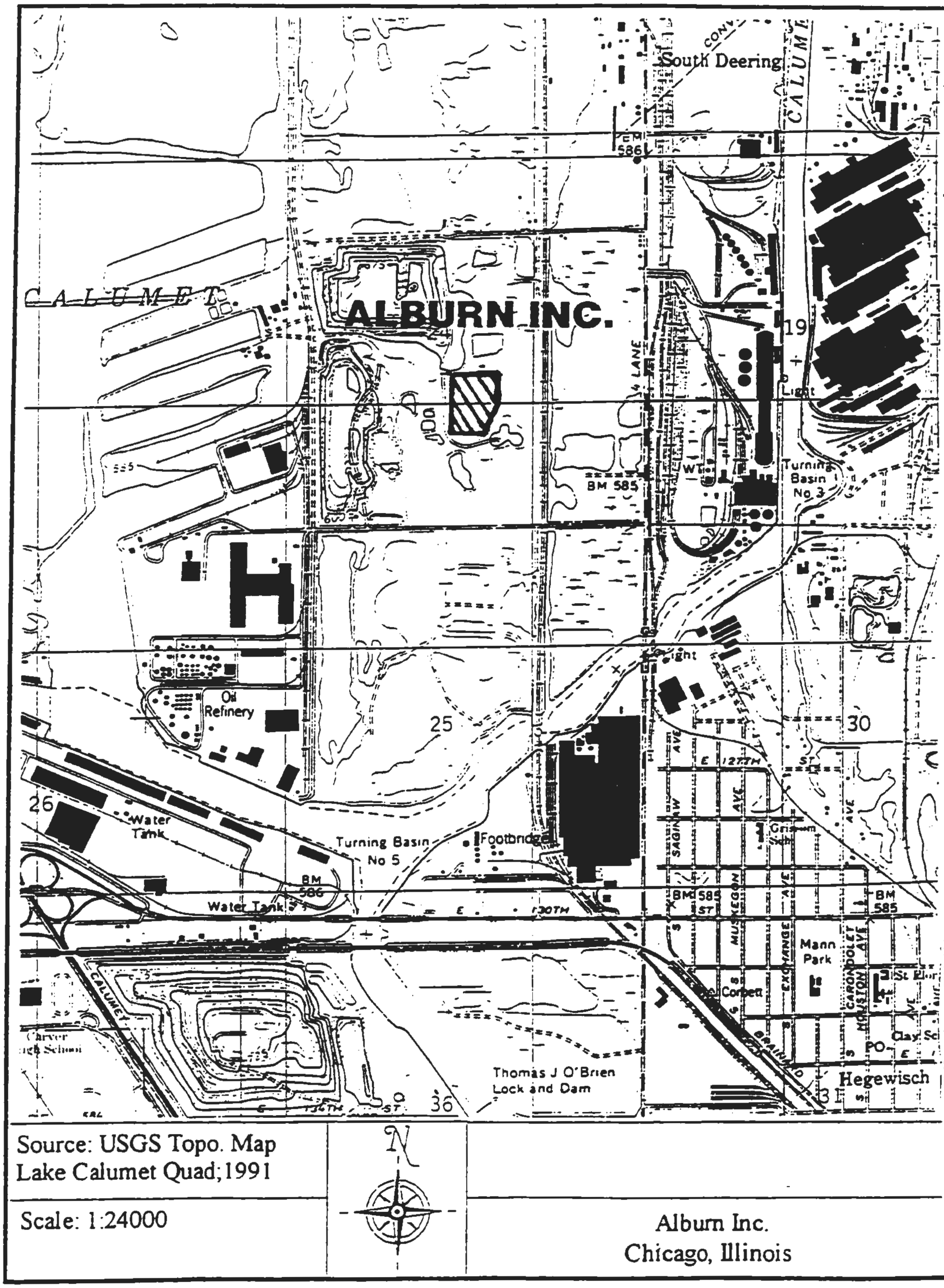


Figure 4-61. Site Location Map of Alburn Inc.

In December 1993, the ESI field team collected 10 surface-soil samples (4 to 18 inches) and 1 background sample. Six soil samples (SS01 to SS06) were collected on site to identify potential soil contamination from prior hazardous substance storage and dumping activities and to evaluate the effectiveness of the cap. Samples SS01 to SS03 were collected from the west, center, and east quadrants in the north half of the site. Sample SS04 was collected as close as possible to the southwest corner, and SS06 was collected from the southeastern portion of the site. Three off-site samples (SS07 to SS09) were collected from areas east and south of the site, where contaminants could migrate along the surface water pathway. A background sample (SS10) was collected approximately 150-yards east of the Paxton Landfill guard house. This location was representative of natural soil conditions in the area (U.S. EPA, 1995g). A proposed background sample (SS11) was abandoned, because it was believed that an untainted sample could not be collected (Figures 4-62 and 4-63).

Analyses results indicated the presence of 8 VOCs, 10 SVOCs, 14 pesticides, 1 PCB, 1 dioxin, and 10 inorganic substances (U.S. EPA, 1995g). The concentration ranges of contaminants are presented in Table 4-85. Several VOCs and SVOCs ranged from 3.0 μg/kg to 17,000 μg/kg; PCBs ranged from 340 μg/kg to 500 μg/kg; and pesticides ranged from 0.18 μg/kg to 180 μg/kg. Organics and pesticides contamination of the site was primarily found in the site's midsection. Iron concentrations ranged from 12,400 mg/kg to 204,000 mg/kg; lead ranged from 38.2 to 1,320 mg/kg; and mercury ranged from 0.35 to 0.87 mg/kg. Other maximum concentrations for contaminants included: aluminum at 23,900 mg/kg; manganese at 18,300 mg/kg; antimony at 34.7 mg/kg; barium at 1,110 mg/kg; cadmium at 13.3 mg/kg; and cyanide at 6.8 mg/kg (U.S. EPA, 1995g).

Volatile and semivolatile contamination was detected in the site's midsection (SS06) and northwestern quadrant (SS02). Pesticides and inorganics were detected throughout the site, and in areas south, east, and northeast of the site. The most significant contamination was located in the site's midsection and east half of the site (U.S. EPA, 1995g).

Sample analyses indicated release of contaminants to the surface water runoff pathway. Nine acres were contaminated (U.S. EPA, 1995g). Three factors potentially affecting the migration of contaminants in the soil pathway are: the reduction of the thickness of the cap, migration of surface water on site, and groundwater to surface water recharge. The site is currently inactive and is located

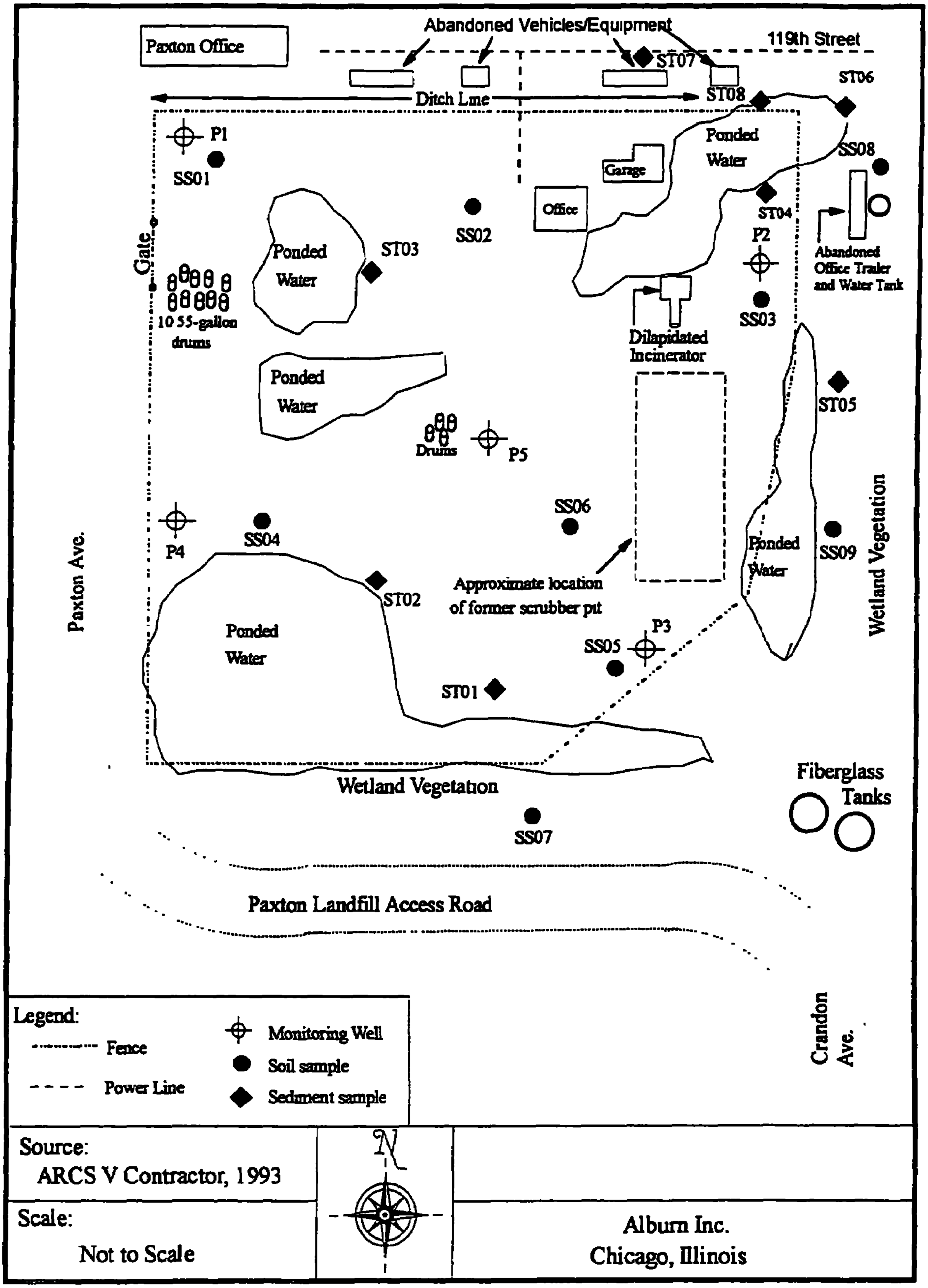


Figure 4-62. Soil Sample Locations (SS01 to SS09) at Alburn Inc.

Source: U.S. EPA. 1995g.

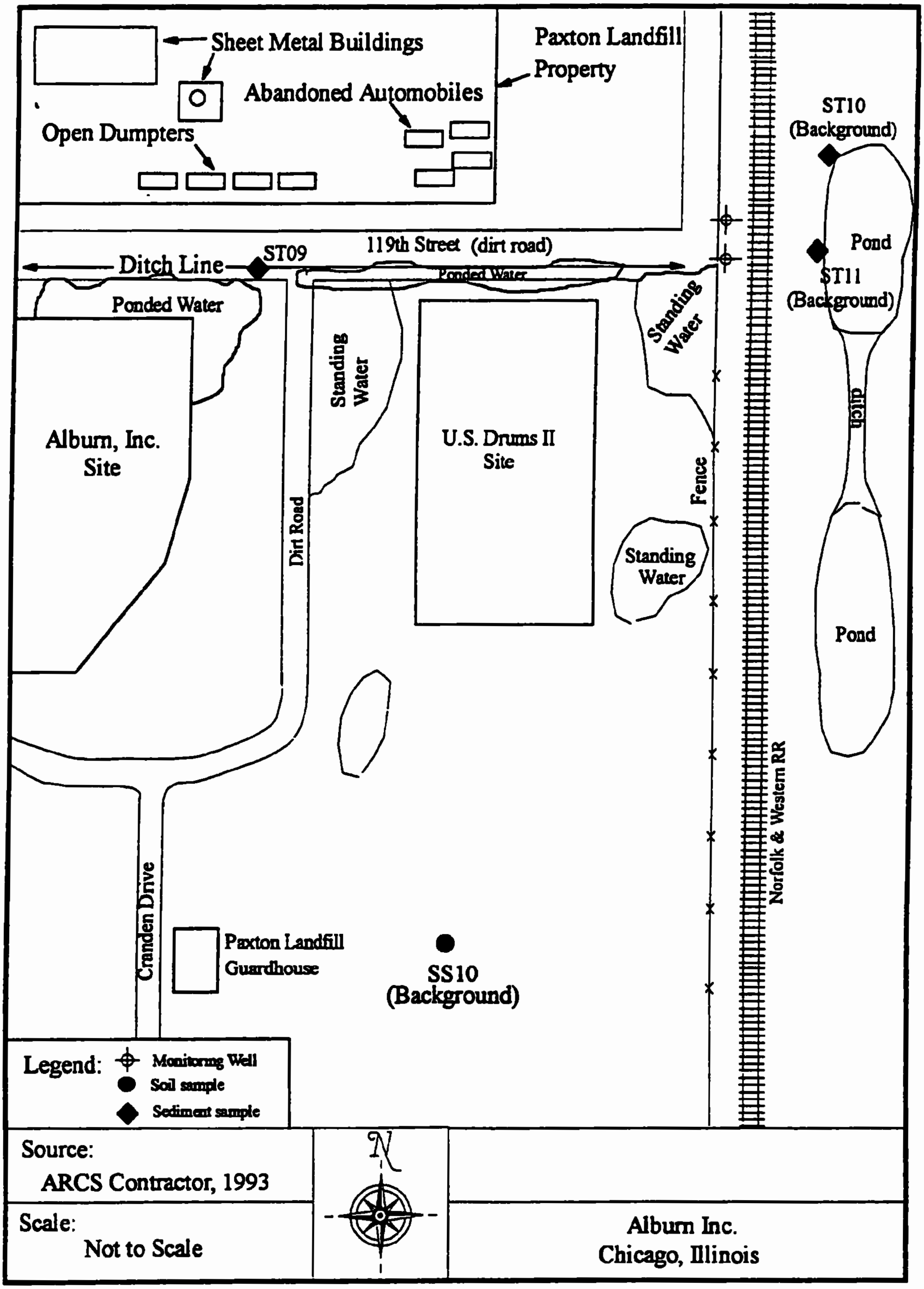


Figure 4-63. Background Soil Sample Location (SS10) at Album Inc.

Source: U.S. EPA, 1995g

Table 4-85. Concentration Ranges of Soil Contaminants at Alburn, Inc.

Contaminant	Concentrations Range
Organics (μg/kg)	
Ethylbenzene	20 - 86
Xylenes (Total)	17 - 53
Acetone	450
1,1 Dichloroethane	26
2-Butanone	1200
Benzene	44
4-Methyl-2-Pentanone	250
Toulene	290
Chrysene	110 - 3,600
Bis(2-ethylhexyl)phthalate	46 - 17,000
Benzo(b)fluoranthene	180 - 980
Benzo(k)fluoranthene	180 - 980
Benzo(a)pyrene	94 - 500
Phenanthrene	130 - 2,800
Fluoranthene	230 - 5,700
Pyrene	130 - 4,500
Butylbenzylphthalate	79 - 3,200
Benzo(a)anthracene	150 - 4,100
4,4'-DDT	5.3 - 12
delta-BHC	0.44 - 8.7
Aldrin	0.35 - 8
Dieldrin	0 91 - 180
4,4'-DDE	0.25 - 22
4,4'-DDD	1 1 - 68
Alpha Chlordane	0 43 - 51
PCB-Aroclor 1260	340 - 500

Table 4-85. Concentration Ranges of Soil Contaminants at Alburn, Inc. (continued)

Contaminant	Concentrations Range
Heptachlor epoxide	0.18 - 30
Methoxychlor	38 - 110
Endosulfan Sulfate	0.18 - 49
Endrin Ketone	4.4
alpha-BHC	5.2
gamma-Chlordane	33
1,2,3,4,6,7,8-HpCDD	0.51
Inorganics (mg/kg)	
Aluminum	4,890 - 23,900
Antimony	2.9 - 34.7
Barium	35.7 - 1,110
Cadmium	10 3 - 13 3
Iron	12,400 - 204,000
Lead	38 2 - 1,320
Manganese	450 - 18,300
Mercury	0.35 - 0.87
Potassium	1,200 - 3,600
Cyanide	0.98 - 6.8

Source: U.S. EPA, 1995g.

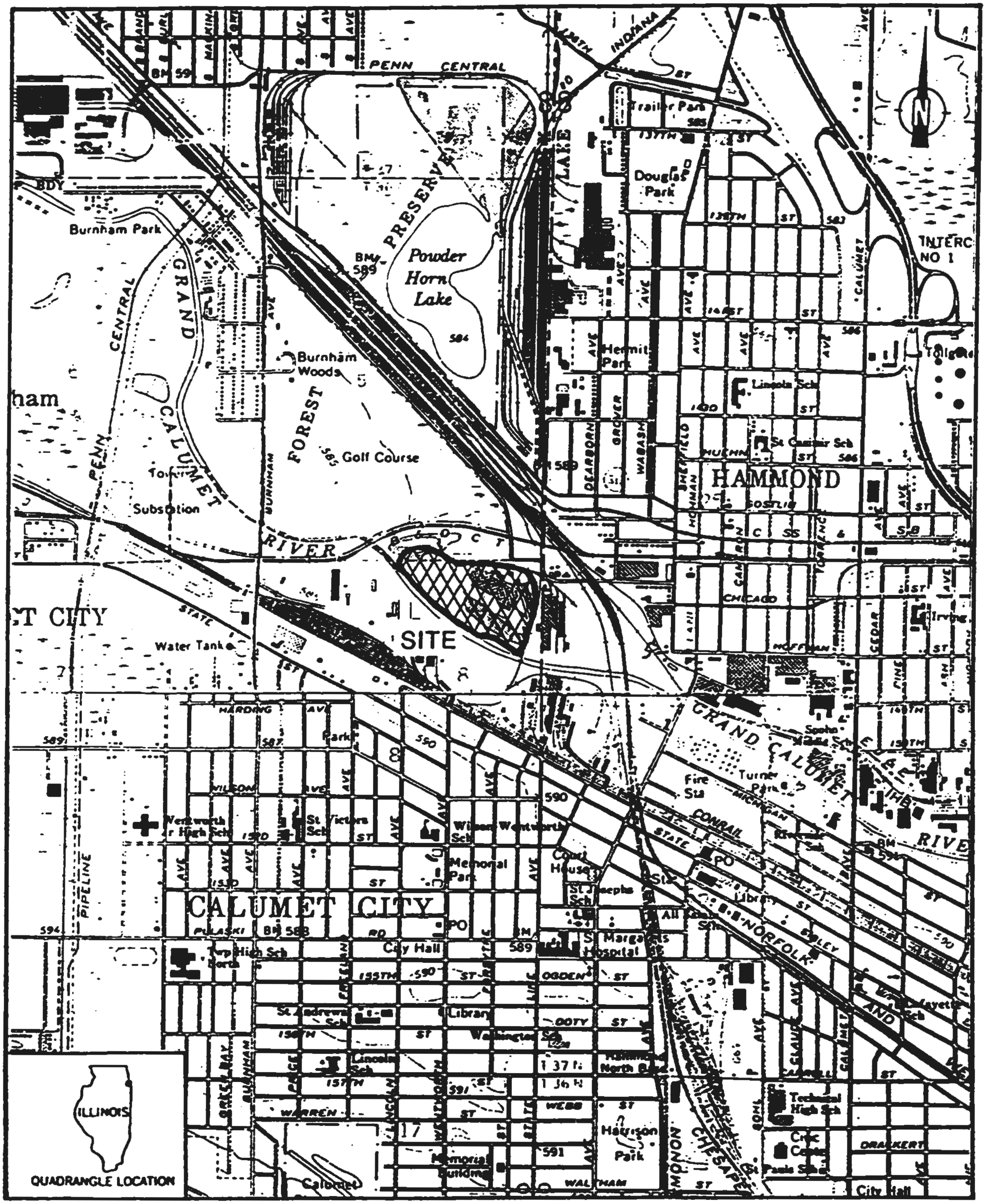
in a highly industrial area. No schools or day-care centers are located within 200 feet of the site (U.S. EPA, 1995g).

4.5.3.8 *Estech General Chemical*

EPA issued a Screening Site Inspection (SSI) report for the Estech General Chemical (also known as G & M Wrecking), located in Calumet City in Southeast Chicago (Figure 4-64) (Ecology and Environment, 1991). The site is an abandoned fertilizer manufacturing plant, which produced organic phosphate and chlorinated hydrocarbon pesticides, as well as contact sulfuric acid from 1950 until 1982. The pesticide plant closed in 1969. The sulfuric acid plant, which generated vanadium pentoxide dust waste from catalyst screening, closed in 1982. In the 1980s, removal action was implemented to remove buried drums containing waste. In 1989, on-site buildings were demolished, and IEPA collected soil samples. No further action was recommended (Ecology and Environment, 1991).

The field investigation team collected six subsurface soil samples on site and two background soil samples at various depths. Soil sample S1 was collected at depth of 10 feet at a site located away from the fill area. Sample S2 was collected at 8 inches from a location near the site's northwest corner, at the toe of the fill slope. Sample S3 was also collected at the toe of the fill slope, from a depth of approximately 6 inches. S4 was collected near the southeast corner of the site on a level area below the fill, from a depth of approximately 9 inches. In addition, samples S3 and S4 were collected near the Grand Calumet River to assist in evaluating the potential for substances to migrate from the site to the river. Sample S5 was collected from the top of the fill, at an approximate depth of 12 inches. Sample S6 was collected at an approximate depth of 18 inches from a location near the fence on the east side. Two background samples (S7 and S8) were collected from the same hole on Memorial Park (Ecology and Environment, 1991) (Figures 4-65 and 4-66).

Contaminant concentration ranges are presented in Table 4-86. Analyses of collected soil samples revealed VOCs concentrations between 3 μg/kg to 140 μg/kg; SVOCs between 47 to 91,000 μg/kg; pesticides 14 and 910 μg/kg; PCBs between 53,000 to 62,000 μg/kg; and metals between 0.1 to 177,000 mg/kg. According to Federal, State, and local file information, no incidents of direct contact with hazardous substances attributable to the Estech site are documented; however, a



SOURCE: Ecology and Environment, Inc. 1989; BASE MAPS: USGS, Lake Calumet, IL, IN Quadtangle, 7.5 Minute Series, 1965, Photorevised 1973; Calumet City, IL, IN Quadrangle, 7.5 Minute Series, 1968, Photorevised 1980.

SCALE
0 ½ 1 MILE

Figure 4-64. Site Location Map of Estech General Chemical

Source: Ecology and Environment, 1991.

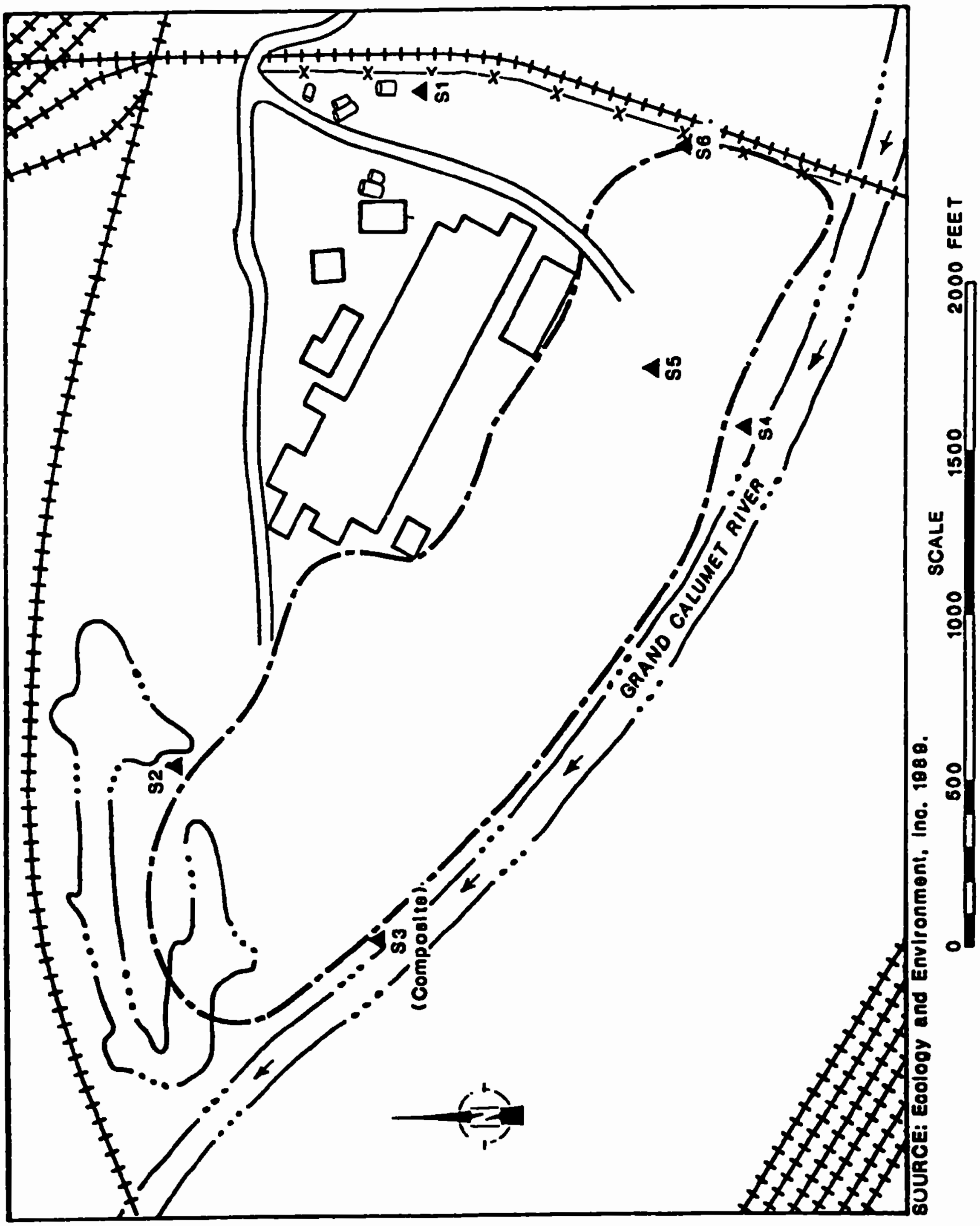


Figure 4-65. Soil Sample Locations (SS01 to SS06) at Estech General Chemical

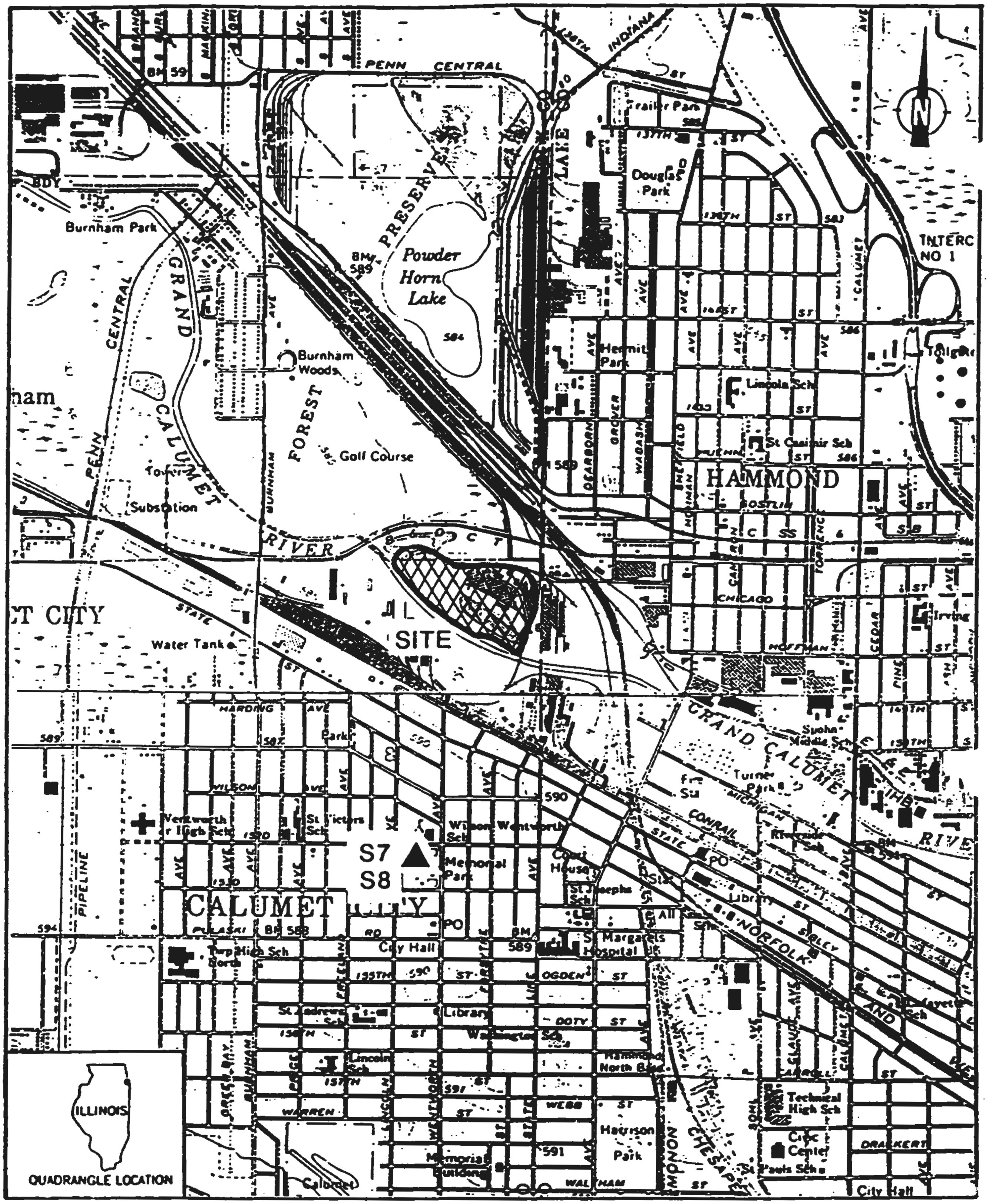


Figure 4-66. Soil Sample Locations (SS07 to SS08) at Estech General Chemical

Table 4-86. Concentration Ranges of Soil Contaminants at Estech General Chemical

Contaminant	Concentrations Range
VOCs (μg/kg)	
Methylene Chloride	9 - 25
Acetone	24 - 140
1,2 dichloroethane	15
Tetrachloroethene	7
Toulene	4 - 16
Ethylbenzene	7
Xylenes (Total)	3 - 14
Pesticides (μg/kg)	
Heptachlor	14
Heptachlor Epoxide	62
Dieldrin	64 - 100
4,4'-DDE	71 - 110
4,4'-DDT	130 - 910
Methoxychlor (Mariate)	110 - 570
Alpha Chlordane	130
PCB-Aroclor 1254	53,000 - 62,000
SVOCs (μg/kg)	
4-methylphenol	3,800
Naphthalene	140 - 2,900
2-methylnaphthalene	160 - 1,800
Acenaphthylene	1,800
Acenaphthane	130 - 4,600
Dibenzofuran	300 - 2,400
Fluorene	150 - 6,500
Phenanthrene	85 - 34,000
Anthracene	77 - 10,000

Table 4-86. Concentration Ranges of Soil Contaminants at Estech General Chemical (Continued)

Contaminant	Concentrations Range
Di-n-butylphthalate	74
Fluoranthene	100 - 45,000
Pyrene	130 - 51,000
Butylbenzylphthalate	1,300 - 6,400
Benzo(a)anthracene	60 - 28,000
Chrysene	78 - 30,000
Bis(2-ethylhexyl)phthalate	190 - 91,000
Di-n-octylphthalate	800 - 1,500
Benzo(b)fluoranthene	71 - 27,000
Benzo(k)fluoranthene	47 - 18,000
Benzo(a)pyrene	540 - 28,000
Indeno(1,2,3-cd)pyrene	1,000 - 19,000
benzo(g,h,i)perylene	1,700 - 20,000
Inorganics (mg/kg)	
Aluminum	1,960 - 27,800
Antimony	4 - 101
Arsenic	3 - 40.9
Barium	6.7 - 1,060
Beryllium	0.35 - 3
Cadmium	1 - 62 2
Calcium	9,760 - 75,500
Chromium	7.6 - 385
Cobalt	2.8 - 37.8
Copper	8 4 - 10,000
Iron	5,670 - 177,000
Lead	7.6 - 3,000
Magnesium	4,530 - 23,200

Table 4-86. Concentration Ranges of Soil Contaminants at Estech General Chemical (Continued)

Contaminant	Concentrations Range
Manganese	155 - 1,730
Mercury	0.1 - 13.1
Nickel	7 - 304
Potassium	379 - 2,930
Selenium	3 2
Silver	3.5 - 14 7
Sodium	128 - 2,140
Vanadium	8.7 - 60
Zinc	205 - 89,100
Cyanide	1.9 - 20.7

Source: Ecology and Environment, 1991.

potential target population of approximately 11,000 persons reside within 1-mile radius of the Estech site (Ecology and Environment, 1991).

4.5.3.9 *Pullman Factory/Sewage Farm*

Two reports contained data on soil levels at the Pullman Factory/Sewage Farm; an IEPA report from 1990 and an expanded site investigation prepared by EPA in 1994. IEPA (1990) issued an SSI report for Pullman Sewage Farm, located in the vicinity of Altgeld Gardens in southeastern Cook County, IL (Figure 4-67). The site was primarily used for land farming of industrial and municipal sewage (IEPA, 1990). Soil and raw sewage were discharged into the Calumet River in early 1900s. The site pumped raw sewage from 1882 to 1892 (IEPA, 1990).

During the May 1990 SSI, IEPA collected 20 soil samples to compare background samples to on-site samples. Two soil samples (X101 and X102) were taken as background, from behind Carver Primary School, because soil in this area appeared to be representative and undisturbed. The remainder of the soil samples (X103 to X120) were representative of the site and the surrounding areas, collected from depths of 0 to 6 feet (Figure 4-68).

Soil samples analyses revealed pesticides in excess of background concentrations in 5 of the 20 samples. Acetone was the highest concentration VOC at 220 ppb, and the highest SVOC was 1,800 ppb of fluoranthene. Inorganic compounds, such as aluminum, cadmium, iron, mercury, and nickel, were found in a number of the soil samples (IEPA, 1990). Analyses indicated a potential for direct contact with contaminants. The exposure potential to humans is based on the analytical results indicating soil contamination in samples X103 (4,4'-DDE 844 ppb, 4,4'-DDT 742 ppb, chromium 59 ppm, and 4,4'-DDD 79 ppb); X105 (aluminum 13,000 pmm, nickel 27 ppm, and cadmium 2.4 ppm); X107 (iron 14,800 ppm, nickel 16 ppm, aluminum 9,100 ppm, 4,4'-DDE 138 ppb, and 4,4'-DET 119 ppb); and X109 (4,4'-DDE 85 ppb, 4,4'-DDT 62 ppb, mercury 0.08 ppm, and nickel 19 ppm) (IEPA, 1990). All samples were collected from the surface to a depth of 14 feet. There are no barriers at the site due to the presence of an apartment complex and single family homes. The nearest resident is considered to be on site, with 3,811 people living in apartments or houses that were built on the property once occupied by the Pullman Factory and the sewage farm. Approximately 21,590 people were estimated to live within a 1-mile radius of the site (IEPA, 1990).

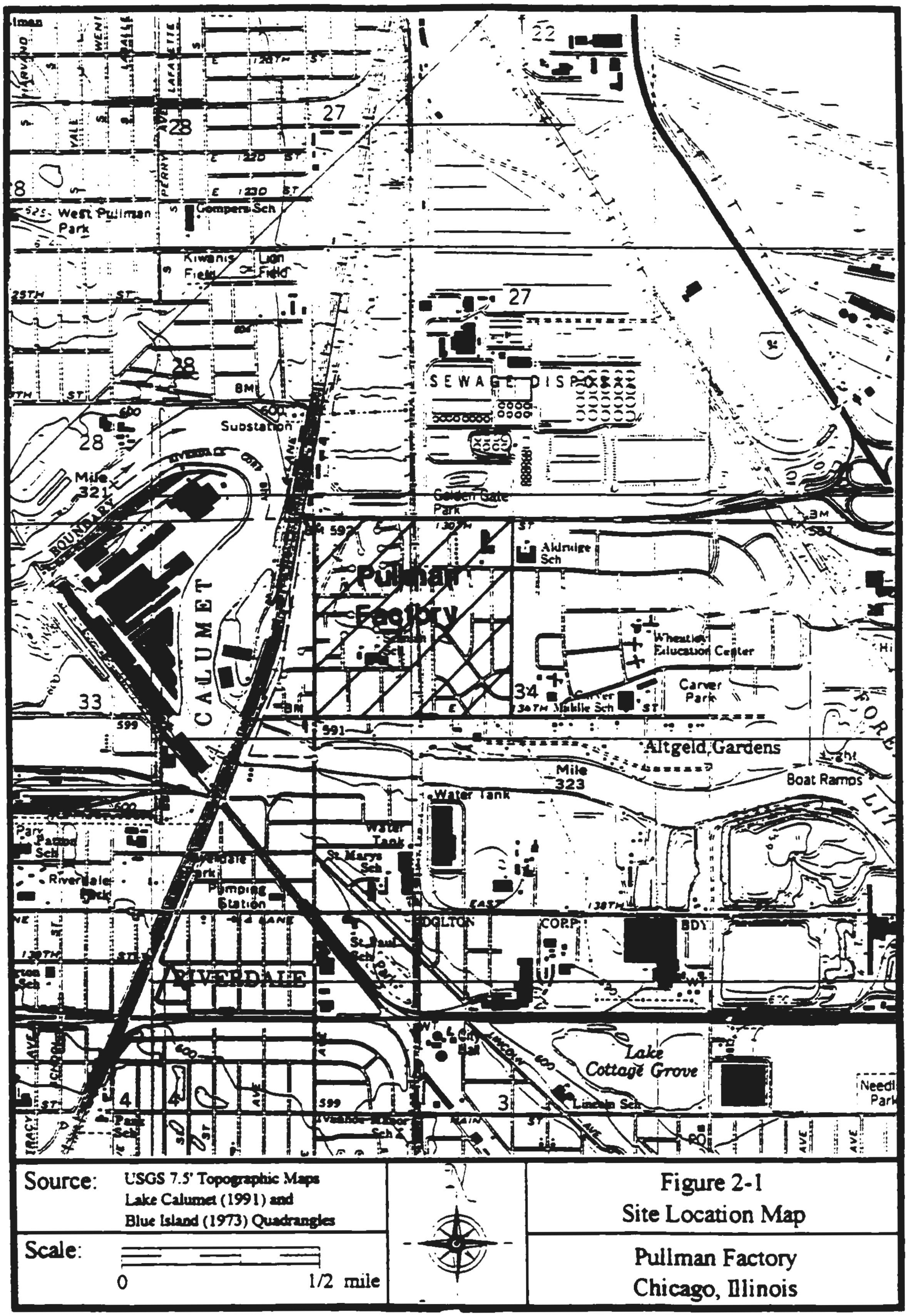
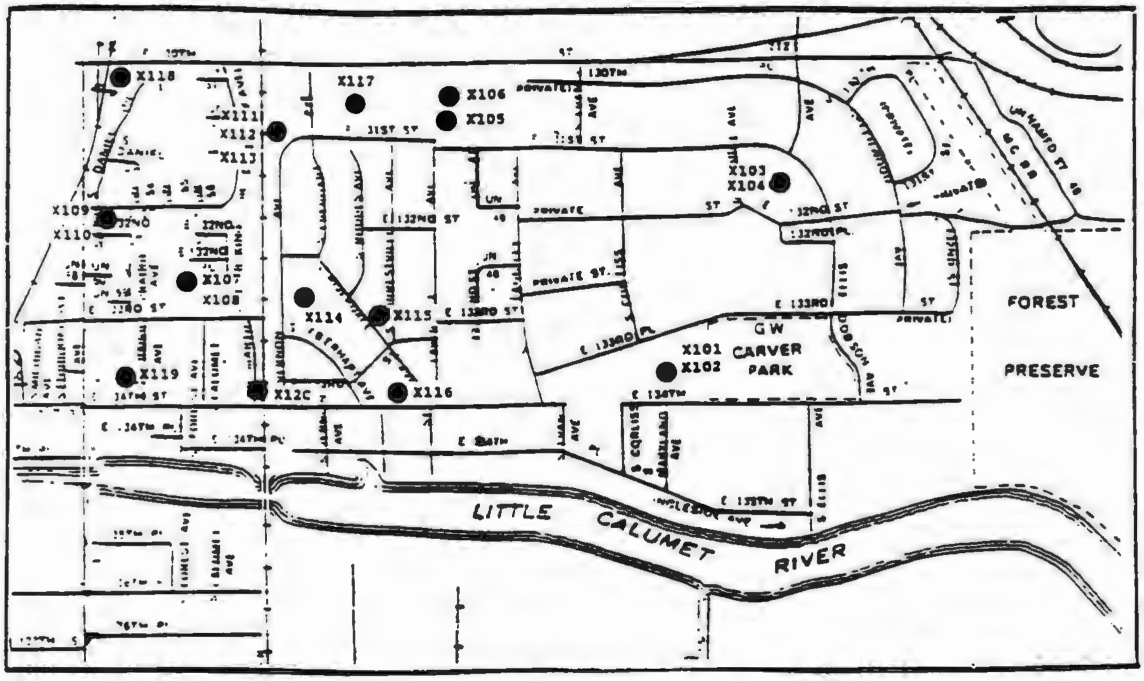


Figure 4-67. Site Location Map of Pullman Sewage Farm

Source: IEPA, 1990.



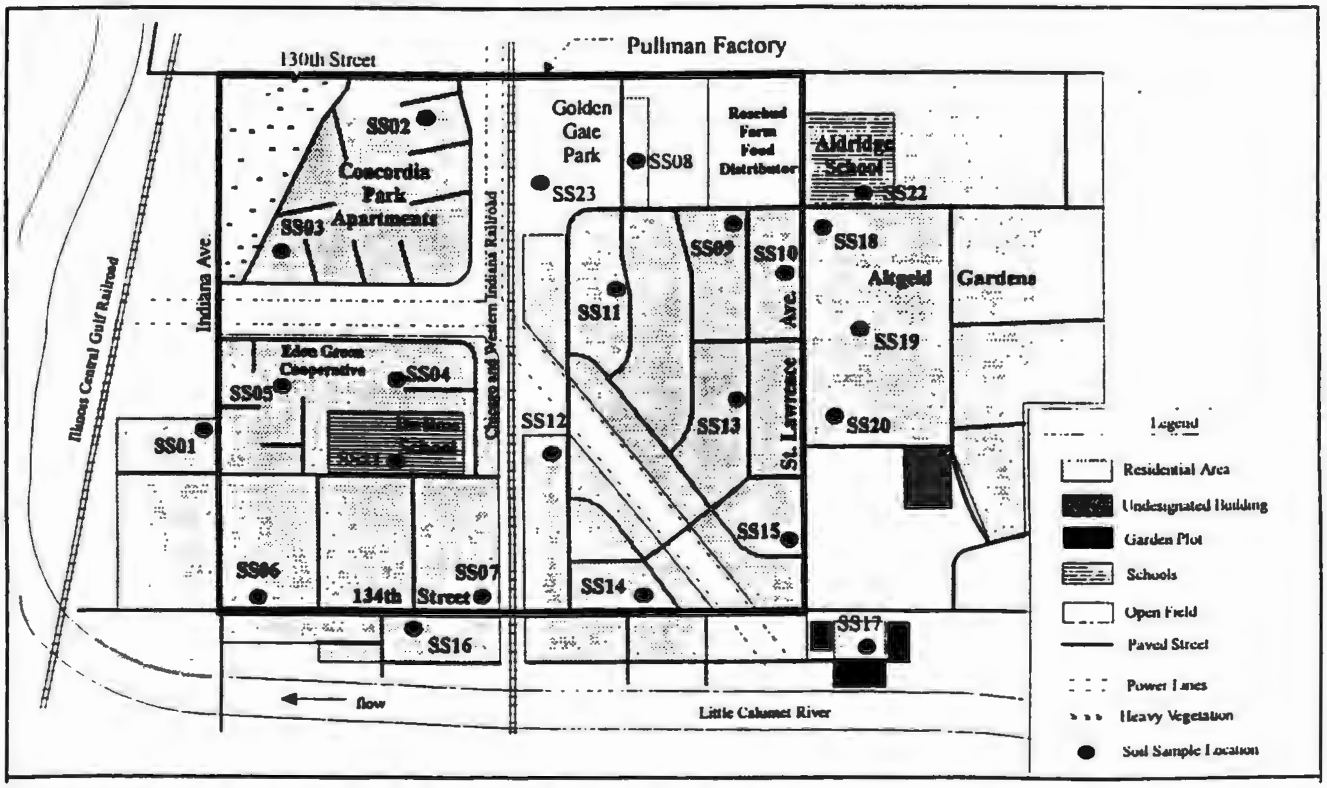


Figure 4-68. Sample Locations from 1990 IEPA Report and 1994 U.S. EPA Report on Pullman Factory/Sewage Farm

Source: U.S. EPA, 1994f.

In January 1994, 23 soil samples were collected from the Pullman Factory as part of EPA Region 5's expanded site investigation (U.S. EPA, 1994f). Of these, 14 were collected from residential properties developed on the site after the facility closed, and 5 were collected from properties just outside the site boundaries (EPA, 1994f). Two samples were taken from schools in the area, and one was taken from a park in the northern section of the site. The final sample, collected from an area west of the site, was used to determine background concentrations of contaminants.

Analyses of these samples indicated no volatile organics above the detection limits. Eleven semivolatiles were identified above their detection limits, including bis(2-ethylhexyl)phthalate, with a maximum 89 ppm detected, pyrene (22 ppm maximum), and chrysene (12 ppm maximum). Two pesticides, 4,4'-DDE and 4,4'-DDT, were detected in the samples, showing maximum concentrations of 580 ppb and 370 ppb, respectively. A number of inorganics were detected, most of which were also found in the background sample. These included arsenic (33.1 ppm maximum), chromium (36.7 ppm maximum), lead (270 ppm maximum), and nickel (36.6 ppm maximum). Cyanide was detected in one sediment sample at a concentration of 6.4 ppm. A comparison between the 1990 and 1994 studies is shown in Table 4-87. EPA (1994f) notes that the contaminants identified are generally consistent with the results from the 1990 IEPA study.

4.5.3.10 *Paxton Landfill LHL #2*

EPA conducted an ESI of Paxton Landfill LHL #2 site, which is composed of several landfills: Paxton I, Paxton II, and LHL Landfills, located in Southeast Chicago (Figure 4-69) (U.S. EPA, 1995h). Properties bordering Paxton Landfills are Land and Lakes #3 Landfill, southwest of the site, and Alburn Incinerator and U.S. Drum II, southeast of the site. Paxton I operated from 1971 to 1976 under special waste permits authorized by IEPA and accepted general refuse and industrial wastes. IEPA noted inadequate procedures during inspections between 1974 to 1976. Paxton II opened illegally in 1976, legally in 1978, and operated until 1992, accepting special hazardous waste. Paxton was cited for various violations between 1976 until 1978. Site operations in LHL landfills were poorly documented. LHL I was inactive, and LHL II operated from 1977 to 1978. IEPA permitted the landfill to handle refuse and demolition debris; no records were available. Between 1974 and 1990, IEPA site inspections documented many violations, including

Table 4-87. Concentrations of Soil Contaminants at Pullman Factory/Sewage Farm, 1990 and 1994

Pollutant	Concentration Ranges	
	1990	1994
Volatiles (µg/kg)		
Methylene Chloride	2-6	–
Acetone	25-220	–
2-Butanone	12-13	–
Trichloroethene	4-9	–
Tetrachloroethene	10-18	–
Toluene	6-17	–
Xylene (total)	2-3	–
Semivolatiles (µg/kg)		
Phenanthrene	240-630	390-21,000
Fluoranthene	200-1,800	440-2,300
Pyrene	200-1600	440-22,000
Benzo(a)anthracene	160-1,000	480-9,700
Chrysene	170-720	450-12,000
bis(2-Ethylhexyl)phthalate	170-480	590-89,000
Benzo(b)fluoranthene	170-830	490-7,900
Benzo(k)fluoranthene	400-510	11,000
Benzo(a)pyrene	580-670	500-9,000
Ideno(1,2,3-cd)pyrene	440-510	460-4,600
Benzo(g,h,I)perylene		460-580
Pesticides (µg/kg)		
Lindane	0 88-6	–
Aldrin	1.6	–
Heptachlor Epoxide	3-50	–
Dieldrin	1.5-9	–
Endrin Ketone	10	–
Gamma-Chlordane	10	–
4,4'-DDD	23-104	–
4,4'-DDE	26-844	340-580
4,4'-DDT	6-742	140-370
Inorganics (mg/kg)		
Aluminum	1,400-13,000	5,410-25,100
Antimony	0.3-0 4	–
Arsenic	1 5-17	7.3-33.1
Barium	14-97	49.6-2,590
Beryllium	0 1-0 7	1.3-1.4
Cadmium	0 7-3 7	–
Calcium	2,900-83,600	3,540-67,500

Table 4-87. Concentrations of Soil Contaminants at Pullman Factory/Sewage Farm, 1990 and 1994 (cont'd)

Pollutant	Concentration Ranges	
	1990	1994
Chromium	6.6-59	9-36.7
Cobalt	4.5-24	12.8-13.3
Copper	6-40	–
Iron	4,800-29,600	9,370-36,400
Lead	6.7-128	13.2-270
Magnesium	1,600-113,000	2,180-32,000
Manganese	200-1,170	209-1,200
Mercury	0.1-0.41	–
Nickel	8.4-51	12.4-36.6
Potassium	510-2,700	1,230-4,320
Selenium	0.2	–
Sodium	67-260	–
Vanadium	6.4-28	13.9-69.1
Zinc	26-167	78.2-99.7
Cyanide	1.1-3	6.4

– = Not Detected.

Source: IEPA, 1990; U.S. EPA, 1994f.

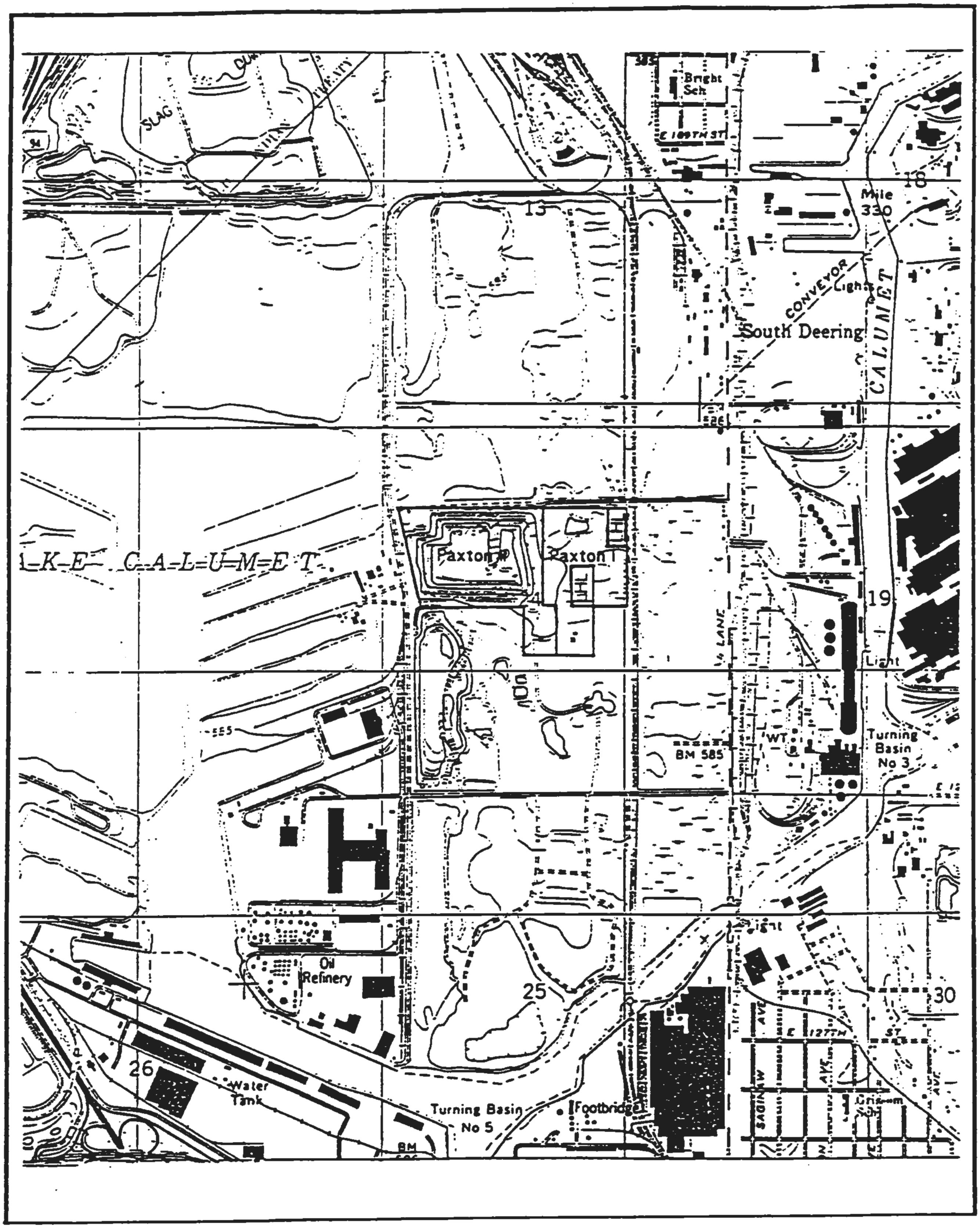


Figure 4-69. Site Location Map of Paxton Landfill Corp.

Source: U.S. EPA, 1995h.

inadequate cover and leachate containment problems. In 1988, Paxton contracted Roy F. Weston to conduct facility investigation of Paxton II; various media samples were taken and analyzed, and contaminants were found at elevated levels, posing risk to general populations (U.S. EPA, 1995h).

In December 1993, four surface soil samples (SS01, SS02, SS04, SS05) were collected from the Paxton site. SS01 was collected from the north-central portion; SS02 was collected from the southwestern corner of fenced in equipment and scrap area; SS04 25 feet north of the ditch, along the north-central section of Paxton II; and SS05 represented background conditions (Figure 4-70). The contaminant concentration ranges are presented in Table 4-88.

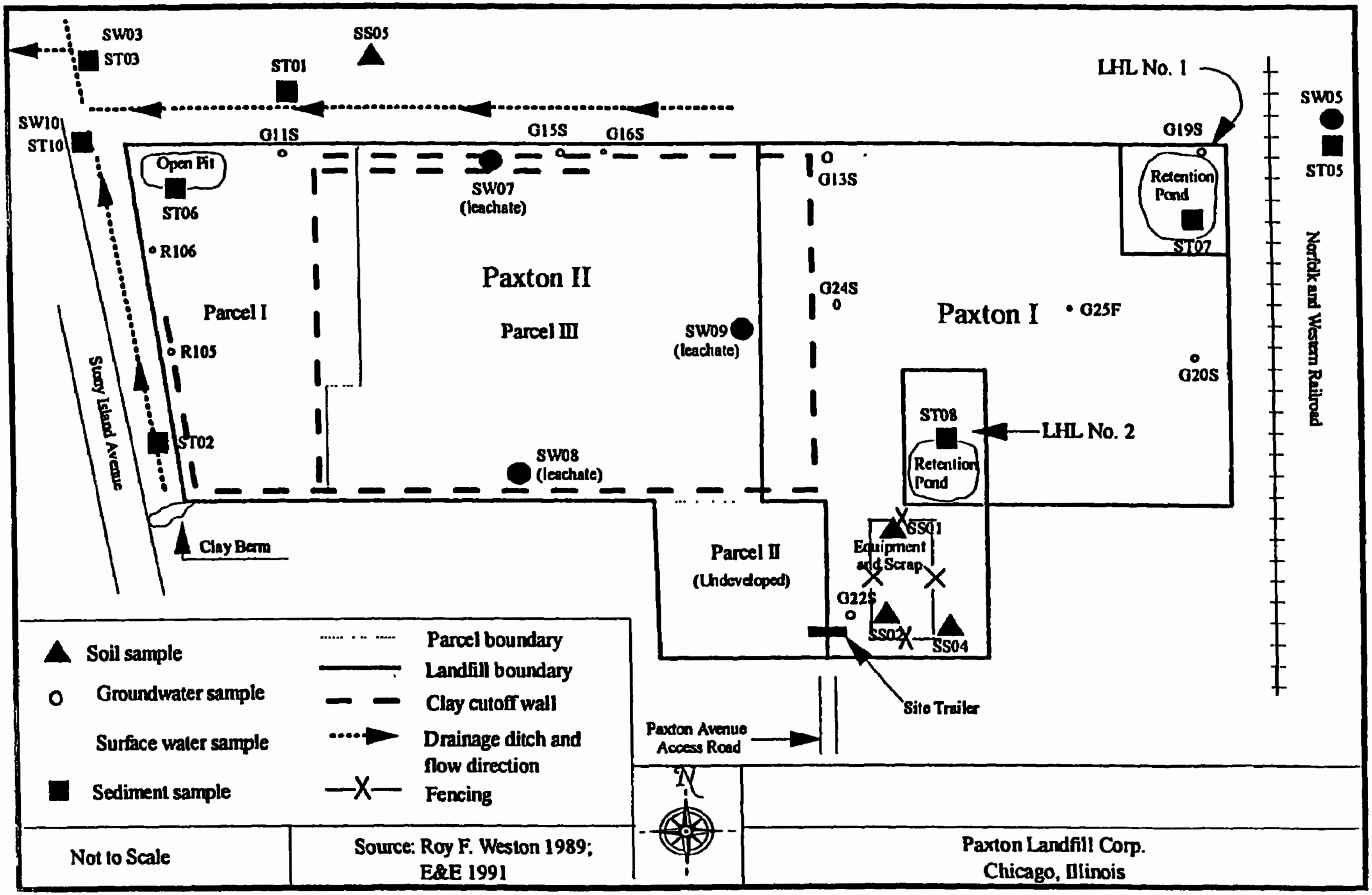
Analytical results indicated mercury concentrations between 0.10 to 0.15 mg/kg, and nickel concentrations between 19.6 to 138 mg/kg. An on-site population of 12 workers may be affected by exposure to the contaminants. The population within 1-mile radius of the site is 274 people (U.S. EPA, 1995h).

4.5.3.11 *Indiana Harbor Belt Railroad*

An EPA field investigation team collected four soil samples from the Indiana Harbor Belt Railroad, located in Hammond, IN. The railroad yard handled drums and performed maintenance. The sample results show that the soil was contaminated. One organic sample revealed several PAHs: phenanthrene (320,000 μg/kg) and chrysene (250,000 μg/kg) exceeded the required detection limit. An inorganic sample revealed several heavy metals including lead (1,250 mg/kg); tin (64 mg/kg); cadmium (35 mg/kg); chromium (101 mg/kg); mercury (0.3 mg/kg); nickel (78 mg/kg); and vanadium (53 mg/kg), which exceeded the required detection limit. The shallow aquifer could pose potential contamination to groundwater. The small population using groundwater is located more than 2 miles from the site. Migration of potential contaminants to the drinking water may be difficult to attribute to the site (Fowler et al., 1993).

4.5.3.12 *Ruan Transport Co.*

Ruan Transport Company has elevated levels of contaminants and poses a potential risk to the general populations (Fowler et al., 1993). Ruan Transport Company was a waste



Source: U.S. EPA, 1995h.

Figure 4-70. Sample Locations (SS01 to SS05) at Paxton Landfill Corp.

Table 4-88. Concentration Ranges of Soil Contaminants at Paxton Landfill Corp.

Contaminant	Concentrations Range
Organics (μg/kg)	
2-Methylnaphthalene	68 - 160
Acenaphthene	35 - 200
Dibenzofuran	50 - 240
Phenanthrene	380 - 1,900
Anthracene	37 - 410
Fluoranthene	450 - 3,100
Pyrene	550 - 3,400
Benzo(a)anthracene	390 - 2,200
Chrysene	290 - 1,700
Benzo(b)fluoranthene	750 - 3,800
Benzo(a)pyrene	220 - 1,500
Indeno(1,2,3-cd)pyrene	61 - 970
Benzo(g,h,i)perylene	180 - 1,200
Inorganics (mg/kg)	
Aluminum	8,360 - 10,200
Arsenic	5.5 - 9.4
Barium	66 - 125
Beryllium	0.34 - 0 88
Calcium	48,900 - 158,000
Chromium	26.5 - 1,140
Cobalt	7.8 - 14.9
Copper	40.5 - 84.5
Iron	22,800 - 128,000
Lead	81 - 801
Magnesium	15,300 - 42,800
Manganese	715 - 26,900

Table 4-88. Concentration Ranges of Soil Contaminants at Paxton Landfill Corp. (continued)

Contaminant	Concentrations Range
Mercury	0.10 - 0.15
Nickel	19.6 - 138
Potassium	392 - 2,520
Selenium	0.37 - 0.73
Silver	0.39
Sodium	261 - 739
Thallium	2 - 5.8
Vanadium	21.6 - 222
Zinc	107 - 473
Cyanide	0.59 - 15.8

Source: U.S. EPA, 1995h.

hauler that stored 40 drums of PCB-contaminated waste and had a surface impoundment of unknown size in a marsh. During a 1984 inspection, contaminated soil was observed at the site. The surface impoundment is an unlined pit, and wastes placed in the pit migrated to the east. No permits were issued for the waste pit. The soil sample analysis results from the pit showed PCBs, and several SVOCs (Fowler et al., 1993).

4.5.3.13 *Soils at NPL Sites*

EPA, as part of their investigations, "scored" each of the seven National Priorities List (NPL) sites in the study area (six in Lake County, IN, and one in Cook County, IL) for the likelihood of adverse impacts to human health from groundwater, surface water, air, and soils at sites. The Hazard Ranking System (HRS) is used by EPA to assess sites based on many factors such as the types and concentrations of chemicals present, their toxicity, the likelihood of migration, and the potential for exposure of populations. The scores for direct contact to soils from these seven sites are summarized in Table 4-89.

4.6 GROUNDWATER

Groundwater quality in Lake County, IN, and Cook County, IL, has been studied by several research programs. A number of indicator parameters are used to evaluate the impact of human activities on groundwater quality and the resulting risk to human health and the environment. Human exposure to groundwater may occur via ingestion of drinking water, inhalation of vapors or mists during showering, and dermal exposure during bathing and other domestic use. Groundwater use is limited, however, in Cook County, IL, and Lake County, IN, because the majority of

Groundwater Quality

- Potential Human Exposure from:
  - Ingestion of Drinking Water
  - Inhalation of Vapors
  - Dermal Contact
- Groundwater Not Widely Used for Domestic Uses in Cook County, IL, and Lake County, IN
- Groundwater Characterization Based Primarily on USGS Study

Table 4-89. Hazard Ranking Scores for Soils at NPL Sites

Site	Score
American Chemical Services, Inc., IN	$S_{DC} = 0$
Lake Sandy Jo (M&M Landfill), IN	$S_{DC} = 62.50$
Lenz Oil Service, Inc., IL	S_s/S_{DC} = Not Scored
MIDCO I, IN	$S_{DC} = 50$
MIDCO II, IN	$S_{DC} = 16.67$
Ninth Avenue Dump, IN	$S_{DC} = 43.75$
U.S. Smelter and Lead Refinery, Inc , IN	S_s = Negligible

Source U.S. EPA, 1995i,j,k,l,m,n,o (seven different documents).

residents receive domestic water from surface sources (Lake Michigan). Nevertheless, the presence of toxic and/or synthetic chemicals in groundwater serves as an indication of potential human risk.

This section presents data summaries and assessments of groundwater quality derived from regional and local monitoring activities conducted by Federal and State agencies. Much of the discussion is based on a study conducted by the USGS (DuWelius et al., 1996). Particular emphasis is placed on the identification of synthetic organic chemicals (SOCs) and other toxics found in the groundwater samples. The following discussion presents a brief summary of the geologic and hydrogeologic construct of the region and is organized by the main aquifer systems (water-bearing units) found in the area.

4.6.1 Regional Geology and Hydrogeology

The study area is underlain by bedrock of Silurian and Devonian age, with unconsolidated glacially-deposited materials on top. Consolidated bedrock is primarily limestone, dolomite, and shale, which are largely flat strata. Bedrock surfaces are irregular due to erosional changes and variations in depositional environment (DuWelius et al., 1996).

Above the bedrock, both lake-bottom and glacial sediments, including sand, silt and clay, are common. (For the purposes of this study, regional interpretation of these strata is limited to identification of the major unconsolidated aquifer systems.) Locally, there are deposits of gravel, muck, peat, and organic matter, which are discontinuous across the region (DuWelius et al., 1996). In addition, dumping of slag and fill, dredging operations, and other anthropogenic source materials serve to change the local geology.

Two major aquifer systems are in the region. The unconfined sand aquifer (surficial) and the Silurian-Devonian bedrock aquifer constitute a complex, integrated hydrologic system, which is typically separated by a confining layer of silty clay. The unconfined sandy aquifer, called the Calumet, overlays the majority of the region and is dominant toward the eastern portion (DuWelius et al., 1996). Because of its surface exposure and permeability, most recharge to the Calumet is via direct infiltration from precipitation and surface water runoff. However, as elsewhere, the impacts of urbanization may be seen on aquifer recharge; extensive paving and stormwater control systems divert recharge waters to streams. Draining and filling-in of wetlands have caused dewatering of the upper reaches of the Calumet aquifer; nevertheless, the average depth to water is approximately 10 feet below ground surface (DuWelius et al., 1996). Although the water from this aquifer is not broadly used in the Chicago area, some commercial/industrial, irrigation, and drinking water wells are installed into the Calumet aquifer.

The bedrock aquifer, which consists of Silurian and Devonian age carbonates, provides water for industrial/commercial use, and to a lesser degree, is a source of domestic water. This aquifer system provides the industrial make-up water in the greater Chicago area (DuWelius et al., 1996).

4.6.2 Groundwater Quality

The Illinois State Water Survey (ISWS) has reported that approximately 4,300 groundwater samples have been collected to characterize contamination in Cook County, IL (Blomberg, 1997). The organic contaminants most frequently detected are summarized in Table 4-90.

Regional groundwater quality, evaluated by USGS, focused on 128 wells in the greater Chicago metropolitan area (DuWelius et. al., 1996). Both water quality indicator parameters, such as pH, specific conductance, dissolved oxygen, and oxidation-reduction potential (redox), as well as sampling and analyses for metals, cations, anions, volatile and semivolatile organic compounds, and pesticides, were measured. On a local scale, impacts to groundwater quality were observed in both the unconsolidated Calumet aquifer and the bedrock aquifer. These impacts included elevated levels of zinc detected in wells lined with galvanized casing material, excessively high pH, and detection of SVOCs in water (DuWelius et al., 1996).

Tables 4-91 through 4-94 present summaries of data from this study. Measured concentrations of contaminants in groundwater samples were compared to EPA Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs). MCLs are regulatory limits for concentrations of various constituents in public water systems that distribute water for human consumption. MCLs are derived on the basis of human health criteria, as well as technological and economic considerations. SMCLs are based on organoleptic (aesthetic) standards for criteria such as taste, color, and odor. SMCLs do not carry the weight of law, but are suggested

Table 4-90. Overview of Organic Groundwater Contaminants in Cook County, IL

Pollutant	Number of Positive Detects
Total Organic Carbon	53
Bromodichloromethane	1
Bromoform	1
Dibromochloromethane	1
Chloroform	2
Phenols	7
Methylene Chloride	9
1,1-Dichloroethylene	1
Trans-1,2-Dichloroethylene	3
Toluene	1
Nonpurgeable Organic Carbon (Dissolved)	18
Nonpurgeable Organic Carbon (Total)	1

Source: Blomberg, 1997.

Table 4-91. Volatile Organic Compounds Detected in Chicago-Area Wells, 1996

Constituent	Number of Wells with VOC	Number of Wells Exceeding MCL	MCL $\mu g/L$
Acetone	4	NA	NR
Benzene	11	11	5
Chloroform	1	0	100
1,1-Dichloroethane	1	NA	NR
1,1-Dichloroethylene	1	1	7
1,2-Dichloroethylene	3	NA	NR
Ethylbenzene	3	0	700
2-Hexanone	1	NA	NR
Methyl Isobutyl Ketone	1	NA	NR
Styrene	1	0	100
Toluene	4	0	1,000
Vinyl Chloride	2	2	2
Xylenes	7	0	10,000

NA - Not applicable
NR - Not regulated
$\mu g/L$ = micrograms per liter

Source: DuWelius et al., 1996.

Table 4-92. Maximum Concentrations of Volatile Organic Compounds Detected in Chicago-Area Wells, 1993

Constituent	Maximum (μg/L)	MCL (μg/L)
Acetone	37	NR
Benzene	9,900	5
Chloroform	5	100
1,1-Dichloroethane	7	NR
1,1-Dichloroethylene	66	7
1,2-Dichloroethylene	42,000	NR
Ethylbenzene	330	700
2-Hexanone	7	NR
Methyl Isobutyl Ketone	4	NR
Styrene	5	100
Toluene	600	1,000
Vinyl Chloride	10,000	2
Xylenes	400	10,000

NR - Not regulated
μg/L = micrograms per liter.

Source: DuWelius, et al, 1996.

Table 4-93. Semivolatile Organic Compounds Detected in Chicago-Area Wells, 1993

Constituent	Number of Wells with SVOC
Phenol	8
1,4-Dichlorobenzene	1
Ortho-cresol	2
Para-cresol	4
2,4-Dimethylphenol	4
Naphthalene	7
2-Methylnaphthalene	4
Dimethylphthalate	2
Acenaphthylene	4
Acenaphthene	3
Dibenzofuran	3
Fluorene	6
Phenanthrene	8
Carbazole	3
Di-n-butyl phthalate	15
Fluoranthene	4
Pyrene	4
Bis(2-ethyl hexyl) phthalate	28
Diethylphthalate	3
Anthracene	2
Di-n-octyl phthalate	4
Benzo[b]fluoranthene	1

NR - Not regulated

Source: DuWelius et al., 1996.

Table 4-94. Maximum Levels of Semivolatile Organic Compounds Detected in Chicago-Area Wells, 1993

Constituent	Maximum (μg/L)
Phenol	1,600
1,4-Dichlorobenzene	4
Ortho-cresol	550
Para-cresol	1,400
2,4-Dimethylphenol	360
Naphthalene	12
Dimethylphthalate	2
Acenaphthalene	36
Acenaphthene	4
Dibenzofuran	13
Fluorene	2
Phenanthrene	14
Carbazole	18
Di-n-butyl phthalate	2
Fluoranthene	2
Pyrene	2
bis(2-ethyl hexyl) phthalate	11
Diethylphthalate	3
Anthracene	2
Di-n-octyl phthalate	4
Benzo[b]fluoranthene	0.5

μg/L = micrograms per liter

Source: DuWelius et al., 1996.

levels. In addition, for lead and copper, EPA provides guidance through action levels (rather than MCLs), because these two metals are common constituents of plumbing and water supply systems. These metals must be identified at the tap, rather than the source (DuWelius et al., 1996).

4.6.3 Volatile Organic Constituents in Groundwater

VOCs are generally associated with groundwater contamination of human origin. Organic contaminants may result from leaking underground storage tanks (USTs), solvents and thinners, chemical manufacturing, or a variety of industrial processes. For example, the Amoco petroleum refinery in Whiting, IN, has been a major source of contamination for the Calumet aquifer. Over the course of a century, an estimated 16-million gallons of petroleum have passed under the refinery and into the ground, leaving a number of VOCs (PAHLS, 1993). In addition, VOCs may be released into the groundwater from improperly constructed or poorly maintained solid-waste disposal facilities, such as landfills.

Chemical analysis of groundwater samples collected in the Lake County, IN, and Cook County, IL, region reveal that VOCs are present in both the shallow and deep aquifers that underlie the area (DuWelius et al., 1996). Samples were analyzed for 33 volatile compounds found on the EPA Target Compound List (TCL). VOCs were identified in 20 of the 128 samples collected for the DuWelius et al. study (1996). Eighteen of the 20 affected wells were located in or near industrial operations or in areas known to have been impacted by waste disposal or fill operations. Tables 4-91 and 4-92 summarize the detection of these organic compounds in regional wells. It should be noted that 14 of the 20 wells in which VOCs were detected are installed into the shallow Calumet aquifer, rather than the deeper bedrock aquifers. Shallow unconsolidated aquifers are typically more prone to groundwater contamination than deeper consolidated bedrock aquifers.

VOCs detected by DuWelius et al. (1996) were primarily solvents and degreasers. Benzene, ethylbenzene, toluene, and xylenes (BTEX) were among the compounds most often identified. These chemicals are constituents of petroleum products and are associated not only with petrochemical refining operations, but also with releases from leaking USTs. The presence of the identified VOCs in groundwater indicates anthropogenic contamination, because it is believed that they do not naturally occur in groundwater (DuWelius et al., 1996).

The presence of high levels of vinyl chloride and two isomers of dichloroethylene indicates a probable prior release of trichlorethylene or tetrachloethylene. Neither of these two compounds, which are used for dry cleaning and degreasing operations, were detected in any samples. However, both of these compounds undergo microbial degradation over time when released into the environment, producing daughter products such as vinyl chloride (DuWelius et al., 1996). The sample that contained the highest level of vinyl chloride (10,000 micrograms per liter [μg/L]) was obtained from a well located at the entrance road to a landfill. The presence of low levels of several compounds, including acetone, may possibly be attributed to background contamination of sampling devices or to cross-contamination produced by the laboratory.

4.6.4 Semivolatile Organic Constituents in Groundwater

Groundwater samples from 128 wells were analyzed for 64 SVOCs as found on the EPA's TCL (DuWelius et al., 1996). Of the wells sampled, 56 showed detectable levels of SVOCs; however, several constituents detected are common laboratory contaminants and may not be reflective of actual groundwater contaminant levels. Several phthalate compounds, which are constituents of plastics, have been documented to be widely distributed in the environment and appear as background contaminants.

SVOCs detected in the groundwater included plasticizers, combustion products, and organic compounds associated with coal tar and petrochemical processing (DuWelius et al., 1996). Phenol, phenanthrene, naphthalene, and several cresols were most commonly detected (Table 4-93). Contamination was found most frequently near industrial operations and in areas of made land or fill. Total SVOCs were highest along an interstate highway in an area near the western edge of Lake Calumet. Several potential sources for these elevated levels were postulated by Roadcap and Kelly (1994), including road salting, petroleum, and steel making. Two of the SVOCs detected in the groundwater samples are currently regulated by the EPA: 1,4-dichlorobenzene and benzo[b]fluoranthene. Of all the wells, only one exceeded the limit for benzo[b]fluoranthene with a concentration of 0.5 μg/L. No wells exceeded the limit for 1,4-dichlorobenzene (DuWelius et al., 1996).

4.6.5 Metals in Groundwater

A number of metals occur naturally in groundwater. Drinking water standards are established only for toxic metals, such as lead or mercury, or metals that may affect the usability of water, such as iron and manganese. Groundwater samples were obtained from 128 wells and were found to contain varying concentrations of metals and trace elements.

More than half the wells sampled had detectable levels of arsenic, mercury, and lead (DuWelius et al., 1996). Three shallow wells (less than 15 feet in depth), located in areas near waste disposal activities, exceeded the MCL for arsenic. Mercury was not identified at levels exceeding MCL standards in any well; however, the potential for artificially high results was flagged by the EPA quality assurance audit due to potential contamination in the laboratory. Lead levels in groundwater exceeded the EPA action level at two locations; one was near areas of waste disposal activities, the other was installed into the deep bedrock aquifer and is located in a residential area (DuWelius et al., 1996). Because lead may be introduced into drinking water supplies from plumbing, this well may not be representative of regional groundwater quality. Aluminum was identified in 29 samples at levels that exceed the SMCL. Copper was detected in one well at levels above SMCL; however, copper is a common component of plumbing and piping. High levels of zinc were detected in several wells; however, it was later determined that the wells were constructed with galvanized casing or pipes.

4.6.6 Summary of Regional Groundwater Quality

Groundwater quality in the region reflects distinct impacts from human activities, resulting from urbanization and industrial activities. This is not surprising, if one considers the shallow depth to groundwater, the permeable nature of the topmost aquifer, and the area's historical land uses.

SOCs often serve as a barometer for changes in groundwater quality, because they are of manmade origin. The presence and distribution of these chemicals in groundwater underlying the greater Chicago area indicate that industrial and waste disposal activities have contributed to the degradation of the region's groundwater (DuWelius et al., 1996). However, based upon the limited data available on a regional basis, it does not appear that groundwater is currently severely threatened. In addition, because the groundwater is minimally used for domestic purposes, the overall threat to human health posed by the regional groundwater quality is not perceived to be significant.

4.6.7 Groundwater Contamination at Hazardous Waste Sites

A number of landfills and industrial facilities are located in the Southeast Chicago area, near Lake Calumet. Some of these facilities are on the CERCLIS list and have been subject to studies such as expanded site inspections (ESIs), in which concentrations of various compounds were determined. This section is a compilation of the groundwater analyses results for Paxton Landfill, Land and Lakes #2, Cottage Grove, and Cosden Oil and Chemical Co.

4.6.7.1 *Paxton Landfill*

The Paxton site is an inactive landfill which accepted both municipal and industrial wastes from 1971 to 1976. Ten monitoring wells were drilled on site and were used to obtain and analyze groundwater samples. The majority of these are located within waste disposal areas and penetrate between 15 to 20 feet below the ground surface. One well was installed at a corner of the landfill and is separated from the waste disposal area by a retention pond that collects surface runoff from the site. A sample taken from this well was used to determine background concentrations of contaminants. For each of the 10 wells, one groundwater sample was collected between October and December 1993 and analyzed for volatile and semi-volatile organics, pesticides, PCBs, and inorganics (U.S. EPA, 1995h). This analysis indicated the presence of 27 organic and 12 inorganic compounds (Table 4-95). The background sample contained detectable concentrations of copper, iron, magnesium, nickel, potassium, and sodium. However, groundwater samples from the waste disposal areas contained even stronger concentrations of these species--at least by an order of magnitude.

4.6.7.2 *Land and Lakes #2*

The Land and Lakes #2 site accepted municipal wastes from the mid 1950s to the early 1970s, and general solid wastes from 1976 to 1993. General wastes included gasoline-contaminated

Table 4 - 95. Concentrations of Contaminants in Groundwater Samples from Paxton Landfill from 1993

Contaminant	No. of Wells Above CRDL	Min. Concentration Detected (ug/L)	Max. Concentration Detected (ug/L)	Mean Conc. (ug/L)
Organics				
Benzene	4	5.00	240.00	67.75
Toluene	3	5.00	220.00	77.33
Chlorobenzene	1	100.00	100.00	100.00
Ethylbenzene	1	68.00	68.00	68.00
Styrene	1	66.00	66.00	66.00
Xylene	2	240.00	280.00	260.00
Phenol	1	180.00	180.00	180.00
2-Methylphenol	1	290.00	290.00	290.00
4-Methylphenol	1	340.00	340.00	340.00
2,4-Dimethylphenol	1	640.00	640.00	640.00
Naphthalene	2	75.00	7,000.00	3,537.50
2-Methylnaphthalene	1	590.00	590.00	590.00
Acenaphthalene	2	26.00	130.00	78.00
Acenaphthene	1	16.00	16.00	16.00
Dibenzofuran	1	71.00	71.00	71.00
Flourene	1	61.00	61.00	61.00
Phenanthrene	1	150.00	150.00	150.00
Anthracene	1	39.00	39.00	39.00
Flouranthene	1	61.00	61.00	61.00
Pyrene	1	43.00	43.00	43.00
Benzo(a)Anthracene	1	16.00	16.00	16.00
Chrysene	1	17.00	17.00	17.00
bis(2-Ethylhexyl)phthalate	1	37.00	37.00	37.00
Benzo(k)Flouranthene	1	10.00	10.00	10.00
Benzo(a)pyrene	1	10.00	10.00	10.00
Dieldrin	1	0.07	0.07	0.07
4,4'-DDE	1	0.07	0.07	0.07
Inorganics				
Antimony	2	29.00	32.00	30.50
Arsenic	4	4.20	5.80	5.08
Chromium	6	1.40	38.00	15.20
Copper	2	8.60	75.00	41.80
Iron	2	540.00	2,600.00	1,570.00
Lead	6	2.40	9.60	6.22
Magnesium	2	130,000.00	421,000.00	275,500.00
Nickel	3	46.00	790.00	435.33
Potassium	5	88,800.00	456,000.00	306,960.00
Sodium	2	721,000.00	2,590,000.00	1,655,500.00
Thallium	1	9.80	9.80	9.80
Vanadium	5	5.00	29.00	18.00

Source U S EPA, 1995h

soil, zinc catalyst process waste, and river bottom dredgings from the Indiana Harbor Canal. In October and November 1993, groundwater samples were collected from five monitoring wells (U.S. EPA, 1994e). Four of these wells are located along the site's northern boundary, which runs along the Little Calumet River. The fifth well is southwest of the Land and Lakes #2 site, and was used to determine background concentrations. The wells penetrate between 8 to 18 feet below the ground surface. Samples taken from these wells were analyzed for volatile and semi-volatile organics, pesticides, PCBs, and inorganics. This analysis indicated the presence of two organics and four inorganics (Table 4-96). Analysis of the background sample indicated detectable concentrations for calcium, iron, magnesium, manganese, potassium, and sodium.

4.6.7.3 *Cottage Grove Landfill*

The Cottage Grove Landfill operated from 1976 to 1982. Though it was designed to accept municipal and industrial solid waste, the facility accepted hazardous waste, which it was not permitted to accept (U.S. EPA, 1994d). About half the landfill area was covered with lagoon sludge that contained heavy metals. Three monitoring wells and a residential well are located just outside the landfill boundary. In August 1993, groundwater samples were collected from two of the monitoring wells and from the residential well. (Samples could not be obtained from the third monitoring well because of safety concerns arising from the detection of ignitable vapors at the well.) One monitoring well sampled was located at the northwest corner of the waste disposal area, where the Little Calumet River intersects the canal that forms the western border of the landfill. The other monitoring well is east of the landfill's northern boundary, and was used to determine background concentrations. The monitoring wells penetrate 25 feet below the ground, while the residential well penetrates about 200 feet (U.S. EPA, 1994d). Samples obtained were analyzed for volatile and semi-volatile organics, pesticides, PCBs, and inorganics. The analysis indicated the presence of 8 organics and 11 inorganics, plus dilute concentrations of unknown substances (Table 4-97). The background sample contained detectable concentrations of an unknown compound, calcium, iron, magnesium, manganese, potassium, sodium, zinc, and cyanide. Detectable levels of zinc were also found in the residential well, but cyanide was only detected in samples from the background well.

Table 4 - 96. Concentrations of Contaminants in Groundwater Samples from Land and Lakes No. 2 from 1993

Contaminant	No. of Wells Above CRDL	Min. Concentration Detected (ug/L)	Max. Concentration Detected (ug/L)	Mean Conc. (ug/L)
Organics				
Benzene	2	110.00	180.00	145.00
Xylene (total)	1	15.00	15.00	15.00
Inorganics				
Barium	3	252.00	713.00	484.33
Chromium	3	12.00	24.50	16.87
Potassium	2	222,000.00	265,000.00	243,500.00
Cyanide	2	13.90	29.60	21.75

Source U S EPA, 1994e

Table 4 - 97. Concentrations of Contaminants in Groundwater Samples from Cottage Grove Landfill from 1993

Contaminant	No. of Wells Above CRDL	Min. Concentration Detected (ug/L)	Max. Concentration Detected (ug/L)	Mean Conc. (ug/L)
Organics				
1,1-Dichloroethane	1	2.00	2.00	2.00
Xylene (total)	1	2.00	2.00	2.00
Benzene	1	10.00	10.00	10.00
Chlorobenzene	1	1.00	1.00	1.00
1,3-Dichlorobenzene	1	4.00	4.00	4.00
Naphthalene	1	4.00	4.00	4.00
Chlorobenzene	1	1.00	1.00	1.00
Chlorobenzene	1	1.00	1.00	1.00
Inorganics				
Arsenic	1	12.20	12.20	12.20
Barium	1	593.00	593.00	593.00
Calcium	3	15,100.00	240,000.00	137,700.00
Chromium	1	12.70	12.70	12.70
Iron	2	10,100.00	36,800.00	23,450.00
Lead	1	3.50	3.50	3.50
Magnesium	3	3,440.00	290,000.00	129,213.33
Nickel	1	42.80	42.80	42.80
Potassium	3	3,650.00	198,000.00	73,183.33
Sodium	3	78,500.00	826,000.00	339,166.67
Zinc	2	24.60	68.30	46.45
Tentatively Identified				
Unknown	2	1.00	9.00	5.00
Unknown	1	6.00	6.00	6.00
Unknown Silica	1	12 00	12.00	12.00
Furan	1	30.00	30.00	30.00

Source U S EPA, 1994d

4.6.7.4 *Cosden Oil and Chemical Co.*

The Cosden site was the home of a chemical and plastic manufacturing facility, which operated from 1949 to 1990. As part of an expanded site inspection, three groundwater samples were taken in July 1993. The three wells sampled are located on site, and penetrate between 10 to 13 feet below the ground surface (U.S. EPA, 1995f). Samples were analyzed for volatile and semi-volatile organics, pesticides, PCBs, and inorganics. No organic substances were detected in the analysis, and the only inorganics detected were calcium, iron, magnesium, manganese, potassium, and sodium (Table 4-98).

4.6.7.5 *Groundwater at NPL Sites*

EPA, as part of investigations at the seven NPL sites in the study area (six in Lake County, IN, and one in Cook County, IL) "scored" each site for the likelihood of adverse impacts to human health from groundwater, surface water, air, and soils. The Hazard Ranking System (HRS) is used by EPA to score the sites based on many factors such as the types/concentrations of chemicals present, their toxicity, the likelihood of migration, and the potential for exposure of populations. Groundwater frequently is among the most important factors in the overall score for a site. The scores attributed to groundwaters from these seven sites is summarized in Table 4-99.

4.6.7.6 *Sites With No Groundwater Analysis*

Many of the ESIs for sites in Cook County, IL, did not include groundwater analyses. These sites include U.S. Drum II, Estech General Chemical, Land and Lakes #3, MSD #4, and Pullman Factory/Sewage Farm. A lack of monitoring wells at these sites prevented easy access to groundwater samples. Moreover, the potential for human exposure risk caused by contaminated groundwater was low. Most of the population within 4 miles of the sites are supplied drinking water from Lake Michigan (U.S. EPA, 1994a). In general, contamination of groundwater caused by these sites poses little threat to drinking water supplies.

Table 4 - 98. Concentrations of Contaminants in Groundwater Samples from Cosden Oil and Chemical Co., from 1993

Contaminant	No. of Wells Above CRDL	Min. Concentration Detected (ug/L)	Max. Concentration Detected (ug/L)	Mean Conc. (ug/L)
Inorganics				
Calcium	3	111,000.00	210,000.00	170,666.67
Iron	2	50.40	4,610.00	2,233.47
Magnesium	3	5,330.00	75,800.00	37,543.33
Manganese	3	256.00	922.00	610.00
Potassium	1	22,700.00	22,700.00	22,700.00
Sodium	3	10,400.00	77,300.00	37,866 67

Source U S EPA, 1995f

Table 4-99. Hazard Ranking Scores for Groundwater at NPL Sites

Site	Score
American Chemical Services, Inc.	S_{gw} = 59.86
Lake Sandy Jo (M&M Landfill)	S_{gw} = 65.62
Lenz Oil Service, Inc.	S_{gw} = 73.08
MIDCO I	S_{gw} = 67.35
MIDCO II	S_{gw} = 34.69
Ninth Avenue Dump	S_{gw} = 62.86
U.S. Smelter and Lead Refinery, Inc.	S_{gw} = Negligible

Source: U S. EPA, 1995h,i,j,k,l,m,n (7 different documents).

4.7 DRINKING WATER QUALITY

This section describes drinking water quality in Cook County, IL, and Lake County, IN. Monitoring drinking water is important because of the potential for human exposure to contaminants through ingestion as well as other routes of exposure. Exposure to metals (especially lead), pesticides, bacteria, and other contaminants in drinking water is of particular concern for children, who may be more vulnerable than adults because of their high rate of water consumption relative to their size as well as their susceptibility of nervous system damage from lead (U.S. EPA, 1996a). EPA (1997a) estimates that the average daily consumption of drinking water for adults is 1.4 liters, while average children from 3 to 5 years of age can consume 0.87 liter per day (children in the 90th percentile for this age bracket, consume 1.5 liters per day).

Drinking Water

- Most of Population Receives Drinking Water from Lake Michigan
  - 98% in Cook County, IL
  - 96% in Lake County, IN
- Recent Successes in Protecting Lake Michigan from Contamination
- Contaminants with Maximum Concentrations That Exceeded Drinking Water Standards Included:
  - Vinyl Chloride
  - Thallium
  - Fluoride
  - Lead
  - Copper

Assessment of drinking water quality in Cook County, IL, and Lake County, IN, was based on information compiled from reports, data bases, and articles from various sources, including the U. S. EPA as well as the IEPA Bureau of Water Compliance Assurance Section, and the IDEM Public Water Supply Compliance Section Drinking Water Branch. This section presents information on the primary sources of drinking water, monitoring that is conducted, pollutants detected in drinking water supplies, and violations of drinking water standards for both Cook County, IL, and Lake County, IN.

4.7.1 Sources of Drinking Water Supplies

4.7.1.1 *Cook County, IL*

Cook County's sources of drinking water are Lake Michigan and groundwater. Lake Michigan is the primary source of drinking water, providing 98 percent of the supply to Cook County, IL, and the surrounding area (Crumly, 1997). Efforts taken to improve water quality of the Lake, have helped to protect this source of drinking water. Wastewater from municipalities and many industries in Cook County are treated by Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) treatment facilities and are discharged to a system of waterways that flow away from Lake Michigan towards the Des Plaines River. In the early 1900s, efforts were made to divert the polluted Calumet and Chicago Rivers to flow away from Lake Michigan to the Des Plaines River Basin and eventually to the Mississippi River (IEPA, 1994). Currently, all 63 shore miles of Lake Michigan in the State of Illinois are rated as having "good" overall water quality and support drinking water uses (IEPA, 1997a). Sources posing the greatest threat to Lake Michigan's water quality include atmospheric deposition, contaminated sediments, and the sewer and overland flows from Lake Calumet into Lake Michigan after storm events (IEPA, 1997a). During very intense rainfall, the controlling locks at the O'Brien Lock and Dam on the Calumet River are opened to prevent flooding of the Little Calumet and Grand Calumet Rivers, causing these rivers to reverse and flow with their untreated sewage into Lake Michigan. During the 1970s, such overflows released contaminants from Lake Calumet into Lake Michigan approximately 100 times a year (Bhowmik and Fitzpatrick, 1988).

Recent successes of the Tunnel and Reservoir Plan (TARP) have resulted in a reduced number of discharges of CSOs to Lake Michigan (IEPA, 1994). This plan, adopted by MWRDGC, consists of conveyance tunnels (Phase I) and storage reservoirs (Phase II) to transport and store combined sewer overflows during periods of heavy rainfall. Subsequently, these flows, which are presently discharged to the waterways, will be pumped to MWRDGC facilities for treatment (IEPA, 1994). While bypasses occurred about yearly in the 1970s and 80s, no bypasses to Lake Michigan have occurred since November 1990 (IEPA, 1996c). (Additional descriptions of the water quality of Lake Michigan can be found in Section 4.2.5.)

A small percentage of Cook County's population drink groundwater; however, nearly 36 percent of the State's population rely on groundwater for their drinking water source (IEPA, 1996c). Cook County is centered over the deep Cambrian-Ordovician aquifer system. The depth of this system provides a better protection from contamination by surface activities. Abandoned wells are the greatest threat to this aquifer system. By the 1960s, the Chicago region's groundwater levels declined by more than 1,000 feet at some locations. The heavy demand was exceeding the resource's ability to recharge. With deliveries of Lake Michigan water to communities in Cook County in the 1980s, the trend began to reverse.

Information on suppliers of drinking water in Cook County was obtained from the IEPA Bureau of Water Compliance Assurance Section (Crumly, 1997; Patterson, 1997). Table 4-100 shows a list of public water suppliers in Cook County. In Cook County, 98 percent of the population receive drinking water from systems that draw from Lake Michigan. The facilities known to supply water from Lake Michigan are indicated in the table with shading. It is not known which satellite facilities receive water drawn from Lake Michigan; therefore, not all facilities distributing drinking water from the lake are shaded. Six of the suppliers listed are also referred to as parent water suppliers because they also supply water to satellite water suppliers who, in turn, supply water to the public. These six parent water suppliers are Chicago (MWRDGC), Evanston, Wilmette, Winnetka, Northbrook, and Sauk. The largest supplier is Chicago MWRDGC, supplying water to approximately 88 percent of the Cook County population. MWRDGC, as well as five of the other drinking water suppliers, also supply water to populations in adjacent counties. The next largest supplier in Cook County is Arlington Heights, which serves approximately 6 percent of the Cook County population. The total population served by the 158 listed drinking water suppliers was estimated at 5,377,290 people.

4.7.1.2 *Lake County, IN*

The first settlers in Lake County, IN, depended on water from lakes and rivers for their drinking water, until these sources became too polluted. Currently, the primary source of drinking water for over 96 percent of Lake County (and 60 percent of northwestern Indiana) is Lake Michigan (IDEM, 1997a; PAHLS, Inc., 1993). Groundwater is the main source of drinking water outside of municipal supplies and the Lake's watershed. Over 15- to 20-million gallons of groundwater are

Table 4 - 100. Population Served by Drinking Water Systems in Cook County, IL

System	Population Served
Chicago MWRDGC *	3000000
Arlington Heights	75463
Evanston *	73233
Schaumburg	68586
Cicero	67500
Skokie	60278
Oak Lawn	56182
Glenview	56000
Palatine	55000
Oak Park	53648
Des Plaines	53223
Berwyn	48000
Hoffman Estates	46561
Orland Park	45000
Mount Prospect	40750
Calumet City	37840
Tinley Park	37121
Park Ridge	37075
Buffalo Grove	36427
Hanover Park	35579
North Suburban Public Utility Co.	35000
Streamwood	33705
Elk Grove Village	33429
Chicago Heights	33072
Northbrook *	33000
Bartlett	31581
Wheeling	30473
Harvey	29771
South Stickney Sndst.	29000
Niles	28384
Lansing	28109
Maywood	27139
Wilmette *	26690
Oak Forest	26203
Park Forest	24656
Dolton	23930
Elmwood Park	23206
Rolling Meadows	22591
Morton Grove	22373

Table 4 - 100. Population Served by Drinking Water Systems in Cook County, IL

System	Population Served
South Holland	22105
Citizens Chicago Suburban Utl. Dvn.	21252
Blue Island	21203
Evergreen park	20874
Melrose Park	20280
Bellwood	20241
Homewood	19278
Brookfield	18876
Franklin Park	18500
Alsip	18347
Palos Hills	17803
Westchester	17301
Leyden Twsp. Water District	16000
LaGrange	15683
Justice-Willow Sprgs Water Commission	15646
Country Club Hills	15341
Forest Park	14900
Midlothian	14500
Norridge	14459
Bridgeview	14402
Riverdale	13671
Chicago Ridge	13643
Hazel Crest	13334
Markham	13136
Hickory Hills	13021
LaGrange Park	12861
North Lake	12505
Winnetka *	12174
Western Springs	11984
River Forest	11669
Palos Heights	11478
Matteson	11378
Lincolnwood	11365
Worth	11208
Schiller Park	11189
Crestwood	10823
Richton Park	10523
Summit	9971
River Grove	9964

Table 4 - 100. Population Served by Drinking Water Systems in Cook County, IL

System	Population Served
Sauk *	9926
Lyons	9828
Glenwood	9289
Loyola Univ. Med Center	8800
Riverside	8774
Flossmoor	8651
Broadview	8629
Steger	8592
Calumet Park	8418
Glencoe	8200
Harwood Heights	7680
Hillside	7672
Robbins	7500
Lemont	7348
Lynwood	6800
Edward Hines Jr. V.A. Hospital	6030
North Riverside	6005
Stickney	5850
Countryside	5810
Citizens Fernway Utl. Dvn.	5560
Berkeley	5139
Citizens Waycinden Dvn.	5019
Northfield	4777
Hometown	4769
La Grange Highlands Sndst	4700
Stone Park	4383
Ford Heights	4259
Olympia Fields	4248
Posen	4226
Palos Park	4162
Burnham	4000
Rosemont	3995
South Chicago Heights	3693
Dixmoor	3647
Indian Head Park	3503
Mission Brook Sndst.	3218
Oak Forest HSP	3200
Thornton	2778
Kenilworth	2402

Table 4 - 100. Population Served by Drinking Water Systems in Cook County, IL

System	Population Served
Phoenix	2217
Prospect Heights	2121
Central Stickney Sndst.	2000
Merrionette Park	1970
Hodgkins	1963
Oasis MHP	1797
East Hazel Crest	1570
Sunset MHP	1500
Chicago and Norhtwestern R R	1500
Glenview Naval Air Station	1500
S Palos TWSP San District	1430
Bourbon Square Apartments	1224
Spring Lakes MHP	1200
Garden Home Sndst	1090
Touhy MHP	1088
Gleenbrook Sndst.	1011
Arlington International Race Course	1000
Justice-Wesley Fields	780
Paradise MHP	750
Forest View	750
Candlelight Village MHP	750
Signode Corp.	700
W A Howe MHC	680
Plum Creek Condos	570
Bedford Park	566
Willoway Terrace MHP	550
Madden MHC	530
Franciscan Sisters of Chicago	525
Citizens Moreland Dvn.	525
Golf	492
Buckhorn Ranch Ests. MHP	452
Linway Ests. MHP	392
Utl. Inc. county Line Water Company	360
Des Plaines MHP	340
Mccook	300
Glen Eden Ests. Homeowners Assn.	270
Citizens Midwest Palos Dvn.	225
Plum Grove Condos	168
Golf Greenwood Imprv. Assn.	160

Table 4 - 100. Population Served by Drinking Water Systems in Cook County, IL

System	Population Served
Santa Fe MHP	88
Silo MHP	40
Total Population served	**5377290**

Shading indicates suppliers known to draw drinking water from Lake Michigan. Satellite facilities receiving Lake Michigan water were not shaded.

* Designates Parent Water Suppliers.

Source: Crumly, 1997; Patterson, 1997.

used per day in northwest Indiana (PAHLS, Inc., 1993). Towns in southwestern Lake County, IN, get drinking water from shallow bedrock aquifers. The well water, however, used by Town of Lowell in Lake County has been declared unsafe to drink because of naturally high fluoride levels (PAHLS, Inc., 1993). In the last few decades, the major threats of contamination for Lake County's groundwater are landfills, injection of wastes into deep wells, and urban runoff. Large industries such as the Amoco and DuPont are working to clean up contaminated groundwater in areas near their facilities.

Contaminant concentrations along the Indiana shorelines of Lake Michigan have shown the effects of wastewater and tributary contributions from the watershed. Three public water intakes in the near-shore Lake Michigan area serve Lake County, IN, communities. These intake pipes are approximately 3 miles into the lake, but are close to contaminated sediments that have been transported into the lake from the Indiana Harbor. The continued movement of these sediments into the lake may pose a potential future risk to drinking water supplies (U.S. EPA, 1994a). The sediments in the Indiana Harbor Ship Canal have not been dredged for more than 20 years due to problems with disposing of the highly-contaminated sediments (IDEM, 1997a). Pollution in these water basins is a result of direct discharges of wastes from industrial and municipal sources, runoff from waste disposal sites, releases of oil, chemical leaks and spills, and contaminated sediments that have been accumulating for over 100 years (PAHLS, Inc., 1993). U.S. EPA's Assessment and Remediation of Contaminated Sediments (ARCS) Program reported that drinking water supplies from Lake Michigan that served populations in Lake County, IN, in the Grand Calumet River and Indiana Harbor Canal areas of concern, appeared to be safe between 1989 and 1990 (U.S. EPA, 1994a).

Table 4-101 shows the surface water quality monitoring results that were presented in STORET (1997) for the Indiana portion of Lake Michigan. These surface water samples were taken from 1990 to 1995 at intake points for four of Indiana's drinking water systems (East Chicago Water Plant Intake, Whiting Public Water Intake, Hammond Water Plant Intake, and Gary West Plant Intake). Chromium was the only contaminant that exceeded drinking water standards; however, the average value was below this level. Lead was detected at 14 μg/L; and due to the severity of health effects that this contaminant has on children, the Action Level Goal was set by EPA at zero, and the

Table 4 - 101. Lake Michigan Surface Water Quality at Intakes to Four Drinking Water Purification Facilities (1990 - 1995)

Parameter Name	Stations	Total Observations	Minimum	Weighted Average	Maximum
DO MG/L	4	4	8.4	10.37	11.3
BOD 5 DAY MG/L	3	13	1	1.32	2
COD LOWLEVEL MG/L	4	199	4	8.43	46
RESIDUE TOT NFLT MG/L	4	60	1	15.23	86
NH3+NH4- N TOTAL MG/L	4	10	0.1	0.17	0.6
TOT KJEL N MG/L	2	63	0.1	0.26	0.8
NO2&NO3 N-TOTAL MG/L	4	257	0.1	0.3	1.4
PHOS-TOT MG/L P	4	34	0.03	0.05	0 14
CYANIDE CN-TOT MG/L	3	12	0.01	0.01	0.01
ARSENIC AS,TOT UG/L	4	227	0.6	0.91	3
BARIUM BA,TOT UG/L	4	186	10	20.26	30
CADMIUM CD,TOT UG/L	1	1	2	2	2
CHROMIUM CR,TOT UG/L	2	2	4	62	120
COPPER CU,TOT UG/L	4	219	4	25.05	110
IRON FE,TOT UG/L	2	51	20	246.9	1900
LEAD PB,TOT UG/L	4	20	6	7.3	14
MANGNESE MN UG/L	1	23	6	18.04	9[illegible]
NICKEL NI,TOTAL UG/L	3	4	4	4.5	5
ZINC ZN,TOT UG/L	4	93	10	12.47	90
PHENOLS TOTAL UG/L	4	4	5	6.5	9
METHYLEN ECHLORID TOTWUG/L	1	1	14	14	14
DINOCTPH TOTUG/L	1	1	49	49	49
B2ETHHXL PHTHALAT TOT UG/L	1	1	35	35	35
RESIDUE DISS-180 C MG/L	4	247	57	168.56	335
MERCURY HG,TOTAL UG/L	4	16	0.1	0.11	0.2

Source· STORET, 1997.

action level was set at 15 $\mu g/L$. The minimum level of lead detected in the source water to these systems was 6 $\mu g/L$.

Information was obtained from the IDEM Public Water Supply Compliance Section Drinking Water Branch. Table 4-102 shows a list of community drinking water systems in Lake County, IN (Jones, 1997). In Lake County, IN, 96 percent of the population receive drinking water from systems that draw from Lake Michigan (indicated with shading). The largest supplier for Lake County is Northwest Indiana Water Company, supplying drinking water to 46 percent of the county's population. The next largest supplier was Hammond Water Works Department, which serves 16 percent of the county's population. The total population served by the 44 listed drinking water suppliers was estimated at 545,164 (Jones, 1997). All noncommunity water suppliers in Lake County that supply groundwater are listed in Table 4-103.

4.7.2 Levels of Contaminants in Drinking Water

This section describes monitoring results for contaminants in drinking water in Cook County, IL, and Lake County, IN.

4.7.2.1 *Regulatory Requirements for Drinking Water*

Congress has given EPA, the States, and the Indian tribal governments broad authority to set and enforce drinking water regulations. The Safe Drinking Water Act (SDWA) was created in 1974 and amended in 1986 to protect the quality of drinking water in the United States. The law authorized EPA to establish drinking water standards, which represent the maximum contaminant levels (MCLs) allowable (U.S. EPA, 1984; U.S. EPA, 1988a). These levels are the maximum permissible levels of contaminants in water, which is delivered to any user of a public water system and are considered as primary (health-related) standards. State governments, assuming the power from EPA, also encourage attainment of secondary (nuisance-related) standards. State governments have the primary responsibility for enforcing drinking water standards, and monitoring and reporting requirements (IEPA, 1997c). Community and non-community drinking water systems make up what is referred to as public water systems. Community (year-round residential population) and non-community (nonresidential population) water supply systems are required to monitor their drinking

Table 4 - 102. Population Served by Community Drinking Water Systems in Lake County, IN

System	Population Served
Northwest Indiana Water Company	250270
Hammond Water Works Department	87600
East Chicago Water Works	39800
Highland Water Works	23696
Munster Water Company	20000
Schererville Water Department	19926
Crown Point Water Works	18000
Griffith Water Department	17230
Dyer Water Department	11500
Lake Station Water Department	11000
Twin Lakes Utilities Inc	6980
Lowell Water Department	6430
New Chicago Water Works	6412
St. John Municipal Water Utility	6000
Whiting Water Plant	5710
Lincoln Utilities	5465
Turkey Creek Utility Corporation	2629
Peoples Water Company, Inc	2497
Apple Valley Estates	550
Utilities Inc	314
Schneider Water Department	310
Utilities Inc II	300
Glen View Mobile Home Park	300
Ridge Mobile Home Park	250
Wrights Trailer Park #1	250
Dalecarlia Utility	210
Lakeshore Subd Water Assoc	200
Cedar Lake Bible Conference Grounds	150
Ideal Mobile Home Park	150
Chicagoland Christian Village	150
Cedar Lake Mobile Home Park	136
Fehlberg's Main Mobile Home Park	125
Noble Oaks Subdivision Water Association	100
Char El Mobile Home Park	100
Colonial Mobile Home Park	90
Bremerton Mobile Home Park	59
Ross Mobile Home Court	46
Oakwood Mobile Home Park	45
Honeysuckle Mobile Home Park	40
Forty One (41) Ranch Mobile Home Park	39
Avenue Mobile Home Park	30
Cedar Spring Apartment	25
DBL Tree Winfield Water Works	25
Surprise Park Water Association	25
Total Population Served	**545164**

Shading indicates suppliers that draw drinking water from Lake Michigan
Source Jones, 1997

Table 4-103. Population Served by Noncommunity Drinking Water Systems in Lake County, IN

System Name	System City	Population
Cedar Lake Monastery Golf	Cedar Lake	75
Marty's Diner	Cedar Lake	36
Dairy Queen-East Store	Cedar Lake	500
Coffin's Shady Beach	Cedar Lake	25
New Life Bible Baptist Church	Cedar Lake	55
Town Club	Cedar Lake	150
Three Stooges Bar & Grill	Cedar Lake	25
Melody Hill Tavern	Cedar Lake	25
The Other Place	Cedar Lake	30
American Legion Post #261	Cedar Lake	50
Great Oaks After 4 Supper Club	Cedar Lake	40
Lago's Restaurant	Cedar Lake	300
Shore Club	Cedar Lake	30
Community Bible Church	Cedar Lake	180
Tobe's Restaurant	Cedar Lake	50
Jane Ball Elementary School	Cedar Lake	60
Wilke's Mobile Station	Cedar Lake	25
Cedar Lake Fish & Game	Cedar Lake	50
Lake Shore Marina, Inc.	Cedar Lake	25
Cedar Lake Yacht Club	Cedar Lake	45
Latulip Harbor	Cedar Lake	25
Douglas Macarthur Elementary	Cedar Lake	695
Holy Name Parish	Cedar Lake	25
Crestview Motel	Cedar Lake	40

Table 4-103. Population Served by Noncommunity Drinking Water Systems in Lake County, IN (continued)

System Name	System City	Population
The Liberty Restaurant	Cedar Lake	75
Harry O's	Cedar Lake	25
Hope Lutheran Church	Cedar Lake	40
McDonalds #13735	Cedar Lake	750
Coles Mart	Cedar Lake	25
Port Cedar	Cedar Lake	25
Cedar Creek Family Golf Center	Cedar Lake	50
Steve Pizza Palace	Cedar Lake	50
Boys and Girls Club of Cedar Lake	Cedar Lake	124
Cedar Lake Ice Cream Corp.	Cedar Lake	25
Reicherts Tavern	Cedar Lake	25
It's a Small World Child Care Center	Cedar Lake	25
Summer Tree Restaurant	Crown Point	40
Lemon Lake County Park	Crown Point	300
Lemon Lake County Park	Crown Point	300
Lakes of the Four Seasons (Lofs)	Crown Point	510
Lemon Lake County Park	Crown Point	300
Jolly Rogers	Crown Point	25
Lemon Lake County Park	Crown Point	300
Oak Knoll Golf Course	Crown Point	50
Hillside Community Church	Crown Point	25
Lake Region Christian Assembly	Crown Point	150
Winfield Elementary School	Crown Point	600
McDonald's - Crown Point	Crown Point	600
Pheasant Valley Country Club	Crown Point	200

Table 4-103. Population Served by Noncommunity Drinking Water Systems in Lake County, IN (continued)

System Name	System City	Population
Youche Country Club	Crown Point	25
Church of God	Griffith	25
Westpoint Toll Plaza-Indot	Hammond	27
Stony Run County Park	Hebron	200
USA Interstate Restaurant	Hebron	50
Crossroads I-65 Truck Plaza	Hebron	1,040
Super 8 Motel Diversified Hospitality	Hebron	25
Kiddie Day Care Center	Hobart	80
Indian Ridge Golf Course	Hobart	156
Welsh Mart	Lowell	100
Lake Prairie Elementary	Lowell	310
Nona's Restaurant	Lowell	50
Dalecarlia Bible Church	Lowell	25
Red Rock Trading, Inc.	Lowell	50
Conela's Restaurant	Lowell	50
Good Shepherd Day Care	Merrillville	125
Beer Barrel	Merrillville	50
John Wood Elementary	Merrillville	382
S. Lake County Conservation	Schneider	25
Shelby Lounge	Shelby	60
Lake Hills Golf & Country Club	St. John	50
Palmira Golf & Country Club	St. John	50
Dick's Restaurant	St. John	300

Source: Jones, 1997

water periodically. (See Section 4.7.2.2.) Violations of drinking water criteria - as well as of monitoring and reporting requirements - are reviewed periodically by State agencies and EPA (U.S. EPA, 1995p).

MCLs were set for contaminants of special concern to EPA, including microbiological contaminants (e.g., coliform bacteria), turbidity, inorganic chemicals (e.g., copper and lead), organic chemicals (including pesticides, VOCs, and SOCs), radioactive chemicals, and disinfection by-products (primarily the trihalomethanes) produced during water treatment chemical reactions (U.S. EPA, 1984; U.S. EPA, 1988a). National Primary Drinking Water regulations also call for periodic monitoring of public water supplies for the specific contaminants and notification to water users when any standards are exceeded. Local drinking water problems are reported to the State and county health departments and the State agency with groundwater responsibility (U.S. EPA, 1995p).

4.7.2.2 *Monitoring Drinking Water Quality*

Illinois has jurisdiction over approximately 1-million acres (63 miles of shoreline) of Lake Michigan, stretching along the State's northeastern border and the City of Chicago (IEPA, 1996c). Lake Michigan is protected to a greater degree than other lakes in Illinois by having more stringent water quality standards. Water quality in Lake Michigan is monitored through a cooperative agreement between IEPA and the City of Chicago (IEPA, 1993b). IEPA is required to provide the Illinois General Assembly and the Governor's Office with a separate biennial report describing the water quality conditions of Lake Michigan. This report is published in cooperation with the City of Chicago (IEPA, 1993b).

Both Cook County, IL, and Lake County, IN, follow the standardized framework for monitoring drinking water quality from treatment plants and at the tap. The sampling frequency depends on the history of the levels detected. According to the IEPA and IDEM, when chemicals exceed either the MCL or Action Levels, sampling is required more often (Jones, 1997; Timm, 1997). If there are no detects, scheduled sampling is less frequent (Table 4-104). When a public water system first begins sampling, it samples for SOCs quarterly for a year. If no exceedances are detected during four consecutive quarters, the sampling schedule is reduced. VOCs are also sampled quarterly for a year, and if no exceedances are found during four consecutive quarters, sampling is

Table 4 - 104. Sampling Frequency Requirements

Chemicals of Concern	Initial Sampling Frequency	Reduced Sampling Frequency
SOCs	quarterly first year	annually
VOCs	quarterly first year	annually
IOCs	quarterly first year	Surface water - annually Groundwater - three times a year
Lead and Copper	every 6 months	annually
Total coliforms	monthly	monthly

Source: Timm, 1997; Jones, 1997.

reduced to annually for 3 years. Inorganic compounds (IOCs) are initially sampled quarterly, and if no exceedances are detected for four consecutive quarters, surface waters are sampled annually and groundwaters are sampled triannually. Lead and copper are initially sampled for two 6-month periods, back-to-back; if no exceedances are detected, samples are collected annually for 2 years, with half the number of required samples (Table 4-105). When drinking water is supplied to the public by a satellite water supplier, only lead, copper, and bacteria are tested at these facilities. The SOCs, VOCs, and IOCs will have already been tested for at the parent water supplier. The parent water facility is tested for all drinking water contaminants.

Microbial contamination continues to be a national concern because contaminated drinking water systems can rapidly spread disease; therefore, bacteria are routinely monitored. Total coliform is tested by each public water system once a month. Sampling requirements regarding number of samples needed for all contaminants of concern are based on the population being supplied and according to the drinking water violations. Initial sampling is done at the tap (Jones, 1997; Timm, 1997). When an Action Level or MCL is exceeded, sampling is continued at the tap, within the distribution system, and at each entry point to the distribution system (U.S. EPA, 1991b).

4.7.2.3 *Contaminants Detected in Drinking Water Supplies*

<u>Cook County, IL</u>

Results of drinking water sampling for all drinking water suppliers in Cook County, IL, were obtained from IEPA (Crumly, 1997). VOC sampling results are from February 1993 to December 1996, and IOC sampling results are from March 1989 to March 1997. Table 4-106 shows the detected ranges for VOCs and IOCs, the mean result for each chemical detected, and the MCL. Table 4-107 shows the lead and copper results from January 1992 to June 1996. Table 4-108 shows the total coliform results in 1996 for all water systems that tested positive. SOC results were not available.

Table 4 - 105. Lead and Copper Monitoring Requirements

Monitoring Period	Lead/Copper Home Taps
Initial	6 months
After corrosion treatment	6 months
Reduced	
- Conditional	1 year
- Final	3 years

Population Served	Number of Samples Collected at Home Taps for Lead/Copper
>100000	100
10001 - 100000	60
3301 - 10000	40
501 - 3300	20
101 - 500	10
< or = 100	5

Source: U.S. EPA, 1991b.

Table 4 - 106. Drinking Water Results for Cook County, IL

Chemical	Range	Units	Mean	MCL	Units	Comments
VOCs						**Represents 2/93 - 12/96**
1,1,1-Trichloroethane	0 7 - 1 1	ug/L	0 92	200	ug/L	
1,1-Dichloroethane	0 7 - 6 3	ug/L	3 91			Unregulated
1,1-Dichloroethylene	0 7 - 1 0	ug/L	0.87	7	ug/L	
cis 1,2-Dichloroethylene	0 5 - 11	ug/L	5 63	70	ug/L	
Trichloroethylene	0 9 - 3 7	ug/L	2.16	5	ug/L	
Vinyl Chloride	0 5 - 2 9	ug/L	1 37	2	ug/L	
Xylene (total)	0 7	ug/L	0 7	10000	ug/L	
IOCs						**Represents 3/89 - 3/97**
Boron	19 - 1400	ug/L	429 7			Unregulated
Calcium	15 - 220	mg/L	83 8			Unregulated
Chloride	14	mg/L	14			Unregulated
Chromium	4 2	ug/L	4 2	100	ug/L	
Copper	10 -1300	ug/L	245.7	1300	ug/L	Action Level
Copper*	5 - 2280	ug/L	339 1	1300	ug/L	Action Level 1/92 - 6/96
Cyanide	10 - 30	ug/L	20	200	ug/L	
Fluoride	170 - 15170	ug/L	1000	4000	ug/L	
Iron	56 - 8200	ug/L	692			Unregulated
Lead*	3 - 25	ug/L	8 4	15	ug/L	Action Level 1/92 - 6/96
Magnesium	11 - 94	mg/L	54 6			Unregulated
Manganese	10 - 285	ug/L	83 9			Unregulated
Mercury	0 02 - 0 5	ug/L	0 19	2	ug/L	
Molybdenum	21 - 49	ug/L	26 5			Unregulated
Nickel	16 - 40	ug/L	21 7	100	ug/L	
Potassium	1 4 - 10	mg/L	2 82			Unregulated
Selenium	1 - 2 2	ug/L	1 25	50	ug/L	
Silver	4 - 5	ug/L	4 5			Unregulated
Sodium	5.1 - 360	mg/L	64.8			Unregulated
Strontium	440 - 2400	ug/L	1773 4			Unregulated
Sulfate	11 5 - 660	mg/L	358 3			Unregulated
Thallium	1 - 2 5	ug/L	1 29	2	ug/L	
Vanadium	5	ug/L	5			Unregulated
Zinc	52 - 936	ug/L	146 3			Unregulated

* Data are representative of separate sampling events specifically for Lead and Copper monitoring.

Source: Crumly, 1997

Table 4 - 107. Lead and Copper Drinking Water Results for Cook County, IL

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (mg/L)
ARLINGTON PK RACE TRACK	INITIAL	1/1/95	20	0.013	0 340
BARTLETT	INITIAL	4/1/92	60	0.020	0.397
BARTLETT	INITIAL	10/1/92	60	0.011	0.430
BARTLETT	INITIAL	4/1/93	60	0 009	0.860
BARTLETT	REDUCED	6/1/94	30	0.017	0 580
BOURBON SQUARE APTS	INITIAL	1/1/94	20	0.005	0 480
BOURBON SQUARE APTS	INITIAL	7/1/94	20	0 005	0.520
BOURBON SQUARE APTS	REDUCED	6/1/95	10	0.005	0 420
BOURBON SQUARE APTS	REDUCED	6/1/96	10	0.005	0 510
BUCKHORN RANCH ESTS MHP	INITIAL	4/1/93	10	0.013	0.210
BUCKHORN RANCH ESTS MHP	INITIAL	7/1/95	10	0 005	0.100
BUCKHORN RANCH ESTS MHP	INITIAL	1/1/96	10	0 005	0.110
BUCKHORN RANCH ESTS MHP	REDUCED	6/1/96	5	0.005	0.100
CHICAGO	INITIAL	1/1/92	100	0.010	0.011
CHICAGO	INITIAL	7/1/92	100	0.020	0.013
CHICAGO	CONTINUE	1/1/93	100	0 013	0.012
CTZNS MIDWEST PALOS DVN	INITIAL	1/1/95	10	0.005	1.460
DES PLAINES MHP	INITIAL	4/1/93	20	0.012	0.570
DES PLAINES MHP	INITIAL	10/1/93	20	0.005	0 100
DES PLAINES MHP	REDUCED	6/1/94	10	0.005	0 100
DES PLAINES MHP	REDUCED	6/1/95	5	0.005	0 100
EVANSTON	INITIAL	1/1/92	60	0.025	0 090
EVANSTON	INITIAL	7/1/92	60	0.007	0 100
EVANSTON	CONTINUE	1/1/93	60	0 006	0.045
FORD HEIGHTS	INITIAL	4/1/92	40	0.005	0.100
FORD HEIGHTS	INITIAL	10/1/92	40	0.010	0.300
FORD HEIGHTS	REDUCED	6/1/93	20	0 011	0.850
FORD HEIGHTS	REDUCED	6/1/94	20	0.005	0.910
FORD HEIGHTS	REDUCED	6/1/96	20	0.020	0 850
FRANCISCAN SISTERS OF CHICAGO	INITIAL	4/1/93	20	0.005	0 150
FRANCISCAN SISTERS OF CHICAGO	INITIAL	10/1/93	20	0.008	0 130
FRANCISCAN SISTERS OF CHICAGO	REDUCED	6/1/94	10	0.009	0 170
FRANCISCAN SISTERS OF CHICAGO	REDUCED	6/1/95	10	0.011	0 110
GLENCOE	INITIAL	4/1/92	40	0 015	0.250
GLENCOE	INITIAL	10/1/92	40	0.011	0.000
GLENCOE	REDUCED	6/1/94	20	0.006	0 150
GLENCOE	REDUCED	6/1/95	20	0.007	0 036
GLENCOE	REDUCED	6/1/96	20	0.005	0 089
KENILWORTH	INITIAL	4/1/93	20	0.018	0.230
KENILWORTH	INITIAL	10/1/93	20	0.015	0.180
KENILWORTH	CONTINUE	4/1/94	20	0.009	0.300
KENILWORTH	REDUCED	6/1/95	10	0.006	0.160
KENILWORTH	REDUCED	6/1/96	10	0.009	0 420
LEMONT	INITIAL	4/1/92	40	0.012	0.110
LEMONT	INITIAL	10/1/92	40	0.007	0 210
LEMONT	REDUCED	6/1/93	20	0.008	0 550
LEMONT	REDUCED	6/1/94	20	0.007	0 120
LEMONT	REDUCED	6/1/96	20	0 005	0 130

Table 4 - 107. Lead and Copper Drinking Water Results for Cook County, IL

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (m
LINWAY ESTS MHP	INITIAL	4/1/93	10	0.005	[illegible]
LINWAY ESTS MHP	INITIAL	10/1/93	10	0.005	[illegible]
LINWAY ESTS MHP	REDUCED	6/1/94	5	0.005	0.100
LINWAY ESTS MHP	REDUCED	6/1/95	5	0.005	0.100
NORTHBROOK	INITIAL	4/1/92	60	0.016	0.100
NORTHBROOK	INITIAL	10/1/92	60	0.020	0.240
OASIS MHP	INITIAL	4/1/93	20	0.005	0.100
OASIS MHP	INITIAL	10/1/93	20	0.005	0.190
OASIS MHP	REDUCED	6/1/94	10	0.005	0.100
OASIS MHP	REDUCED	6/1/95	10	0.005	0.200
PARADISE MHP	INITIAL	4/1/93	20	0.005	0.480
PARADISE MHP	INITIAL	10/1/93	20	0.005	0.400
PARADISE MHP	REDUCED	6/1/94	10	0.005	1.900
PARADISE MHP	CONTINUE	10/1/94	20	0.005	0.100
PARK FOREST	INITIAL	4/1/92	60	0.005	0.100
PARK FOREST	INITIAL	10/1/92	60	0.005	0.100
PARK FOREST	REDUCED	6/1/93	30	0.005	0.100
PARK FOREST	REDUCED	6/1/94	30	0.003	0.010
PARK FOREST	REDUCED	6/1/96	30	0.003	0.700
PLUM CREEK CNDOS	INITIAL	4/1/93	20	0.013	0.480
PLUM CREEK CNDOS	INITIAL	10/1/93	20	0.014	0.661
PLUM CREEK CNDOS	REDUCED	6/1/94	10	0.005	0.170
PLUM CREEK CNDOS	REDUCED	6/1/95	10	0.005	0.120
PLUM GROVE CNDOS	INITIAL	4/1/93	10	0.006	0.270
PLUM GROVE CNDOS	INITIAL	10/1/93	10	0.005	[illegible]
PLUM GROVE CNDOS	REDUCED	6/1/94	5	0.005	[illegible]
PLUM GROVE CNDOS	REDUCED	6/1/95	5	0.005	[illegible]
PROSPECT HEIGHTS	INITIAL	4/1/93	20	0.021	2.280
PROSPECT HEIGHTS	INITIAL	10/1/93	20	0.015	1.310
PROSPECT HEIGHTS	CONTINUE	4/1/94	20	0.006	1.880
RICHTON PARK	INITIAL	4/1/92	60	0.009	0.420
RICHTON PARK	INITIAL	10/1/92	60	0.008	0.230
RICHTON PARK	REDUCED	6/1/93	30	0.005	0.670
RICHTON PARK	REDUCED	6/1/94	30	0.005	0.170
RICHTON PARK	REDUCED	6/1/96	30	0.005	0.100
SANTA FE MHP	INITIAL	1/1/94	5	0.005	0.100
SANTA FE MHP	INITIAL	7/1/94	5	0.011	0.462
SANTA FE MHP	REDUCED	6/1/95	5	0.009	0.100
SANTA FE MHP	REDUCED	6/1/96	5	0.006	0.100
SAUK	INITIAL	4/1/92	40	0.005	0.640
SAUK	INITIAL	10/1/92	40	0.006	0.570
SAUK	REDUCED	6/1/93	20	0.005	0.420
SAUK	REDUCED	6/1/94	20	0.005	0.580
SAUK	REDUCED	6/1/96	20	0.011	0.470
SILO MHP	INITIAL	4/1/93	5	0.013	0.385
SILO MHP	INITIAL	7/1/94	5	0.008	0.270
SILO MHP	INITIAL	1/1/95	5	0.006	0.360
SILO MHP	REDUCED	6/1/95	5	0.007	0.675

Table 4 - 107. Lead and Copper Drinking Water Results for Cook County, IL

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (mg/L)
SILO MHP	REDUCED	6/1/96	5	0.007	0 420
SOUTH CHICAGO HEIGHTS	INITIAL	4/1/92	40	0 013	0 700
SOUTH CHICAGO HEIGHTS	INITIAL	10/1/92	40	0 024	0.640
SOUTH CHICAGO HEIGHTS	CONTINUE	4/1/93	40	0.014	0.620
SPRING LAKES MHP	INITIAL	4/1/93	20	0.005	0.950
SPRING LAKES MHP	INITIAL	10/1/93	20	0.005	1.130
SPRING LAKES MHP	REDUCED	6/1/94	10	0 005	0.310
SPRING LAKES MHP	REDUCED	6/1/95	10	0 005	0.340
STEGER	INITIAL	4/1/92	40	0 014	0.693
STEGER	INITIAL	10/1/92	40	0 015	0.310
STEGER	REDUCED	6/1/93	20	0.011	0.800
STEGER	REDUCED	6/1/94	20	0 019	0.330
STEGER	CONTINUE	10/1/95	40	0.016	0 480
SUNSET MHP	INITIAL	4/1/93	20	0 005	0 100
SUNSET MHP	INITIAL	10/1/93	20	0.005	0.100
SUNSET MHP	REDUCED	6/1/94	10	0 005	0.100
SUNSET MHP	REDUCED	6/1/95	10	0 005	0.100
TOUHY MHP	INITIAL	4/1/93	20	0.011	0 150
TOUHY MHP	INITIAL	10/1/93	20	0 006	0.100
TOUHY MHP	REDUCED	6/1/94	10	0.007	0.240
TOUHY MHP	REDUCED	6/1/95	10	0 005	0.140
UTL INC COUNTY LINE WTR CMPNY	INITIAL	4/1/93	10	0 010	0.540
UTL INC COUNTY LINE WTR CMPNY	INITIAL	10/1/93	10	0.006	0.200
UTL INC COUNTY LINE WTR CMPNY	REDUCED	6/1/94	5	0 005	0.395
UTL INC COUNTY LINE WTR CMPNY	REDUCED	6/1/95	5	0.005	0.260
W A HOWE MHC	INITIAL	4/1/93	20	0.005	0.100
W A HOWE MHC	INITIAL	10/1/93	20	0.005	0.100
W A HOWE MHC	REDUCED	6/1/95	10	0 005	0 005
WESTERN SPRINGS	INITIAL	4/1/92	60	0.005	0 100
WESTERN SPRINGS	INITIAL	10/1/92	60	0 005	0.100
WESTERN SPRINGS	REDUCED	6/1/93	30	0.005	0.650
WESTERN SPRINGS	REDUCED	6/1/94	30	0.005	0 100
WESTERN SPRINGS	REDUCED	6/1/96	30	0.005	0.100
WILLOWAY TERRACE MHP	INITIAL	4/1/93	10	0.005	0 100
WILLOWAY TERRACE MHP	INITIAL	10/1/93	10	0.005	0 100
WILLOWAY TERRACE MHP	REDUCED	6/1/94	5	0.005	0 100
WILLOWAY TERRACE MHP	REDUCED	6/1/95	5	0.005	0.100
WILMETTE	INITIAL	4/1/92	60	0.018	0.200
WILMETTE	INITIAL	10/1/92	60	0.020	0 220
WILMETTE	CONTINUE	7/1/94	60	0 010	0 130
WINNETKA	INITIAL	4/1/92	60	0 014	0 220
WINNETKA	INITIAL	10/1/92	60	0.013	0.110
WINNETKA	REDUCED	6/1/93	30	0.009	0.900
WINNETKA	REDUCED	6/1/94	30	0.009	0 150
WINNETKA	REDUCED	6/1/96	30	0.005	0 100
Source· Crumly, 1997.					

Purpose = Type of monitoring conducted. Monitoring is conducted for Public Water Suppliers at three different levels (initial, continued and reduced)

No Req = Number of samples required

Table 4 - 108. Total Coliform Results for Public Drinking Water Systems in Cook County, IL

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
Alsip	3/5/96	**Present**	Absent
Arlington Heights	5/28/96	**Present**	Absent
Arlington Heights	8/6/96	**Present**	Absent
Arlington Heights	8/6/96	**Present**	Absent
Arlington Heights	11/26/96	**Present**	Absent
Bourbon Square Apartments	4/18/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/20/96	**Present**	Absent
Bourbon Square Apartments	6/27/96	**Present**	Absent
Bourbon Square Apartments	6/27/96	**Present**	Absent
Bourbon Square Apartments	6/27/96	**Present**	Absent
Bourbon Square Apartments	6/27/96	**Present**	Absent
Bourbon Square Apartments	6/28/96	**Present**	Absent
Bourbon Square Apartments	6/28/96	**Present**	Absent
Bourbon Square Apartments	7/1/96	**Present**	Absent
Bourbon Square Apartments	7/1/96	**Present**	Absent
Bourbon Square Apartments	7/11/96	**Present**	Absent
Bourbon Square Apartments	7/11/96	**Present**	Absent
Bourbon Square Apartments	7/11/96	**Present**	Absent
Bourbon Square Apartments	7/11/96	**Present**	Absent
Bourbon Square Apartments	7/11/96	**Present**	Absent

Table 4 - 108. Total Coliform Results for Public Drinking Water Systems in Cook County, IL

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/11/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/16/96	Present	Absent
Bourbon Square Apartments	7/20/96	Present	Absent
Bourbon Square Apartments	7/22/96	Present	Absent
Bourbon Square Apartments	7/22/96	Present	Absent
Bourbon Square Apartments	7/22/96	Present	Absent
Bourbon Square Apartments	8/6/96	Present	Absent
Bourbon Square Apartments	8/6/96	Present	Absent
Bourbon Square Apartments	8/9/96	Present	Absent
Bourbon Square Apartments	8/9/96	Present	Absent
Bourbon Square Apartments	9/17/96	Present	Absent
Bourbon Square Apartments	9/17/96	Present	Absent
Bourbon Square Apartments	9/17/96	Present	Absent
Bourbon Square Apartments	9/17/96	Present	Absent
Bourbon Square Apartments	9/17/96	Present	Absent
Bourbon Square Apartments	10/16/96	Present	Absent
Bourbon Square Apartments	10/16/96	Present	Present
Bourbon Square Apartments	10/21/96	Present	Present
Bourbon Square Apartments	10/21/96	Present	Absent
Bourbon Square Apartments	10/23/96	Present	Present
Bourbon Square Apartments	11/6/96	Present	Absent
Bourbon Square Apartments	11/6/96	Present	Absent
Bourbon Square Apartments	11/13/96	Present	Absent
Bourbon Square Apartments	11/13/96	Present	Absent

Table 4 - 108. Total Coliform Results for Public Drinking Water Systems in Cook County, IL

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
Bourbon Square Apartments	12/12/96	Present	Absent
Bourbon Square Apartments	12/12/96	Present	Absent
Brookfield	6/17/96	Present	Absent
Buchhorn Ranch Estates Moble Home Park	5/29/96	Present	Absent
Buffalo Grove	6/26/96	Present	Absent
Chicago MWRDGC	1/3/96	Present	Absent
Chicago MWRDGC	1/9/96	Present	Absent
Chicago MWRDGC	1/17/96	Present	Absent
Chicago MWRDGC	2/8/96	Present	Absent
Chicago MWRDGC	2/20/96	Present	Absent
Chicago MWRDGC	2/23/96	Present	Absent
Chicago MWRDGC	2/23/96	Present	Absent
Chicago MWRDGC	2/27/96	Present	Absent
Chicago MWRDGC	3/11/96	Present	Absent
Chicago MWRDGC	3/29/96	Present	Absent
Chicago MWRDGC	4/1/96	Present	Absent
Chicago MWRDGC	4/1/96	Present	Absent
Chicago MWRDGC	4/10/96	Present	Absent
Chicago MWRDGC	4/12/96	Present	Absent
Chicago MWRDGC	4/23/96	Present	Absent
Chicago MWRDGC	5/7/96	Present	Absent
Chicago MWRDGC	5/21/96	Present	Absent
Chicago MWRDGC	5/28/96	Present	Absent
Chicago MWRDGC	6/3/96	Present	Absent
Chicago MWRDGC	6/5/96	Present	Absent
Chicago MWRDGC	6/11/96	Present	Absent
Chicago MWRDGC	6/12/96	Present	Absent
Chicago MWRDGC	6/20/96	Present	Absent
Chicago MWRDGC	6/25/96	Present	Absent
Chicago MWRDGC	7/2/96	Present	Absent
Chicago MWRDGC	7/5/96	Present	Absent
Chicago MWRDGC	7/9/96	Present	Absent
Chicago MWRDGC	7/9/96	Present	Absent
Chicago MWRDGC	7/16/96	Present	Absent
Chicago MWRDGC	7/17/96	Present	Absent
Chicago MWRDGC	7/29/96	Present	Absent
Chicago MWRDGC	7/29/96	Present	Absent
Chicago MWRDGC	7/30/96	Present	NR
Chicago MWRDGC	7/30/96	Present	Absent
Chicago MWRDGC	8/1/96	Present	Absent
Chicago MWRDGC	8/6/96	Present	Absent
Chicago MWRDGC	8/29/96	Present	Absent
Chicago MWRDGC	9/16/96	Present	Absent
Chicago MWRDGC	9/19/96	Present	Absent

Table 4 - 108. Total Coliform Results for Public Drinking Water Systems in Cook County, IL

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
Chicago MWRDGC	10/10/96	**Present**	Absent
Chicago MWRDGC	10/16/96	**Present**	Absent
Chicago MWRDGC	10/17/96	**Present**	Absent
Chicago MWRDGC	10/24/96	**Present**	Absent
Citizens Fernway Utl Dvn	11/20/96	**Present**	Absent
Evanston	3/15/96	**Present**	Absent
Franklin Park	5/29/96	**Present**	Absent
LaGrange	8/12/96	**Present**	**Present**
LaGrange Park	6/18/96	**Present**	Absent
Leyden TWSP Water District	2/12/96	**Present**	**Present**
Leyden TWSP Water District	5/20/96	**Present**	**Present**
Leyden TWSP Water District	9/9/96	**Present**	Absent
Leyden TWSP Water District	10/15/96	**Present**	Absent
Markham	11/6/96	**Present**	Absent
Matteson	2/6/96	**Present**	Absent
Matteson	7/9/96	**Present**	Absent
Matteson	7/9/96	**Present**	Absent
Matteson	7/9/96	**Present**	**Present**
Matteson	7/9/96	**Present**	**Present**
Morton Grove	8/13/96	**Present**	Absent
Mount Prospect	6/11/96	**Present**	Absent
Mount Prospect	8/13/96	**Present**	Absent
Niles	6/11/96	**Present**	Absent
Niles	8/6/96	**Present**	Absent
Niles	8/6/96	**Present**	Absent
Niles	10/22/96	**Present**	Absent
Norridge	9/16/96	**Present**	Absent
North Suburban Public Util Co	1/14/96	**Present**	Absent
North Suburban Public Util Co	1/23/96	**Present**	Absent
North Suburban Public Util Co	6/11/96	**Present**	Absent
Northwest Suburban Muncpl Jawa	7/16/96	**Present**	Absent
Northwest Suburban Muncpl Jawa	9/17/96	**Present**	Absent
Oak Lawn	7/9/96	**Present**	Absent
Oasis Moble Home Park	10/16/96	**Present**	Absent
Oasis Moble Home Park	10/16/96	**Present**	Absent
Park Ridge	8/19/96	**Present**	Absent
River Grove	9/23/96	**Present**	Absent
Riverdale	6/17/96	**Present**	**Present**
Riverdale	6/17/96	**Present**	Absent
Robbins	6/28/96	**Present**	Absent
Robbins	8/19/96	**Present**	Absent
Rolling Meadows	8/19/96	**Present**	Absent
Santa Fe Moble Home Park	9/23/96	**Present**	Absent
Santa Fe Moble Home Park	9/23/96	**Present**	Absent

Table 4 - 108. Total Coliform Results for Public Drinking Water Systems in Cook County, IL

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
Santa Fe Mobile Home Park	9/23/96	**Present**	Absent
South Stickney Sndst	1/16/96	**Present**	**Present**
South Stickney Sndst	1/19/96	**Present**	**Present**
Stone Park	8/27/96	**Present**	Absent
Worth	8/6/96	**Present**	Absent
Source Patterson, 1997.			

Cook County Drinking Water

- As Much as 8 Years of Monitoring Data Were Obtained and Assessed
- Highest Concentrations Detected for Certain Contaminants Exceeded Drinking Water Standards for:
  - Vinyl Chloride
  - Thallium
  - Chloride
  - Fluoride
  - Copper
  - Lead
- Ford Heights Drinking Water System Had Most Violations in 1995

Most VOCs and IOCs in Cook County's drinking water were either not detected or were detected at levels far below MCLs for drinking water. MCLs for vinyl chloride, thallium, and fluoride were exceeded, but the mean results were below the MCL for each of these contaminants. Copper was analyzed during the IOC sampling and in a separate sampling specifically intended for the analysis of lead and copper in drinking water. The IOC sampling showed that copper was detected at the Action Level, and the MCL was exceeded for thallium in taps supplied by one facility that serves 0.02 percent of Cook County's population. Chicago MWRDGC, the largest supplier in Cook County, exceeded the MCL for fluoride by twice the MCL in February 1996. Three other suppliers also exceeded the MCL for fluoride at the tap. The MCL for vinyl chloride was exceeded twice at the tap by the same supplier in August and October 1996; this supplier provides water for 0.07 percent of Cook County's population. The lead and copper sampling results showed that the lead Action Level was exceeded at the tap by 11 of the 36 drinking water suppliers in Cook County, IL. Copper was at or above the Action Level for 4 of the 36 drinking water suppliers in Cook County, 3 of which were initial samplings. In 1996, 30 facilities tested positive for total coliforms. Of these 30 facilities, 6 tested positive for fecal coliform as well. Bourbon Square Apartments had the most bacteria violations, having tested positive for total coliforms 85 times from April 1996 to December 1996. Chicago MWRDGC was second on the list for the most bacteria violations in 1996. Chicago MWRDGC showed positive results 43 times from January 1996 through October 1996.

A total of 104 violations were reported in the Safe Drinking Water Information System (SDWIS, 1997) for Cook County, IL, in 1995 (Table 4-109). These violations may be due to the exceedance of MCLs and Action Levels or they could be due to administrative problems with the drinking water systems. Ford Heights far exceeded all of the remaining 49 facilities in the number

Table 4 - 109. Drinking Water Violations in 1995 for Cook County, IL

Rank	Violations	System Name
1	20	FORD HEIGHTS
2	6	MELROSE PARK
3	4	BOURBON SQUARE APTS
4	4	GOLF
5	4	MARKHAM
6	3	BARTLETT
7	3	BUCKHORN RANCH ESTS MOBILE HOME PARK
8	3	DIXMOOR
9	3	NORTH SUBURBAN PUBLIC UTILITY CO
10	2	BEDFORD PARK
11	2	BELLWOOD
12	2	CENTRAL STICKNEY SNDST
13	2	CTZNS CHICAGO SBRBN UTL DVN
14	2	GLEN EDEN ESTS HOMEOWNERS ASSN
15	2	LYNWOOD
16	2	MISSION BROOK SNDST
17	2	NORTH RIVERSIDE
18	2	NORTHWEST SUBURBAN MUNCPL JAWA
19	2	PROSPECT HEIGHTS
20	2	RIVERDALE
21	2	SOUTH HOLLAND
22	2	STEGER
23	1	ALSIP
24	1	ARLINGTON PK RACE TRACK
25	1	BROADVIEW
26	1	CHICAGO
27	1	COUNTRY CLUB HILLS
28	1	CRESTWOOD
29	1	CTZNS FERNWAY UTL DVN
30	1	CTZNS MIDWEST PALOS DVN
31	1	DIVINE WORD SEMINARY
32	1	DOLTON
33	1	GARDEN HOME SNDST
34	1	GLENVIEW NAVAL AIR STATION
35	1	HARVEY
36	1	HILLSIDE
37	1	LA GRANGE PARK
38	1	LEMONT
39	1	LYONS
40	1	MORTON GROVE
41	1	OAK FOREST
42	1	OAK PARK
43	1	PALOS PARK
44	1	PARADISE MHP
45	1	PHOENIX
46	1	PLUM CREEK CNDOS
47	1	RIVERSIDE
48	1	SCHILLER PARK
49	1	SUNSET MHP
50	1	WHEELING
	104	**Total Violations**

Source SDWIS, 1997

of violations reported. Ford Heights serves a population of 4,259 in Cook County. In 1991, 85 violations were reported for all drinking water systems in Cook County (Table 4-110). The number of violations peaked at 242 in 1993 and have shown a decline since that date.

Lake County, IN

Public water suppliers in Lake County, IN, that use Lake Michigan water were tested periodically for VOCs, IOCs, and bacteria between 1989 and 1990. Most VOCs and other organic compounds were either not detected or were detected at levels far below the MCLs. The Action Level for lead (15μg/L) was exceeded by 10 μg/L for one water sample, and no bacteriological counts were present in any sample (U.S. EPA 1994a).

Drinking Water in Lake County, IN

- As Much as 15 Years of Monitoring Data Were Obtained and Assessed
- Highest Concentrations Detected for Certain Contaminants Exceed Drinking Water Standards for:
  - Beryllium
  - Cadmium
  - Mercury
  - Nickel
  - Thallium
  - Fluoride
  - Lead
- Bacteria Tested Positive in About 25% of Suppliers in 1996

More current drinking water monitoring data for VOCs, SOCs, IOCs, lead and copper 90th percentile results, and total coliform positive results were obtained from IDEM (Jones, 1997). VOC sampling results are from February 1993 to July 1996; SOC sampling results, May 1993 to August 1996; IOC sampling results, May 1982 to March 1997; lead and copper 90th percentile sampling results, January 1992 to September 1996; and total coliform positive results, May 1996 to December 1996.

Table 4-111 shows the range for which VOCs, SOCs, and IOCs were detected, the mean result for each chemical detected, and the MCL. Tables 4-112 and 4-113 are provided for the lead and copper and the total coliform positive results. All reported VOCs and SOCs were either not detected or were detected at levels far below the MCLs. Beryllium, cadmium, mercury, nickel, and thallium were all detected at the MCL during 1993 to 1994 sampling. Fluoride from one supplier exceeded the MCL at the tap.

Table 4 - 110. Drinking Water Violations in Cook County, IL, for 1991 - 1996

Rank	Violations	Year
1	242	1993
2	188	1994
3	130	1992
4	104	1995
5	90	1996
6	85	1991
	873	Total Violations

Source. SDWIS, 1997.

Table 4 - 111. Community Drinking Water Results for Lake County, IN

Chemical	Range	Units	Mean	MCL	Units	Comments
VOC s						**Represents 2/93 - 7/96**
1,1,1-Trichloroethane	0.5	ug/L	0.5	200	ug/L	
1,2-Dichloroethane	1	ug/L	1	5	ug/L	
1,2-Xylenes	0.61	ug/L	0.61	10000	ug/L	MCL for xylenes (total)
1,3-Xylenes	1 37	ug/L	1.37	10000	ug/L	MCL for xylenes (total)
1,4-Xylenes	1 37 - 1.4	ug/L	1 38	10000	ug/L	MCL for xylenes (total)
Bromodichloromethane	4.12	ug/L	4 12	100	ug/L	MCL for trihalomethanes (total)
Chlorodibromomethane	4.24 - 7.26	ug/L	5.75	100	ug/L	MCL for trihalomethanes (total)
Chloroform	4.48	ug/L	4.48	100	ug/L	MCL for trihalomethanes (total)
Dichloromethane	0.6 - 1.4	ug/L	0.88	5	ug/L	
Toluene	6.1	ug/L	6.1	1000	ug/L	
Trichloroethylene	0.6 - 1.7	ug/L	1.03	5	ug/L	
SOCs						
2,4,5-TP (Silvex)	0.28	ug/L	0 28	50	ug/L	**Represents 5/93 - 8/96**
Di (2-ethylhexyl) Adipate	2.1 - 5.6	ug/L	3 85	400	ug/L	
Di (2-ethylhexyl) Phthalate	0.6 - 5.4	ug/L	1.49	6	ug/L	
IOCs						**Represents 5/82 to 3/97**
Antimony	3 - 5	ug/L	4 6	6	ug/L	
Arsenic	1 - 16	ug/L	4.5	50	ug/L	
Barium	7 - 400	ug/L	71.6	2000	ug/L	
Beryllium	0 01 - 4	ug/L	1.2	4	ug/L	
Cadmium	0 04 - 5	ug/L	1.3	5	ug/L	
Chromium	1 - 50	ug/L	6.1	100	ug/L	
Copper*	1.1 - 1232	ug/L	158.8	1300	ug/L	Action Level (1/92 - 7/96)
Cyanide (free)	20 - 74	ug/L	34.2	200	ug/L	
Fluoride	100 - 6000	ug/L	892 8	4000	ug/L	

Table 4 - 111. Community Drinking Water Results for Lake County, IN

Chemical	Range	Units	Mean	MCL	Units	Comments
Lead*	1 - 287 5	ug/L	7 1	15	ug/L	Action Level (1/92 - 7/96)
Mercury	0.1 - 2	ug/L	0.4	2	ug/L	
Nickel	1 - 100	ug/L	13.1	100	ug/L	
Selenium	2 -10	ug/L	5.3	50	ug/L	
Sodium	5.6 - 80000	ug/L	16844			Unregulated
Sulfate	27 - 340000	ug/L	84790			Unregulated
Thallium	1 - 2	ug/L	1.3	2	ug/L	

* Data are representative of separate sampling events specifically for Lead and Copper monitoring

Source Jones, 1997

Table 4 - 112. Lead and Copper Community Drinking Water Results for Lake County, IN

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (mg/L)
APPLE VALLEY ESTATES	INITIAL	1/1/94		0.005	0.19
APPLE VALLEY ESTATES	INITIAL	7/1/93		0.011	0.16
APPLE VALLEY ESTATES	REDUCED	6/1/95		0.0014	0.15
APPLE VALLEY ESTATES	REDUCED	6/1/96	10	0.0036	0.08
AVENUE MOBILE HOME PARK	REDUCED	6/1/95		0.001	0.05
AVENUE MOBILE HOME PARK	REDUCED	6/1/96	5	0.001	0.05
AVENUE MOBILE HOME PARK	INITIAL	7/1/93		0.005	0.027
AVENUE MOBILE HOME PARK	INITIAL	1/1/94		0.002	0.02
BREMERTON MOBILE HOME PARK	REDUCED	6/1/95		0.005	0.614
BREMERTON MOBILE HOME PARK	REDUCED	6/1/96	5	0.005	0.016
BREMERTON MOBILE HOME PARK	INITIAL	1/1/94		0.001	0.007
BREMERTON MOBILE HOME PARK	INITIAL	7/1/93		0.001	0.0055
CEDAR LAKE BIBLE CONFERENCE GROUNDS		1/1/94		0.024	0.1
CEDAR LAKE BIBLE CONFERENCE GROUNDS		7/1/93		0.01	0.08
CEDAR SPRING APARTMENT	INITIAL	7/1/96	5	0.0019	0.05
CHAR EL MOBILE HOME PARK		1/1/93		0.005	0.01
CHAR EL MOBILE HOME PARK		7/1/94		0.002	0.009
CHAR EL MOBILE HOME PARK		1/1/95		0.001	0.005
CHAR EL MOBILE HOME PARK		6/1/96		0.001	0.005
CHICAGOLAND CHRISTIAN VILLAGE	REDUCED	6/1/95		0.0013	0.9
CHICAGOLAND CHRISTIAN VILLAGE	INITIAL	1/1/94		0.005	0.725
CHICAGOLAND CHRISTIAN VILLAGE	INTIAL	7/1/94		0.007	0.2
CHICAGOLAND CHRISTIAN VILLAGE	REDUCED	6/1/96.	5	0.001	0.064
COLONIAL MOBILE HOME PARK	REDUCED	6/1/95		0.005	0.015
COLONIAL MOBILE HOME PARK	INITIAL	7/1/93		0.001	0.01
COLONIAL MOBILE HOME PARK	INITIAL	1/1/94		0.001	0.006
COLONIAL MOBILE HOME PARK	REDUCED	6/1/96	5	0.005	0.005
CROWN POINT WATER WORKS	REDUCED	6/1/96	30	0.0046	0.05
CROWN POINT WATER WORKS	INITIAL	7/1/92		0.004	0.05
CROWN POINT WATER WORKS	REDUCED	6/1/95		0.003	0.05
CROWN POINT WATER WORKS	INITIAL	1/1/93		0.005	0.04
CROWN POINT WATER WORKS	REDUCED	6/1/94		0.001	0.037
DALECARLIA UTILITY	INITIAL	7/1/93		0.002	0.78
DALECARLIA UTILITY	REDUCED	6/1/96	5	0.009	0.515
DALECARLIA UTILITY	INITIAL	1/1/94		0.001	0.31
DALECARLIA UTILITY	REDUCED	6/1/95		0.0055	0.18
DYER WATER DEPARTMENT	INITIAL	1/1/93		0.002	0.301
DYER WATER DEPARTMENT	INITIAL	7/1/92		0.002	0.246
DYER WATER DEPARTMENT	REDUCED	6/1/96	30	0.0108	0.19
DYER WATER DEPARTMENT	REDUCED	6/1/95		0.007	0.106
DYER WATER DEPARTMENT	REDUCED	6/1/94		0.004	0.072
EAST CHICAGO WATER WORKS	FOLLOW-UP	1/1/93		0.013	0.092
EAST CHICAGO WATER WORKS	INITIAL	7/1/92		0.026	0.05
EAST CHICAGO WATER WORKS	FOLLOW-UP	7/1/93		0.012	0.05
EAST CHICAGO WATER WORKS	REDUCED	6/1/96	30	0.012	0.039
EAST CHICAGO WATER WORKS	REDUCED	6/1/95		0.012	0.015
EAST CHICAGO WATER WORKS	REDUCED	6/1/94		0.01	0.011
FEHLBERG'S MAIN MOBILE HOME PARK	REDUCED	6/1/96	5	0.005	0.038
FEHLBERG'S MAIN MOBILE HOME PARK	INITIAL	7/1/93		0.001	0.026
FEHLBERG'S MAIN MOBILE HOME PARK	REDUCED	6/1/95		0.005	0.019
FEHLBERG'S MAIN MOBILE HOME PARK	INITIAL	1/1/94		0.001	0.018
FORTY ONE (41) RANCH MOBILE HOME PARK	INITIAL	1/1/94		0.007	0.1
FORTY ONE (41) RANCH MOBILE HOME PARK	REDUCED	6/1/96	5	0.2875	0.07
FORTY ONE (41) RANCH MOBILE HOME PARK	INITIAL	7/1/94		0.002	0.06
FORTY ONE (41) RANCH MOBILE HOME PARK	REDUCED	6/1/95		0.005	0.01
GLEN VIEW MOBILE HOME PARK	INITIAL	7/1/93		0.018	0.02
GLEN VIEW MOBILE HOME PARK	REDUCED	6/1/96	10	0.003	0.01
GLEN VIEW MOBILE HOME PARK	FOLLOW-UP	1/1/95		0.002	0.01
GLEN VIEW MOBILE HOME PARK	SPECIAL PURPOSE	1/1/94		0.001	0.01
GLEN VIEW MOBILE HOME PARK	FOLLOW-UP	7/1/95		0.001	0.01

Table 4 - 112. Lead and Copper Community Drinking Water Results for Lake County, IN

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (mg/L)
GRIFFITH WATER DEPARTMENT	REDUCED	6/1/96	30	0 005	0 176
GRIFFITH WATER DEPARTMENT	INITIAL	7/1/92		0 001	0 165
GRIFFITH WATER DEPARTMENT	REDUCED	6/1/95		0 005	0 113
GRIFFITH WATER DEPARTMENT	INITIAL	1/1/93		0 0015	0 0995
GRIFFITH WATER DEPARTMENT	REDUCED	6/1/94		0 001	0 089
HAMMOND WATER WORKS DEPARTMENT	INITIAL	1/1/92		0 027	0 21
HAMMOND WATER WORKS DEPARTMENT	INITIAL	7/1/92		0 022	0 13
HAMMOND WATER WORKS DEPARTMENT	SPECIAL PURPOSE	7/1/93		0 013	0 076
HAMMOND WATER WORKS DEPARTMENT	SPECIAL PURPOSE	1/1/94		0 01	0 069
HIGHLAND WATER WORKS	REDUCED	6/1/94		0 005	0 37
HIGHLAND WATER WORKS	REDUCED	6/1/95		0 005	0 24
HIGHLAND WATER WORKS	INITIAL	7/1/92		0 005	0 23
HIGHLAND WATER WORKS	REDUCED	6/1/96	30	0 005	0 2
HIGHLAND WATER WORKS	INITIAL	1/1/93		0 005	0 039
HONEYSUCKLE MOBILE HOME PARK	INITIAL	7/1/93		0 01	0 155
HONEYSUCKLE MOBILE HOME PARK	INITIAL	1/1/94		0 0015	0 058
HONEYSUCKLE MOBILE HOME PARK	REDUCED	6/1/96	5	0 0023	0 055
HONEYSUCKLE MOBILE HOME PARK	REDUCED	6/1/95		0 0029	0 044
IDEAL MOBILE HOME PARK	REDUCED	6/1/96	5	0 00315	0 05
IDEAL MOBILE HOME PARK	INITIAL	1/1/95		0 001	0 05
IDEAL MOBILE HOME PARK	REDUCED	6/1/95		0 001	0 05
IDEAL MOBILE HOME PARK	INITIAL	7/1/95		0 001	0 05
LAKE STATION WATER DEPARTMENT	REDUCED	6/1/94		0 005	0 2
LAKE STATION WATER DEPARTMENT	REDUCED	6/1/96	20	0 005	0 2
LAKE STATION WATER DEPARTMENT	INITIAL	7/1/92		0 005	0 17
LAKE STATION WATER DEPARTMENT	INITIAL	1/1/93		0 005	0 13
LAKE STATION WATER DEPARTMENT	REDUCED	6/1/95		0 005	0 12
LAKESHORE SUBD WATER ASSOC	INITIAL	7/1/95		0 0033	0 08
LAKESHORE SUBD WATER ASSOC	INITIAL	7/1/96	10	0 001	0 05
LAKESHORE SUBD WATER ASSOC	INITIAL	7/1/93		0 005	0 01
LINCOLN UTILITIES	INITIAL	1/1/93		0 005	0 36
LINCOLN UTILITIES	REDUCED	6/1/95		0 01	0 19
LINCOLN UTILITIES	REDUCED	6/1/96	20	0 005	0 19
LINCOLN UTILITIES	REDUCED	6/1/94		0 005	0 13
LINCOLN UTILITIES	SPECIAL PURPOSE	7/1/94		0 005	0 13
LINCOLN UTILITIES	INITIAL	7/1/92		0.001	0 052
LOWELL WATER DEPARTMENT	REDUCED	6/1/94		0 011	0 79
LOWELL WATER DEPARTMENT	INITIAL	7/1/92		0 012	0 47
LOWELL WATER DEPARTMENT	INITIAL	1/1/93		0 007	0 3
LOWELL WATER DEPARTMENT	INITIAL	1/1/96		0 0066	0 1
LOWELL WATER DEPARTMENT	INITIAL	7/1/95		0 0112	0 06
MUNSTER WATER COMPANY	REDUCED	6/1/95		0 008	0 18
MUNSTER WATER COMPANY	INITIAL	7/1/92		0 027	0 16
MUNSTER WATER COMPANY	REDUCED	6/1/96	30	0 011	0 16
MUNSTER WATER COMPANY	FOLLOW-UP	1/1/93		0 013	0 14
MUNSTER WATER COMPANY	REDUCED	6/1/94		0 007	0 14
MUNSTER WATER COMPANY	FOLLOW-UP	7/1/93		0 015	0 12
NEW CHICAGO WATER WORKS	INITIAL	7/1/92		0 0235	0 49
NEW CHICAGO WATER WORKS	REDUCED	6/1/95		0 002	0 23
NEW CHICAGO WATER WORKS	FOLLOW-UP	1/1/93		0 002	0 19
NEW CHICAGO WATER WORKS	REDUCED	6/1/96	20	0 003	0 16
NEW CHICAGO WATER WORKS	FOLLOW-UP	7/1/93		0 003	0 008
NEW CHICAGO WATER WORKS	REDUCED	6/1/94		0 003	0 004
NOBLE OAKS SUBDIVISION WATER ASSOC		1/1/94		0 0014	0 125
NOBLE OAKS SUBDIVISION WATER ASSOC		6/1/95		0 0018	0 06
NOBLE OAKS SUBDIVISION WATER ASSOC		6/1/96		0 002	0 05
NOBLE OAKS SUBDIVISION WATER ASSOC		7/1/93		0 001	0 01
NORTHWEST INDIANA WATER COMPANY		1/1/92		0 0103	0 154
NORTHWEST INDIANA WATER COMPANY		7/1/92		0 0092	0 108
OAKWOOD MOBILE HOME PARK	INITIAL	7/1/93		0 001	0 436

Table 4 - 112. Lead and Copper Community Drinking Water Results for Lake County, IN

PUBLIC WATER SUPPLIER	PURPOSE	PERIOD	NO. REQ	LEAD (mg/L)	COPPER (mg/L)
OAKWOOD MOBILE HOME PARK	REDUCED	6/1/96	5	0 005	0 2435
OAKWOOD MOBILE HOME PARK	REDUCED	6/1/95		0 005	0.201
OAKWOOD MOBILE HOME PARK	INITIAL	1/1/94		0 001	0 1495
PEOPLES WATER COMPANY, INC	REDUCED	6/1/96	10	0 005	0 29
PEOPLES WATER COMPANY, INC	INITIAL	7/1/93		0 005	0 23
PEOPLES WATER COMPANY, INC	INITIAL	1/1/94		0 005	0 19
PEOPLES WATER COMPANY, INC	REDUCED	6/1/95		0 005	0 03
RIDGE MOBILE HOME PARK	INITIAL	7/1/93		0 001	0 065
RIDGE MOBILE HOME PARK	REDUCED	6/1/96	5	0 005	0 0545
RIDGE MOBILE HOME PARK	REDUCED	6/1/95		0 005	0 018
RIDGE MOBILE HOME PARK	INITIAL	1/1/94		0 001	0 005
ROSS MOBILE HOME COURT	REDUCED	6/1/95		0 005	0 0295
ROSS MOBILE HOME COURT	INITIAL	1/1/94		0 001	0 005
ROSS MOBILE HOME COURT	REDUCED	6/1/96	5	0 005	0 00135
ROSS MOBILE HOME COURT	INITIAL	7/1/93		0 001	0 0011
SCHERERVILLE WATER DEPARTMENT	INITIAL	7/1/92		0 005	0 34
SCHERERVILLE WATER DEPARTMENT	INITIAL	1/1/93		0 005	0 32
SCHERERVILLE WATER DEPARTMENT	REDUCED	6/1/96	30	0 005	0 31
SCHERERVILLE WATER DEPARTMENT	REDUCED	6/1/95		0 005	0 27
SCHERERVILLE WATER DEPARTMENT	REDUCED	6/1/94		0 005	0 2
SCHNEIDER WATER DEPARTMENT	REDUCED	6/1/95		0 005	0 215
SCHNEIDER WATER DEPARTMENT	INITIAL	7/1/93		0 005	0 16
SCHNEIDER WATER DEPARTMENT	REDUCED	6/1/96	5	0 005	0 1
SCHNEIDER WATER DEPARTMENT	INITIAL	1/1/94		0 005	0 08
ST JOHN MUNICIPAL WATER UTILITY	REDUCED	6/1/95		0 005	1 05
ST JOHN MUNICIPAL WATER UTILITY	REDUCED	6/1/96	20	0 005	0 984
ST JOHN MUNICIPAL WATER UTILITY	INITIAL	1/1/93		0 001	0 825
ST JOHN MUNICIPAL WATER UTILITY	INITIAL	7/1/92		0 001	0 562
ST JOHN MUNICIPAL WATER UTILITY	REDUCED	6/1/94		0 001	0 372
SURPRISE PARK WATER ASSOCIATION	REDUCED	6/1/96	5	0 00975	0 28
SURPRISE PARK WATER ASSOCIATION	INITIAL	1/1/94		0 0035.	0 23
SURPRISE PARK WATER ASSOCIATION	REDUCED	6/1/95		0 0056	0 05
SURPRISE PARK WATER ASSOCIATION	INITIAL	7/1/93		0 0015	0 0375
TURKEY CREEK UTILITY CORPORATION	INITIAL	1/1/94		0 0011	0 21
TURKEY CREEK UTILITY CORPORATION	REDUCED	6/1/96	10	0 0024	0 16
TURKEY CREEK UTILITY CORPORATION	REDUCED	6/1/95		0 008	0 14
TURKEY CREEK UTILITY CORPORATION	INITIAL	7/1/93		0 005	0 093
TWIN LAKES UTILITIES, INC	INITIAL	1/1/93		0 005	0 23
TWIN LAKES UTILITIES, INC	REDUCED	6/1/94		0 005	0 21
TWIN LAKES UTILITIES, INC	REDUCED	6/1/95		0 008	0 2
TWIN LAKES UTILITIES, INC	INITIAL	7/1/92		0 005	0 2
TWIN LAKES UTILITIES, INC	REDUCED	6/1/96	20	0 005	0 2
UTILITIES INC II	INITIAL	7/1/96	10	0 005	1 232
UTILITIES, INC	REDUCED	6/1/96	5	0 005	0 065
UTILITIES, INC	INITIAL	7/1/93		0 001	0 058
UTILITIES, INC	REDUCED	6/1/95		0 005	0 007
UTILITIES, INC	INITIAL	1/1/94		0 001	0 005
WHITING WATER PLANT	INITIAL	7/1/92		0.021	0 05
WHITING WATER PLANT	FOLLOW-UP	1/1/93		0 013	0 05
WHITING WATER PLANT	FOLLOW-UP	7/1/93		0 0077	0 05
WHITING WATER PLANT	REDUCED	6/1/96	20	0 0075	0 05
WHITING WATER PLANT	REDUCED	6/1/94		0 0073	0 05
WHITING WATER PLANT	REDUCED	6/1/95		0 0051	0 05
WRIGHTS TRAILER PARK #1	INITIAL	1/1/94		0 0017	0 05
WRIGHTS TRAILER PARK #1	INITIAL	7/1/94		0 001	0 02
Source Jones, 1997					

Purpose = Type of monitoring conducted Monitoring is conducted for Public Water Suppliers at three different levels (initial, continued and reduced)

No Req = Number of samples required

Table 4 - 113. Total Coliform Results for Community Drinking Water Systems in Lake County, IN

PUBLIC WATER SUPPLIER	SAMPLE DATE	T. COLIFORM	F. COLIFORM
COLONIAL MOBILE HOME PARK	7/1/96	**PRESENT**	**PRESENT**
FEHLBERG'S MAIN MOBILE HOME PARK	5/13/96	**PRESENT**	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	5/20/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	6/5/96	**PRESENT**	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	6/11/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	6/12/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	12/10/96	**PRESENT**	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	12/13/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	12/13/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	12/13/96	ABSENT	ABSENT
FEHLBERG'S MAIN MOBILE HOME PARK	12/13/96	**PRESENT**	ABSENT
GRIFFITH WATER DEPARTMENT	6/19/96	**PRESENT**	**PRESENT**
HAMMOND WATER WORKS DEPARTMENT	5/13/96	**PRESENT**	**PRESENT**
HAMMOND WATER WORKS DEPARTMENT	5/16/96	ABSENT	ABSENT
LAKE STATION WATER DEPARTMENT	10/2/96	**PRESENT**	ABSENT
NOBLE OAKS SUB WATER ASSOC	8/6/96	**PRESENT**	ABSENT
NOBLE OAKS SUB WATER ASSOC	8/14/96	ABSENT	ABSENT
RIDGE MOBILE HOME PARK	10/8/96	**PRESENT**	ABSENT
RIDGE MOBILE HOME PARK	10/14/96	ABSENT	ABSENT
RIDGE MOBILE HOME PARK	10/14/96	**PRESENT**	ABSENT
ST JOHN MUNICIPAL WATER UTILITY	9/9/96	**PRESENT**	ABSENT
ST JOHN MUNICIPAL WATER UTILITY	9/17/96	ABSENT	ABSENT
ST JOHN MUNICIPAL WATER UTILITY	10/1/96	**PRESENT**	ABSENT
ST JOHN MUNICIPAL WATER UTILITY	10/8/96	**PRESENT**	ABSENT
SURPRISE PARK WATER ASSOC.	5/6/96	**PRESENT**	**PRESENT**
SURPRISE PARK WATER ASSOC	5/9/96	ABSENT	ABSENT
SURPRISE PARK WATER ASSOC	7/9/96	**PRESENT**	ABSENT
SURPRISE PARK WATER ASSOC	7/12/96	ABSENT	ABSENT
TWIN LAKES UTILITIES, INC	12/12/96	**PRESENT**	ABSENT
TWIN LAKES UTILITIES, INC	12/18/96	ABSENT	ABSENT
TWIN LAKES UTILITIES, INC	12/18/96	ABSENT	ABSENT
TWIN LAKES UTILITIES, INC	12/18/96	ABSENT	ABSENT
TWIN LAKES UTILITIES, INC.	12/18/96	ABSENT	ABSENT
TWIN LAKES UTILITIES, INC	12/18/96	ABSENT	ABSENT
UTILITIES, INC	6/24/96	**PRESENT**	ABSENT

Source Jones, 1997

Hammond's Water Works Department was the only large population server (second largest in the county) reported to have a contaminant present at levels as high as the MCL. The remaining 16 facilities ranged from 0.1 to 3.3 percent of the population served. Hammond also exceeded the lead Action Level on two occasions, and both total coliform and fecal coliform were detected in May 1996. Repeat sampling showed an absence of both total coliform and fecal coliform. Eight of the 44 parent water suppliers in Lake County, IN, also exceeded the Action Level for lead. Table 4-113 shows that 11 of the 44 parent water suppliers in Lake County had positive detects of total coliform from May 1996 to December 1996.

A total of 361 violations were reported in SDWIS for Lake County, IN, during 1995 (Table 4-114). MCLs and Action Levels or administrative problems with the drinking water systems could be the reasons for these violations. Three of the 16 drinking water systems were responsible for 329 violations. Cedar Lake Mobile Home Park was reported with the most violations at 147. Cedar Lake serves a population of 136 in Lake County. In 1991, 38 violations were reported for all drinking water systems in Lake County was 38 (Table 4-115). The number of violations increased significantly to 361 in 1995. In 1996, the number of violations reported dropped to 88.

4.8 HUMAN EXPOSURE BIOMARKERS

> **Human Exposure Biomarkers**
>
> - Indicator of Human Exposure to Chemicals
> - Childhood Blood Lead Monitoring Conducted in Cook County, IL, and Lake County, IN
> - Almost 30% of Children in Chicago Are Estimated to Have Lead Poisoning

One of the most reliable ways to measure an individual's exposure to environmental pollution is through human tissue monitoring. Blood lead levels are the most prevalent type of human monitoring because of the potential for childhood lead poisoning. This is of particular concern in Cook County, IL, and Lake County, IN. Almost 30 percent of the children in Chicago are estimated to have lead poisoning. Estimated prevalence rates for childhood lead poisoning (blood lead levels ≥ 10 micrograms per deciliter [μg/dL]) in the City of Chicago are 27 percent for

Table 4 - 114. Drinking Water Violations in 1995 for Lake County, IN

Rank	Violations	System Name
1	147	CEDAR LAKE MOBILE HOME PARK
2	104	IDEAL MOBILE HOME PARK
3	78	WRIGHTS TRAILER PARK #1
4	8	LAKESHORE SUBD. WATER AS
5	7	FEHLBERG'S MAIN MOBILE HOME PARK
6	5	INDEPENDENCE HILL WATER
7	2	SURPRISE PARK WATER ASSOCIATION
8	2	TURKEY CREEK UTILITY CORPORATION
9	1	CEDAR LAKE BIBLE CONFERENCE GROUNDS
10	1	CHAR EL MOBILE HOME PARK
11	1	GLEN VIEW MOBILE HOME PARK
12	1	LINCOLN UTILITIES
13	1	LOWELL WATER DEPARTMENT
14	1	NOBLE OAKS SUBDIVISION WATER ASSOCIATION
15	1	OAKWOOD TRAILER PARK
16	1	WHITING WATER PLANT
	361	**Total Violations**

Source. SDWIS, 1997

Table 4 - 115. Drinking Water Violations in Lake County, IN, for 1991 - 1996

Rank	Violations	Year
1	361	1995
2	111	1994
3	88	1996
4	74	1993
5	73	1992
6	38	1991
	748	**Total Violations**

Source: SDWIS, 1997.

children 12-24 months of age, and 28.4 percent for children 24-60 months of age (Fornoff, 1997a). In Lake County, IN, the estimated prevalence rate for lead poisoning in children 6 years of age and under is 17 percent (Nordholm, 1997).

This section focuses on human exposure biomarkers in Cook County, IL, and Lake County, IN. This discussion generally focuses on lead levels found in children's blood; it is not intended to identify the sources of exposure (such as lead paint, air pollution, etc.). Also included is a brief discussion of a human tissue monitoring/epidemiological study of African-American women to determine exposures to chlorinated hydrocarbons as a result of Great Lakes fish consumption. Information on childhood blood lead levels was collected from various public health organizations including the Agency for Toxic Substances and Disease Registry (ATSDR), the Centers for Disease Control and Prevention (CDC), the Illinois Department of Public Health (IDPH), Indiana State Department of Health (ISDH), Cook County Department of Public Health, and the City of Chicago Health Department. Summarized below are statistics highlighting the severity of the problem and current strategies used by Lake County, IN, and Cook County, IL, to address the high blood lead levels of the children in their communities. Included is an example of how community concern about high blood lead levels of children in their neighborhood spurred the funding of a project in Chicago's near-west side, aimed at creating a "lead safe zone."

4.8.1 Concern for Blood Lead Levels in Children

Childhood lead poisoning is considered one of the most significant environmental health problems in the United States today. It is also one of the most preventable (CDC, 1991a). The health effects of elevated blood lead levels are well known, and children are particularly vulnerable. Lead poisoning in children causes IQ deficiencies, reading and learning disabilities, impaired hearing, reduced attention spans, hyperactivity, and antisocial behavior (U.S. EPA, 1996a). The developing brains and nervous systems of young children are easily harmed by lead; and their behavior patterns, such as increased hand-to-mouth behavior create a potential for increased exposure from lead-based paint and contaminated soils (Calabrese, et al., 1989).

Lead is extremely toxic even at low levels. New studies have demonstrated that adverse health effects occur at blood levels previously considered safe. As a result, CDC has progressively lowered its "level of concern" to the current 10 μg/dL figure (ATSDR, 1992b). CDC has issued guidelines for State and local health departments as an update to its 1991 strategic plan to prevent childhood lead poisoning. These guidelines suggest that children with levels ≥ 15 μg/dL should receive individual case management. Medical evaluation and environmental inspection activities and remediation should be done for all children with blood lead levels ≥20 μg/dL. Medical intervention, including chelation therapy, is necessary for children with blood lead levels ≥45 μg/dL (CDC, 1991b).

CDC's Action Level for Lead in Blood Has Lowered in the Last 30 Years

1960-1970	60 μg/dL
1970-1985	30 μg/dL
1985-1991	25 μg/dL
1991-	10 μg/dL

Source: ATSDR, 1992b.

4.8.2 Blood Lead Screening/Monitoring Programs

Blood lead monitoring of children to identify incidents of lead poisoning has been conducted in the study area for a number of years. In the summer of 1997, however, CDC issued new guidelines outlining a strategy for targeted screening as opposed to universal screening (CDC, 1997a). This strategy calls for State and local health departments to set criteria to determine children at high risk for potential lead exposure. These recommendations are necessary because data indicate that while the average exposure of children in the United States has declined, many children, especially those living in low income families and in older housing with deteriorating leaded paint, continue to be heavily exposed to lead (CDC, 1997b).

Lead Exposure Risk Factors

- 43% of Children in Chicago Metro Area Live in Pre-1950 Housing
- 34% of Children in Lake County, IN, Live in Pre-1950 Housing
- 21% of Families with Children Under 5 Years in Cook County, IL, Live Below Poverty Line
- 24% of Children 6 Years and Under in Lake County, IN, Live Below the Poverty Linc

Lead exposure nsk factors are evident in the study area. In the Chicago metropolitan area, 271,500 (or 43.1 percent) of children, 0.5-

5 years old, live in pre-1950 housing (ATSDR, 1990). Furthermore, Cook County, IL, 1990 Census data report that 21 percent of all families with children under 5 years of age live below the poverty line (U.S. Bureau of the Census, 1997). In Lake County, IN, 11,822 children 6 years old and under (24 percent) live below the poverty line. Also, 34 percent of Lake County, IN, children live in housing units built prior to 1950 (Nordholm, 1997). Approximately 24,400 (or 37.3 percent) of the children 0.5-5 years of age residing in the Gary- Hammond-East Chicago metropolitan area live in pre-1950 housing (ATSDR, 1990). According to guidelines outlined by CDC, these children are at increased risk for potential exposure to lead.

Pediatric Lead Poisoning
High Risk ZIP Code Areas
Cook County, IL

All Chicago ZIP Codes	
60022	60411
60093	60426
60153	60472
60201	60501
60202	60513
60305	60546
60402	60666
60406	60804

Source: Fornoff, 1997a.

The IDPH is required by a 1995 amendment to the Illinois Lead Poisoning Prevention Act to designate areas of the State where children 6 years of age and under are considered to be at high risk for lead exposure. This strategy addresses perhaps the most serious remaining potential sources of lead exposure: deteriorating paint from older homes, and dust and soil contaminated with lead from past residues of leaded gasoline (U.S. EPA, 1996e). In developing the risk index, IDPH used 1990 census data and the following factors: percentage of housing in a ZIP Code built before 1949, percentage of housing in a ZIP Code built between 1950 and 1959, and the percentage of families in a ZIP Code at 200 percent of the Federal poverty level (Fornoff, 1997b). These criteria were combined and given equal weight to come up with a risk index. IDPH ranked all Chicago ZIP Codes as high-risk. Children living in high-risk ZIP Codes are more likely to have elevated blood lead levels than children living elsewhere. The City of Chicago Health Department identified 12 neighborhoods of particular concern to receive U.S. Department of Housing and Urban Development (HUD) lead abatement grants (Deppe, 1997). According to the guidelines set up by IDPH, children age 6 years and under should be screened annually, and must be screened before entering school if they live in a high-risk ZIP Code. Children living in low-risk ZIP Codes should be assessed annually using an Illinois

Childhood Lead Poisoning Prevention Program assessment questionnaire. A "yes" response to any of the questions indicates that the child should be screened for blood lead levels (Fornoff, 1997a). These screening efforts play a key role in ensuring prompt and appropriate environmental, educational, and medical interventions (CDC, 1997a).

Pediatric blood lead screening in Lake County, IN, is performed on a voluntary basis. Participants are recruited from Maternal and Child Health Clinics, Supplemental Food Program for Women, Infants, and Children (WIC) Clinics, and a private physician network (Nordholm, 1997). The Childhood Lead Prevention Program received a grant from CDC to target screening programs in certain high risk counties where they will cooperate with ISDH Environmental Epidemiology Branch.

4.8.3 Childhood Blood-Lead Surveillance Data

Both the IDPH and the ISDH Childhood Lead Poisoning Prevention Programs keep blood lead registry information for children ≤6 years old. In Cook County, IL, analyzing laboratories are required to report results of all blood lead testing to IDPH. Lake County, IN, has no mandatory reporting requirement as yet (Nordholm, 1997a).

IDPH routinely publishes a surveillance report with information by county on the number of children screened and identified with elevated blood lead levels (IDPH, 1997). A summary of the blood lead levels in children 6 years of age and under for Cook County, IL, as presented in that report is shown in Table 4-116. In 1996, 136,432 children in Cook County, IL, were screened for lead poisoning. During that time period, 13,448 children (10 percent) were identified with blood lead levels ≥15 μg/dL; and 271 of those children demonstrated levels indicative of severe lead poisoning (≥45 μg/dL)

Childhood Lead Poisoning in Cook County, IL

- 10% of Children 6 Years and Under in Cook County, IL, Have Blood Lead Levels ≥ 15μg/dL
- Recent IDPH Estimates Put Chicago Lead Poisoning Levels (≥ 10μg/dL) at 30%
- Percentage of Children in Chicago With Lead Poisoning is 3 Times Higher Than the Percentage of Children in Suburban Cook County

Table 4-116. Summary of Blood Lead Levels for Children $\leq$ 6 Years in Cook County, IL (Chicago and Cook County Without Chicago)

Location	Base Pop. of Children 6 and Under	Year	Total Tested	15-19 µg/dL	% of Screened Pop.	20-44 µg/dL	% of Screened Pop.	45 µg/dL and over	% of Screened Pop.	Total ≥ 15 µg/dL	% of Screened Pop.
Chicago	296,408	1993	175,731	11,408	6%	7,684	4%	318	<1	19,410	11%
		1994	130,008	8,137	6%	6,250	5%	351	<1	14,738	11%
		1995	99,097	6,808	7%	4,579	5%	288	<1	11,675	12%
		1996	118,156	7,418	6%	5,217	4%	246	<1	12,881	11%
Cook County w/o Chicago	239,334	1993	16,088	424	3%	329	2%	20	<1	773	5%
		1994	12,112	352	3%	266	2%	19	<1	637	5%
		1995	9,546	339	4%	226	2%	12	<1	577	6%
		1996	18,276	316	2%	226	1%	25	<1	567	3%

µg/dL = micrograms per deciliter

Source: Illinois Department of Public Health, 1997, 1996a,b,c, and 1994a

(IDPH, 1997). It should be pointed out that the percentage of pediatric lead poisoning cases in the city of Chicago is over 3 times the percentage of children in suburban Cook County with elevated levels. The IDPH surveillance report does not identify numbers of children with blood lead levels between 10-15 μg/dL levels which CDC considers to be of concern. The addition of data in this range would most likely double the figures for estimated prevalence of lead poisoning in Cook County (Fornoff, 1997a).

Childhood Lead Poisoning in Lake County, IN

- 17% of Children 6 Years and Under in Lake County, IN, Have Blood Lead Levels ≥ 10μg/dL
- Of the Screened Children With Lead Poisoning, 64% are Black, 13% are White, and 23% are Other Races

Summary data for blood lead testing for children 6 years of age and under for Lake County, IN, were obtained from the registry of pediatric blood lead levels kept by the ISDH Childhood Lead Prevention Program. During the reporting period of fiscal years 1994, 1995, and 1996, a total of 12,604 children in Lake County, IN, were screened. Of those screened, 2,113 children age 6 years and under (or 17 percent) had levels of lead in their blood exceeding the level of concern (≥10 μg/dL). Tables 4-117 and 4-118 show the breakdown of pediatric lead poisoning by race and age, respectively. Of the Black children screened for lead poisoning, 21 percent had blood lead levels ≥ 10 μg/dL, 8 percent of the White children had comparable results, and 16 percent of children of other races demonstrated lead poisoning (Figure 4-71). Also, of the lead-poisoned group, 764 (or 36 percent) were children under 36 months of age (Table 4-118) (Nordholm, 1997). This is of particular importance, because of the mouthing behaviors of toddlers. Young children of this age may put anything from toys and food to paint chips in their mouths, thereby increasing the potential for exposure. Also, a small number of people (mostly children) will exhibit behavior called "pica," which is the deliberate ingestion of a non-food item such as soil, paint chips, or plaster. This may result in significant increases in potential exposure (Calabrese, 1989).

Table 4-117. Summary of Blood Lead Levels in Children ≤ 6 Years by Race in Lake County, IN (Fiscal Years 94, 95, 96)

Race	Base Pop. Of Children 6 and Under	Total No. Children 6 and Under Screened	0-9 µg/dL	% of Screened Pop.	10-14 µg/dL	% of Screened Pop.	15-19 µg/dL	% of Screened Pop.	20-44 µg/dL	% of Screened Pop.	≥ 45 µg/dL	% of Screened Pop.	Total Number with Levels ≥ 10 µg/dL	% of Screened Pop.
White	49,121	12,604	2,990	24%	189	1%	48	<1%	37	<1%	3	<1%	277	2%
Black			4,948	39%	840	7%	277	2%	214	2%	16	<1%	1347	11%
Other			2,553	20%	308	2%	95	1%	77	1%	9	<1%	489	4%
Total			10,491		1,337		420		328		28		2,113	

µg/dL = micrograms per deciliter

Source Nordholm, 1997

Table 4-118. Summary of Blood Lead Levels in Children ≤ 6 Years by Age in Lake County, IN (Fiscal Years 94, 95, 96)

Age	Base Pop. Of Children 6 and Under	Total No. Children 6 and Under Screened	0-9 µg/dL	% of Screened Pop.	10-14 µg/dL	% of Screened Pop.	15-19 µg/dL	% of Screened Pop.	20-44 µg/dL	% of Screened Pop.	≥ 45 µg/dL	% of Screened Pop.	Total Number with Levels ≥10 µg/dL	% of Screened Pop.
<6 Mo			159	1%	13	<1%	3	<1%	4	<1%	2	<1%	22	<1%
6 Mo-1 Yr			883	7%	40	<1%	12	<1%	8	<1%	3	<1%	63	<1%
1 Yr-3 Yrs	49,121	12,604	2,560	20%	410	3%	145	1%	111	1%	13	<1%	679	5%
3 Yrs-5Yrs			5,322	42%	756	6%	212	2%	164	1%	7	<1%	1139	9%
≤ 6 Yrs			1,567	12%	118	1%	48	<1%	41	<1%	3	<1%	210	2%
Total			10,491		1,337		420		328		28		2,113	

µg/dL = micrograms per deciliter

Source Nordholm, 1997

Figure 4-71. Children with Lead Poisoning* in Lake County, IN

*Lead P ing is defined by CDC as a blood lead level ≥10 µg/dL.
Source. .dholm, 1997

99-056

4.8.4 Lead Project in West Town

Lead Poisoning in West Town

- West Town's Demographics
  - 75% of Population are Hispanic
  - 46% of Population Live Below the Poverty Line
  - 71% of Homes Were Built Before 1940
- 39% of Children Screened Had Lead Poisoning

Lead poisoning is a problem affecting almost 40 percent of the children in the West Town community of Chicago (Neighborhood Based Childhood Lead Primary Prevention Project, 1997). To attack this problem, CDC and HUD funded the West Town Lead Project. This is an example of a community-based approach to creation of a "lead safe zone," which Project Coordinator H. Hastings describes as "a contiguous area in which children can live without threat of hazardous lead exposure" (Hastings et al., 1997). This project is a comprehensive effort that includes blood lead screening, education, and lead hazard reduction. The study area is a 4-block section of the West Town community on Chicago's near-west side. According to 1990 Census data, the West Town Lead Project area is comprised of the following demographic sample: 75 percent Hispanic, 46 percent living on incomes below poverty level and 71 percent of homes were built before 1940, with many in deteriorating condition (Hastings et al., 1997). Of the 134 children screened for blood lead in this community, 39 percent had blood lead levels above the level of concern ($\geq 10\ \mu g/dL$) (Figure 4-72). Of the children screened, 23 percent had levels between 10-15 $\mu g/dL$; 7 percent had levels between 15-20 $\mu g/dL$; and 9 percent had levels greater than 20 $\mu g/dL$. These results are consistent with the screening results in the ZIP Code that encompasses the project area (Hastings et al., 1997).

Another aspect of the West Town project is the examination of environmental sources of lead, especially dust samples in the housing. Of the 125 units that had baseline dust lead loadings measured, 94 percent contained at least one sample with an elevated level (i.e., floor >100 micrograms per square foot [$\mu g/ft^2$], window sill >500 $\mu g\ g/ft^2$, and window well >800 $\mu g/ft^2$). After lead hazard reduction is performed, housing units must pass the HUD clearance testing criteria of 100 $\mu g/ft^2$ for floors, and the IDPH health criteria for horizontal surfaces of 200 $\mu g/ft^2$ (Hastings et al., 1997). To date, 110 housing units have been thoroughly inspected. All were found to contain lead hazards (Hastings et al., 1997).

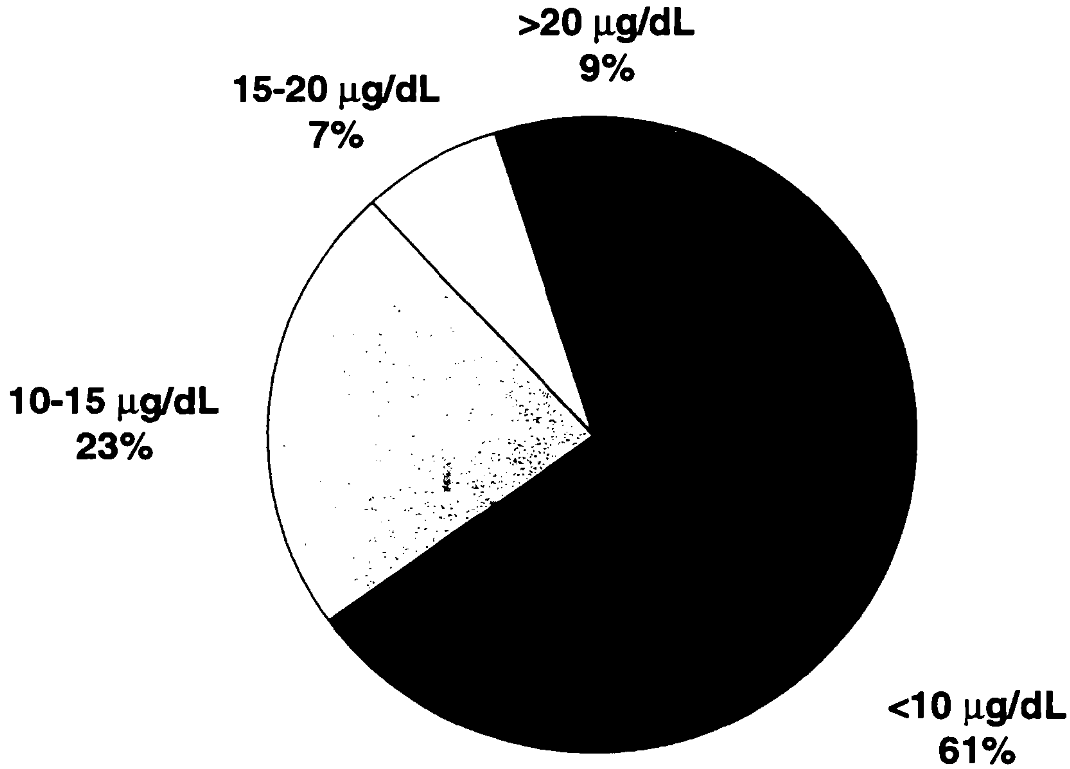


Figure 4-72. Distribution of Blood Lead Levels in 134 Children West Town Lead Project

Source: Binns, H. (1997)

99-056

4.8.5 Human Tissue Monitoring to Estimate Exposures to Chlorinated Hydrocarbons from Fish Consumption

Researchers at the University of Illinois at Chicago are following a cohort of pregnant African-American women who regularly consume Great Lakes fish (Waller et al., 1996). These women are being recruited from prenatal clinics at the University of Chicago Lying-In Hospital and the University of Illinois at Chicago Hospital. The information obtained in this study will help identify populations at risk of adverse health effects due to the consumption of Great Lakes fish. Biological specimens collected include maternal blood, cord blood, placenta, adipose tissue, infant meconium, and breast milk, if possible (Waller et al., 1996). The children of these women will also be studied to determine their exposure to contaminants via maternal exposure.

4.9 INDOOR AIR QUALITY

> **Indoor Air Quality**
>
> - People Spend Most of Their Time Indoors
> - ATSDR Health Consultation on Indoor Air Quality in Southeast Chicago
> - Other Studies of Indoor Air Underway With Results Expected in the Near Future

Indoor air pollution is now recognized as an area of environmental concern. Studies indicate that people spend approximately 90 percent of their time indoors, and indoor levels of many pollutants may be at least 2-5 times higher than outdoor levels (U.S. EPA, 1993c). In addition, the young, the elderly, and the chronically ill, those who spend the longest periods of time indoors, may be the most susceptible to the effects of indoor air pollution. Major indoor pollutants in the home include radon, environmental tobacco smoke, biologicals, carbon monoxide, nitrogen dioxide, organic gases, respirable particles, formaldehyde, pesticides, asbestos, and lead (U.S. EPA, 1995q).

Summarized below are three studies that looked at indoor air quality in Cook County, IL, and Lake County, IN. They include results of an ATSDR health consultation performed in Southeast Chicago; an ongoing human exposure research project looking at the effects of multimedia exposures to pollutants at the community and regional levels; and a recently published study on the effects of a common biological pollutant on inner city asthmatic children.

4.9.1 ATSDR Health Consultation for Southeast Chicago Indoor Air Investigation

The concern of citizens in Southeast Chicago prompted an indoor air quality investigation by ATSDR and the IDPH on the possible health effects from exposure to hazardous substances in their neighborhood (ATSDR, 1996). In 1994, IDPH collected indoor air samples periodically for 1 year from 10 homes in Southeast Chicago, representing the areas of Altgeld Gardens, Beverly, and Torrence. They also administered questionnaires before sampling to document any activities that might affect the chemical levels. ATSDR tested the samples for VOCs, SVOCs, IOCs, carbon dioxide, temperature, and relative humidity.

Several approaches were used in the evaluation of the results. First, they compared the chemical concentration levels from the Southeast Chicago study homes to indoor air concentrations from similar studies in the United States. The range and concentration for each chemical detected in all 10 homes are summarized in Table 4-119. With the exception of xylene and methylene chloride, the range of chemical concentrations from the study homes falls within the range of levels in studies of other homes in the United States. Xylene exceedances occurred on three sampling dates; however, the levels of xylene detected were determined not to be harmful (ATSDR, 1996). Also, the levels of methylene chloride in the study samples were higher than expected. One possible explanation for this finding is laboratory contamination. This is unlikely, however, due to the small amounts of methylene chloride found in the blank samples, and the consistent discovery of the chemical throughout the investigation. Also, solvents such as paint strippers and propellants in aerosol products, such as paints and insect sprays, could possibly account for high levels of methylene chloride; however, IDPH administered questionnaires to the households designed to rule out this sort of activity (ATSDR, 1996); therefore this explanation also seems unlikely. ATSDR has been unable to determine the cause of the elevated levels of methylene chloride, and states that even at the elevated levels detected, methylene chloride is not expected to cause harmful effects (ATSDR, 1996).

Table 4-119. Levels of Chemicals Found by ATSDR in Indoor Air Samples of 10 Homes in Southeast Chicago

Substance	# Detects/ # Samples	Mean (Average) ($\mu g/m^3$) All Homes	Range ($\mu g/m^3$) All Homes	Comparison Range ($\mu g/m^3$)
Volatile Organic Compounds				
Benzene	48 / 48	4.188	1.34 - 33.89	U - 97
Bromochloromethane	2 / 48	0.004	U - 0.16	
Bromodichloromethane	4 / 48	0.188	U - 6.89	
1,3-Butadiene	39 / 48	0.424	U - 2.54	
Carbon Tetrachloride	45 / 48	0.517	U - 1.26	U - 2.2
Chlorobenzene	1 / 48	0.01	U - 0.46	
Chloroform	47 / 48	1.804	U - 10.57	U - 13
Chloromethane	48 / 48	2.001	0.97 - 4.33	
Chloroprene	1 / 48	0.004	U - 0.18	
Dibromochloromethane	6 / 48	0.02	U - 0.26	
m-Dichlorobenzene	1 / 44	0.005	U - 0.24	
o-Dichlorobenzene	1 / 36	0.003	U - 0.12	
p-Dichlorobenzene	18 / 27	4.867	U - 95.53	U - 330
1,1-Dichloroethane	3 / 48	0.008	U - 0.32	
1,2-Dichloroethane	9 / 48	0.114	U - 1.53	
cis-1,2-Dichloroethylene	4 / 48	0.01	U - 0.16	
trans 1,2-Dichloroethylene	4 / 48	0.008	U - 0.16	
Methylene Chloride	42 / 42	161.202	2.01-1194.4	U - 106
Styrene	41 / 45	1.116	U - 9.48	U - 81
Tetrachloroethylene	48 / 48	2.611	0.54 - 13.13	U - 53

Table 4-119. Levels of chemicals found by ATSDR in Indoor Air Samples of 10 Homes in Southeast Chicago (continued)

Substance	# Detects/ # Samples	Mean (Average) ($\mu g/m^3$) All Homes	Range ($\mu g/m^3$) All Homes	Comparison Range ($\mu g/m^3$)
1,1,1-Trichloroethane	33 / 34	24.767	1.25-207.68	U - 300
Trichloroethylene	42 / 47	0.493	U - 2.52	U - 15
Vinyl Chloride	3 / 48	0.009	U - 0.2	
m,p-Xylene	48 / 48	597.81	5.72 - 27047	U - 170
o-xylene	46 / 46	11.552	1.13-186.25	U - 68
Semivolatile Organics				
Acenaphthene	26 / 48	0.075	U - 1.042	
Acenaphthylene	20 / 48	0.012	U - 0.122	U - 0.05
Anthracene	11 / 48	0.002	U - 0.04	
Fluoranthene	33 / 48	0.006	U - 0.026	U - 0.023
Fluorene	36 / 48	0.055	U - 0.6	
Phenanthrene	21 / 48	0.056	U - 0.82	
Pyrene	29 / 48	0.006	U - 0.047	U - 0.017
Metals				
Lead (Pb)	28 / 28	0.057	0.01 - 0.83	0.1 - 0.2
Selenium (Se)	7 / 24	0.002	U - 0.008	
Zinc (Zn)	23 / 23	0.122	0.03 - 0.206	0.027 - 0.5

U - Compound not detected

$\mu g/m^3$ = micrograms chemical per cubic meter of air

Source: ATSDR, 1996.

ATSDR employed another approach in evaluating the indoor air sampling results from the Southeast Chicago study homes. The results were compared to health-based guidelines such as ATSDR's Inhalation Minimal Risk Levels and EPA's Reference Concentrations. If the indoor air concentration in Southeast Chicago homes exceeded the reference concentrations for that chemical; ATSDR compared the indoor air concentrations with air concentrations identified in human and animal studies to cause harmful effects. The evaluation also assessed the possibility of harmful effects occurring from additive and synergistic effects of the group of chemicals. Employing these methods, ATSDR concluded that the chemical concentrations in indoor air of homes in the Southeast Chicago study are unlikely to cause noncancerous harmful effects (ATSDR, 1996).

ATSDR Health Consultation

- Indoor Air Sampling of 10 Homes in Southeast Chicago
- Levels of Xylene and Methylene Chloride Were Elevated But Determined Not to Be Harmful

ATSDR also evaluated the chemicals for carcinogenic effects. They utilized a mathematical model developed by EPA to estimate the potential increase in number of cancers from exposure to these chemicals. Using this model, ATSDR concluded the risk of developing cancer from indoor air exposure in Southeast Chicago study homes is low and may be zero (ATSDR, 1996). These conclusions were based on the best available risk assessment information and methods currently available (ATSDR, 1996).

4.9.2 National Human Exposure Assessment Survey (NHEXAS)

The National Human Exposure Assessment Survey (NHEXAS) is a Federal interagency research project. Its focus is to examine total human exposure to multiple chemicals as experienced by individuals in their everyday lives. Such estimates of total exposure incorporate information on potential exposures for chemicals encountered in the home, office, and other environments. Sample collection began in mid-1995 and was expected to be completed by mid-1997. Draft results are expected to be published in 1998-99 (U.S. EPA, 1997b). The project was conducted in three geographic areas, one included portions of Illinois and Indiana. Specifically, approximately 30-35 counties in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin were studied by researchers at Research Triangle Institute and the Environmental Occupational Health Sciences Institute (U.S. EPA, 1997b).

Researchers measured the levels of chemicals in the air participants breathe -- in food, drinking water, and other beverages -- and in the soil and dust around their homes. Blood and urine samples of some participants were analyzed to determine chemical levels, and questionnaires were administered to identify possible sources of exposure to chemicals (U.S. EPA, 1997b). The chemicals studied by NHEXAS include VOCs, such as formaldehyde and benzene; metals, such as lead and mercury; and pesticides, such as chlorpyrifos and diazinon (U.S. EPA, 1997b). It is the hoped that these results will help individuals, communities, States, EPA, and others to understand the greatest health risks from various chemicals and decide whether steps to reduce those risks are needed (U.S. EPA, 1997b).

4.9.3 National Cooperative Inner City Asthma Study

The National Institutes of Health funded a study aimed at identifying risk factors for children with severe asthma in eight major inner city areas, one of which was Chicago. This study, called the National Cooperative Inner City Asthma Study, involved researchers from Cook County Memorial Hospital and participants from Chicago's inner city. Factors studied in the indoor environment included indoor allergens (dust mite, cat, cockroach), tobacco smoke, and indoor pollutants. The first reports from this study have been released. Investigators found the combination of cockroach allergy and exposure to high levels of this allergen may help explain the frequency of asthma-related health problems in inner city children. Children meeting this combination of criteria had almost four times as many hospitalizations and twice as many medical visits as compared to the other asthmatic children in the study. They also had significantly more days of wheezing and missed school. Similar patterns were not found for the combination of allergy to dust mites or cat dander and high levels of the respective allergen (Rosenstreich et al., 1997). These results are of particular importance to this study area, because Cook County, IL, has been previously reported to have twice the asthma mortality rate of the United States as a whole (Weiss et al., 1992). Future journal articles from the National Cooperative Inner City Asthma Study will present data on environmental tobacco smoke and chemical pollutants.

5.0 Integrated Characterization

5.0 INTEGRATED ENVIRONMENTAL CHARACTERIZATION

> **Integrated Environmental Characterization**
>
> - Multimedia Perspective
> - Case Studies on Geographic Areas
>   - Southeast Chicago
>   - Southwest Chicago
>   - North Lake County
>   - Lake Michigan
> - Multimedia Chemical Profiles
>   - Lead, VOCs, PCBs, Mercury, PAHs, and Endocrine Disruptors
> - Industrial Sector Multimedia Loadings Analysis

This section presents integrated information on environmental pollution in Cook County, IL, and Lake County, IN. Three major subsections provide overviews of environmental loadings, ambient levels, and general indications of environmental quality according to (1) geographic areas of interest, (2) chemicals of interest, and (3) major industries with the largest air, water, hazardous waste, and toxic chemical loadings. This section of the Environmental Loadings Profile is intended to provide multimedia information for a more holistic perspective of environmental loadings, including information on the chemicals released in the largest quantities. For geographic analyses, this section describes select areas with the greatest number of sources and the largest loadings, and characterizes the types of chemicals released in these areas and found in the ambient environment.

This section is a value-added summary of some of the data included in Sections 3 and 4 of the report, with attention on multimedia loadings and levels. In general, this section highlights and presents information in a different context. As a result, this section does not include rigorous literature citations; it is intended to be more easily read and minimizing citations simplifies the discussion. The majority of the report has focused on the counties as a whole. Section 3 of this report presented information on sources, generally organized according to media and pollutant. Section 4 identified chemical levels information across the two counties from ambient monitoring data. This section includes multimedia analyses of the sources and chemicals released in certain geographic areas such as Southeast Chicago/Calumet area, Southwest Chicago/Cook County, and North Lake County (Gary, Hammond, East Chicago, and Whiting). Similarly, information is presented on ambient levels of contaminants found in air, water, fish tissue, sediments, groundwater, soils, and drinking water in these select "case study" areas. In addition, a multimedia summary is presented on Lake Michigan, which focuses on sources of pollution, environmental levels, and the use of the Lake as the primary drinking source for most of the population in the area. The next subsection includes profiles for specific chemicals and groups of chemicals from all types of sources (air emissions, water discharges, hazardous waste generation, and toxic chemical releases and transfers). These profiles focus on lead, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), mercury, polycyclic aromatic hydrocarbons (PAHs), and the group of chemicals considered to be endocrine disruptors. Limited summary data are also presented on levels of these chemicals in the ambient environment.

Finally, this section provides a multimedia examination of the major industries and sources to provide a characterization of the loadings from industries as a whole. Examining SIC Codes reveals the industries with the largest combined loadings to the various media. For example, it provides the loadings from the largest facilities from each media/data base (AFS, RAPIDS, BRS, PCS, and TRI) on point source releases. (More information on these data bases is presented in Sections 2 and 3 of this report.) Although limitations exist to the use of these data for such purposes, this information can provide a screening level indication of the industries with the largest combined loadings from air emissions, water discharges, hazardous waste generation, and toxic chemical releases and off-site transfers. Profiles are presented on chemical primary metals/iron and steel, petroleum, utilities (sewage treatment plants, power plants), food processing, and other industries.

It should be noted that recognized limitations and uncertainties are inherent in these types of analyses. Section 1.4 of this report describes overall uncertainties and limitations of the data presented; however, discussed below are some limitations and uncertainties that are pertinent to analyses performed in preparing Section 5 of the Environmental Loadings Profile.

Uncertainties in Multimedia Chemical Loadings Estimates

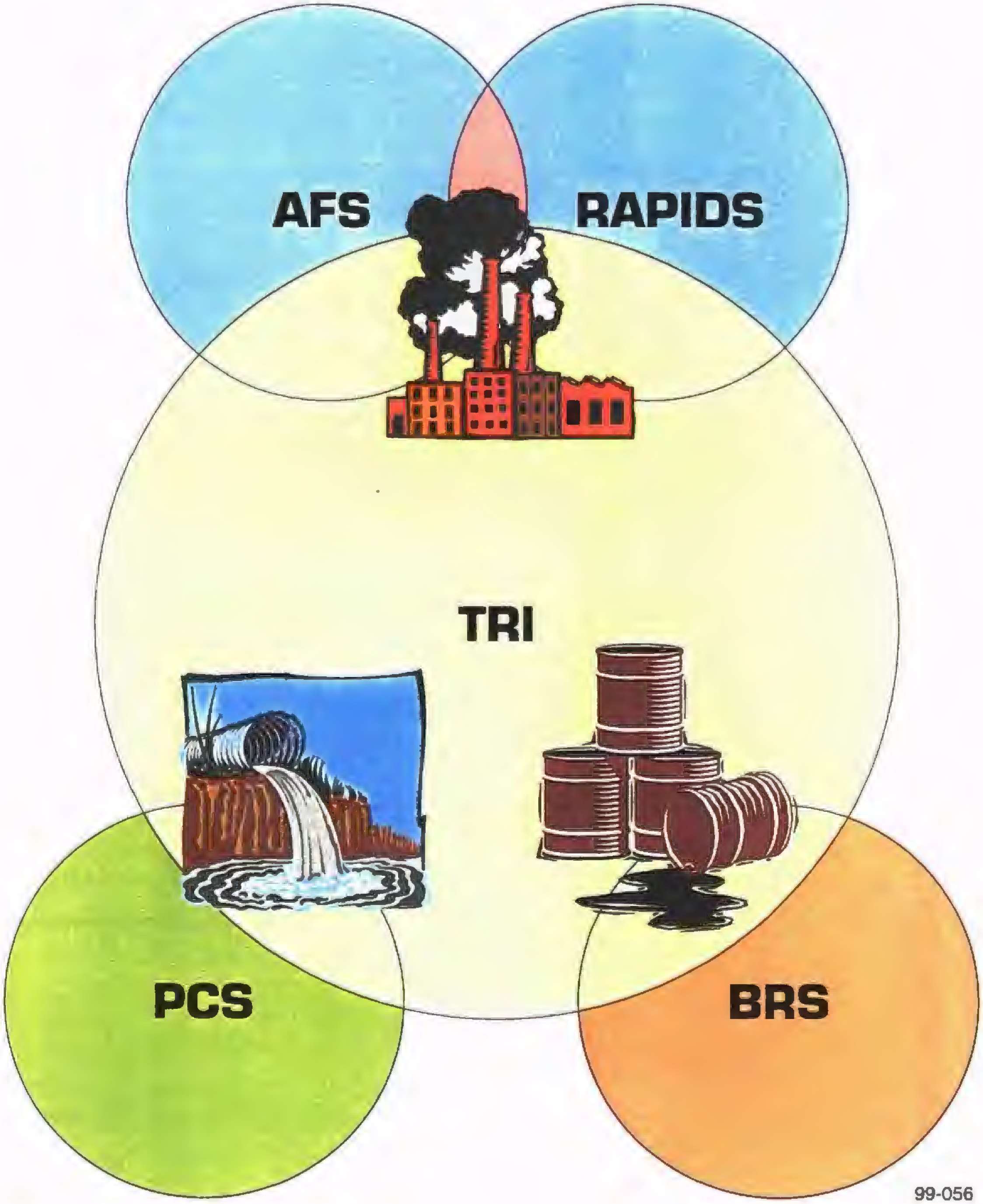
- Multiple "Forms" of Chemicals
- Lack of Chemical-Specific Data for Hazardous Wastes
- Overlap in Data Bases
- Potential for Double Counting

Estimates of environmental loadings are based on 1995 data from AFS, PCS, and TRI; 1993 data from BRS; and 1996 data from RAPIDS (based on 1993 emission inventories). Some of the limitations result from the nature of the data bases and the different reporting procedures required by State and Federal regulatory agencies in tracking compliance under numerous statues. To some degree, this lack of uniformity occurs because several of the systems were established primarily as permit compliance and tracking systems for point sources under specific media/regulations. Certain shortcomings in these data become apparent when they are used for environmental loadings estimates. Uncertainties result because of multiple "forms" of chemicals, lack of chemical-specific information on hazardous wastes, and potential overlap among data bases. Some of these limitations may result in double counting of some types of loadings and/or chemicals. The names of chemicals in these systems are not uniform; any given "chemical" might appear in different ways or even may be reported in multiple forms. For example, information on lead might be reported in one or more of the data bases as lead, lead compounds, lead (TSP), lead total recoverable, lead as PB, and several others. Some of these parameters are specific to the medium and or the data bases in which they appear.

While several of these data bases are well-suited for estimating loadings of individual chemicals, BRS poses significant challenges, because hazardous wastes are assigned waste codes. As a result, characterizing the chemical content of hazardous wastes is not usually possible. One can not determine from the waste code designations what chemicals are present and in what quantities. For example, many waste codes reflect the type of industrial process that generates the waste, not the chemical constituents present. Only for characteristic wastes (the "D" wastes, which are defined by the presence of a particular chemical), discarded products ("P" and "U" wastes), and select other waste codes, can one be certain of finding the chemical of interest. Regardless, the concentration or amount of chemicals present is not reported like in TRI, AFS, and other systems. One other peculiarity for hazardous wastes is that multiple waste types may be commingled and assigned a string of waste codes to describe the waste. Therefore, one cannot determine what portion of the total mass that is the waste of interest, much less the chemical makeup. As a result, the estimates of mass of particular chemicals in hazardous wastes may be over estimated (if one assumes that the total mass of a particular waste is the chemical of interest) or underestimated (if one cannot be certain the chemical of interest is present in other waste codes).

As is the case with all of these data bases, they only account for those facilities and chemicals that are permitted and/or monitored for reporting to State and Federal regulatory agencies. In addition, the potential exists for double counting because of overlap among systems (Figure 5-1). This is true of estimating air emissions using AFS, portions of TRI, and RAPIDS. Estimates from these three data sources may overlap to some degree even though they may address different types of facilities and different chemicals. The degree of overlap may vary from facility to facility because of the different reporting requirements (different chemicals, reporting thresholds, etc.) for data that are reported in AFS, RAPIDS, and TRI. Because of the differences in reporting procedures (and reporting years) among the three systems with air emissions data, no attempt has been made to compare or reconcile the data sets. Therefore, these rankings are best taken within the context of the same systems. Overlap among systems can also occur with other media. TRI includes information on water discharges, land disposal, and transfers of materials offsite, there could be overlap and potential double counting of loadings that might also be documented in BRS and PCS.

In addition to the uncertainties in loadings estimates, the use of ambient monitoring data has limitations. As mentioned in Section 4, ambient monitoring is not usually conducted uniformly across areas, in all years, and for all chemicals; therefore, uncertainties exist in the ability to extrapolate from a few data points to a geographic area. Associating ambient levels of pollutants to point source inputs requires much more rigorous monitoring and assessment work than is possible for this report; however, general indications of the overall health of the system may be apparent when looking at both loadings and ambient levels in the water column, sediments, fish, groundwater, and other media. It should be pointed out that sediments, and to some degree fish, act as sinks and accumulate contaminants over long time periods. Contaminants found in these media may reflect historic loadings, nonpoint source inputs, as well as more recent discharges from industrial, municipal, and combined sewer overflow (CSO) sources.



AFS = Point source air emissions
RAPIDS = Air emissions of toxic chemicals from point and area sources
BRS = Hazardous wastes generated, received, managed and shipped
PCS = Discharges to surface waters
TRI = Toxic chemical releases and transfers

Figure 5-1. Databases for Multimedia Loadings Estimates

5.1 CASE STUDIES OF SELECT GEOGRAPHIC AREAS

> **Geographic Case Studies**
>
> - Focus on Southeast Chicago, Southwest Chicago, North Lake County, and Lake Michigan
> - Multimedia Loadings and Ambient Levels
>   - Air Emissions
>   - Water Discharges and Surface Water Quality
>   - Sediments and Fish Tissue
>   - Hazardous Waste Generation
>   - Groundwater, Soil, and Drinking Water Quality

This subsection provides case studies of select geographic areas in Cook County, IL, and Lake County, IN, from the holistic perspective by documenting multimedia loadings and ambient levels of pollutants in various media. First presented is a top-down inventory of sources and loadings summarized at the county level, across media, and including all chemicals. Following that discussion are examples, or case studies, that profile environmental conditions in three geographic areas. These areas were the subject of the case studies because they were believed to have the greatest number of sources, the largest loadings, and high ambient levels of chemicals. In addition, these areas have been the focus of previous studies. Specifically, this subsection focuses on Southeast Chicago, Southwest Chicago, and North Lake County (Hammond, Gary, East Chicago, and Whiting). Lake Michigan is also discussed in this section, mostly from the perspective of the Lake as a receptor of pollution and the potential for human exposure through use of the resource. These geographic areas are shown on Figure 5-2.

The geographic case studies are multimedia summaries of sources and environmental conditions. Emphasis is placed on estimating loadings to air, with descriptions of the major sources in the areas and the chemical pollutants emitted (as reported in AFS, RAPIDS, and TRI for stack and fugitive air emissions). Extended discussion is also presented on the waterbodies that receive the largest cumulative loadings from multiple point source discharges, as well as descriptions of hazardous waste generation in the three areas. This information is complemented by select data on air quality, water quality, and the presence of chemicals in air, water, sediments, fish, soil, groundwater, and other media to which people may be exposed. In general, these data were taken

Figure 5-2. Case Study Geographic Areas

from earlier presentations in Sections 3 and 4. As such, they reflect the same years of interest (e.g., STORET data are from 1990 to 1995).

More than 5,000 facilities in Cook County, IL, and Lake County, IN, are sources of environmental pollution. Collectively, these sources produce about 8-billion pounds of pollution, which includes air emissions, water discharges, hazardous waste generation, and toxic chemical releases and transfers. In general, BRS drives the total loadings, especially in Cook County, with about 4.5-billion pounds of hazardous waste generated in 1993. In general, environmental loadings of pollutants are greater in Lake County than Cook County (Figure 5-3). Specifically, the total mass of pollutant loadings to air and water is larger in Lake County. In Cook County, toxic chemical releases are slightly larger, and hazardous waste generation is significantly larger than Lake County. Though Lake County often has larger loadings, Cook County has a significantly greater number of inventoried facilities. For example, in the AFS data base for point source emitters to air, more than 95 percent of the facilities inventoried are in Cook County; however, Lake County emits about two-thirds (67 percent) of the pollutant loadings. A relatively few large facilities generate much of the air, water, and toxic chemical pollution in Lake County.

Table 5-1 displays the largest facilities for each major type of loadings (air emissions, water discharges, hazardous waste generation, and toxic chemical releases and transfers). Figure 5-4 shows the locations of some of the largest facilities in the two county area. Cook County's largest facilities include Acme Steel, Corn Products & Best Foods, Bradshaw-Praeger, and Nalco Chemical. Large facilities in Lake County include Amoco Oil Co., U.S. Steel-Gary, Inland Steel, LTV Steel, Hammond Municipal Sewage Treatment Plant, and Keil Chemical/Ferro Corp. Many of these facilities are among the largest sources to several media and are described in more detail below in the context of the geographic case studies.

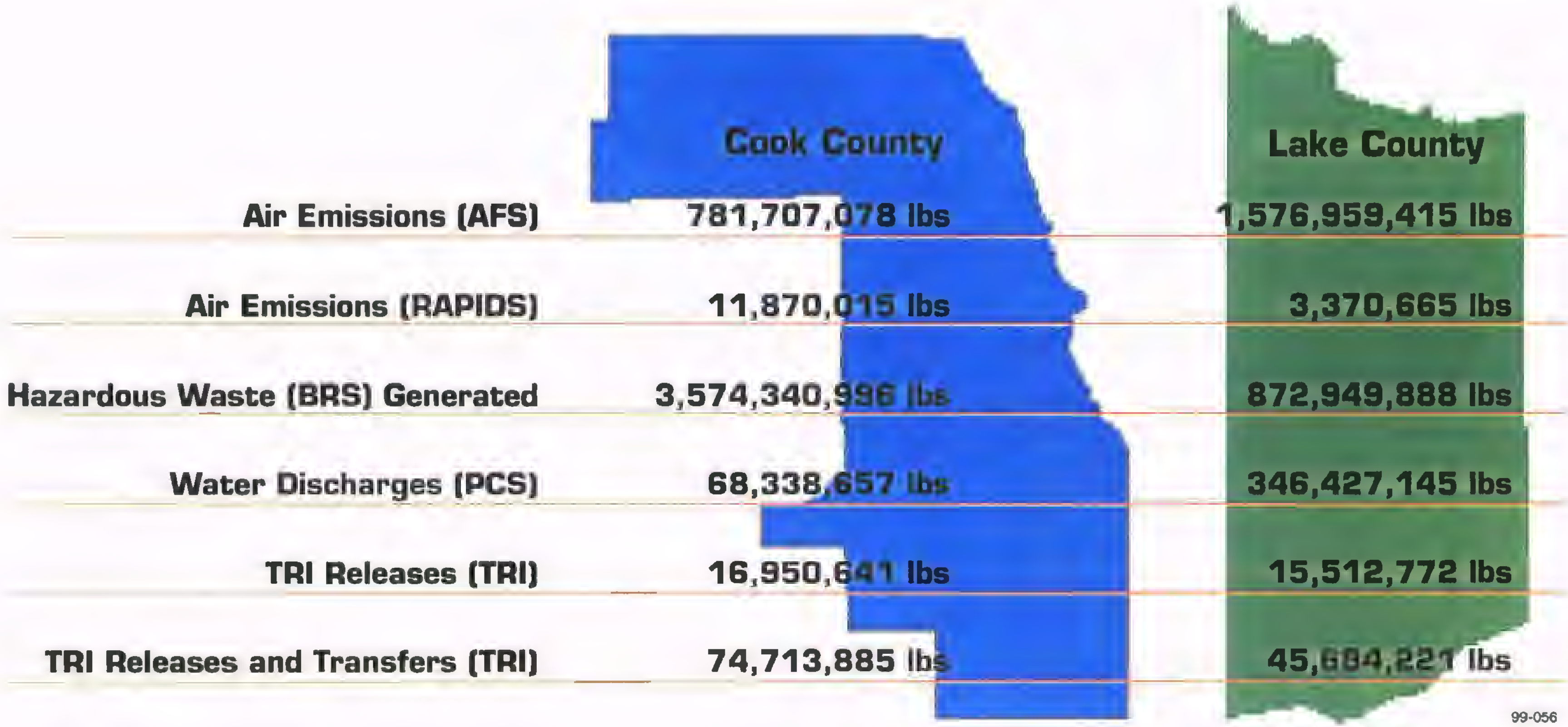


Figure 5-3. Comparison of Multimedia Loadings in Cook County, IL, and Lake County, IN

Table 5-1. Multimedia Facility Rankings - Top Facilities in Loadings to Each Media

Facility	Rank					
	AFS (1995)	RAPIDS (1993)	BRS Generators (1993)	PCS[1] (1995)	TRI Releases (1995)	TRI Releases + Transfers (1995)
Amoco Oil Co.	1		3	11	4	
U.S. Steel - Gary	2	1		10	1	2
Acme Steel	3					
Inland Steel	4	9		8	15	
Bradshaw-Praeger	5					
LTV Steel	6	10	5	6	6	4
Commonwealth Edison	7					
Keil Chemical/Ferro		2				12
General Foam/PMC		3			7	
Senior Flexonics		4			14	
Zenith Electronics		5			12	
Nalco Chemical			1			
Amber Plating Works			2			
Motorola, Inc.			4			
Safety Kleen Envirosystems			6			
CID Recycling & Disposal			7			
Corn Products & Best Foods					2	6
Ford Motor Co					5	13
Viscase Corp.					3	
Safety Kleen Oil Recovery						1
Steel Co						3
H Kramer & Co.						5
Total Number of Facilities	**3,397**	**1,501[2]**	**607**	**86**	**540**	**897**
Percent of Total Mass Contributed by Top 15	**86%**	**40%**	**94%**	**99 %**	**73%**	**58%**

[1] The highest ranking water dischargers were sewage treatment plants, which generally did not have multimedia loadings

[2] Much of RAPIDS data address area sources of chemical emissions, which are grouped by type of industry (e.g., dry cleaners); therefore, the total number of individual facilities included in the RAPIDS inventory are much higher.

Source: AIRS/AFS, 1997; RAPIDS, 1998, BRS, 1997, PCS, 1997; TRI, 1997.

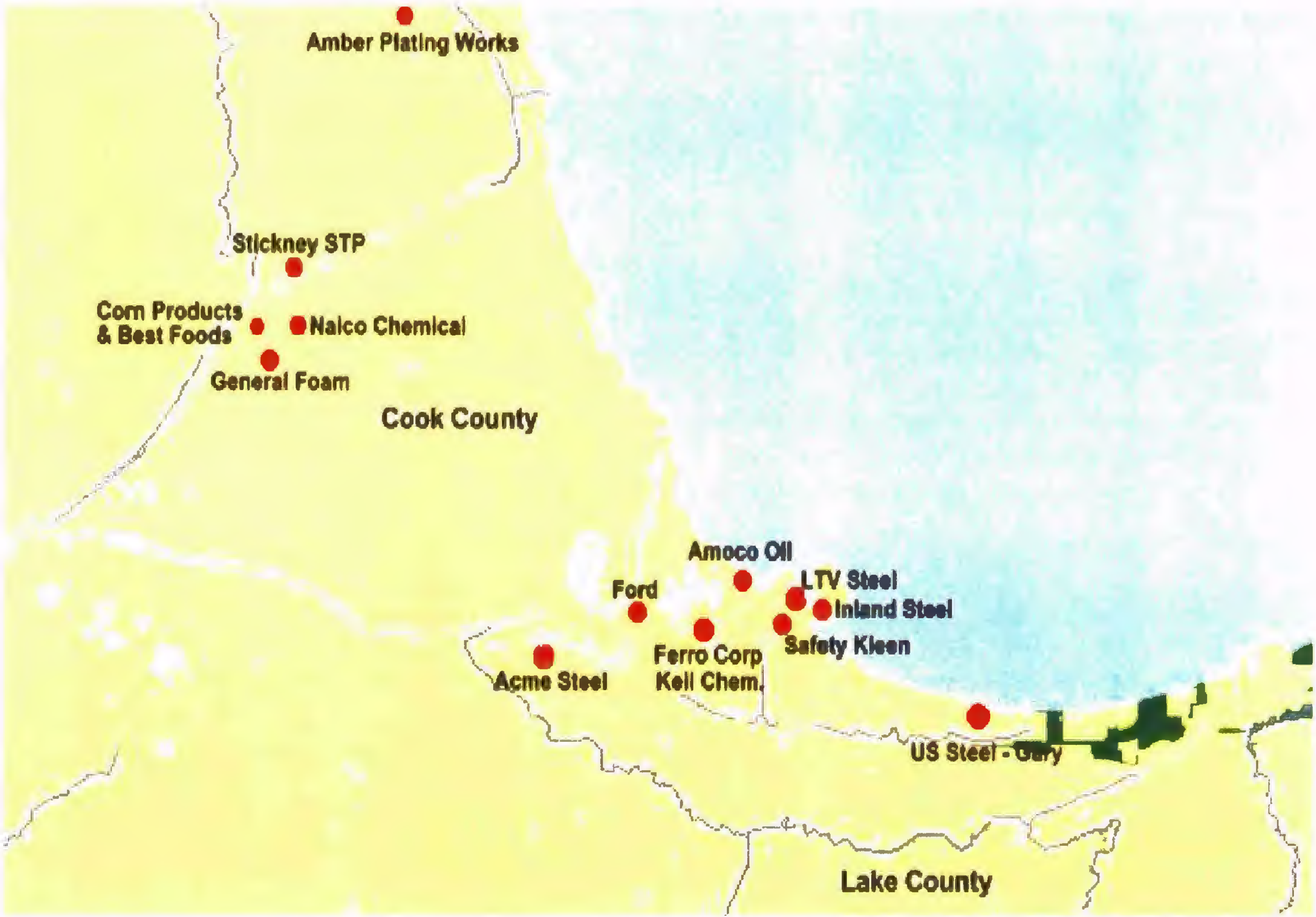


Figure 5-4. Largest Sources in Cook County, IL, and Lake County, IN

5.1.1 Southeast Chicago/Calumet Region

Southeast Chicago

- Area Includes 11 ZIP Codes
- Historic Environmental Problems
- Large Number of Facilities in Concentrated Area
- Acme Steel, Clark Oil, LTV Steel, Ford Motor Co., Safety Kleen, and U.S. Steel-South Works

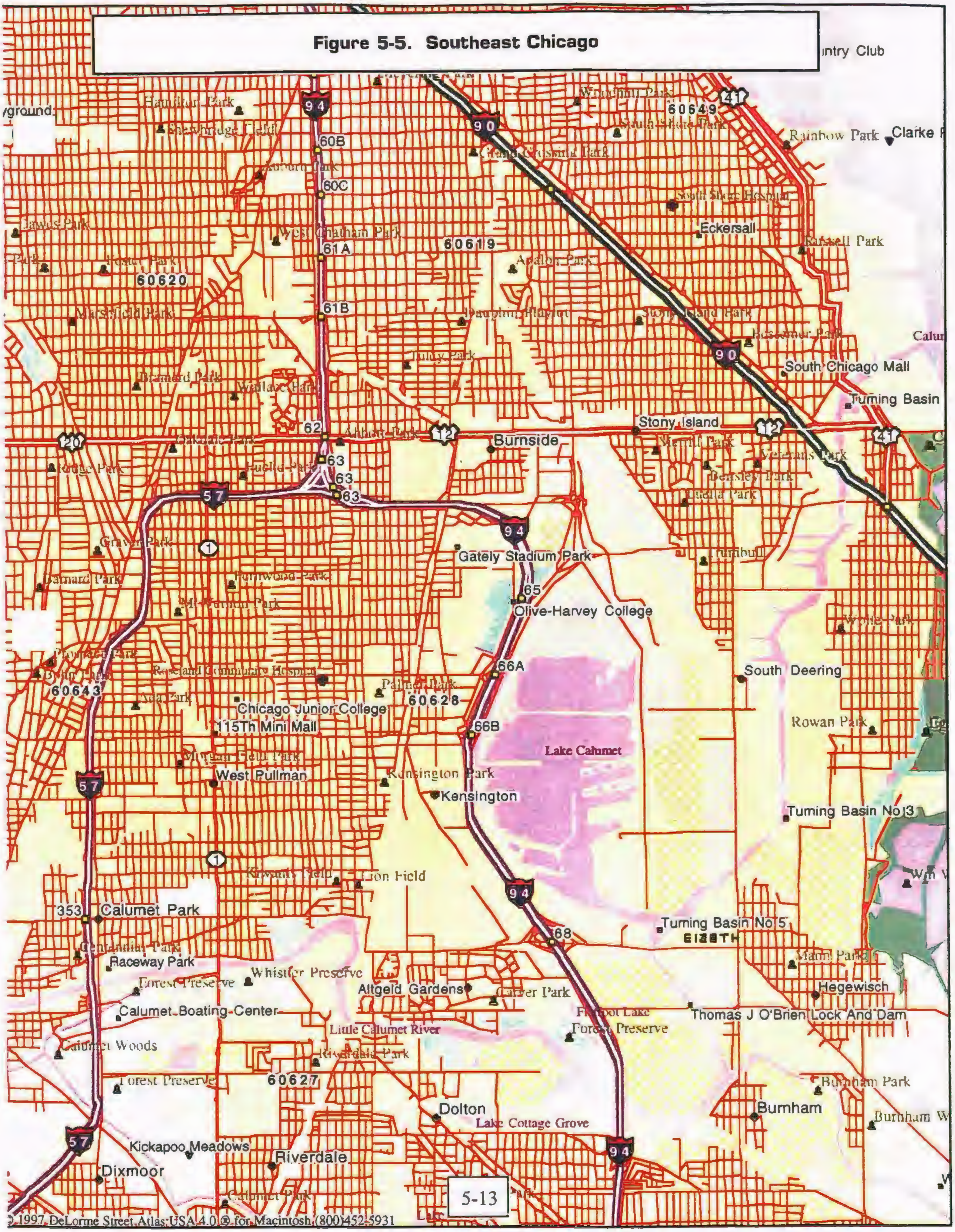
The Southeast Chicago/Calumet Region has a large number of facilities with air emissions, water discharges, hazardous waste generation and treatment, and toxic chemical releases/transfers. As discussed in previous sections, more than 100 years of intense industrialization have degraded environmental conditions in this area, resulting in documented pollution of the air, water, sediments, soil, groundwater, and other resources.

This subsection provides an overview of the magnitude of current environmental loadings, particularly to air and water, as well as summary data on levels of select contaminants identified in air, surface waters, sediments, fish tissue, groundwater, drinking water, and other media in Southeast Chicago and neighboring areas around Lake Calumet. For this subsection, Southeast Chicago is defined in a manner modeled after previous studies such as *A Guide to Southeast Chicago's Major Polluting Industries* (Hamblin and Hoelscher, 1996) and U.S. EPA's *Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southeast Chicago* (U.S. EPA, 1989b). Specifically, pollution sources were inventoried in the areas comprising ZIP Codes 60617, 60619, 60620, 60627, 60628, 60633, 60643, 60406, 60409, 60419, and 60426. Discussion of other aspects of environmental quality in the Southeast Chicago area generally addresses a similar area, including adjacent communities. Approximately 1.2-million people live in Southeast Chicago (Harley, 1998). Figure 5-5 displays a map of the Southeast Chicago/Calumet area.

5.1.1.1 *Air Quality*

Southeast Chicago has more than 350 point sources of air pollution (355 in AFS, 152 in RAPIDS, and 47 in TRI for air emissions) with estimated annual loading of almost 400-million

Figure 5-5. Southeast Chicago



pounds per year. Facilities in this area emit about 50 percent of the total mass emitted in Cook County, when measured using data from AFS. This area's contribution of total TRI air emissions and RAPIDS emissions in Cook County are only about 15 and 13 percent, respectively. Figure 5-6 displays the air emissions estimates for Southeast Chicago from AFS, RAPIDS, and TRI. Table 5-2 lists the largest air emitters in the area, based on AFS, TRI, and RAPIDS data. Based on AFS data, the largest facilities in Southeast Chicago are Acme Steel Co. (238,402,927 pounds), Clark Oil & Refining Corp. (35,529,291 pounds), Acme Steel Co.- Chicago Coke Plant (33,720,838 pounds), LTV Steel Co., Inc. (21,765,922 pounds), and Continental Grain Co. (11,242,777 pounds). The cities of Riverdale, Chicago, and Blue Island had the largest loadings, collectively accounting for more than 98 percent of the total for Southeast Chicago. The pollutants emitted in the largest amounts included carbon monoxide (209,207,871 pounds or 53 percent of the total mass of AFS emissions in Southeast Chicago), sulfur dioxide (51,612,490 pounds), total particulate matter (46,236,587 pounds), VOCs (32,417,726 pounds), and four other pollutants, including 665,848 pounds of lead (Table 5-3).

TRI air emissions in Southeast Chicago totaled 2,388,251 pounds during 1995, which included 69 chemicals emitted from 47 facilities. The largest TRI emitters included Ford Motor Co. (which emitted 1,185,589 pounds, almost 50 percent of the total), Allied Tube & Conduit Corp. (588,700 pounds), Sherwin-Williams Co. (155,142 pounds), Acme Steel Co. (111,808 pounds), and Clark Refining & Marketing, Inc. (77,771 pounds). Table 5-2 includes a list of the largest TRI air emitters in Southeast Chicago. Almost 67 percent of the TRI air emissions in Southeast Chicago came from facilities located in Chicago, 25 percent from Harvey, and 5 percent in Blue Island, with Riverdale, Calumet City, and Dolton contributing the balance. About 50 percent of the emissions were from the transportation manufacturing industrial sector (Ford Motor Co.), 32 percent from primary metals/iron and steel, and 12 percent from chemical producers. Chemicals emitted by these facilities were predominantly VOCs, including methyl ethyl ketone (529,463 pounds), methyl isobutyl ketone (429,663 pounds), xylene (362,890 pounds), glycol ethers (340,786 pounds), 1,2,4-trimethylbenzene (105,840 pounds), toluene (84,732 pounds), methanol (81,752 pounds), and 62 others that collectively total to 2,388,251 pounds (Table 5-3).

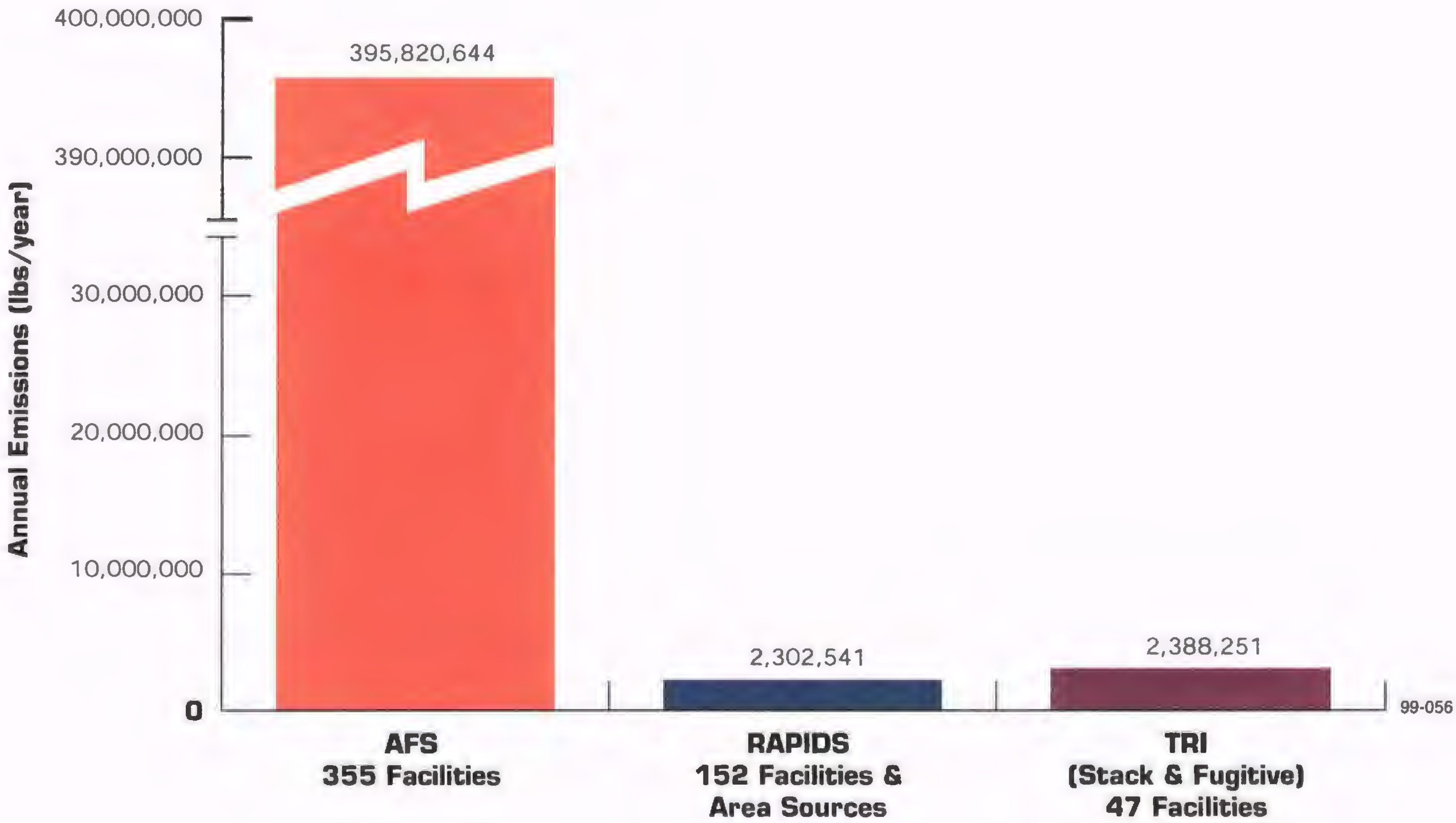


Figure 5-6. Air Emissions in Southeast Chicago

Table 5-2. Largest Air Emitters in Southeast Chicago

AFS Facility	Emissions (pounds/year)	TRI Facility	Emissions (pounds/year)
Acme Steel Co	238,402,927	Ford Motor Co.	1,185,589
Clark Oil & Refining Corp.	35,529,291	Allied Tube & Conduit Corp.	588,700
Acme Steel Co.-Chicago Coke Plant	33,720,838	Sherwin-Williams Co.	155,142
LTV Steel Co., Inc. (Republic)	21,765,922	Acme Steel Co.	111,808
Continental Grain Co.-Elevator Co.	11,242,777	Clark Refining & Marketing Inc.	77,771
Cargill Inc. - Commodity Marketing Div.	11,070,249	Witco Corp.	44,947
Cargill, Inc. - Oilseeds Division	10,694,601	Ashland Chemical Co.	33,030
Acme Packaging Corp.	5,083,713	LTV Steel Co., Inc.	30,790
Marblehead Lime Co	4,716,780	Steel Co.	28,000
Horsehead Resource Development Co.	2,998,448	115th Street Corp.	21,936
115th Street Corp.	2,318,736	American Clybourn Finishing	18,300
Ball-Incon Glass Packaging Corp.	2,195,996	Co	17,457
Republic Engineered Steels, Inc.	1,663,076	Spraylat Corp.	17,448
U.S. Steel - South Works	1,509,582	Acme Packaging Corp.	13,060
Ford Motor Co	1,023,727	Ingersoll Products Corp.	9,726
340 Other Facilities		Horsehead Resource	
		Development Co.	
		32 Other Facilities	
TOTAL	395,820,644	TOTAL	2,388,251

RAPIDS Facility	Emissions (pounds/year)
U.S. Steel - South Works	484,798
LTV Steel Co., Inc.	286,726
Ingersoll Products	186,800
G.W. Electric Specialty	99,700
Horsehead Resource Development Co.	93,712
Acme Steel Co. - Chicago Coke Plant	67,220
Hysan Corp.	59,525
Ford Motor Co.	58,308
American Clybourn Finishing Co.	37,800
Modern Drop Forge Co.	28,182
115th Street Corp.	27,404
Ellis Cleaners	22,651
Globe Industries, Inc.	16,400
Acme Steel Co.	14,013
Kingsgard Cleaners, Inc.	13,884
137 Other Facilities	
Total for RAPIDS Facilities	**1,604,016**
Area Sources	698,525
Total RAPIDS Emissions for Southeast Chicago	**2,302,541**

Source AIRS/AFS, 1997; TRI, 1997, RAPIDS, 1998.

Table 5-3. Major Air Pollutants/Chemicals Emitted in Southeast Chicago

AFS Chemical	Emissions (pounds/year)	TRI Chemical	Emissions (pounds/year)
Carbon Monoxide	209,207,871	Methyl Ethyl Ketone	529,463
Sulfur Dioxide	51,612,490	Methyl Isobutyl Ketone	429,663
Particulate Matter (Total)	46,236,587	Xylene (Mixed Isomers)	362,890
Volatile Organic Compounds	32,417,726	Certain Glycol Ethers	340,786
Nitrogen Dioxide	31,722,601	1,2,4-Trimethylbenzene	105,840
Particulate Matter (<10 μm)	23,747,450	Toluene	84,732
Lead	655,848	Methanol	81,752
Chlorofluorocarbons	129,922	Ethylbenzene	70,633
Methylene Chloride	90,149	N-Butyl Alcohol	70,325
		Benzene	31,987
		Hydrochloric Acid	31,981
		Ethylene	30,830
		Ammonia	29,470
		N-Hexane	27,780
		Zinc Compounds	21,715
		Trichloroethylene	18,319
		Sec-Butyl Alcohol	16,400
		52 Other Chemicals	
TOTAL	**395,820,644**	**TOTAL**	**2,388,251**

μm = micrometers

Source: AIRS/AFS, 1997; TRI, 1997

RAPIDS contains data on point and area sources in Cook County, IL. The RAPIDS data base includes 152 point sources in Southeast Chicago, with total estimated annual loadings of 1,604,016 pounds (Table 5-2). The facilities with the largest emissions (based in the 1993 emissions inventories) included U.S. Steel-South Works (484,798 pounds or about 30 percent of the total RAPIDS point source emissions in South Chicago), LTV Steel Co., Inc. (286,726 pounds), Ingersoll Products (186,800 pounds), G.W. Electric Specialty (99,700), Horsehead Resource Development Co. (93,712 pounds), and Acme Steel Co.-Chicago Coke Plant (67,220 pounds). The chemicals emitted in the largest quantities from these point sources included manganese (482,370 pounds, mostly from U.S. Steel), coke oven gas (254,876 pounds), 1,1,1-trichloroethane (200,279 pounds), trichloroethylene (143,801 pounds), cadmium (104,540 pounds), and 25 other chemicals (Table 5-4). Because area source data in RAPIDS are county-wide estimates and do not have the exact geographic location of the sources, it is not possible to determine which loadings are from area sources located in Southeast Chicago. Therefore, for estimation purposes, it was assumed that about 15 percent of the area source emissions for all of Cook County come from business located in Southeast Chicago. That assumption is based on the fact that in TRI, Southeast Chicago represented about 15 percent of the total air emissions for all of Cook County. Using this assumption, the estimated contribution of area sources in Southeast Chicago is about 698,525 pounds per year from 8 types of area sources. The largest emissions from area sources include consumer solvent use of 1,1,1-trichloroethane (307,726 pounds), perchloroethylene emissions from dry cleaners (274,684 pounds), and consumer use of napthalene (36,657 pounds). The total RAPIDS air emissions estimate for point and area sources in Southeast Chicago of 2,302,541 pounds.

5.1.1.2 *Water Quality/Sediments/Fish*

Waterbodies in Southeast Chicago have a long history of chemical pollution from industrial and municipal sources. (See Chapters 2 and 3.) For more than 100 years, manufacturing and municipal wastes have been discharged to the Calumet, Grand Calumet, and Little Calumet Rivers. In addition, physical alteration of these waterbodies from dredging and filling wetland areas has impacted water quality. While some efforts during the last few decades (e.g., the Tunnel and Reservoir Plan) have helped to reduce inputs of nutrients, bacteria, and other contaminants to these waterbodies, they have contaminated sediments and continue to receive loadings from point sources.

Table 5-4. Toxic Chemicals Emitted from Point and Area Sources in Southeast Chicago from RAPIDS Data Base

RAPIDS Chemical	Point-Source Emissions (pounds/yr)	Area Source Emissions* (pounds/yr)	Total (pounds/yr)
Manganese	482,370	0 74	482,371
Coke Oven Gas	254,876	---	254,876
1,1,1-Trichloroethane	200,279	307,726	508,005
Polycyclic Organic Matter	181,459	9	181,468
Trichloroethylene	143,801	386	144,187
Cadmium	104,540	0.11	104,540
Ethylbenzene	69,720	13,985	83,705
Methylene Chloride	68,921	28,944	97,865
Perchloroethylene	66,804	297,108	363,912
Phenol	22,724	5	22,729
Benzo(a)pyrene	6,812	32	6,844
Nickel	788	0.11	788
Copper	446	2	448
Mercury	296	0.38	296
Cobalt	74	---	74
Chromium	62	0 13	62
Lead	21	---	21
Arsenic	16	---	16
Chromium VI	5	0.019	5
Naphthalene	0.88	47,560	47,561
Polycyclic Aromatic Hydrocarbons	0.24	2,657	2,657
Fluoranthene	0.01	42	42
Chrysene	0.01	53	53
1,2-Dichlorethane	0 00275	11	11
Benzo(a)anthracene	0.0021	5	5
PCBs	0.00014	---	0.00014
Carbon Tetrachloride	0.00010	---	0.00010
PCDF	0.0000093	0.0845	0.08451
PCDD	0.0000011	0 0153	0.0153
2,3,7,8-TCDF	0.0000002	0 0024	0.0024
2,3,7,8-TCDD(EQ)	---	0.0003	0.0003
TOTAL	**1,604,016**	**698,525**	**2,302,541**

* Because the RAPIDS data for area sources represent the county-wide emissions, estimates for Southeast Chicago were made assuming that 15 percent of Cook County's area sources were located in this area

Source: RAPIDS, 1998.

In addition, nonpoint source runoff contributes to the loadings to these waterbodies, as can runoff from the numerous landfills, contaminated sites, and other sources in this highly industrialized region.

Southeast Chicago and adjacent sections of Cook County have numerous facilities that discharge to waterbodies in this area, including the Calumet River, Grand Calumet River, and especially the Little Calumet River. Specifically, the Calumet River received about 125,000 pounds of wastewater effluents; the Grand Calumet River received about 675,000 pounds, and the Little Calumet River received about 11-million pounds of pollutants in 1995 (Figure 5-7). In addition, loadings to Thorn Creek approached 1-million pounds. Loadings to these waterbodies included conventional water pollutants, such as total suspended solids, biological oxygen demand, oil and grease, iron, nitrogen, and other pollutants. Loadings to the Little Calumet River in this area (not to mention pollutants flowing into Illinois from the Indiana portion of the river) of 11-million pounds in 1995 included more than 6-million pounds of total suspended solids, 2-million pounds of nutrients ammonia/nitrogen, and the largest inputs of zinc (more than 76,000 pounds) of any waterbody in the study area (Table 5-5). Other metals and organics included in loadings to the Little Calumet River include copper (15,305 pounds), phenolics (15,615 pounds), and cyanide (30,332 pounds).

While most of the rivers and streams in Cook County were rated as in "good" or "fair" condition by IEPA in its 1994-95 water quality assessment report, parts of the Little Calumet River were rated as "poor" condition (IEPA, 1997). IEPA's assessment commented that municipal and industrial point sources, in addition to other stressors, were impacting water quality in the Little Calumet. The Cal-Sag Channel was also one of the areas rated as "poor" water quality. Though the direct point source loadings to the Cal-Sag are not substantial, it receives inputs from both the North and South Branches of the Little Calumet, as well as the Grand Calumet River, flowing west from Indiana. IEPA's previous water quality assessment of these systems rated 67 percent of the Little Calumet, Grand Calumet, and Cal-Sag Channel, as "not supporting aquatic life use" (IEPA, 1994). This lowest rating, on a five-point scale, was found to be attributable to nutrients, ammonia, and low dissolved oxygen. More than 2-million pounds of nutrients were discharged to the Little Calumet in 1995. Examining monitoring data for these waterbodies indicates some of the highest ambient levels of certain measures of nutrients (nitrogen and phosphorus), as well as phenols and solvents

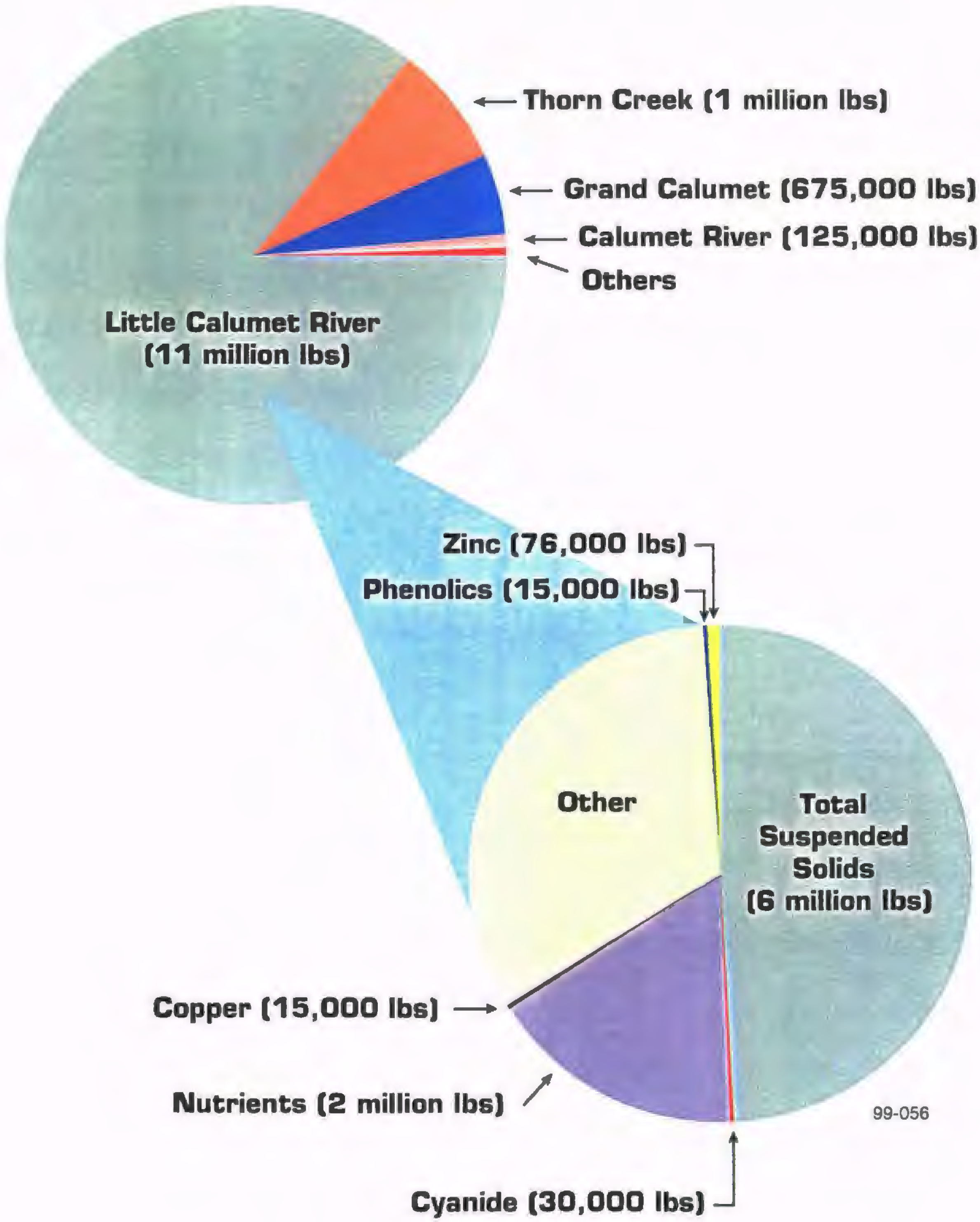


Figure 5-7. Discharges to Waterbodies in Southeast Chicago/Lake Calumet Area

Table 5-5. Combined Point Source Discharge Loadings to the Little Calumet River (IL) in 1995

Pollutant/Parameter/Chemical	Water Discharges (pounds)	Number of Facilities
BOD, 5-DAY (20° C)	12,982	1
SOLIDS, TOTAL SUSPENDED	6,291,131	2
OIL AND GREASE (SOXHLET EXTR.) TOT.	174,733	3
NITROGEN, AMMONIA TOTAL (as N)	2,006,879	2
CYANIDE, TOTAL (as CN)	30,332	2
FLUORIDE, TOTAL (as F)	1,917	1
ARSENIC, TOTAL (as AS)	256	2
BARIUM, TOTAL (as BA)	117	2
BERYLLIUM, TOTAL (as BE)	0	1
CADMIUM, TOTAL (as CD)	23	2
CHROMIUM, HEXAVALENT (as CR)	58	2
CHROMIUM, TOTAL (as CR)	117	2
COPPER, TOTAL (as CU)	15,305	2
IRON, TOTAL (as FE)	1,246	2
LEAD, TOTAL (as PB)	255	2
MANGANESE, TOTAL (as MN)	307	2
THALLIUM, TOTAL (as TL)	0	1
NICKEL, TOTAL (as NI)	117	2
SILVER, TOTAL (as AG)	117	2
ZINC, TOTAL (as ZN)	76,823	2
ANTIMONY, TOTAL (as SB)	0	1
SELENIUM, TOTAL (as SE)	0	1
PHENOLICS, TOTAL RECOVERABLE	15,615	3
CHLORINE, TOTAL RESIDUAL	2,156	1
MERCURY, TOTAL (as HG)	0	2
BOD, CARBONACEOUS 5-DAY, 20° C	2,371,510	1
CHEMICAL OXYGEN DEMAND (COD)	293,431	1
TOTAL	**11,295,427**	

Source· PCS, 1997.

in the Cal-Sag Channel and mercury (dissolved) in the Calumet River. Also, levels of fecal coliform were very high in the Little Calumet, the Cal-Sag Channel, Thorn Creek, and other streams and rivers in the Southeast Chicago area.

Wolf Lake, which lies on the Illinois/Indiana border, has a few point source inputs, including Lever Brothers, which discharged more than 500,000 pounds of total suspended solids, oil and grease, chemical oxygen demand, and other pesticides in 1995. Ambient water column monitoring data indicate that 12 pollutants are present at their highest concentrations in the study area, including barium, iron, lead, manganese, PCBs, pentachlorophenol, zinc, and other chemicals. Similarly, high levels of barium, iron, and PCBs were found in Wolf Lake's sediments. Thirteen contaminants were identified in fish tissue samples from three sites in Wolf Lake, including the highest concentrations of 1,1,1-trichloroethane (0.022 milligrams per kilogram [mg/kg]), 2-butanone (0.41 mg/kg), and carbon disulfide (0.068 mg/kg) in the study area.

Sediments in waterbodies in Southeast Chicago and the Lake Calumet area are contaminated with metals, PAHs, organic solvents, PCBs, and other chemicals. While levels in the Cal-Sag Channel are generally higher than the other rivers and lakes in the area, many have sediments with chemicals present at levels of concern. The sediments on the eastern side of Lake Calumet generally have been found to have higher concentrations than other parts of the lake, with zinc, chromium, copper, PAHs, arsenic, and other contaminants present. Many of these chemicals are also present in fish tissue samples collected from the Little Calumet, Cal-Sag Channel, Calumet River, Lake Calumet, and other waterbodies in the Southeast Chicago area. From five to eight chemicals were detected in fish from these systems, with hexachlorobenzene present in fish from Lake Calumet at its highest level in the study area (0.02 mg/kg). Sampling in Lake Calumet in the early 1980s and again in 1990 detected chlordane, DDT, dieldren, PCBs, and other chemicals. The levels of chlordane detected in 1990 exceeded the Food and Drug Administration's (FDA) action level.

5.1.1.3 *Hazardous Wastes*

In Southeast Chicago, 48 facilities generated 164,888,294 pounds of hazardous wastes mass in 1993. The largest generator, Safety Kleen Envirosystems accounted for about 45 percent of the total for this area, with 73,352,994 pounds. CID Recycling and Disposal generated 40,217,320 pounds (24 percent), Republic Engineered Steels generated 15,331,720 pounds, Sherwin Williams generated 9,410,150 pounds, LTV Steel generated 6,806,000 pounds, and General Tube Corp. generated 3,459,356 pounds. These 6 facilities generated 90 percent of the total hazardous waste in Southeast Chicago, with the majority of the mass generated by facilities in Dolton, Calumet City, Chicago, and Blue Island. The waste codes generated in the largest amounts included 67,162,008 pounds of a mixture of D001 and F001 through F005, or spent solvent wastes. Other wastes generated in the largest quantities included 27,294,130 pounds of F039 (leachate from landfills containing specific chlorinated benzenes and phenols) and 15,338,118 pounds of K062 from steel finishing operations. These wastes comprised about 70 percent of the total mass, with the remainder being more than 500 mixtures of various waste codes. Southeast Chicago has several large facilities that receive hazardous wastes from other generators for treatment, storage, disposal, recycling, and other processing. More than 525-million pounds of hazardous wastes were received by these facilities in 1993, with the largest being CID Recycling and Disposal (166,319,262 pounds), Safety Kleen Envirosystems (156,858,008 pounds), Envirite Corp (140,515,088 pounds), and Clean Harbors of Chicago (64,331,546 pounds).

5.1.1.4 *Soils*

Levels of certain contaminants have been identified in soils in Southeast Chicago. The most comprehensive survey of soil contamination was conducted by the Illinois EPA (IEPA, 1986). IEPA compared the concentrations of contaminants found in Southeast Chicago soils to ranges of these compounds normally found in soils, concluding that several metals were present in concentrations above the normal range. Chromium was found with a maximum concentration of 2,500 parts per million (ppm), which was detected to the east of Lake Calumet. Concentrations of cadmium ranged from nondetect to 13.2 ppm, with the highest concentration detected in the Wolf Lake Conservation Area. The highest levels of manganese (9,250 ppm in surface soil) were found in Southeast Chicago near Addams Elementary School. Other metals detected at elevated concentrations in Southeast Chicago included selenium, zinc, and lead, which was found in concentrations as high as 576 ppm. More extensive discussion of soil contaminants is presented in Section 4.5.

5.1.1.5 *Groundwater and Drinking Water*

Groundwater contamination in Southeast Chicago and the Calumet region has been well documented, especially in the areas around waste disposal sites near Lake Calumet. Some of the highest concentrations of metals, VOCs, semivolatile organics, PCBs, and other contaminants were detected in this area, often at concentrations exceeding drinking water standards (DuWelius et al., 1995). Though groundwater is generally not used as drinking water in this region, it is an indicator of the impact of industrialization on this resource. In Southeast Chicago, the highest groundwater contaminant levels were often identified to the south and east of Lake Calumet, near waste disposal sites and industrial facilities. Specific contaminants found in these areas included vinyl chloride (a carcinogen) at concentrations as high as 10,000 micrograms per liter (μg/L), or 5,000 times higher than the drinking water standard; 1,2-dichloroethene at 42,000 μg/L; benzene at 9,900 μg/L; and lead from several wells around Lake Calumet at levels above EPA's 15 μg/L action level.

Ten facilities that supply drinking water to the Southeast Chicago area had violations listed in the SDWIS data base. A total of 77 violations were recorded for all 10 facilities over the course of 7 years, dating from 1991 to 1997. The violations ranged from 2 for the drinking water systems serving Harvey, Calumet Park, and Blue Island, to 27 for Markham. The Markham facility, serving a population of 13,334, was ranked 13th on the violations list of all drinking water systems in the study. The majority of the violations reported in drinking water systems serving Southeast Chicago were due to the presence of coliforms (bacteria). Violations involving lead and copper were a close second. Of the 10 facilities listed with violations in this region, Calumet City, which serves the largest population (37,840), was ranked the fourth highest in the region with 9 violations between the years of 1991 and 1997.

5.1.2 Southwest Chicago

Southwest Chicago

- Defined by 10 Cities and 5 ZIP Codes
- Emissions from Food Processors, Paint Manufacturers, and Plastics Manufacturers
- Large Sewage Treatment Plant
- Largest Hazardous Waste Generator in Study Area

Southwest Chicago has significant loadings to the environment from a multitude of industrial facilities, a large sewage treatment plant, and other types of sources. The food processors, chemical and plastics manufacturers, and other industries in the area contrast the heavy primary metals, petroleum, and manufacturing industries in Southeast Chicago. Loadings of criteria pollutants reported in AFS are about half the magnitude of Southeast Chicago's emissions, but TRI air releases of chemicals are three times larger. Also, hazardous waste generation is largest in this area, mostly due to one large generator, Nalco Chemical.

This subsection provides an overview of the magnitude of current environmental loadings, particularly to air and water, as well as summary data on levels of select contaminants identified in ambient air, surface waters, sediments, fish tissue, groundwater, drinking water, and other media in Southwest Chicago and neighboring areas. For the purposes of this analysis, Southwest Chicago is composed of about 10 cities and 5 ZIP Codes, some of which are in the City of Chicago. This definition is based on the study area used by EPA in *Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southwest Chicago* (Vigyan, 1993); however, it has been expanded to cover adjacent towns and ZIP Codes that have significant sources of pollution. Specifically, the cities included in this definition of Southwest Chicago are Berwyn, Bedford Park, Bridgeview, Burbank, Cicero, Forest View, Lyons, Mc Cook, Stickney, and Summit, including the areas covered by ZIP Codes 60501, 60629, 60632, 60638, and 60652. Approximately 1.75-million people live in the Southwest Chicago area (Harley, 1998). Figure 5-8 displays a map of the Southwest Chicago area.

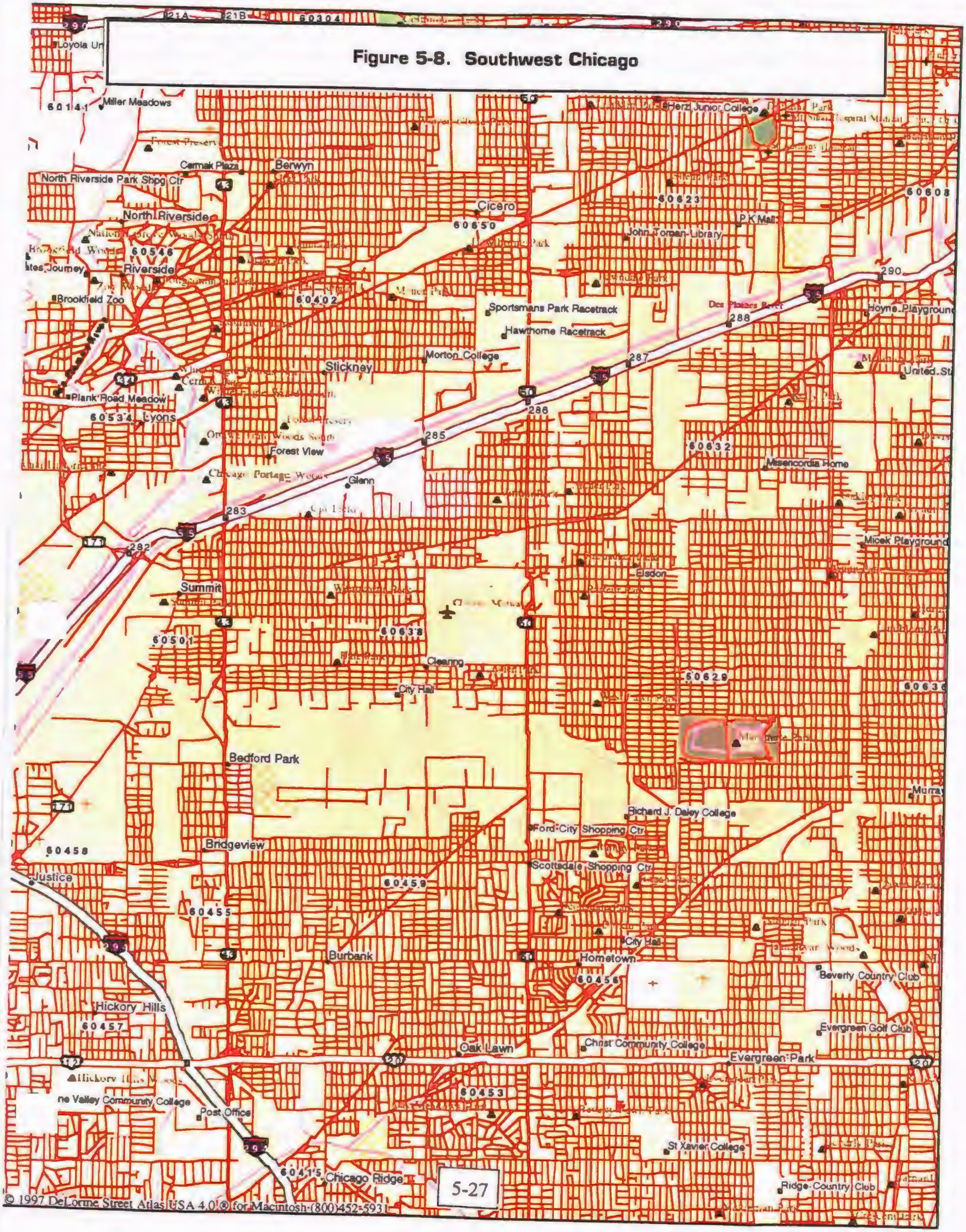


Figure 5-8. Southwest Chicago

5.1.2.1 *Air Quality*

Southwest Chicago has more than 415 point sources of air pollution (417 in AFS, 269 in RAPIDS, and 82 in TRI for air emissions), with estimated annual loadings of over 200-million pounds per year. AFS emissions are the largest, with 191,493,040 pounds, followed by TRI with 7,490,596 pounds, and RAPIDS for point and area sources of 1,489,377 pounds and 698,525 pounds, respectively. Though Southwest Chicago has smaller AFS emissions than Southeast Chicago, the TRI emissions are about three times larger (Figure 5-9). This area contributes about 44 percent of the total TRI air emissions in Cook County. Table 5-6 lists the largest air emitters in the area, based on AFS, TRI, and RAPIDS data.

According to AFS data, the largest polluters in Southwest Chicago are Bradshaw-Preager & Co. (87,380,728 pounds, or 45 percent of the total), Koppers Industries, Inc. (32,129,783 pounds), CPC International, Inc. (19,998,310 pounds), Reynolds Metals Co. (7,405,144 pounds), 3M Industrial Tape (7,329,130 pounds), and General Motors - Electro-Motive Division Plant 1 (3,862,457 pounds). Although 417 emitting facilities are in the area, the top 5 contributed more than 80 percent of the total mass. Facilities in the chemical industry emitted 124,620,624 pounds, or 65 percent of the total, with the majority of the balance contributed by food (21,128,892 pounds), paper (9,890,467 pounds), and primary metal (8,491,045 pounds) industries. The pollutants emitted in the largest amounts included total particulate matter (98,014,424 pounds or 51 percent of the total mass of AFS emissions in Southwest Chicago), carbon monoxide (34,417,214 pounds), VOCs (24,399,113 pounds), and nitrogen dioxide (17,585,023 pounds). Methylene chloride emissions in this area were 724, 688 pounds, which is 84 percent of the loadings for the two-country area. Lead emissions from these sources totaled 447,732 pounds. Table 5-7 presents the compounds emitted in Southwest Chicago from AFS and TRI. About 50 percent of the emissions came from facilities located in Chicago (96,654,401 pounds), with remaining significant loadings in Bedford Park (35,604,009 pounds), Stickney (33,016, 450 pounds), and McCook (16,694, 296 pounds). Table 5-8 presents the AFS loadings by City and ZIP Code.

TRI air emissions in Southwest Chicago totaled about 7,490,596 pounds in 1995 from 82 facilities that emitted 84 chemicals. The largest TRI emitters included Corn Products & Best Foods

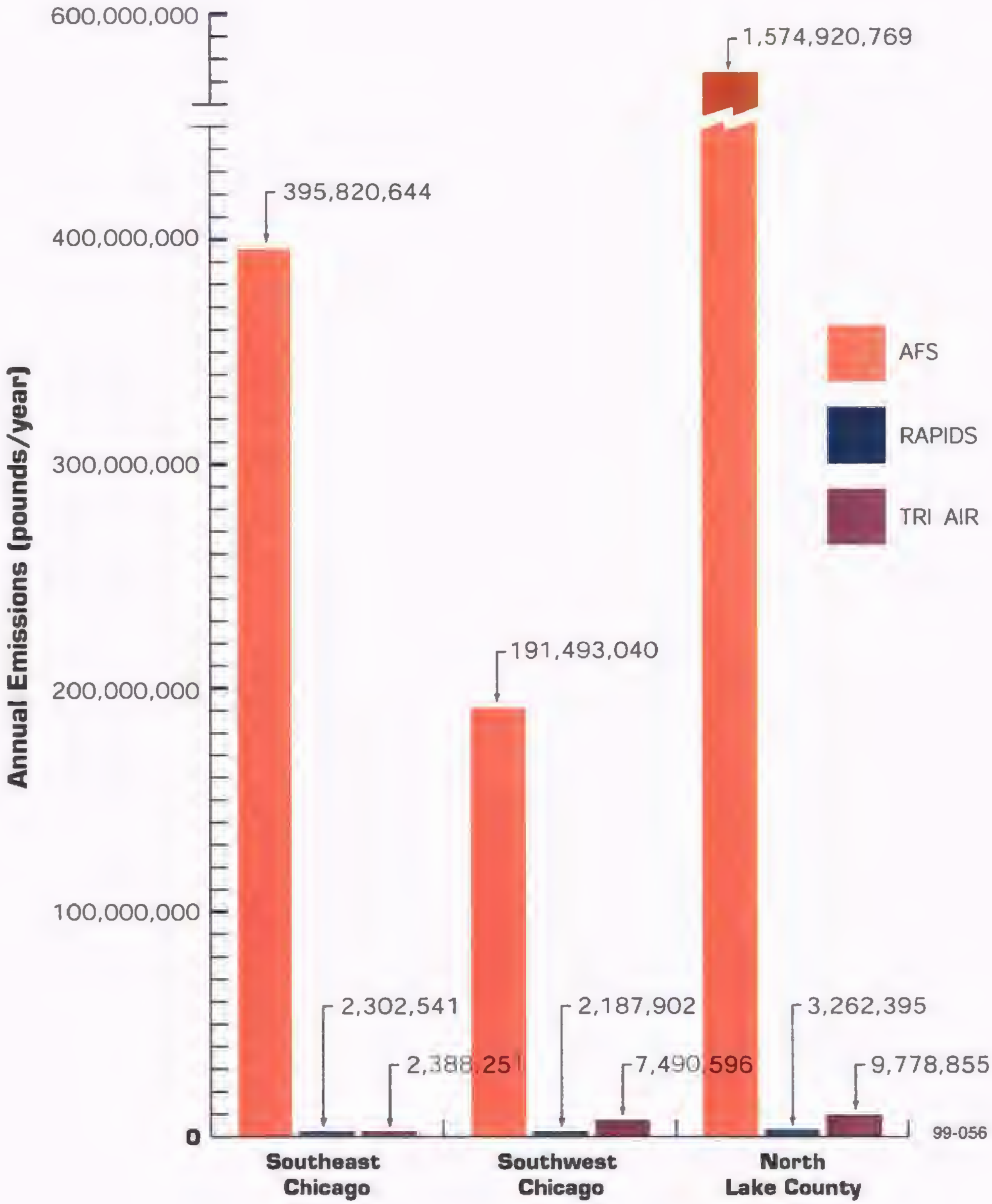


Figure 5-9. Comparison of Air Emissions in Southeast Chicago, Southwest Chicago, and North Lake County

Table 5-6. Largest Air Emitters in Southwest Chicago

AFS Facility	Emissions (pounds/year)	TRI Facility	Emissions (pounds/year)
Bradshaw-Praeger & Co.	87,380,728	Corn Products & Best Foods	2,747,655
Koppers Industries, Inc.	32,129,783	Viskase Corp	1,551,050
CPC International, Inc.	19,998,310	General Foam Corp.	714,385
Reynolds Metals Co.	7,405,144	3M	553,200
3M Industrial Tape	7,329,130	Akzo Nobel Chemicals, Inc.	458,047
General Motors - Electro-Motive Div. Plant 1	3,862,457	C. P. Hall Co.	191,416
Vulcan Materials-Lime Plant #540	3,489,112	Nabisco Biscuit Co.	129,430
Owens-Corning Fiberglas Corp.	2,037,974	Precoat Metals	128,291
Viskase Corp.	1,797,724	Alltrista Metal Services Co.	112,619
General Foam Corp (Div. of PMC, Inc.)	1,682,362	National Castings, Inc.	89,155
Gatx Terminals Corp.	1,598,946	Koppers Industries, Inc	86,902
Ball Metal Decorating	1,002,329	Signode	82,650
Nalco Chemical Co. - Clearing Plant	939,935	Now Products Inc.	76,064
Sweetheart Cup Corp.	939,754	GMC	50,694
MWRDGC	829,159	W. R. Grace & Co.	46,970
402 Other Facilities		67 Other Facilities	
TOTAL	**191,493,040**	**TOTAL**	**7,490,596**

RAPIDS Facility	Emissions (pounds/year)
General Foam Corp. (Div. of PMC, Inc)	663,899
Reynolds Metals Co.	130,176
Bagcraft Corp. of America	111,878
Mobil Oil Corp. - Lube Plant	84,615
Now Products Corp.	64,698
Celco Industries, Inc.	47,440
Accurate Anodizing Corp	45,760
Koppers Industries, Inc.	34,855
Douglas Furniture Corp	33,764
AMD Industries, Inc.	30,883
Gatx Terminals Corp	30,123
Alltrista Metal Services Co.	24,669
Shell Oil Company, Argo Plant	18,346
Castle Metal Finishing Corp.	14,560
National Castings, Inc.	11,458
254 Other Facilities	
Total for RAPIDS Facilities	**1,489,377**
Area Sources	698,525
Total RAPIDS Emissions for Southwest Chicago	**2,187,902**

Source: AIRS/AFS, 1997; TRI, 1997; RAPIDS, 1998

Table 5-7. Major Air Pollutants/Chemicals Emitted in Southwest Chicago

AFS Chemical	Emissions (pounds/year)	TRI Chemical	Emissions (pounds/year)
Particulate Matter (Total)	98,014,424	Hydrochloric Acid	2,144,638
Carbon Monoxide	34,417,214	Carbon Disulfide	1,535,800
Volatile Organic Compounds	24,399,113	Dichloromethane	817,822
Nitrogen Dioxide	17,585,023	N-Hexane	529,500
Sulfur Dioxide	10,062,520	Chloromethane	373,000
Particulate Matter (<10 μm)	5,819,527	Xylenes (Mixed Isomers)	327,707
Methylene Chloride	724,688	Toluene	321,757
Lead	447,732	Ammonia	289,606
Chlorofluorocarbons	14,302	Methanol	195,426
Trichloroethane	8,497	Sulfuric Acid	150,041
		N-Butyl Alcohol	149,053
		Certain Glycol Ethers	139,447
		Methyl Ethyl Ketone	81,278
		Sec-Butyl Alcohol	46,099
		Manganese	35,993
		69 Other Chemicals	
TOTAL	**191,493,040**	**TOTAL**	**7,490,596**

μm = micrometers

Source: AIRS/AFS, 1997; TRI, 1997.

Table 5-8. Air Emissions From AFS in Southwest Chicago by City and ZIP Code

City	Emissions (pounds/year)	ZIP Code	Emissions (pounds/year)
Chicago	96,654,401	60632	91,998,768
Bedford Park	35,604,009	60650	35,854,296
Stickney	33,016,450	60501	31,909,525
McCook	16,694,296	60525	16,670,447
Bridgeview	3,108,865	60638	7,735,687
Cicero	2,910,759	60455	3,111,311
Summit	2,246,944	60629	2,080,131
Forest View	793,853	60652	1,138,297
Lyons	293,177	60402	491,669
Berwyn	100,615	60534	245,140
Bedford	38,268	60499	65,505
Stickney Township	24,434	60502	52,888
Burbank	6,969	60176	47,288
		60529	23,849
		60405	21,314
		60605	18,607
		60005	10,483
		60656	7,207
		60459	6,170
		60514	3,192
		60457	1,267
TOTAL	**191,493,040**	**TOTAL**	**191,493,040**

Source: AIRS/AFS, 1997

(2,747,655 pounds or 36 percent of the area's total), Viskase Corp (1,551,050 pounds), General Foam Corp. (714,385 pounds), 3M (553,200 pounds), and Akzo Nobel Chemicals, Inc. (458,047 pounds). Table 5-6 includes a list of the largest TRI air emitters in Southwest Chicago. About 68 percent of the TRI air emissions in Southwest Chicago came from facilities located in Bedford Park, 11 percent (852,172 pounds) from Bridgeview, 9 percent (681,572 pounds) from Chicago, and the remainder from McCook and Cicero (no TRI air emissions were from Summit, Lyons, or Forest View). More than 90 percent of the loadings in the area came from 5 ZIP Codes, including 3,307,272 pounds, or 44 percent of the loadings, from 60501. Other ZIP Codes with large contributions included 60638 (1,691,997 pounds), 60455 (852,172 pounds), and 60525 (541,371 pounds). The remaining 15 percent were emitted by sources in 5 ZIP Codes. The food industry was the largest emitter of TRI chemicals, with 39 percent (2,892,535 pounds) of the loadings. Plastics (2,290,692 pounds), chemical (895,364 pounds), and paper (625,754 pounds) industries provided much of the remaining air emissions. Chemicals emitted by these facilities were 2,144,638 pounds of hydrochloric acid (mostly from Corn Products & Best Foods), which were the majority of the chemical's release in the entire study area), and 1,535,800 pounds of carbon disulfide. These two chemicals comprised 50 percent of the area's TRI emissions. The remaining 84 chemicals provided the balance, with the largest being dichloromethane (817,822 pounds), n-hexane (529,500 pounds), chloromethane (373,000 pounds), xylenes (327,707 pounds), and toluene (321,757 pounds).

The RAPIDS data base includes 269 point sources in Southwest Chicago, with total estimated annual loadings of 1,489,377 pounds (Table 5-6). The point source facilities in RAPIDS with the largest emissions included General Foam Corp. (Division of PMC, Inc.), which emitted 663,899 pounds, or 45 percent of the total emissions for this area. Other large emitters included Reynolds Metals (130,176 pounds), Bagcraft Corp. of America (111,878 pounds), Mobil Oil - Lube Plant (84,615 pounds), Now Products Corp. (64,698 pounds), Celco Industries (47,440 pounds), Accurate Anodizing Corp. (45,760 pounds), Koppers Industries (34,855 pounds), and Douglas Furniture Corp. (33,764 pounds). These point sources in Southwest Chicago emitted 32 chemicals. Chemicals emitted in the largest quantities included 756,179 pounds of methylene chloride (50 percent of the total mass); 263,866 pounds of polycyclic organic matter; 247,555 pounds of 1,1,1-trichloroethane; 100,228 pounds of trichloroethylene; and 62,823 pounds of perchloroethylene (Table 5-9). Most of the methylene chloride were emitted by General Foam (663,899 of the 765,178

Table 5-9. Toxic Chemicals Emitted from Point and Area Sources in Southwest Chicago from RAPIDS Data Base

RAPIDS Chemical	Point-Source Emissions (pounds/yr)	Area Source Emissions* (pounds/yr)	Total (pounds/yr)
Methylene Chloride	756,179	28,944	785,123
Polycyclic Organic Matter	263,866	9	263,875
1,1,1-trichloroethane	247,555	307,726	555,281
Trichloroethylene	100,228	386	100,614
Perchloroethylene	62,823	297,108	359,931
Ethylbenzene	36,535	13,985	50,520
Phenol	13,433	5	13,438
Cadmium	2,317	0.11	2,317
Dibutyl Phthalate	1,723	---	1,723
Nickel	1,104	0.11	1,104
Manganese	788	0.74	789
Chromium VI	761	0.019	761
Arsenic	693	---	696
Lead	659	---	659
Mercury	486	0.38	486
Cobalt	124	---	124
Copper	102	2	104
Dioctylphthalate	1.4	---	1.4
1,2-dichlortoethane	0.29	11	11.29
Naphthalene	0.18	47,560	47,560
Polycyclic Aromatic Hydrocarbons	0.17	2,657	2,657
Fluoranthene	0.14	42	42
2,3,7,8-TCDD (EQ)	0.024	0.0003	0.0243
Chrysene	0.019	53	53
PCBs	0.019	---	0.019
Benzo(a)anthracene	0.015	5	5
Carbon Tetrachloride	0.011	---	0.011
Benzo(a)pyrene	0.0072	32	32
PCDF	0.0007	0.0845	0 085
PCDD	0.00013	0.0153	0.0154
2,3,7,8-TCDD	0 000017	---	0.000017
2,3,7.8-TCDF	0.0000053	0 0024	0.0024
TOTAL	1,489,377	698,525	2,187,902

* Because the RAPIDS data for area sources represent the county-wide emissions, estimates for Southwest Chicago were made assuming that 15 percent of Cook County's area sources were located in this area.

Source RAPIDS, 1998.

pounds), while several facilities had sizable 1,1,1-trichloroethane emissions, including Bagcraft Corp of America (110,882 pounds), Reynolds Metals (103,000 pounds), and Douglas Furniture (16,200 pounds). Because the area source data in RAPIDS are county-wide estimates and do not show the exact geographic location of the sources, it is not possible to determine which loadings are from area sources located in Southwest Chicago. Therefore, for estimation purposes, it was assumed that about 15 percent of the area source emissions for all of Cook County come from business located in Southwest Chicago. This is identical to the assumed area source emissions for Southeast Chicago. Using this assumption, the estimated contribution of area sources in Southeast Chicago is about 698,525 pounds per year from 8 different types of area sources. The largest emissions from area sources include consumer solvent use of 1,1,1-trichloroethane (307,726 pounds), and perchloroethylene emissions from dry cleaners (274, 684 pounds). The total RAPIDS air emission estimate for point and area sources in Southwest Chicago is 2,187,902 pounds.

5.1.2.2 *Water Quality/Sediments/Fish*

A considerable portion of industrial and municipal wastewaters generated in the Chicago area flow away from the city, eventually to the Mississippi River. As mentioned earlier, much of the natural hydrology was altered to reverse the flow of rivers away from Lake Michigan. In addition, much of the commercial and industrial wastewaters are treated by the Metropolitan Waste Reclamation District of Greater Chicago's (MWRDGC) sewage treatment plants (STP). Several of the larger MWRDGC plants discharge to the Des Plaines River system, especially the Stickney STP, which discharges to the Chicago Sanitary and Ship Canal. Located in Southwest Chicago, the Stickney STP is the largest municipal wastewater treatment plant in the world and has the capability to serve more than 2 million people with a design capacity of 1,200 million gallons per day (MWRDGC, 1999). The Stickney plant discharged more than 45-million pounds of pollutants in 1995. Though other facilities in the study area had larger total mass discharges than Stickney STP, this facility had some of the highest loadings of individual chemical parameters. About one-third of the loadings to the Chicago Sanitary and Ship Canal in 1995 were total suspended solids. Other pollutant loadings included about 2.5-million pounds of nutrients, 22,000 pounds of cyanide, and 44,000 pounds of lead. Biological oxygen demand (BOD) loadings to the Chicago Sanitary and Ship Canal from Stickney STP were the highest of any facility and waterbody in the study area, more than

8-million pounds. Other permitted discharges to the Chicago Sanitary and Ship Canal include MWRDGC Lemont STP (1-million pounds). The other waterbodies in the Des Plaines system receiving sizable loadings form point sources include Flagg Creek (almost 5-million pounds, most of which was total suspended solids) from the MWRDGC Hinsdale S.D. McElwain STP, Higgens Creek (over 1-million pounds) from MWRDGC Kirie STP, Salt Creek (almost 250,000 pounds) from MWRDGC Egan Water Reclamation Plant, and West Branch (about 200,000 pounds) from MWRDGC Hanover Park STP.

One of the major waterbodies in Southwest Chicago is the Chicago Sanitary and Ship Canal, which is the main conduit for surface water from the Chicago area toward the Des Plaines River. All 25 miles of the Chicago Sanitary and Ship Canal were rated as "poor" quality and "nonsupport for aquatic life support" by IEPA in its 1994-1995 water quality assessment (IEPA, 1996). EPA's recent national assessment of sediment contamination reported that sediments in the Canal were among the most heavily contaminated in the county (U.S. EPA, 1997c). Metals, nutrients, pesticides, and other chemicals are present in sediments from historic loadings from municipal and industrial discharges, as well as nonpoint source runoff. Five chemicals were detected in fish tissue at one sampling location on the Chicago Sanitary and Ship Canal, though none were present at levels that were highest in the study area.

5.1.2.3 *Hazardous Wastes*

Southwest Chicago has the largest mass of hazardous waste generation of the three case study areas, with a 1993 total of 2,140,213,512 pounds from 82 facilities. Most of the generated mass (97 percent) were from one facility, Nalco Chemical Co., which is the largest hazardous waste generator in the entire two county area. Nalco generated most of the 2,081,515,538 pounds of D002 (corrosive wastes). Other large facilities in Southwest Chicago included Precoat Metals (33,056,218 pounds), HH Howard Co. (3,521,652 pounds), Berkshire Furniture (2,926,214 pounds), Koppers Industries (2,522,380 pounds), Chicago Extruded Metals (2,412,326 pounds), and 3M Company (1,709,584 pounds). The remaining 75 facilities each generated less than one tenth of 1 percent of the total mass. Besides D002, other waste codes generated included 32,862,862 pounds of D007 (chromium wastes), D001 (2,896,748 pounds), and a mixture of D002 and D008 (corrosive and lead wastes) amounting to 2,208,208 pounds. Mixtures of more than 120 waste codes comprise the remainder of the less than 1 percent of the mass of hazardous wastes generated in Southwest Chicago.

5.1.3 North Lake County (Hammond, East Chicago, Gary, and Whiting)

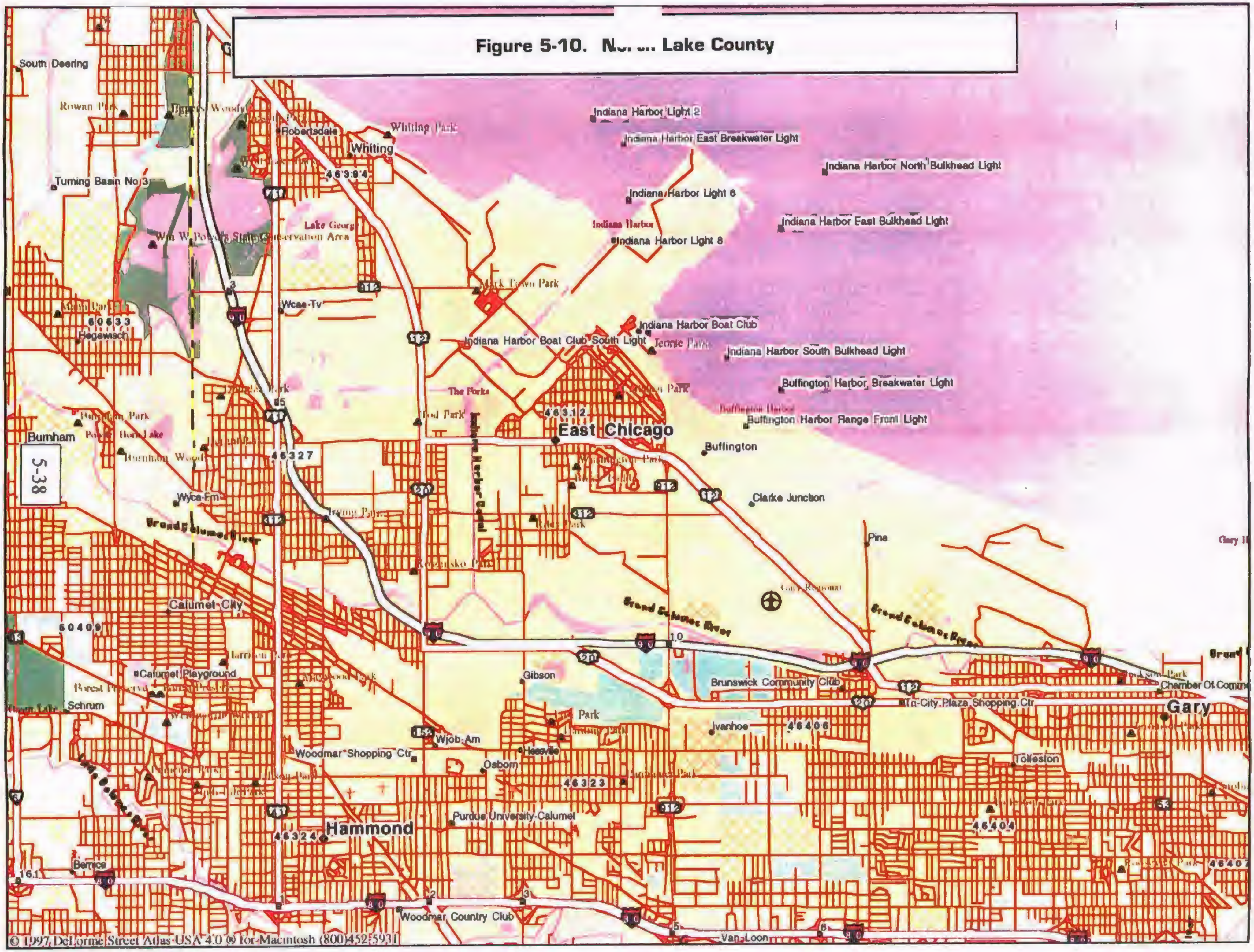
North Lake County

- Hammond, East Chicago, Gary, and Whiting
- Largest Facilities and Loadings to Air and Water in Study Area
- Degraded Water Quality and Contaminated Sediments/Fish in Grand Calumet River and Indiana Harbor Ship Canal

North Lake County, including the cities of Hammond, East Chicago, Gary, and Whiting, is an area with numerous large industrial facilities with multimedia loadings to air, water, and other media. In addition, this region has a well documented history of anthropogenic stress to the environment from about 100 years of development. As a result, the air quality, water quality, and presence of toxics in ambient media may pose risks to human health and ecological resources. The major waterbodies in this area, the Grand Calumet River and Indiana Harbor Ship Canal, receive the largest point source loadings in the entire study area by an order of magnitude. These systems are also a Great Lakes Area of Concern because of contaminated sediments, fish consumption warnings, and related degradation to the health of the system.

This subsection provides an overview of the magnitude of environmental loadings, including air emissions, discharges to waterbodies, hazardous waste generation, and toxic chemical releases and transfers in North Lake County (Figure 5-10). Summary data are also presented on the levels of select contaminants in ambient air, surface waterbodies, sediments, fish tissue, groundwater, drinking water, and other media in North Lake County to which people may be exposed. About 410,000 people live in North Lake County (Harley, 1998).

Figure 5-10. N... Lake County



5.1.3.1 *Air Quality*

The northern area of Lake County, IN, has more than 100 facilities (106 in AFS, 36 in RAPIDS, and 34 in TRI) that emit pollutants to the atmosphere, as documented in AFS, RAPIDS, and TRI (for stack and fugitive emissions). More than 1.5-billion pounds of air pollutants were emitted from facilities in the cities of Hammond, East Chicago, Gary, and Whiting. This total loading comprised more than 99 percent of the total air emissions in Lake County and about two-thirds of the atmospheric loadings in the study area. In other words, several of the largest emitters in all of Cook County, IL, and Lake County, IN, are located in this area, including U.S. Steel-Gary Works, Amoco Oil Co. - Whiting Refinery, Inland Steel, and others (Table 5-10). When examining the loadings to air in this region of Lake County, facilities in Gary account for about 45 percent of the AFS emissions and 73 percent of the TRI air emissions. Sources in Whiting (Amoco Oil) comprise about 35 percent and 14 percent of these types of air emissions, respectively, with East Chicago and Hammond providing the balance. Analysis of air emissions by industrial sector (SIC Code) indicates that primary metals production accounts for about 57 percent of the AFS total and 82 percent of the TRI air emissions in this region. The pollutants emitted in North Lake County (Hammond, East Chicago, Gary, and Hammond) include numerous criteria air pollutants (carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter, VOCs, lead, and others) amounting to most of the 1.5-billion pounds. TRI air emissions, which total to about 9.8-million pounds, include 77 compounds such as ammonia, manganese compounds, methyl ethyl ketone, methanol, phenol, toluene, zinc compounds, and many other VOCs, PAHs, and metals. Table 5-11 summarizes the pollutants emitted in the largest quantities in the four-city area as reported in AFS and TRI.

Fifty-one facilities and seven area sources are included in the RAPIDS data for Lake County, IN. Thirty-six facilities were determined to be located in North Lake County, based on ZIP Code information. Because the area source data in RAPIDS are county-wide estimates and do not have the exact geographic location of the sources, it is not possible to determine loadings from area sources in the four-city area. Therefore, for estimation purposes, it was assumed that about 75 percent of the area source emissions for all of Lake County come from business located in the four major cities included in this analyses. That assumption is based on the fact that for all of Cook

Table 5-10. Largest Air Emitters in North Lake County (Hammond, East Chicago, Gary, and Whiting)

AFS Facility	Emissions (pounds/year)	TRI Facility	Emissions (pounds/year)
Amoco Oil Co - Whiting Refinery	541,338,197	U S Steel	7,148,261
U.S Steel Co. - Gary Works Part 2	401,097,072	Amoco Oil Co.	1,445,256
U.S Steel Co - Gary Works	270,356,725	American Steel Foundries	625,191
Inland Steel Co.	157,631,587	Silgan Containers Corp.	141,310
LTV Steel Co., Inc.	76,735,156	LTV Steel Co. Inc.	121,560
Commonwealth Edison	49,188,019	Inland Steel Co.	120,311
NIPSCO-Dean H Mitchell Station - Gary	28,219,906	Ferro Corp.	50,720
Reith-Riley Asphalt Plant #671 / Atlas	28,217,930	Union Tank Car Co.	31,524
American Maize Products Co.	9,895,880	Cerestar USA Inc.	24,610
Jupiter Aluminum Corp.	2,423,809	Rhone-Poulenc	24,565
Methodist Hospital	1,693,161	Harbison-Walker Refractories	18,385
Lehigh Portland Cement Co.	1,130,941	Jupiter Aluminum Corp.	6,640
Keil Chemical-Ferro Co.	1,030,318	Harsco Corp.	6,250
American Steel Foundries	910,106	Davies Imperial Coatings Inc.	3,000
92 Other Facilities		20 Other Facilities	
TOTAL	1,574,920,769	TOTAL	9,778,855

RAPIDS Facility	Emissions (pounds/year)
U S Steel - Gary Works	1,498,869
Keil Chemical-Ferro Corp.	965,100
Inland Steel Co.	309,702
Rhone-Poulenc	184,510
Union Tank Car Co.	30,101
American Steel Foundries	25,724
Harbison-Walker Refractories	21,500
LTV Steel Co., Inc.	18,862
Amoco Oil Co	17,740
Ortman Fluid Power	11,076
Lehigh Portland Cement Co.	8,587
25 Other Facilities	
Total Facility Loadings	3,129,277
Area Sources	133,395
Total RAPIDS Loadings for North Lake County	**3,262,395**

Source: AIRS/AFS, 1997; TRI, 1997; RAPIDS, 1998

Table 5-11. Major Air Pollutants/Chemicals Emitted in North Lake County (Hammond, East Chicago, Gary, and Whiting)

AFS Chemical	Emissions (pounds/year)	TRI Chemical	Emissions (pounds/year)
Carbon Monoxide	1,004,244,531	Ammonia	4,015,182
Sulfur Dioxide	212,093,470	Manganese Compounds	1,351,827
Nitrogen Dioxide	146,594,219	Methyl Ethyl Ketone	636,275
Particulate Matter (<10μm)	135,241,222	Methanol	631,715
Volatile Organic Compounds	54,161,685	Phenol	583,240
Particulate Matter (total)	20,999,783	Toluene	499,505
Lead	1,578,611	Zinc Compounds	380,657
Hydrogen Chloride	6,231	Hydrochloric Acid	284,894
Cadmium	895	Copper Compounds	250,540
Chlorine	84	Naphthalene	173,777
Mercury	35	Xylene (mixed isomers)	161,620
Chromium Compounds	3	Lead Compounds	119,168
		Benzene	87,640
		Cyanide Compounds	81,000
		Propylene	66,100
		Methyl Tert-Butyl Ether	63,140
		Anthracene	49,200
		N-Hexane	45,887
		Certain Glycol Ethers	42,848
		1,2-Dichloroethane	35,320
		Ethylene	31,600
		Dichloromethane	27,875
		Phenanthrene	19,240
		Ethylbenzene	17,721
		1,2,4-Trimethylbenzene	17,064
		Chromium Compounds	15,564
		Cyclohexane	15,048
		N-Butyl Alcohol	10,505
		49 Other Chemicals	
TOTAL	**1,574,920,769**	**TOTAL**	**9,778,855**

Source: AIRS/AFS, 1997, TRI, 1997.

County, for most media, the majority (at least 75 percent and sometimes more than 90 percent) of the loadings come from the more developed areas in the northern portion of the County.

From the RAPIDS data, it is estimated that 3,129,277 pounds of air pollution are emitted by point sources (Table 5-10) and 133,395 pounds come from area sources such as dry cleaners, auto refinishing shops, and other area sources. Thirty-one chemicals emitted from 36 point sources included 1,2-dichloroethane, coke oven gas, manganese, compounds, and several others. The facilities with the largest loadings were U.S. Steel-Gary Works (1,498,869 pounds), Keil Chemical-Ferro Corp. (965,100 pounds), Inland Steel (309,702 pounds), Rhone-Poulenc (184,510 pounds), Union Tank Car Co. (30,101 pounds), American Steel Foundries (25,724 pounds), and Amoco Oil (17,740 pounds). Major pollutants emitted by the 36 facilities that were inventoried for the RAPIDS study are presented in Table 5-12. Examination of the pollutants emitted from point sources in the largest quantities reveals that all 964,600 pounds of 1,2-dichloroethane came from Keil Chemicals-Ferro Corp; 95 percent of the 798,774 pounds of coke oven gas and 89 percent of 124,110 pounds of lead were from U.S. Steel-Gary; 78 percent of the 136,075 pounds of methylene chloride were from Rhone-Poulenc; and about 40 percent of the mercury were emitted by the NIPSCO-Dean H. Mitchell Station. Perchloroethylene emissions in this area totaled 278,112 pounds (187,077 pounds from point sources and 91,035 pounds from area sources) with about 64 percent from Inland Steel, and much of the remainder from dry cleaning establishments.

Total area source emissions in this four-city area are estimated at about 133,395 pounds per year. The major area sources in this area include dry cleaning establishments (about 91,035 pounds), architectural coatings and auto refinishing (about 32,407 pounds), cold degreasers (about 4,125 pounds), and the remainder from residential wood combustion, chromium electroplaters, gasoline dispensing, and residential coal combustion. Major chemicals emitted by area sources are presented in Table 5-12, with perchloroethylene (91,035 pounds), napthalene (24,901 pounds), ethylbenzene (9,171 pounds), and methylene chloride (4,125 pounds) as the chemicals emitted in the largest quantities. Other metals, PAHs, and dioxins and furans are the remaining chemicals emitted from area sources in Hammond, Gary, East Chicago, and Whiting. Quantities of the dioxins and furans emitted from area sources were estimated to include PCDD (0.0044 pounds); PCDF (0.00053 pounds); 2,3,7,8-TCDD (0.000198 pounds); and 2,3,7,8-TCDF (0.000031 pounds). Point source

Table 5-12. Toxic Chemicals Emitted from Point and Area Sources in North Lake County (Hammond, Gary, East Chicago, and Whiting) from RAPIDS Data Base

RAPIDS Chemical	Point-Source Emissions (pounds/yr)	Area Source Emissions* (pounds/yr)	Total Emissions (pounds)
1,2-dichloroethane	964,600	--	964,600
Coke Oven Gas	798,774	--	798,774
Polycyclic Organic Matter	496,615	--	496,615
Manganese Compounds	221,339	0.54	221,340
Perchloroethylene	187,077	91,035	278,112
Methylene Chloride	136,075	4,125	140,200
Lead	124,110	--	124,110
Ethylbenzene	68,703	9,171	77,874
Phenol	31,835	31	31,866
1,1,1-trichloroethane	19,098	--	19,098
Trichloroethylene	19,076	--	19,076
Copper	13,801	1.3	13,803
Naphthalene	12,934	24,901	37,835
Chromium	10,392	1,958	12,350
Dibutyl Phthalate	8,000	160	8,160
Cadmium	6,187	0 08	6,187
Nickel Compounds	3,257	0.08	3,257
Benzo(a)pyrene	2,551	23	2,574
Carbon Tetrachloride	2,000	--	2,000
Mercury	1,000	--	1,000
Arsenic	672	--	672
Cobalt	601	--	601
Diethylhexyl Phthalate	255	--	255
PCDF	250	0.00053	250
Fluoranthene	37	31	68
Dioctyl Phthalate	21	--	21
Chrysene	12	38	50
Polycyclic Aromatic Hydrocarbons	5 55	1,919	1,925
Chromium VI	1.34	--	1.34
Benzo(a)anthracene	0.48	1 48	1.96
PCDD	0.00112	0 0044	0.00552
2,3,7,8-TCDD		0.00019	0.00019
2,3,7,8-TCDF	0 0002	0 000031	0.000231
TOTAL	3,129,277	133,395	3,262,672

* Because the RAPIDS data for area sources represent the county-wide emissions, estimates for the four-city area were made assuming that 75 percent of Lake County's area sources were located in these cities.

Source RAPIDS, 1998.

emissions of these compounds in these four cities included: PCDD (0.00112 pounds), PCDF (250 pounds), and 2,3,7,8-TCDF (0.0002) pounds.

Emissions of VOCs from facilities in this area contribute to the formation of ozone, which is one of the primary air quality problems. EPA designated this area of North Lake County as nonattainment for ozone, particulate matter (PM_{10}), sulfur dioxide, and carbon monoxide. Although ozone is a regional phenomenon and many other sources (such as automobiles) in the immediate area and from adjacent areas contribute, annual loadings of VOCs in the four-city area exceed 55-million pounds. Based on AFS data, about half of the VOC loadings come from U.S. Steel-Gary, Amoco Oil, LTV, and Inland Steel. Nitrogen oxides, another ingredient in the formation of ozone, are emitted in excess of 145-million pounds. Particulate matter, both total particulates and the smaller PM_{10} (less than 10 microns in size) are emitted in large quantities from these facilities in northern Indiana. U.S. Steel-Gary emits about 90 percent of the PM_{10} loadings in the four-city area.

Lead is an air pollutant of concern because of its toxic effects to children. Total lead emissions to air have dropped dramatically nationwide in the last few decades because of the phase-out of leaded gasoline. Point-source emissions of lead and lead compounds to the air in North Lake County in 1995 were about 1,698,140 pounds, as reported in AFS and TRI. Most of those emissions were from U.S. Steel-Gary, which released 1,572,000 pounds of lead and lead compounds in 1995. RAPIDS data for lead indicate that U.S. Steel-Gary emitted 111,478 of the total 124,110 pounds of lead in this area.

5.1.3.2 *Water Quality/Sediments/Fish*

Water quality in North Lake County has been severely impacted by almost 100 years of chemical and municipal discharges, alteration of waterbodies, and other anthropogenic stresses. Much of this part of Lake County, IN, lies within the Little Calumet-Galien watershed (or cataloguing unit), with about 40 facilities discharging to rivers and streams. The East Branch of the Grand Calumet begins in Gary and flows west to join the Indiana Harbor Ship Canal and the West Branch of the Grand Calumet River (Figure 5-11). Several of the largest facilities in the entire study area discharge effluents to these waterbodies, including the Hammond Municipal STP, East Chicago

Figure 5-11. Waterbodies in North Lake County

Municipal STP, Gary Wastewater Treatment Plant, U.S. Steel-Gary, and several others. Combined annual loadings to the Little Calumet-Galien system from these point sources are almost 350-million pounds (based on 1995 discharge data, which include four facilities in Illinois that discharge to waterbodies in the watershed). In addition, inputs to these waterbodies from combined sewer overflows (CSOs) and nonpoint source runoff add to the loadings from industry and sewage treatment plants. The cumulative impact of these discharges on the water quality in the area is substantial, especially the long-term accumulation of toxics in the sediments of the Grand Calumet River and Indiana Harbor Ship Canal.

The waterbody receiving the largest quantity loadings in the entire study area is the Grand Calumet River. As mentioned in Sections 2 and 4, the majority of the dry weather flow of the Grand Calumet River is input from the municipal and industrial sources that line the River (HydroQual, 1985). The Grand Calumet River receives effluents from three large STPs in Hammond, East Chicago, and Gary, IN, as well as industrial effluents from U.S. Steel-Gary and DuPont. Collectively, these 5 facilities discharged an estimated 314,602,550 pounds of pollutants into the Grand Calumet River in 1995, a mass greater than any other receiving waterbody in the study area by an order of magnitude (Figure 5-12). Table 5-13 displays the combined loadings to the Grand Calumet River. More than two-thirds of the discharged mass were total dissolved solids. Other major pollutants discharged were conventional pollutants such as total suspended solids, oil and grease, sulfate, chloride, and other parameters, as well as metals such as cadmium, chromium, copper, and lead. In addition, the Grand Calumet River also received the large quantities of organics (PAHs, VOCs, and other forms of organics).

Similarly, the Indiana Harbor Ship Canal received wastewater discharges amounting to about 26-million pounds from Inland Steel, American Steel, and LTV Steel. Pollutants discharged by these facilities in 1995 included conventional parameters, such as total suspended solids, sulfate, chloride, an oil and grease. About 5,700 pounds of cyanide, 5,000 pounds of zinc, 3,000 pounds of phenolics, and 2,000 pounds of lead were discharged to the Indiana Harbor Ship Canal from these facilities. One large facility in the northern part of Lake County, Amoco Oil Refinery in Whiting, discharges directly to Lake Michigan. Wastewater loadings from this facility for 1995 were about 3,235,799

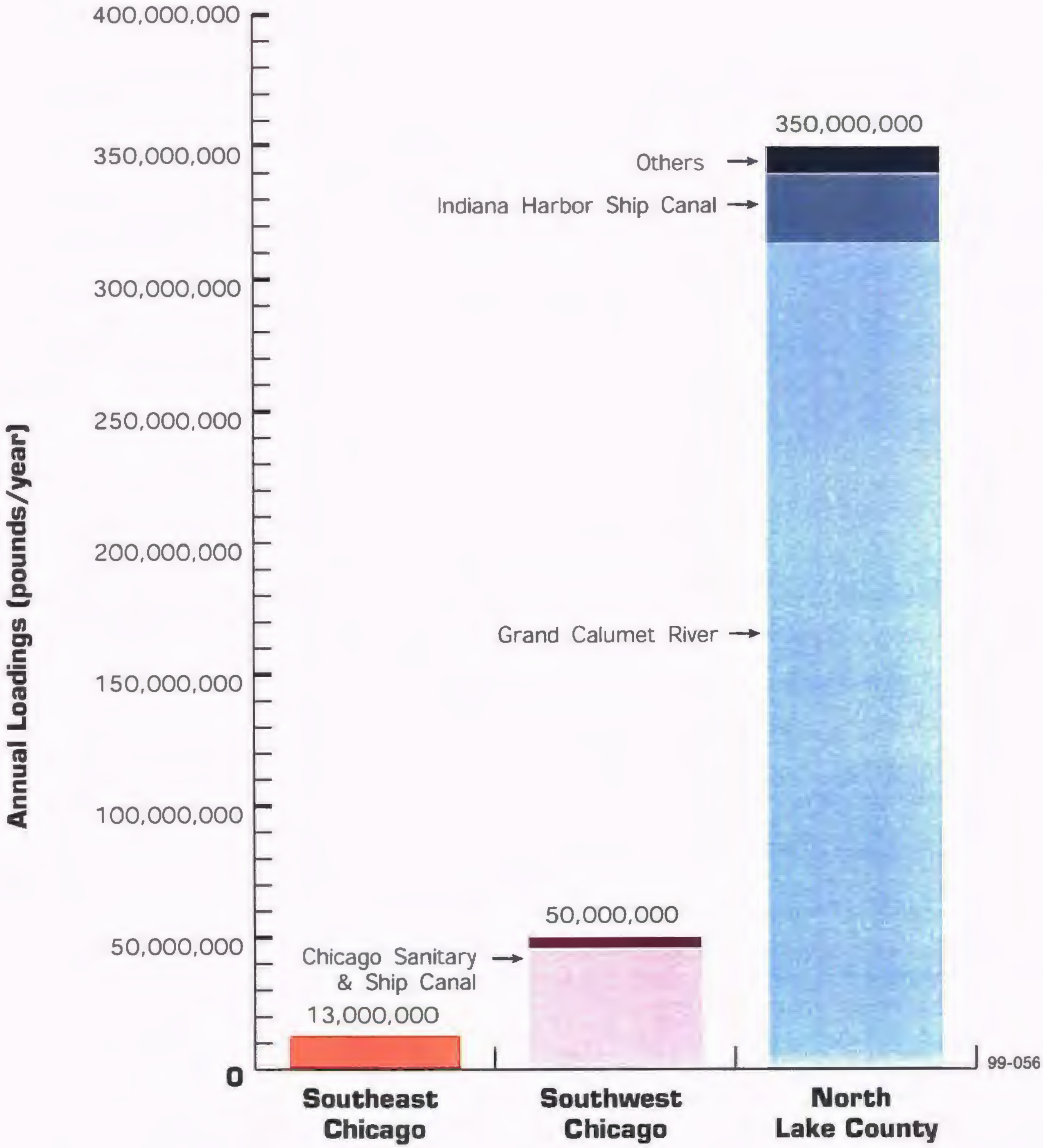


Figure 5-12. Comparison of Water Discharges in Southeast Chicago, Southwest Chicago and North Lake County

Table 5-13. Combined Point Source Discharge Loadings to Grand Calumet River in 1995

Pollutant/Parameter/Chemical	Water Discharges (pounds)	Number of Facilities
OXYGEN, DISSOLVED (DO)	2,532,118	4
BOD, 5-DAY (20° C)	108,739	2
OXYGEN DEMAND, CHEM. (LOW LEVEL) (COD)	9,808	1
SOLIDS, TOTAL SUSPENDED	1,226,423	5
OIL AND GREASE FREON EXTR-GRAV METH	6,744,491	4
NITROGEN, AMMONIA TOTAL (as N)	306,536	5
PHOSPHORUS, TOTAL (as P)	72,760	3
CYANIDE, TOTAL (as CN)	1,872	4
CHLORIDE (as CL)	35,124,916	4
SULFATE, TOTAL (as SO4)	54,021,576	4
FLUORIDE, TOTAL (as F)	277,630	3
ARSENIC, TOTAL RECOVERABLE	546	1
CADMIUM, TOTAL (as CD)	1,090	2
COPPER, TOTAL (as CU)	6,624	2
IRON, DISSOLVED (as FE)	18,392	3
NICKEL, TOTAL (as NI)	4,761	1
NICKEL TOTAL RECOVERABLE	3,966	1
ZINC, TOTAL (as ZN)	32,423	3
ZINC TOTAL RECOVERABLE	19,091	2
CADMIUM TOTAL RECOVERABLE	686	1
LEAD TOTAL RECOVERABLE	3,274	4
CHROMIUM TOTAL RECOVERABLE	2,194	4
COPPER TOTAL RECOVERABLE	102	1
CHROMIUM, HEXAVALENT DISSOLVED (as CR)	980	1
PHENOLICS, TOTAL RECOVERABLE	6,647	3
BENZENE	1,755	1
BENZO(A)PYRENE	2	1
TETRACHLOROETHYLENE	38	1
NAPHTHALENE	168	1
FLOW, WASTEWATER BY-PASSING TRTMNT PLANT	325	3
CHLORINE, TOTAL RESIDUAL	8,980	4
SOLIDS, TOTAL DISSOLVED	212,613,193	4
MERCURY TOTAL RECOVERABLE	27	3
BOD, CARBONACEOUS 5-DAY, 20° C	1,450,417	4
TOTAL	**314,602,550**	

Source PCS, 1997

pounds, which included 411,825 pounds total suspended solids, 365,135 pounds total organic carbon, other conventional parameters, and a few metals such as chromium and selenium.

The impact of these loadings to water quality is reflected in numerous ambient water quality assessments, especially IDEM's 1994-95 Biennial Water Quality Assessment Report, which stated that the Grand Calumet River and Indiana Harbor Ship Canal are "nonsupporting for both aquatic life and recreational use" with probable causes of oil and grease, lead, PCBs, pesticides, mercury, ammonia, and CSOs (IDEM, 1996a). Other monitoring and assessment efforts on the water quality of the Grand Calumet have found excessive levels of metals (such as lead, mercury, cadmium, copper), PAHs, phenol, cyanide, solvents, bacteria, and other pollutants in the water column, sediments, and fish tissue. In addition, low dissolved oxygen has been a long-term problem in these waterbodies; this may be partially attributable to high BOD and nutrient-containing discharges from municipal, industrial, and CSOs to the Grand Calumet River and Indiana Harbor Ship Canal. The degraded water quality in these waterbodies is also reflected in warnings not to consume fish caught from these waters, which have the highest warning level to prevent fish consumption, because they have the highest levels of fish contamination in the State (IDEM, 1996a).

Ambient levels of many pollutants in the Grand Calumet and Indiana Harbor Ship Canal were among the highest in the study area. Specifically, 14 pollutants were identified in the water column at the highest concentrations, including metals, pesticides, cyanide, VOCs, nutrients, and BOD. While in some cases it is possible to identify relationships between ambient levels and point source discharges, many times there are many confounding factors such as nonpoint sources, unmonitored pollutants, atmospheric sources, and sediments releasing pollutants to the water column. For example, 1-2-dichloroethane was identified in one water sample in the Grand Calumet in 1990; however, no facilities on this waterbody have loadings data that specifically include this chemical. Similarly, relatively higher levels of barium were identified in water column samples of the Grand Calumet, yet the chemical is not specifically listed in permits, so monitoring of this particular chemical effluents may not be required.

The sediments of the Grand Calumet River and Indiana Harbor Ship Canal are some of the most heavily contaminated in the Great Lakes, with elevated levels of PCBs, PAHs, metals, pesticides, and other pollutants. EPA's recent nationwide sediment contamination study found that these waterbodies are among the more highly contaminated areas in the Nation (U.S. EPA, 1997c). While contaminated sediments result from years of pollution, significant sedimentation continues to occur. The U.S. Army Corps of Engineers, EPA, and IDEM have conducted numerous studies to identify the magnitude and extent of sediment contamination and have a remedial action plan underway. While most metals are present in the Grand Calumet River and Indiana Harbor Ship Canal's sediments, the metals of greatest concern are zinc, lead, cadmium, chromium, mercury, and others, because their levels exceed guidelines. Furthermore, PCB and PAH concentrations exceeded sediment quality guidelines by 90 and 25 times, respectively (U.S. EPA, 1996c). The highest concentrations were generally found in the Indiana Harbor Ship Canal, though there are indications of decreasing levels in lead and zinc in the Grand Calumet. Sediment loadings from these waterbodies to Lake Michigan were believed to contain about 100,000 pounds of lead, 67,000 pounds of chromium, and 420 pounds of PCBs per year (U.S. ACOE, 1996).

As might be expected, elevated concentrations of many of these chemicals have been detected in fish tissue from these waterbodies. In fact, the greatest number of chemicals detected in fish tissue in the study area were from the Indiana Harbor Ship Canal and the Grand Calumet River, with 58 and 46 chemicals, respectively. Furthermore, fish tissue from these waterbodies contained the highest concentrations of numerous chemicals in the entire study area, such as PAHs, pesticides, lead, PCBs, zinc, and more than 10 other chemicals. Fish tissue from the Indiana Harbor Ship Canal had increasing concentrations of DDT, dieldren, and PCBs between 1979 and 1994 (IDEM, 1994b).

5.1.3.3 *Hazardous Wastes*

Hazardous wastes were generated by 53 facilities in 1993 in North Lake County with a total mass of 866,276,500 pounds. The largest generator, Amoco Oil - Lakefront, generated almost 82 percent of the total mass for this area. LTV Steel was the second largest generator, with 141,070,762 pounds or 16 percent of the total. Other facilities each contributed less than 1 percent of the total: U.S. Steel-Gary Works (4,926,464 pounds), Keil Chemical-Ferro Corp. (3,068,634 pounds), Inland Steel (1,895,044 pounds), Citgo Petroleum Corp. (1,306,044 pounds), and AMG Resources Corp (1,264,778 pounds). The waste codes generated in the largest amounts included 572,157,024 pounds of a mixture of 5 petroleum refining wastes (F037, K048, K049, K050, K051) from Amoco. Wastes from LTV Steel included K062 (steel finishing waste) and D002 (corrosive wastes), with a total mass of 125,560,000 pounds. A wastestream containing K048 (a petroleum refining waste) amounted to 97,524,678 pounds. These wastestreams accounted for more than 90 percent of the total mass. Remaining wastes contained more than 600 mixtures of waste codes. Two facilities in this area received hazardous wastes in 1993 for treatment, storage, disposal, recycling, or other processing, including Safety-Kleen Oil Recovery Co. (131,141,086 pounds) and Amoco Oil-Lakefront (5,144,688 pounds).

5.1.3.4 *Groundwater and Drinking Water*

Groundwater contamination in this area of Lake County includes documented concentrations of volatile organics (possibly associated with petroleum facilities), semivolatiles, pesticides, and PCBs. Highest levels of VOCs and pesticides in this area were found in areas between Lake George and the Indiana Harbor Ship Canal, including benzene as high as 1,850 μg/L which exceeded EPA's drinking water standard. Similarly, other VOCs associated with petroleum, including xylene, toluene, and ethylbenzene were detected in groundwater samples from in this area. Though certain metals were found in groundwater samples in North Lake County, their prevalence and concentrations were generally lower than those identified in Cook County. Groundwater samples in the Gary area included benzene at elevated levels and 11 semivolatile organics.

The following drinking water problems were found in North Lake County. From 1991 to 1997, there were a total of 206 violations in the drinking water systems serving Gary, East Chicago, Whiting, and Hammond (81 of the total 206 violations were reported in 1995). Drinking water suppliers in Gary reported 143 of those violations. East Chicago and Whiting had 26 violations each, and Hammond reported 11 violations. The East Chicago Water Plant, Whiting Public Water Facility, and the Hammond Water Plant draw their drinking water supply from Lake Michigan. Wright's Trailer Park #1 drinking water facility, located in Gary, and serving 250 people, was second on the list of violators in the entire study area. This facility accumulated 129 violations between 1991 and 1997, 78 of them in 1995. The 129 violations reported involved 47 contaminants, coliform, lead and copper, DBCP, dioxin, silvex, 2,4-D, and atrazine. The Whiting Water plant, which serves 5,710 people, had 26 violations between 1991 and 1997. Antimony, arsenic, barium, beryllium, cadmium, chromium, fluoride, lead and copper, mercury, nickel, selenium, and thallium had two violations each. East Chicago Water Works, which serves 39,800 people, reported 26 violations between 1991 and 1997. Twenty-six contaminants, including pesticides and PCBs, were listed as parts of their violations. The Glen View Mobile Home Park drinking water facility, located in Hammond, serves a population of 300. Eleven violations were reported between 1991 and 1997. Five of the 11 violations were due to problems with coliform, and the remaining 6 reported violations were due to lead and copper and nitrate levels.

5.1.4 Lake Michigan

Lake Michigan is part of the Great Lakes, the largest system of fresh surface water in the world. The lake is an important resource to the citizens of the Chicago area, providing transportation, recreation, aesthetic, and other benefits. It is the source of drinking water for more than 95 percent of the populations in the two counties. In general, the water quality of Lake Michigan in the study area is good; having been the recipient of more than 20 years of effort to improve its condition. However, the lake still has problems from over a century of environmental stresses.

Lake Michigan

- Multiple Uses of the Lake and Potential Human Exposures
- Historical Problems and Improved Conditions
- Direct Discharges and Other Sources
- Levels of Chemicals in Lake Michigan Waters, Sediments, and Fish Tissue
- Use as Source of Drinking Water

This subsection provides summary information on sources/loadings to Lake Michigan in the two county area as well as various measures of its condition. Included are characterizations of sources and the levels of contaminants in the water column, sediments, and fish tissue. This information is useful to residents of Cook County, IL, and Lake County, IN, who can be potentially exposed to toxic chemicals that are present in these media. Exposures to Lake Michigan's contaminants could occur from swimming/wading or consuming fish and drinking water taken from the lake.

Historical problems of the lake and associated tributaries (described earlier in this report) are more than 100 years old. Typhoid, cholera, and other epidemics occured in the late 1800s because of drinking water contamination after rainfall washed refuse out into the lake to the drinking water intake points. Concerns over sewage and industrial discharges prompted efforts in the early 1900s to reverse the flows of the Chicago and Calumet Rivers away from Lake Michigan. Construction of the Chicago Sanitary and Ship Canal and the North Shore and Cal-Sag Channels provided the means to carry polluted waters away from Lake Michigan. Still, for much of this century, the lake suffered from local- and regional-scale stresses from discharges of municipal and industrial wastes. In the last few decades, additional progress has been made in reducing these impacts. Wastewater from municipalities and many industries in Cook County are treated by Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) treatment facilities. More recently, the Tunnel and Reservoir Plan (TARP) has been implemented, which prevents sewer overflows from polluting the rivers in Cook County and Lake Michigan.

5.1.4.1 *Point Source Discharges to Lake Michigan*

Few of the approximately 86 major facilities in Cook County, IL, and Lake County, IN, directly discharge pollutants to Lake Michigan. As described earlier, considerable efforts have been made to reduce the input of wastewaters into Lake Michigan, particularly in Cook County, IL. As a result, much of the discharges go to other waterbodies (e.g., the Chicago Sanitary and Ship Canal) that flow away from the lake. However, a few facilities discharge to the lake and some discharge to rivers that indirectly flow into the lake. Of the 414 million pounds of pollutants that were discharged to water bodies in 1995 in the two counties, it is estimated that less than one percent of the mass (about 3.5-million pounds) were directly discharged to Lake Michigan (PCS, 1997). Confirmed facilities with outfalls to Lake Michigan included Amoco Oil Co.- Whiting, Praxair, NIPSCO - Dean Mitchell Station, and State Line Energy. More than 90 percent of the almost 3.5-million pounds discharged in 1995 came from Amoco, including 2,056,607 pounds of chemical oxygen demand; 411,825 pounds of total suspended solids; 365,135 pounds of total organic carbon;

and 278,689 pounds of oil and grease. Other estimated loadings from Amoco included 253 pounds of total chromium, 45 pounds of hexavalent chromium, and 184 pounds of selenium. Other facilities in the area may discharge some portion of their wastewaters directly to Lake Michigan, but the loadings cannot be confirmed due to conflicting data from different information sources. For example, some data indicate that U.S. Steel South Works may discharge wastewaters directly to the lake, while other data show their outfalls going to the Calumet River. If one were to assume that all ofU.S. Steel South Works' discharges in 1995 went directly to Lake Michigan, that would contribute another 676,276 pounds, almost all of which were total suspended solids. Adding this value to the previous total brings the estimated total direct discharges to Lake Michigan in the two county area to about 4.1-million pounds, or about 1 percent of the total loadings to all waterbodies.

In addition to the loadings coming from the few facilities that directly discharge to the lake, there are indirect wastewater loadings, particularly from facilities that line the Grand Calumet River and Indiana Harbor Ship Canal. The Grand Calumet River received almost 315 million pounds of pollutants in 1995, from three large STPs in Hammond, East Chicago, and Gary, IN, as well as industrial effluents from U.S. Steel-Gary and DuPont. This loading is larger than any other water body in the study area by an order of magnitude. Similarly, the Indiana Harbor Ship Canal received wastewater discharges amounting to about 26-million pounds from Inland Steel, American Steel, and LTV Steel. Depending on wind direction and other factors that influence flows between the lake and these waterbodies, some portion of these loadings may reach Lake Michigan.

5.1.4.2 *Other Sources of Pollution to Lake Michigan*

In addition to direct inputs to the lake from point sources, there are other sources of pollution, such as nonpoint source runoff, atmospheric deposition, sediment entrainment, and unanticipated combined sewer overflows and back ups to the lake. While there is potential for combined sewer overflows to impact Lake Michigan, this problem has been virtually eliminated in Cook County in recent years by the Tunnel and Reservoir Plan (TARP), which has been implemented to prevent sewer overflows from polluting the rivers and Lake Michigan. Historically, flows in excess of capacity were discharged untreated into adjacent water bodies, which sometimes overflowed into the lake. In the mid-1970s, the City of Chicago estimated that 45 percent of the pollutant loadings to the rivers of the area were attributable to the estimated 100 overloads per year. Bypasses to Lake Michigan at the Wilmette Pumping Station, Chicago River Controlling Works, and the O'Brien Lock and Dam occurred 12 times in the 1970s, 18 times in the 1980s, and only 3 times in the early 1990s. Data from 1996 indicated that bypasses of the locks/dams to Lake Michigan have not occurred since 1990. To a degree, CSOs no longer pose a severe threat to Lake Michigan because of the 75 miles of tunnels (of the eventual 131 miles) constructed to reduce bypasses to Lake Michigan.

Another source of pollution to Lake Michigan comes from contaminated sediments, particularly from the Indiana Harbor Canal and Grand Calumet River. It has been estimated that each year, over 180-million pounds of sediments are transported to the lake, containing 420 pounds of PCBs, 2,300 pounds of cadmium, and 110,000 pounds of lead. The IHC was last dredged in 1972; the lack of subsequent dredgings has resulted in restriction of the flow of traffic on the canal. Although it is more difficult for boat traffic to get through the canal, some boats are able to power their way through the soft sediments. This frequent churning up of sediments from both ship traffic and storm events results in the resuspension, transport, and deposition of these highly contaminated sediments, some of which settle in the lake.

Another characterized source is the result of long-range atmospheric transport and deposition of pollutants, such as PCBs. This issue has received greater attention as a source to the lake, because most of the direct sources have already been controlled. It has been estimated that about 58 percent of loadings of PCBs to Lake Michigan come from atmospheric deposition. In addition, Lake Michigan is a "net source" of PCBs to the Cook County, IL, and Lake County, IN, area due to volatilization of PCBs from the water column to the air. The rate and magnitude of volatilization from Lake Michigan to the atmosphere often exceeds the rate of deposition, depending on season and location (temperature/wind direction).

5.1.4.3 *Ambient Levels in Water, Sediment, and Fish Tissue in Lake Michigan*

Various studies have been conducted to characterize levels of chemicals in the water column, sediments, and fish tissue in Lake Michigan. Past loadings to these water bodies contaminated not only the surface water, but the associated sediments and biota. Recent improvements have been seen in water quality; however, the sediments and fish tissue do not improve as rapidly. Information on levels of contaminants in these media is useful for assessing the magnitude of potential human exposures from direct contact during swimming/wading or from consuming fish and drinking water taken from the lake. Water quality of the 63 miles of Illinois Lake Michigan shoreline has improved since the 1970s. These waters are considered to have low levels of toxics and are suitable for swimming and use as a source of drinking water. Since the inception of organochlorine monitoring in 1979, few compounds have been detected in the water column in this portion of Lake Michigan. IEPA and the City of Chicago regularly monitor these waters to ensure their suitability for public use. Their assessments have concluded that this resource was in good to excellent condition.

Cook County has a long history of beach closings due to pollution, primarily due to combined sewer overflows. The TARP has reduced this problem in recent years. Forty-five public beaches are located in Cook County and data show that bacteria (total coliform) levels have dropped from maximums of 1,200 per 100 mL during the 1970s to maximums less than 140 per 100 mL during the 1980s and early 1990s. Fecal coliform measurements from 1993 ranged from 6 to 76 per 100 mL, with the higher levels at Montrose, Jackson Park, South Shore, North Avenue, and Rainbow South locations. All locations were assessed "full support," except Jackson Park, which was "partial/minor support" due to the presence of pathogens. Thirty six of the Cook County beaches had beach closings from 1981 through 1994, ranging from 5 to 9 occasions. The beaches with the most closings (8 or more) were Tower, Lloyd, Elder and Lakefront/Maple (U.S. EPA, 1999a). The reasons for closings were either pollution (1986-1992, except 1991) or "locks open" (1981-1985 and 1991). No beach closings occurred during 1993-1994. In 1997, beach closings were mostly limited to northern Cook County, where Clark, Northwestern, Lighthouse, and Greenwood beaches were closed for 2 days in August due to open locks at the Wilmette Pumping Station (U.S. EPA, 1999b). Also, Jackson Park beach had closures through about a 10 day period in August, 1997 due to elevated bacteria levels.

Seven Lake Michigan beaches in Lake County, IN, are reported to have had closings between 1981 and 1994. Several beaches in Lake County, IN, have been closed for several years or permanently due to pollution, spills, and related causes (U.S. EPA, 1999a). The number of beach closings ranged from 4 to 13 occasions. Of these beaches, Hammond Lake Front Beach and Jerose

Park had 8 or more closing periods. Hammond Lake Front Beach has been closed permanently due to pollution. Jerose Park has also been closed permanently on two reported occasions and 5 times for entire seasons.

While the water column has shown improvements from the control efforts, the sediments are slower to respond to the reduced loadings. The presence of PCBs, chlordane, other organics, and metals (lead, zinc, and copper) are of concern in sediments, especially in harbors (including Chicago and Calumet) along the Lake Michigan shoreline. PCB contamination of fish tissue has resulted in fish consumption advisories. Illinois rated the 63 shoreline miles of Lake Michigan as "full support/threatened" for overall and aquatic life uses. The threatened rating is in place because of sport fish consumption advisories, which are the result of PCB and chlordane contamination in the Illinois portion of Lake Michigan. Fish tissue monitoring data collected over the last decade from the Illinois water of Lake Michigan showed high levels of several organochlorine pesticides such as DDT (total), Mirex, benzene hexachloride, and chlordane. The highest concentrations of these compounds were detected in fish in the Illinois waters of Lake Michigan.

The 43 miles of Indiana's Lake Michigan shoreline were assessed by IDEM in 1996 to be "fully supporting" recreational and aquatic life uses; however, these waters were only "partially supporting" for fish consumption use. All of Indiana's portion of the lake are considered to be impacted by PCBs and mercury and are under the lake-wide fish consumption advisory. As described above, the flow to the lake from the Grand Calumet River and Indiana Harbor Canal contributes to water quality, sediment, and fish tissue concerns. The majority (about one billion gallons per day) of the river's water flows into Lake Michigan via the Indiana Harbor and Ship Canal (U.S. EPA, 1999). The Grand Calumet River is known to be contaminated with PCBs, PAHs, and heavy metals, such as mercury, cadmium, chromium, and lead. In addition, there are high levels of coliform bacteria, BOD, suspended solids, oil, and grease. These contaminants originate from both point and nonpoint sources.

Sediments in the Grand Calumet River and Indiana Harbor Canal (a Great Lakes Area of Concern) are highly contaminated with PCBs and other chemicals. The channel has not been dredged in over 25 years because of restrictions on disposing of the contaminated spoils. PCB concentrations in the Indiana Harbor Canal sediments ranged from 4.55 to 102.52 ppb, with an average concentration of 59 ppb. PCB concentrations in sampling sites in Lake Michigan, located close to the shoreline, ranged from 17.69 to 494.60 ppb. The average concentration was 131 ppb. High levels of PCBs, mercury, and other contaminants in the Grand Calumet River/Indiana Harbor Canal system have resulted in a Group 5 fish consumption advisory. This is the highest level of fish advisory, and is defined as no consumption (do not eat) for all persons. This river system is considered to have the most contaminated fish in the State of Indiana with 95 percent of the fish tissue samples exceeding the FDA action level. In fact, all 1994 fish tissue samples from the IHSC had PCB concentrations that exceeded 2.0 ppm (total).

5.1.4.4 *Drinking Water Sources*

Lake Michigan is the primary source of drinking water for the local populations, providing 98 percent of the supply to Cook County, IL, and 96 percent of Lake County, IN. In Cook County, most drinking water is supplied from the Jardine and the South Water Purification Plants, which serve more than 5 million people in Chicago and the Illinois suburbs. These two plants are the largest drinking water purification plants in the world and collectively they can supply 2.5 billion gallons of water per day. The intakes points for these plants are located two to three miles offshore in Lake Michigan. Currently, all 63 shore miles of Lake Michigan in the State of Illinois are rated as having "good" overall water quality and support drinking water uses. As mentioned above, water quality measurements have rarely detected chemicals in the water column in areas near the drinking water intakes for Cook County's supplies.

Lake County, IN, also relies on Lake Michigan as the major source for drinking water. Three public water intakes are approximately 3 miles into the lake, but are close to contaminated sediments that have been transported into the lake from the Indiana Harbor. The continued movement of these sediments into the lake may pose a potential future risk to drinking water supplies. Surface water samples were taken in the early 90s from the intake points for four of Indiana's drinking water systems (East Chicago Water Plant, Whiting Public Water, Hammond Water Plant, and Gary West Plant). Chromium was the only contaminant that exceeded drinking water standards; however, the average value was below this level. Lead was detected at levels of potential concern.

5.2 MULTIMEDIA CHEMICAL PROFILES

This subsection provides multimedia profiles of specific chemicals and groups of chemicals released from facilities in Cook County, IL, and Lake County, IN. This subsection reorganizes data presented earlier in Sections 3 and 4, and summarizes total loadings of select chemicals to all media (air emissions, water discharges, and hazardous waste generation, and toxic chemical releases and transfers.) Included is in-depth analysis of the multimedia loadings of chemicals such as lead, VOCs, PCBs, mercury, PAHs, and the group of chemicals known as endocrine disruptors. In addition to the information on their loadings, data are also provided on the presence of these chemicals in ambient media as identified by monitoring programs (more detailed information on ambient levels and the data sources are presented in Section 4).

Multimedia Chemical Profiles

- Multimedia Loadings of Select Chemicals - Lead, VOCs, PCBs, Mercury, PAHs, and Endocrine Disruptors
- Air Emissions, Water Discharges, Hazardous Waste Generation, and Toxic Chemical Releases and Transfers
- Three Levels of Estimates for Multimedia Loadings
- Ambient Levels of Select Chemicals

For these high-profile chemicals, estimates are provided on loadings to all media in the two-county area. These loadings data were extracted from the following data bases.

- AFS - point source air emissions;
- RAPIDS - air emissions of toxic chemicals from point and area sources;
- BRS - hazardous wastes generated and received;

- PCS - discharges to surface waters; and
- TRI - toxic chemical releases and transfers.

(See Sections 1 and 3 for additional information on these data bases.)

Uncertainties in Multimedia Chemical Loadings Estimates

- Multiple "Forms" of Chemicals
- Lack of Chemical-Specific Data for Hazardous Wastes
- Overlap in Data Bases
- Potential for Double Counting

As introduced earlier in this section, uncertainties exist in estimating multimedia loadings of particular chemicals or groups of chemicals, mostly resulting from the limitations of the data sources. Some of the uncertainties associated with these estimates result from the different reporting requirements of these data systems and the lack of uniformity among the data systems on reporting of chemical information. In addition, the potential exists for double counting because of different "forms" of the same chemical, as well as overlap among systems. Three types of estimates of total loadings are included for the multimedia chemical profiles, recognizing that the number of uncertainties and the potential for double counting of individual chemicals is more prevalent here than in the analyses presented earlier. These three estimates span a range from low to high, based on including different data sets in the estimates for each chemical or group of chemicals:

- Low Estimate - includes loadings from AFS, RAPIDS, PCS, and TRI releases;
- Medium Estimate - adds BRS wastes received and TRI transfers to the above estimate; and
- High Estimate - adds BRS generated to the above estimate.

The confidence in the low estimate is greater than the high estimate for reasons explained above about determining chemical content of hazardous wastes as well as for potential double counting due to overlap in these systems.

Described below are multimedia loadings estimates for select chemicals of interest: lead, VOCs, PCBs, mercury, PAHs, and endocrine disruptors. Summaries of the three estimates for each chemical/group are presented in Table 5-14. Brief descriptions of each chemical (or group) are provided on typical uses of the chemicals, potential modes of release, ways people might become exposed, and possible health effects. These summaries are by no means comprehensive, and interested readers might want to consult other documents (such as the ATSDR Toxicological Profiles) for additional information on these chemicals.

5.2.1 Lead

Lead is a naturally occurring metal found in all parts of our environment, but most of it comes from human activities like mining, burning of fossil fuels, batteries, metal products (solder and pipes), and other uses. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. Exposure to lead may occur mostly from breathing workplace air or dust (lead smelting, foundries, and manufacturing industries); eating lead-based paint chips; drinking water that comes from lead pipes or lead soldered fittings; and breathing or ingesting contaminated soil, dust, air, or water. Lead is of great concern, especially for children who are susceptible to lead's effects on central nervous system, kidneys, and the immune systems, which may result in learning deficiencies and other deleterious effects (ATSDR, 1998).

Estimates of total lead loadings in Cook County, IL, and Lake County, IN, range from 2,835,415 to 572,092,157 pounds per year. Lead is included in loadings data from all media, in 8 different forms, with contributing amounts in AFS (2,235,812 pounds), RAPIDS (142,260 pounds), PCS (56,094 pounds), and TRI releases (301,250 pounds). Wastes generated that contain lead (including D008 and U144) total 565,727,570 pounds. Table 5-15 and Figure 5-13 present summaries of loadings of lead to the environment. These totals represent several different forms of

Table 5-14. Estimates of Multimedia Loadings of Select Chemicals/Groups of Chemicals

	Range of Loadings Estimates		
Chemical/Group	**Low (pounds/yr)**	**Medium (pounds/yr)**	**High (pounds/yr)**
Lead	2,835,415	310,464,594	572,092,157
VOCs	197,369,837	692,261,931	754,579,973
PCBs	2	3	3
Mercury	4,304	4,857,466	6,485,336
PAHs	106,231	192,680	515,998
Endocrine Disruptors	3,223,098	322,328,490	1,466,217,318

Table 5-15. Multimedia Loadings of Lead

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
Lead										
Lead	2,335,812	142,260				7,791	1,704,511	2,485,862	4,190,373	4,190,373
Lead compounds						293,459	1,824,661	293,459	2,118,120	2,118,120
Lead total recoverable					3,274			3,274	3,274	3,274
Lead, Total (as Pb)					52,820			52,820	52,820	52,820
D008			305,986,112	259,232,522				0	259,232,522	565,218,634
U144			505,800	3,136				0	3,136	508,936
Total	2,335,812	142,260	306,491,912	259,235,658	56,094	301,250	3,529,172	2,835,415	310,464,594	572,092,157

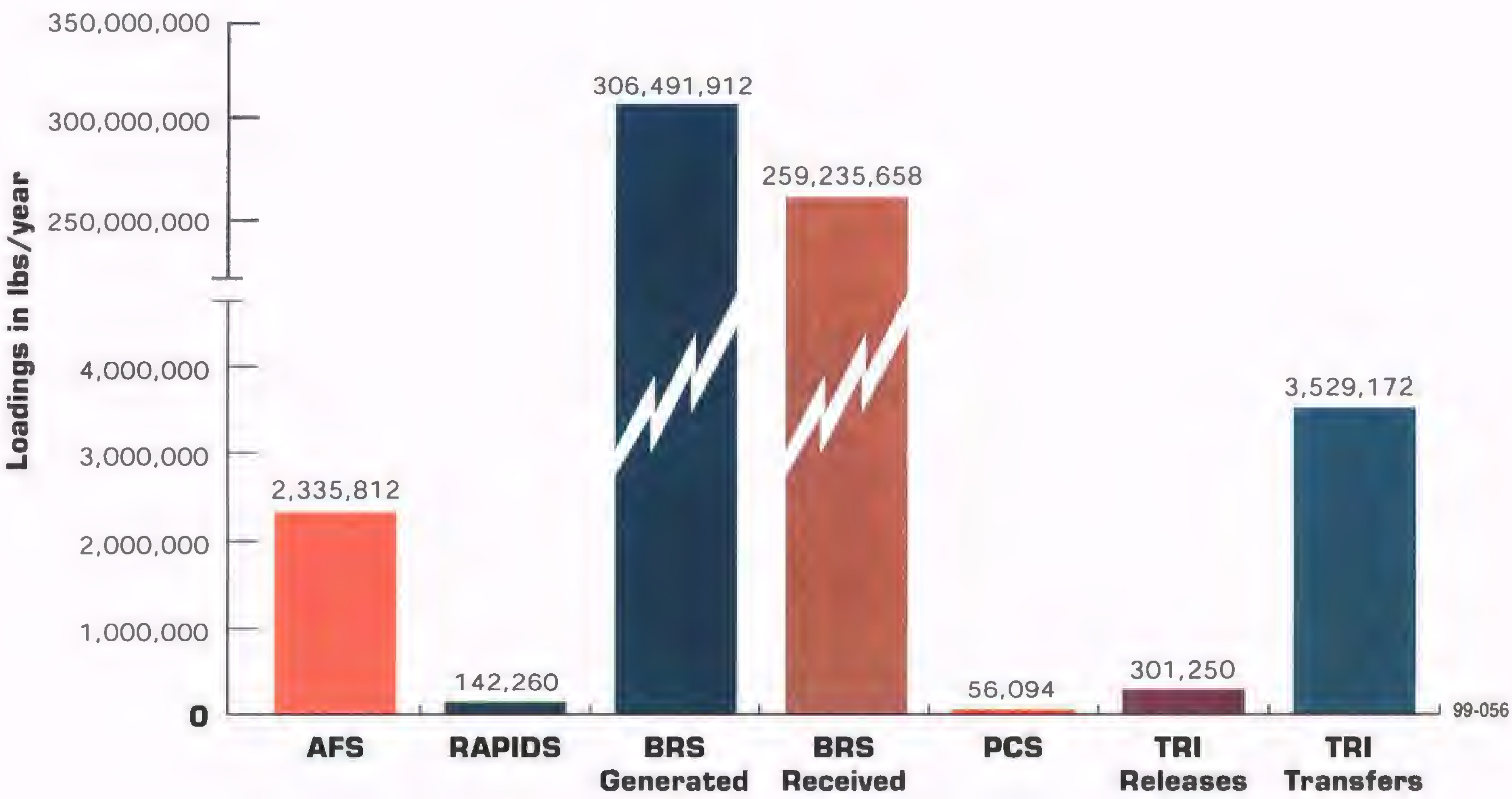


Figure 5-13. Multimedia Loadings for Lead

the parent chemical and could be an over or underestimate of actual loadings because of the nature of the data reported in the data bases.

As presented in Section 4, lead has been identified in almost all media, including air, water, sediments, fish, soil, groundwater, and human tissue. In recent years, the highest ambient air lead levels have generally been monitored in Southeast Chicago near the Horsehead Resource Development Co. In 1995, the average lead concentrations from 10 sites across Cook County were 0.123 micrograms per cubic meter ($\mu g/m^3$), with a maximum of 0.59 $\mu g/m^3$ at the Horsehead 2 monitoring site. The highest water column concentrations detected were 11 $\mu g/L$ of dissolved lead at Calumet Harbor (near the confined disposal facility) and 400 $\mu g/L$ total lead at Wolf Lake site 3. Lead was found at elevated levels in sediments throughout the study area, with maximums of 322 milligrams per gram (mg/kg) of lead at Garfield Park Lagoon and 108 $\mu g/g$ of suspended lead in the Des Plaines River at Riverside, IL. The highest lead level detected in fish tissue was 8.9 mg/kg in 1987 in the Grand Calumet River in Lake County. Groundwater levels of lead were generally highest in Southeast Chicago near Lake Calumet and were found above EPA's 15 $\mu g/L$ drinking water action level. Limited data on soil levels in Southeast Chicago detected lead at concentrations as high as 576 ppm and, in the Austin neighborhood, as high as 1,850 ppm. Additional data on ambient levels of lead, especially for children's blood levels, can be found in Section 4.

5.2.2 Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) are prime ingredients of ground level ozone, or smog. Ozone is formed when nitrogen oxides (NO_x), and VOCs react with oxygen in the air in the presence of strong sunlight when temperatures are higher during summer. These compounds, known as ozone precursors, are often emitted from automobiles and other vehicles, from power plants, use of cleaning solvents, and other sources. When inhaled, ozone can damage the lungs and can cause chest pain, coughing, nausea, throat irritation, and congestion. It may also worsen bronchitis, heart disease, emphysema, and asthma (U.S. EPA, 1996a).

This subsection summarizes information on sources of VOCs and ambient ozone levels in the two-county area. Table 5-16 presents a summary of loading of VOCs to the environment.

Table 5-16. Multimedia Loadings of VOCs

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
VOCs										
1,1-Dichloroethane					1			1	1	1
U076			4,448,474					0	0	4,448,474
1,1-Dichloroethene					1			1	1	1
D029			49,404	14,804,292				0	14,804,292	14,853,696
U078			8,800					0	0	8,800
1,1,1-Trichloroethane		3,050,406			1	85,096	101,036	3,135,503	3,236,539	3,236,539
U226			154,618	26,976				0	26,976	181,594
1,1,2-Trichloroethane					1			1	1	1
U227			65,424					0	0	65,424
1,2-Dichlorobenzene					1			1	1	1
U070			4,513,612	1,416				0	1,416	4,515,028
1,2-Dichloroethane		964,680			1	35,320	14,404	1,000,001	1,014,405	1,014,405
D028			1,309,028	7,823,548				0	7,823,548	9,132,576
U077			350	14,368				0	14,368	14,718
1,2-Dichloroethene (total)					1			1	1	1
1,2-Dichloropropane					1			1	1	1
1,2,4-Trichlorobenzene					1			1	1	1
1,2,4-Trimethylbenzene						166,063	197,849	166,063	363,912	363,912
1,3-Dichlorobenzene					1			1	1	1
1,4-Dichlorobenzene					1			1	1	1
D027			649,348	2,288,222				0	2,288,222	2,937,570
U072			4,448,474	328				0	328	4,448,802
1,4 Dioxane						275		275	275	275
Acetone			1,674,502	656,542				0	656,542	2,331,044
Acetonitrile						1	1	1	2	2
U003			16,544	1,882				0	1,882	18,426
Acrylonitrile					1	177	1	178	179	179
Allyl alcohol						51	1	51	52	52
P005			20	348				0	348	368

Table 5-16. Multimedia Loadings of VOCs (cont.)

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
Benzene					1,755	157,937	12,551	159,692	172,243	172,243
D018			27,112,616	218,390,146				0	218,390,146	245,502,762
U019			35,856	21,144				0	21,144	57,000
Benzyl chloride (α-chlorotoluene)						317	1	317	318	318
P028			548	2,350				0	2,350	2,898
Bromoacetone			44					0	0	44
Carbon disulfide						1,536,405	167,000	1,536,405	1,703,405	1,703,405
P022			216,314	438				0	438	216,752
Carbon tetrachloride		2,000			1	5	4	2,006	2,010	2,010
D019			152,972	3,639,748				0	3,639,748	3,792,720
CFCs	6,176,693							6,176,693	6,176,693	6,176,693
Chlorobenzene					1			1	1	1
D021			191,148	1,497,870				0	1,497,870	1,689,018
U037				270				0	270	270
Chloroethane					1			1	1	1
Chloroform					1			1	1	1
U044			4,449,348	28,796				0	28,796	4,478,144
Chloromethane					1	373,000	1	373,001	373,002	373,002
Dichlorodifluoromethane						1	1	1	2	2
Epichlorohydrin						1,579	421	1,579	2,000	2,000
Ethyl benzene		304,595			15	130,014	680,960	434,624	1,115,584	1,115,584
Ethylene oxide						10,483	21,000	10,483	31,483	31,483
Hexachlorobutadiene					1			1	1	1
m-Xylene					1	10,879	26,834	10,880	37,714	37,714
Methyl methacrylate						3,457	1,269	3,457	4,726	4,726
Methylene chloride	860,706	1,706,170			1			2,566,877	2,566,877	2,566,877
U080			10,430	22,132				0	22,132	32,562
Naphthalene		366,855			149	239,239	138,149	606,243	744,392	744,392
U165			228,642	85,558				0	85,558	314,200
o-Xylene					1	9,777	750	9,778	10,528	10,528

Table 5-16. Multimedia Loadings of VOCs (cont.)

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
p-Xylene (total)					1			1	1	1
U239			124,040	65,378				0	65,378	189,418
Pyridine						30	1	30	31	31
U196			32	23,454				0	23,454	23,486
Styrene						145,999	131,407	145,999	277,406	277,406
Tetrachloroethene					38	138,173	131,955	138,211	270,166	270,166
D040			970,574	9,721,304				0	9,721,304	10,691,878
U210			74,524	4,208				0	4,208	78,732
Toluene					1	1,831,072	2,816,522	1,831,073	4,647,595	4,647,595
U220			1,362,402	251,164				0	251,164	1,613,566
Trichloroethylene	191,662	2,114,551			1	1,810,434	803,684	4,116,648	4,920,332	4,920,332
D039			9,816,194	213,761,598				0	213,761,598	223,577,792
U228			205,986	15,713,482				0	15,713,482	15,919,468
Trichlorofluoromethane			2,904	1,596				0	1,596	4,500
Unspecified VOCs	174,932,862							174,932,862	174,932,862	174,932,862
Vinyl acetate						10,891	44,084	10,891	54,975	54,975
Vinyl chloride					1			1	1	1
D043			24,870	753,650				0	753,650	778,520
Total	182,161,923	8,509,257	62,318,042	489,602,208	1,982	6,696,675	5,289,886	197,369,837	692,261,931	754,579,973

Multimedia loadings of VOCs in Cook County, IL, and Lake County, IN, are estimated to range from 197,369,837 to 754,579,973 pounds per year. These estimates are based on data on about 100 individual VOC chemicals, data on unspecified VOC emissions, and other materials such as hazardous wastes that contain these chemicals. The contributions to the totals from the different media/data bases are: 182,161,923 pounds for AFS emissions; 8,509,257 pounds for RAPIDS emissions; 1,982 pounds of water discharges from PCS; 6,696,675 pounds of TRI releases; and 5,289,886 pounds of TRI transfers. Hazardous wastes containing VOC chemicals included 62,318,042 pounds generated and 489,602,208 pounds received in 1993. The VOC chemicals with the largest multimedia loadings included trichloroethylene (from 4,116,648 to more than 240-million pounds), benzene (from 159,692 to more than 245-million pounds), unspecified CFCs (6,176,693 pounds), methylene chloride (from 2,566,877 to 2,599,439 pounds), unspecified VOCs (174,932,862 pounds), 1,1,1-trichloroethane (from 3,135,503 to 3,418,133 pounds), 1,2-dichloroethane (from 1,000,001 to 10,161,699 pounds), carbon disulfide (from 1,536,405 to 1,920,157 pounds), and toluene (from 1,831,073 to 6,261,161 pounds).

VOCs are often identified in ambient media at detectable concentrations from monitoring programs. In addition, ozone levels in air are often a result of regional emissions from point, area, and mobile sources of VOCs (and nitrogen oxides). Some individual VOCs detected in ambient air by various monitoring programs included toluene (maximum concentration of 106 parts per billion [ppb] in Chicago), benzene (maximum concentration of 160 ppb in Gary), formaldehyde (mean concentration of 9.6 ppb), ethylene (13.4 ppb), and many other VOCs (U.S. EPA, 1996b). More extensive VOC monitoring data are presented in Section 4.1.7 of the Environmental Loadings Profile.

VOCs, because their tendency to volatilize to the air, are not regularly found in water column, sediment, and fish tissue samples at detectable concentrations. However, they are occasionally found in these media. For example, 1,2-dichloroethane was detected in the water column in the Grand Calumet River/Indiana Harbor Ship Canal at a maximum concentration of 40,500 μg/L. Other VOCs detected in waterbodies in the area included bromoform at 2.8 μg/L and methylene chloride at 19 μg/L in the Grand Calumet River, in 1990 and 1992, respectively. Water column samples from the Cal-Sag Channel contained maximum levels of VOCs such as methylene chloride (4 μg/L) tetrachloroethylene (4 μg/L); 1,1,1-trichloroethane (2 μg/L); and 1,2-dichloroethane (2 μg/L). The Chicago River had some of the highest concentrations of VOCs in the water column including tetrachloroethylene (maximum of 404 μg/L), trichloroethylene (546 μg/L), chloroform (52 μg/L), and several other VOC. Focused sampling in waterbodies in Southeast Chicago in 1983 detected several VOCs, including 1,2-dichloroethane (maximum of 16 μg/L); chlorobenzene (3.5 μg/L), chloroform (30 μg/L), carbon tetrachloride (0.7 μg/L); and 1,1-dichloroethene (0.5 μg/L). Wolf Lake Channel had a maximum of 16 μg/L of methylene chloride in 1991-92.

Limited data exist on the presence of VOCs in sediments. Focused sampling in areas around Lake Calumet in 1983 identified chloroethane (480 μg/kg); 1,1-dichloroethane (38 μg/kg); 1,1,1-trichloroethane; and toluene (9.0 μg/kg) in sediments on the east side of Lake Calumet. Other monitoring efforts detected maximum concentrations of VOCs in sediments in the Grand Calumet River and Indiana Harbor Ship Canal, including dichlorophenol (3.3 μg/g), dimethylphenol (3.2 μg/g), and several other VOCs such as p-chlorotoluene, ethylbenzene, and p-dichlorobenzene at concentrations ranging from 2 to 20 μg/g (Hoke et al., 1993).

Certain VOCs were detected in fish tissue samples from waterbodies in the area, including: 1,1,1-trichloroethane at a maximum of 0.022 mg/kg in Wolf Lake; 2-butanone at a maximum concentration of 0.41 mg/kg in Wolf Lake; benzene at a maximum of 0.12 mg/kg in the Grand Calumet River; carbon disulfide at a maximum of 0.068 mg/kg in Wolf Lake; ethylbenzene at a maximum of 0.064 mg/kg in the Indiana Harbor Ship Canal; tetrachlorethylene at a maximum of 0.099 mg/kg in Lake George; toluene at a maximum of 0.037 mg/kg in the Grand Calumet River, and total xylenes at a maximum of 0.25 mg/kg in Indiana Harbor Ship Canal.

VOCs were identified in 20 of the 128 wells sampled in this region as part of a groundwater study conducted by USGS and EPA in 1993 (DuWelius et al., 1996). Eighteen of the 20 wells with detectable concentrations of VOCs were located in areas with industrial operations, waste disposal, or fill material. Compounds most frequently detected included solvents and degreasers used in industrial and manufacturing processes. Many of the chemicals detected in groundwater can be associated with petroleum refining and coking operations, such as benzene, ethylbenzene, toluene, and xylenes (BTEX). Several VOCs were identified at levels exceeding drinking water standards, including maximums for benzene (9,900 μg/L), 1,1-dichloroethylene (66 μg/L), and vinyl chloride (10,000 μg/L). Other VOCs detected included maximums for acetone (37 μg/L), chloroform (5 μg/L); 1,1-dichloroethane (7 μg/L); 1,2-dichloroethene (42,000 μg/L); ethylbenzene (330 μg/L); 2-hexanone (7 μg/L); methyl isobutyl ketone (4 μg/L); styrene (5μg/L); toluene (600 μg/L); and xylenes (400 μg/L). The high concentrations of vinyl chloride and 1,2-dichloroethene were identified in groundwater near the entrance to a landfill in Southeast Chicago near Lake Calumet and may be the result of spillage or leakage from transports, or possibly illegal dumping (DuWelius et al., 1996).

5.2.3 Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a group of manufactured organic chemicals that contain 209 individual chlorinated chemicals. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment; however, the manufacture of PCBs was banned in the United States in 1977 because of evidence that they build up in the environment and cause harmful effects to human heath and wildlife. Despite decreasing use of PCBs, they remain in the environment for years, often concentrating in sediments and fish tissue. They can be released into the environment from hazardous waste sites that contain PCBs; illegal or improper dumping of PCB wastes; and leaks from electrical transformers containing PCBs. Human exposure can occur by eating food, including fish, meat and dairy products containing PCBs; breathing air near hazardous waste sites that contain PCBs; drinking PCB-contaminated well water; and repairing or maintaining PCB transformers. PCB inhalation and ingestion may cause liver, kidney, stomach, thyroid gland, and skin damage, and certain PCB compounds/mixtures may be carcinogens (ATSDR, 1998).

Only 3 pounds of PCBs were estimated in loadings to the environment in Cook County, IL, and Lake County, IN. Less than 1 pound was estimated (0.69 pounds) in air emissions from sources inventoried for RAPIDS. Two additional pounds of PCBs were included in TRI releases and transfers in 1995. No hazardous waste codes were identified that directly indicated the presence of PCBs. PCBs are present in environmental media such as air, surface water, sediments, fish tissue, and others as a result from years of accumulation in ambient media from their previous use. In particular, PCBs are commonly detected at levels of concern in sediments and fish tissue. Current loadings of PCBs are mostly atmospheric deposition from long-range transport. Recent measures to reduce the use and release of PCBs into the environment have been successful; however, they are still detected because of their persistence in the environment.

Limited PCB air monitoring has been conducted in the Chicago area at the sites in central Chicago and offshore in Lake Michigan. The average total PCBs measured in central Chicago were 2,139 picograms per cubic meter (pg/m^3) and 808 pg/m^3 in Lake Michigan. PCBs, because of other physical/chemical properties, tend to accumulate in sediments (and fish) and are rarely found in the water column at detectable concentrations. One sample from Wolf Lake (Site #3) had 2.0 μg/L total PCBs, and a maximum concentration of 0.27 μg/L of PCB-1248 was detected in the water column in the primary setting basin of the confined disposal facility near Calumet Harbor. PCBs are of major concern in sediments in much of the area, particularly in the Grand Calumet River and Indiana Harbor Ship Canal. An estimated 420 pounds of PCBs are annually deposited in Lake Michigan from sediments transported out of the Grand Calumet River and Indiana Harbor Ship Canal. Because of high levels of PCBs (and other contaminants) fish consumption warnings and bans have been issued for these waterbodies and for Lake Michigan. Detected total PCB levels in sediments of these waterbodies are as high as 102.3 mg/kg (ppm). PCBs have been detected in sediments at lower concentrations, 4,000 μg/kg (ppb) in Wolf Lake and 600 μg/kg in Salt Creek. (Extensive data and discussion on PCB levels in sediments are presented in Section 4.3 of this document.)

PCBs were one of the most frequently detected organic compounds in fish tissue samples from this area, with 29 samples exceeding the FDA action level for these compounds. The highest concentration, 27 ppm, was detected in the Grand Calumet River in 1994. The mean detected PCB level in the study area was 1.76 ppm. Only three wells in the study area yielded detectable concentrations of PCBs, though two of the samples exceeded EPA's drinking water standard of 0.5 μg/L for total PCBs. The largest concentration, 0.99 μg/L for total PCBs was found north of the Grand Calumet River near steel industry. One other sample contained total PCBs at 0.17 μg/L; this sample was found near Lake Calumet in areas with filled land and waste disposal activities (DuWelius, 1996).

5.2.4 Mercury

Mercury is a naturally occurring metal used to produce chlorine gas and caustic soda and also in thermometers, dental fillings, and batteries. Mercury can be found in the environment in several forms, including methyl mercury. Exposure may occur from eating fish or shellfish contaminated with methyl mercury; breathing vapors in air from incinerators and industries that burn mercury-containing fuels and other sources. Exposure to high levels of inorganic mercury salts can cause kidney damage, nervous system effects, nausea, and diarrhea. Exposure to methyl mercury is more dangerous for young children than for adults, because more of it passes into children's brains where it interferes with normal development (ATSDR, 1998).

Estimates of mercury loadings in the two-county area range from 4,304 to 6,485,336 pounds per year. Mercury loadings include five different forms of the chemical measured in air emissions, water discharges, and hazardous wastes generated and received, with contributing amounts in AFS (35 pounds), RAPIDS (4,274 pounds), and PCS (28 pounds). Major sources of mercury in this area are NIPSCO-Dean H. Mitchell Station (30 pounds in AFS and 404 pounds in RAPIDS), Inland Steel (4 pounds in AFS and 240 pounds in RAPIDS), East Chicago Sanitary District (220 pounds in RAPIDS) and U.S. Steel-South Works (87 pounds in RAPIDS). Two waste codes, D009 and U151, containing mercury were generated and received in 1993 in amounts of 1,627,614 and 4,852,962 pounds, respectively.

Mercury has been detected in ambient media including air, surface waters, sediments, fish, soil, and other media in Cook County, IL, and Lake County, IN. Though mercury is not routinely monitored in ambient air, it is a chemical of increasing concern emitted from incinerators, power plants, and other sources. Air monitoring conducted in 1991 in central Chicago and offshore in Lake Michigan detected vapor-phase mercury (Keeler, 1994a). The average concentration of 58 samples at the central Chicago site was 8.7 nanograms per cubic meter (ng/m^3) (0.0087 μg/m^3), with a maximum of 62.7 ng/m^3. The average concentration from 25 offshore samples was 2.3 ng/m^3, with a maximum of 4.9 ng/m^3. Detected levels of mercury in surface waters in the area include concentrations as high as 3.1 μg/L (dissolved mercury) and 1.1 μg/L (total mercury) near the confined disposal facility near Calumet Harbor and 0.3 μg/L (total mercury) in the Grand Calumet

River. Sediment levels of mercury included maximums of 6.2 mg/kg at Axehead Site #1, 2.2 mg/kg in the Grand Calumet River/Indiana Harbor Ship Canal, and 1 mg/kg in Wolf Lake. Mercury was one of the most commonly detected contaminants in fish tissue, with the highest concentrations detected in Sherman Park Lagoon (1.4 mg/kg) between 1988 and 1990 and 0.47 mg/kg in Marquette Park Lagoon in 1990. The highest mercury levels detected in fish tissue exceeded the FDA action level. Soil levels of mercury detected in Southeast Chicago were as high as 0.29 ppm, and mercury was detected in 69 groundwater samples at concentrations ranging from 0.1 to 1.1 μg/L, though none of the levels exceeded drinking water standards.

5.2.5 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture of these compounds, such as soot, coal tar, crude oil, creosote, and roofing tar. Exposure to PAHs may occur by breathing air contaminated by fires, coal tar/asphalt production plants, coking operations at steel mills, smokehouses, municipal trash incineration, cigarette smoke, vehicle exhausts, and many others. PAHs can cause harmful effects on the skin, body fluids, and the ability to fight disease after both short- and long-term exposure. Some PAHs are believed to cause cancer (ATSDR, 1998).

This subsection summarizes information on sources of PAHs and ambient levels in the two county area. Multimedia loadings of PAHs ranged from 106,231 to 515,998 pounds per year, with the majority of the mass accounted for by hazardous wastes. Estimates of loadings of PAHs include 32,322 pounds in RAPIDS; 170 pounds in PCS; 73,739 pounds TRI releases; and 891 pounds TRI transfers. About 323,318 pounds of hazardous wastes were generated, and 85,558 pounds were received that contain PAHs. The individual PAH chemicals with the largest TRI loadings included anthracene, with 54,299 pounds released and 890 pounds transferred, and phenanthrene with 19,440 pounds released in 1995 based on TRI. Air emissions of PAH compounds in RAPIDS were estimated at 9,607 pounds of benzo(a)pyrene, 418 pounds of chrysene, 391 pounds of fluoranthene, 38 pounds of benzo(a)anthracene, and 21,868 pounds of unspecified PAHs. The majority of the mass of hazardous wastes containing PAHs were 228,642 pounds of napthalene wastes (U165).

PAHs have been identified in various media in Cook County, IL, and Lake County, IL; however, because of their physical-chemical properties as semivolatiles, they have a tendency to be found in bottom sediments of waterbodies, fish tissue, and groundwater. In fact, limited data indicate the presence of these compounds in ambient air and the water column. Twenty PAHs were monitored in ambient air in central Chicago and offshore in Lake Michigan in 1991 (Keeler, 1994a). Phenanthrene and napthalene were found in central Chicago, with average concentrations of 0.168 and 0.507 $\mu g/m^3$, respectively. Napthalene also had the highest maximum concentration of 0.806 $\mu g/L$ in central Chicago. Offshore average concentration of napthalene was 0.119 $\mu g/m^3$, while all other PAHs had averages of less than 0.1 $\mu g/m^3$. Maximum concentrations of other PAHs in central Chicago and offshore included: acenapthene (0.133 and 0.081 $\mu g/m^3$), fluorene (0.132 and 0.016 $\mu g/m^3$), and fluoranthene (0.110 and 0.088 $\mu g/m^3$). More detailed information on this study can be found in Section 4.1.7 of this report.

No PAHs were specifically identified in water column data from STORET for the years 1990 to 1995, though these compounds were found frequently at high levels in sediments of waterbodies in this area. The highest concentrations were generally in the Grand Calumet River and Indiana Harbor Ship Canal. Maximum concentrations of select PAHs in these waterbodies included napthalene (2,033 $\mu g/g$), pyrene (3,300 $\mu g/g$), phenanthrene (207 $\mu g/g$), fluoranthene (160 $\mu g/g$), and others (U.S. EPA, 1991a). Several PAHs, including pyrene, athracene, and phenanthrene, were identified at concentrations that exceeded sediment quality guidelines. More recent monitoring results, from studies conducted in 1989 and 1990, reported the presence of PAHs in the Indiana Harbor Ship Canal at concentrations several orders of magnitude above sediment quality guidelines (U.S. EPA, 1996a). Maximums for select PAHs included anthracene (300,000 $\mu g/g$), benzo(a)anthracene (39,000 $\mu g/g$), benzo(a)pyrene (41,000 $\mu g/g$), fluoranthene (120,000 $\mu g/g$), fluorene (61,000 $\mu g/g$), and napthalene (24,000 $\mu g/g$). Total PAH concentrations ranged from 67,971 to 941,340 $\mu g/g$, considerably higher than applicable sediment quality guidelines for total PAHs which range from 4,022 to 10,000 $\mu g/g$ (U.S. EPA, 1996d).

Several PAHs were also identified in fish tissue samples collected from waterbodies in Cook County, IL, and Lake County, IN. Most of the maximum concentrations of these chemicals were found in fish sampled from the Indiana Harbor Ship Canal. Specifically, the maximum concentrations for the following PAHs were detected in this waterbody: anthracene (0.059 mg/kg), fluoranthene (0.21 mg/kg), fluorene (1.41 mg/kg), phenanthrene (0.76 mg/kg), and pyrene (0.16 mg/kg). Maximum concentrations of other PAHs from other waterbodies in the study area include acenapthene at 4.3 mg/kg from the Grand Calumet and acenapthylene at 2.8 mg/kg in the Kankakee River.

Some of the most frequently detected compounds in groundwater in this area were PAHs, specifically phenanthrene and napthalene (DuWelius et al., 1996). Most of the PAHs were found in groundwater in areas with industrial activity and waste disposal sites. Napthalene was detected in 7 wells, with a maximum concentration of 12 μg/L. Phenanthrene was found in 8 wells, with a maximum of 14 μg/L. Several other PAHs were detected in groundwater, including fluorene (maximum concentration 2 μg/L), fluoranthene (2 μg/L), and benzo(a)fluoranthene at 0.5 μg/L which exceeded EPA's proposed drinking water standard of 0.2 μg/L for this chemical.

5.2.6 Endocrine Disruptors

Endocrine disruptor chemicals (EDCs) are a group of chemicals that are believed to cause adverse heath effects in humans and wildlife. EDCs include organochlorine pesticides such as DDT, industrial chemicals such as PCBs, drugs, and contaminants such as dioxins (CENR, 1996). The concern is that these chemicals, even at extremely low concentrations, can act as "hormone imposters" and exert effects such as mimicking or interfering with hormones (IEPA, 1997b). Adverse biological effects that may be associated with exposures to EDCs include cancer, reproductive and developmental alterations, amd neurological and immunological effects. Because of the growing concern about the presence of these chemicals in the environment, government agencies have initiated research programs to address potential risks posed by this group of chemicals.

This subsection summarizes information on sources of EDCs and ambient levels in the two-county area. Loadings of endocrine disruptors in Cook County, IL, and Lake County, IN, are estimated to range from about 3,223,098 to 1,466,217,318 pounds per year. Table 5-17 summarizes the loadings of endocrine disruptors. This estimate includes data on 26 of the 74 chemicals listed by IEPA as endocrine disruptors (IEPA, 1997b). For many of the endocrine disruptors, no data were

Table 5-17. Multimedia Loadings of Endocrine Disruptor Chemicals

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
Endocrine Disruptor Chemicals										
2,4-D						35	226	35	261	261
D016			91,582	618				0	618	92,200
U240			826	6,748				0	6,748	7,574
2,4-Dichlorophenol			300					0	0	300
2,4,5-T			456					0	0	456
Aldrin			8					0	0	8
Amitrole (Aminotriazole)				1,038				0	1,038	1,038
Cadmium	895	115,812			1,803	6,660	365,038	125,170	490,208	490,208
D006			830,877,078	35,467,974				0	35,467,974	866,345,052
Chlordane		816						816	816	816
D020				771,608				0	771,608	771,608
U036			602					0	0	602
DDD			74					0	0	74
DDT				25,700				0	25,700	25,700
Di-n-butyl Phthalate						1,701	3,737	1,701	5,438	5,438
U069			42	209,540				0	209,540	209,582
Diethylstilbestrol (DES)				180				0.00	0.00	180.00
Dioxins (2,3,7,8-)		0 08						0.08	0 08	0.08
Di(2-Ethylhexyl)Phthalate						3,422	99,229	3,422	102,651	102,651
U028			4,152,584	163,770				0	163,770	4,316,354
Furans (2,3,7,8-)		1						1	1	1
U213				4,190				0	4,190	4,190
Heptachlor			188					0	0	188
Hexachlorobenzene					1			1	1	1
D032			32,692	711,074				0	711,074	743,766
Lead	2,335,812	142,260	306,491,912	259,235,658	56,094	301,250	3,529,172	2,835,416	265,600,246	572,092,158

Table 5-17. Multimedia Loadings of Endocrine Disruptor Chemicals (cont.)

Chemical	AFS (lb/yr)	RAPIDS (lb/yr)	BRS Generated (lb/yr)	BRS Received (lb/yr)	PCS (lb/yr)	TRI Releases (lb/yr)	TRI Transfers (lb/yr)	Low Total (lb/yr)	Medium Total (lb/yr)	High Total (lb/yr)
Lindane			227,836	62,832				0	62,832	290,668
U129			60,308					0	0	60,308
Mercury	35	4,241	1,627,870	4,853,162	28	0	0	4,304	4,857,466	6,485,336
D014			160	6,748						
U247			498	6,748				0	6,748	7,246
Methyl Parathion				9,173,750				0	9,173,750	9,173,750
PAHs	0	32,322	323,318	85,558	170	73,739	891	106,231	192,680	515,998
Parathion			120					0	0	120
PCBs		1				1	1	2	3	3
Pentachlorophenol			122	4,328,168				0	4,328,168	4,328,290
Styrene						145,999		145,999	145,999	145,999
Toxaphene			194					0	0	194
Total	2,336,742	295,453	1,143,888,770	315,115,064	58,096	532,807	3,998,294	3,223,098	322,329,528	1,466,218,318

available on their loadings to the environment from air emissions, water discharges, hazardous waste generation, or toxic chemical releases and transfers. This may be explained by several reasons, including the fact that several of these chemicals are pesticides, whose uses have been banned in the United States. In addition, many of these chemicals are not the types routinely measured in air emissions, water discharges, or other types of releases (e.g., many of these chemicals are not on the TRI list.). Therefore, much of the loadings of the endocrine disruptor chemicals were accounted for by hazardous wastes containing these chemicals, and the more commonly monitored compounds such as lead, cadmium, PAHs, and styrene.

Loadings of endocrine disruptor chemicals were from all media sources, including 2,336,742 pounds of air emissions from AFS; 295,453 pounds of air emissions from RAPIDS; 58,096 pounds of water discharges from PCS; TRI releases of 532,807 pounds; and transfers of 3,998,294 pounds (Table 5-17). Hazardous wastes determined to contain some quantities of endocrine disruptor chemicals (based on review of waste code information and also from the methodology used by Illinois EPA in 1997 report on endocrine disruptors) amounted to 1,143,888,770 pounds generated and 315,115,064 pounds received. The individual chemicals with the largest loadings included lead (from 2,835,415 to 572,092,157 pounds); cadmium (from 125,170 to 866,835,260 pounds); mercury (from 4,304 to 6,485,336 pounds); chlordane (from 816 to 772,424 pounds); di-n-butyl phthalate (from 1,201 to 215,020 pounds); and di(2-ethyl hexyl)phthalate (from 3,422 to 4,419,005 pounds). Total loadings from other chemicals, such as pesticides, included methyl parathion (from 0 to 9,173,750 pounds); lindane (from 0 to 350,976 pounds); DDT (from 0 to 25,700 pounds); hexaclorobenzene (from 1 to 743,766 pounds); 2,4-D (from 35 to 100,035 pounds); and 2,3,7,8-Dioxins were 0.08 pounds.

While many of the endocrine disruptors are not routinely released by point sources, they are present in environmental media from years of use and from nonpoint sources. Specifically, many of these chemicals have been identified in sediments, fish tissue, and other media years after their use. Summarized below are select data on the presence of some of the endocrine disruptor chemicals in ambient air, water column, sediments, fish tissue, and groundwater in Cook County, IL, and Lake County, IN.

Numerous endocrine disruptor chemicals have been identified in the ambient environment in Cook County, IL, and Lake County, IN, particularly in sediments and fish tissue. As mentioned above, many of the organochlorine pesticides and herbicides are no longer used; however, their persistence in the environment is demonstrated by their presence in these media. This discussion focuses on select chemicals identified in various media to which people might be exposed. Table 5-18 presents an overview of EDCs detected in water column and sediment samples in this area (information on the endocrine disruptor chemicals lead, mercury, PAHs, and PCBs was presented earlier in this subsection and is not duplicated here).

Ambient air monitoring conducted in 1991 in central Chicago and offshore in Lake Michigan detected a few endocrine disruptors at very low concentrations, usually in the picogram/per cubic meter (pg/m^3) range (a picogram is 1 million times smaller than a microgram). Average concentrations at the central Chicago site included atrazine (183 pg/m^3); 4,4'-DDT (183 pg/m^3); dieldrin (150 pg/m^3); and P,P'-DDE (119 pg/m^3). Offshore concentrations of endocrine disruptor chemicals included atrazine (286 pg/m^3), hexachlorobenzene (104 pg/m^3), and lindane (103 pg/m^3), while all other averages for pesticides were less than 100 pg/m^3 (Keeler, 1994a).

Several endocrine disruptor chemicals have been identified in the water column in this area. Specifically, nine chemicals were found in the water column from monitoring conducted between 1990 and 1995 as presented in STORET and the literature. Maximum concentrations of these chemicals (Table 5-18) include: alachlor in the Kankakee River at 3.2 μg/L (total) and 2.8 μg/L (dissolved), aldrin in the Grand Calumet River at 0.05 μg/L, atrazine in the Kankakee River at 4.4 μg/L (dissolved) and 5.6 μg/L (total), cadmium in Washington Lagoon at 7 μg/L, lindane in both the Des Plaines and Grand Calumet Rivers at 0.02 μg/L, metolachlor (dual) in the Des Plaines River at 2.7 μg/L, metolachlor (dissolved) in the Kankakee River at 1.1 μg/L, and three chemicals in Wolf Lake (P,P'-DDT at 0.01 μg/L, total PCBs at 2 μg/L, and pentachlorophenol at 0.27 μg/L).

These chemicals are more prevalent in sediments of the waterbodies in this region, though they have been detected in Cook County more frequently than in Lake County. About 10 endocrine disruptor chemicals were identified in sediments (Table 5-18), including chlordane (trans isomer), which was detected at a maximum concentration in the Chicago River at 26,000 μg/kg. In general,

Table 5-18. Concentrations of Select Endocrine Disruptor Chemicals in Water Column and Sediment Samples

Water Column			Sediments		
Chemical	**Maximum Concentration (μg/L)**	**Waterbody**	**Chemical**	**Maximum Concentration (μg/kg)**	**Waterbody**
Alachlor (total)	3 2	Kankakee River	Aldrin (sed-dry weight)	1 9	Wolf Lake
Alachlor (dissolved)	2 8	Kankakee River	Aldrin	5 8	Chicago River
Aldrin (total)	0 05	Grand Calumet River	Cadmium	4,500	Grand Calumet River
Atrazine (dissolved)	4 4	Kankakee River	Cadmium (mud-dry weight)	6,000	Wolf Lake
Atrazine (whole sample)	5 6	Kankakee River	Chlordane (dry-tech & exposed met)	7 8	Wolf Lake
Cadmium (total)	7	Washington Lagoon	Chlordane	18	Chicago River
Lindane (total)	0 02	Des Plaines River and Grand Calumet River	Chlordane (trans isomer)	26,000	Chicago River
Metolachlor (dual)	2 7	Des Plaines River	DDT (sum analogs mud)	210	Garfield Lagoon
Metolachlor (dissolved)	1 1	Kankakee River	DDT (sum analogs)	1,000	Chicago River
P,P'-DDT (total)	0 01	Wolf Lake	Dieldrin (sed)	8 7	Lincoln North Park
PCBs (whole sample)	2	Wolf Lake	Dieldrin (sed-dry weight)	58	Douglass Lagoon
Pentachlorophenol (total)	0 27	Wolf Lake	Dieldrin	7	Chicago River
			Endrin (sed-dry weight)	1 8	Wolf Lake
			Endrin	26	Chicago River
			Hexachlorobenzene	2 4	Chicago River
			Methoxychlor	53	Chicago River
			P,P'-DDD (sed-dry weight)	140	Garfield
			P,P'-DDD (sed-dry weight)	620	Chicago River
			P,P'-DDE	68	Garfield
			P,P'-DDE	120	Chicago River
			P,P'-DDT (sed-dry weight)	260	Wolf Lake
			P,P'-DDT	18	Chicago River
			PCBs (mud)	102,300	Chicago River
			2,3,7,8-Dioxins and Furans	3 8-43,000 pg/g	Indiana Harbor Canal/ Grand Calumet River

μg/L = micrograms per liter
μg/kg = micrograms per kilogram
pg/g = picograms per gram

the Chicago River and Wolf Lake had the most number of endocrine disruptors at their maximum concentration. Some of the chemicals detected in the Chicago River included aldrin at 5.8 μg/kg, DDT (sum of analogs) at 1,000 μg/kg, and dieldrin at 7 μg/kg. The maximums for cadmium were 4,500 μg/kg in the Grand Calumet River and cadmium (mud-dry weight) at 6,000 μg/kg in Wolf Lake. Other chemicals detected in these sediments included dieldrin, endrin, hexachlorobenzene, and methoxyclor.

Fish tissue samples in this area containing endocrine disruptor chemicals at their highest concentrations in the study area included aldrin at 0.22 mg/kg in the Indiana Harbor Ship Canal, cadmium at 0.039 mg/kg in the Kankakee River, chlordane at 0.58 mg/kg in Lake Michigan, and DDT (total) at 31 mg/kg in Lake Michigan. DDT, as well as its metabolites DDD and DDE, were detected at their highest concentrations in the Grand Calumet River. Dieldrin's maximum concentration was 0.4 mg/kg in Douglas Park Lagoon. Endin was detected in the Grand Calumet River at concentrations as high as 0.04 mg/kg. Other endocrine disruptors detected in fish tissue in the study area were heptachlor, heptachlor epoxide, hexachlorobenzene, lindane, methoxychlor, and mirex (more information on fish tissue levels can be found in Section 4.4 of the Environmental Loadings Profile).

Groundwater monitoring conducted in 1993 by USGS and EPA identified several endocrine disruptor chemicals in the study area. The EDCs most frequently detected were pesticides, such as endrin (as endrin aldehyde) and P,P'-DDT, which were found in 14 and 9 wells, respectively. Other endocrine disruptors detected were aldrin (4 wells with a maximum of 0.014 μg/L); P,P'-DDD (4 wells with a maximum of 1.5 μg/L); dieldrin (4 wells with a maximum of 0.28 μg/L); gamma-chlordane (3 wells with a maximum of 0.21 μg/L); heptachlor (2 wells with a maximum of 0.11 μg/L); and several others. Most of the pesticides were detected in groundwater from areas in Southeast Chicago near industrial and waste disposal facilities in the vicinity of Lake Calumet. Concentrations of lead, mercury, and PCBs were also detected in groundwater in Cook County, IL, and Lake County, IN, and were described earlier in this section. Other EDCs found in groundwater were styrene in 1 well at 5 μg/L, well below the 199 μg/L drinking water standard for that compound; di-n-butyl phalate in 15 wells at a maximum concentration of 5 μg/L; and cadmium from 1 well at 2 μg/L, which is below its drinking water standard of 5 μg/L.

5.3 INDUSTRY TYPE ANALYSIS

Industry Type Analysis

- Multimedia Loadings from Industrial Sectors
- Ranking of Industries by Air Emissions, Water Discharges, Hazardous Waste Generated and Received, and Toxic Chemical Releases and Transfers
- Focus on Chemical, Primary Metals, Petroleum, Metal Fabrication, and Other Sectors

Analysis of the industries with the largest multimedia loadings indicates that the chemical, primary metals, and petroleum industries are the biggest sources to the air, water, land, and other media in Cook County, IL, and Lake County, IN. This section presents multimedia loadings summaries according to the types of industries that produce air emissions, generate hazardous wastes, discharge chemicals to waterbodies, and have various types of toxic chemical releases and transfers. These data were primarily derived from the data bases described above, including AFS, RAPIDS, BRS, PCS, and TRI. This analysis examines the amount of pollution generated, rather than the potential risks from particular chemicals and media of the release that might result in human exposures. For example, hazardous wastes generated are generally placed in containers and shipped off site for treatment or disposal and, therefore, may not represent a sizeable loading to the air we breathe, the water we drink, and other media to which we might be exposed.

All sources in Cook County, IL, and Lake County, IN, generate about 8-billion pounds per year of air pollution, water pollution, hazardous wastes, and toxic chemical releases/transfers. Hazardous waste generation, at about 4.5-billion pounds, accounts for much of the total. The discussion below presents a relative ranking of the major industries in the two-county area. Table 5-19 summarizes rankings of industry types, based on loadings within each "media/data base." In general, the largest industries are usually among the largest across all media. Specifically, the industries with consistently large loadings are the chemical, primary metals, and petroleum industries. For the seven media/data bases, the chemical industry appears in the top five largest sources in each, with a number one ranking in hazardous wastes generated. The primary metals

Table 5-19. Rankings of the Largest Industrial Sectors by Multimedia Loadings

SIC Code	Industry	AFS	RAPIDS	BRS Generated	PCS	TRI Releases	TRI Transfers
20	Food	5	--	--	5	3	6
27	Printing	10	--	8	--	--	7
28	Chemical	3	3	1	3	5	2
29	Petroleum	2	10	3	4	6	3
30	Plastics	--	6	--	--	4	8
32	Stone/Clay	7	--	--	9	--	--
33	Primary Metal	1	2	5	2	1	1
34	Fabrication/Metals	9	5	2	--	2	4
36	Electrical	--	7	4	--	--	5
37	Transportation	--	9	--	--	--	--
49	Utilities	4	--	7	1	--	--
51	Nondurable	6	--	9	--	--	--
73	Wholesale	--	--	6	--	--	--
99	Business Services	8	--	--	--	--	--
-	Nonclassified Other/Area Sources	--	1	--	--	--	--

industry also appears in the top five for all media/data bases, but it ranked number one in three instances. The petroleum industry appears in the top ten in all seven media, but its highest ranking is number two (for AFS). Described below are multimedia loadings estimates for the largest industries in the study area: chemical, primary metals, petroleum, metal fabrication, and others, such as food, plastics, stone/clay, and electrical industries.

5.3.1 Chemical Industry

The chemical industry, SIC Code 28, accounts for about 25 percent of all loadings in the study area. The chemical industry's major loadings are hazardous wastes (2,142,296,092 pounds generated in 1993), which was more than twice as much as any other industry's. This industry also has significant TRI releases and transfers. Specifically, the chemical industry released 2,280,002 pounds of toxic chemicals and had off-site transfers of 20,714,587 pounds (about 25 percent of the total transfers for all sources). About 5 percent of all wastewater discharge loadings come from chemical producers (22,207,153 pounds). Air emissions from this industrial sector are much smaller than the primary metals industry; point source emissions in AFS are 139,343,132 pounds, which is about one order of magnitude smaller than primary metals facilities. One large chemical and allied products producer, Bradshaw-Praeger, contributed about 87-million pounds or 63 percent of the industry's total AFS loading. About 10 percent of the RAPIDS air emissions (1,556,221 pounds) estimate were attributed to chemical producers such as Keil Chemical/Ferro Corp. (965,100 pounds).

5.3.2 Primary Metals Industry

Primary metals facilities (SIC Code 33) include steel mills and contribute the largest air emissions in the study area (1,241,249,781 pounds or more than 50 percent of all emissions reported in AFS). To some degree, a few large steel mills account for much of the total loadings, including U.S. Steel-Gary, Acme Steel AFS, Inland Steel, and a few others. From RAPIDS, the primary metals industry was the largest emitter, with 3,191,947 pounds of the 15,240,680 pounds total for point sources and area sources in the two-county area. Major emissions from the steel industry documented in RAPIDS included U.S. Steel-Gary Works, with 1,498,869 pounds (mostly coke oven gas, polycyclic organic compounds, and manganese compounds), U.S. Steel-South Works (484,798 pounds); Inland Steel (309,702 pounds); and LTV Steel (286,726 pounds). The primary metals industry also has significant loadings of chemicals to surface waters and multimedia toxic chemical releases and transfers as reported in TRI. In 1995, total water discharges in PCS were 33,709,597 pounds, which was the second largest of any industrial sector (behind utilities which had 352,543,500 pounds discharged). TRI releases and transfers from this industry are the largest in the area, with 15,845,690 pounds released and 23,987,413 transferred offsite in 1995.

5.3.3 Petroleum Industry

The petroleum industry (SIC Code 29) has several large facilities in the area, with Amoco Oil in Whiting, IN, as one of the largest air emitters and generators of hazardous wastes. Overall, the petroleum industry had air emissions in AFS of 611,352,550 pounds (about half as large as the primary metals industry); RAPIDS emissions of 155,867 pounds (about one-tenth as large as the chemical industry's); hazardous waste generation of 712,337,916 pounds (about one-third as large as the chemical industry's); and TRI releases of 1,662,949 pounds and transfers of 17,143,493 (much smaller than both the chemical and primary metals industries'). Besides Amoco Oil, which appears near the top of lists of the largest air emitters and waste generators, Clark Oil and Refining is the other largest source in this industry, with AFS air loadings in 1995 of 35,529,291 pounds and TRI air emissions of 77,771 pounds.

5.3.4 Metal Fabricators

The Chicago area is known as having a large number of metal fabricators, including foundries and other types of manufacturers of metal products (SIC Code 34). While this industry's air emissions in AFS are two orders of magnitude smaller than the primary metals industry, their emissions of toxic chemicals in RAPIDS are significant (1,080,308 pounds compared to primary metals' 3,191,947 pounds). Also, generation of hazardous wastes is more than four times larger (941,533,254 pounds) than the primary metals industry's and second only to the chemical producers. Toxic chemical releases and transfers of 3,292,426 and 9,759,039 pounds, as reported in TRI for 1995, are smaller than both the primary metals and chemical industry.

5.3.5 Utilities

Utilities in the Cook County, IL, and Lake County, IN, area include power plants and municipal sewage treatment plants, which are significant sources of air pollution and have the largest discharges to waterbodies by more than an order of magnitude. Air emissions from these facilities are 136,837,367 pounds (in AFS) or 6 percent of the total. Only the primary metals, petroleum, and chemical industries have collectively larger loadings to air than the power plants. The largest utility sources include Commonwealth Edison in Hammond (49,188,019 pounds), NIPSCO - Dean H. Mitchell Station (28,219,906 pounds), Commonwealth Edison - Crawford Station (27,212,134 pounds), and Commonwealth Edison - Fisk Station (20,851,427 pounds). The utilities with the largest loadings to waterbodies are the sewage treatment plants, with 352,543,500 of the 414,775,802 pounds discharged to waterbodies in the study area. The sewage treatment plants with the largest discharges, based on 1995 data in PCS, are Hammond Municipal STP (182,783,675 pounds), Gary Wastewater Treatment Plant (69,177,958 pounds), MWRDGC Stickney (45,443,631 pounds), East Chicago STP (33,852,917 pounds), MWRDGC Calumet STP (10,755,231 pounds), and MWRDGC Northside STP (6,332,293 pounds).

5.3.6 Other Industries

Several other industrial sectors have significant loadings to the environment in Cook County, IL, and Lake County, IN. In general, these smaller industries may have sizable loadings to one medium or another. Rarely will they have consistently large multimedia loadings like chemicals, primary metals, petroleum, and similar industries. This section summarizes loadings from the food, plastics, stone/clay, and electrical industries and provides comparison to the previously mentioned industry sectors to provide context.

The food industry (SIC Code 20) has significant air emissions (as reported in AFS), wastewater discharges and TRI releases. Specifically, 39,798,970 pounds were emitted, based on AFS data; 1,476,491 pounds were discharged to waterbodies; and 2,975,269 pounds of toxic chemicals were released from food processing facilities. The largest facilities in this industrial sector include Corn Products and Best Foods, which had the majority of the area's TRI air emissions of hydrochloric acid.

The plastics industry (SIC Code 30) had the sixth largest air emissions in the area as estimated in RAPIDS. More than 800,000 pounds were emitted, which trailed only area sources, primary metals, chemicals, machinery, and metal fabricators in air toxics emissions. TRI releases were also significant from the plastics industry, with a combined loadings of 2,588,108 pounds, which is the fourth largest behind primary metals, metal fabrication, and food. The plastics industry generated little hazardous waste and had no direct discharges to surface waters.

The stone/clay industry (SIC Code 32) emitted 28,198,006 pounds (AFS), which was the seventh largest in the area. Other types of loadings were relatively small, including only 21,109 pounds discharged to waterbodies and 65,353 pounds of TRI releases. TRI off-site transfers, on the other hand, were sizeable at 357,232 pounds.

The electrical industry (SIC Code 36) is notable for having large masses of hazardous waste generated, as well as large TRI off-site transfers. Specifically, 265,479,444 pounds of hazardous waste were generated in 1993 by these facilities, which ranked the fourth largest behind the chemical metal fabrication, and petroleum industries. The TRI transfers were 5,004,354 pounds in 1995, which were the fifth largest.

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Appendix -
Glossary and Acronyms

GLOSSARY OF TERMS
and
LIST OF ACRONYMS/ABBREVIATIONS

AIRS/AFS -- Aerometric Information Retrieval System Facility Subsystem
AIRS/AQS -- Aerometric Information Retrieval System Air Quality Subsystem
ALAMC -- American Lung Association of Metropolitan Chicago
AOC --Area of concern
ARCS -- Assessment and Remediation of Contaminated Sediments Program
ARIP -- Accidental Release Information Program
ATSDR -- Agency for Toxic Substances and Disease Registry
BEDS -- Biological Effects Data Base
BOD -- Biological Oxygen Demand
BRS -- Biennial Reporting System
BTEX - Benzene, Toluene, Ethylbenzene, and Xylene
CAA -- Clean Air Act
CAMP -- Continuous Air Monitoring Program
CATS -- Chicago Area Transit Study
CBOD -- Carbonaceous Biological Oxygen Demand
CCRI -- Chicago Cumulative Risk Initiative
CDC -- Centers for Disease Control and Prevention
CERCLIS -- Comprehensive Environmental, Response, Compensation and Liability Information System
CESQG -- Conditionally-exempt Small Quantity Generator
CFC -- Chlorofluorocarbon
CMB -- Chemical Mass Balance
COD --Chemical Oxygen Demand
CSO -- Combined Sewer Overflow
CWA -- Clean Water Act
DDE -- Dichlorodiphenyldichloroethane
DDT -- Dichlorodiphenyltrichloroethane
DO -- Dissolved oxygen
EHS -- Extremely Hazardous Substance
EPA -- U.S. Environmental Protection Agency
EPCRA -- Emergency Planning and Community Right-to-Know Act
ERNS -- Emergency Response Notification System
ESI -- Environmental Site Investigation
FDA -- Food and Drug Administration
GCR/IHSC -- Grand Calumet River/Indiana Harbor Ship Canal
GLC -- Great Lakes Commission

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

HAP -- Hazardous Air Pollutant
HRS -- Hazard Ranking System
HSDB -- Hazardous Substance Data Base
HUD -- U.S. Department of Housing and Urban Development
HWRIC -- Hazardous Waste Research and Information Center
ICMS -- Integrated Chemical Management System
IDEM -- Illinois Department of Environmental Management
IDPH -- Illinois Department of Public Health
IEPA -- Illinois Environmental Protection Agency
IH -- Indiana Harbor
IOC -- Inorganic Chemicals
ISDH -- Indiana State Department of Health
ISWS -- Illinois State Water Survey
LEPC -- Local Emergency Planning Committee
LQG -- Large Quantity Generator
LUST -- Leaking Underground Storage Tank
MCL -- Maximum Contaminant Level
MSDS -- Material Safety Data Sheet
MWRDGC -- Metropolitan Water Reclamation District of Greater Chicago
NAAQS -- National Ambient Air Quality Standards
ND -- Not detected
NHEXAS -- National Human Exposure Assessment Survey
NIOSH -- National Institute of Occupational Safety and Health
NIPC -- Northeastern Illinois Planning Commission
NIRPC -- Northwest Indiana Regional Planning Commission
NPDES -- National Pollutant Discharge Elimination System
NPL -- National Priorities List
NRC -- National Response Center
NRDC -- Natural Resources Defense Council
NURP -- National Urban Runoff Program
OAQPS -- U.S. EPA Office of Air Quality Planning and Standards
OSHA -- Occupational Safety and Health Administration
PAMS -- Photochemical Assessment Monitoring Stations
PCB -- Polychlorinated Biphenyl
PCS -- Permit Compliance System
POM--Polycyclic Organic Matter
POTW -- Publicly Owned Treatment Works
RAP -- Remedial Action Plan

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

RCRA -- Resource Conservation and Recovery Act
RCRIS -- Resource Conservation and Recovery Information System
SARA -- Superfund Amendments and Reauthorization Act
SERC -- State Emergency Response Commission
SIC Code -- Standard Industrial Classification Code
SIP -- State Implementation Plan
SMCL -- Secondary Maximum Contaminant Level
SOC -- Synthetic Organic Chemical
SP -- Soluble Phosphorus
SQG -- Small Quantity Generator
SSI -- Screening Site Inspection
STORET -- Storage and Retrieval of U.S. Waterways Parametric Data
STP -- Sewage Treatment Plant
SVOC -- Semi-volatile Organic Compound
SWLM -- Southwest Lake Michigan
TARP -- Tunnel and Reservoir Plan
TCL -- Target Compound List
TEQ -- Toxic Equivalence
TKN -- Total Kjeldahl Nitrogen
TOC -- Total Organic Carbon
TOX -- Total Organic Halide
TP -- Total Phosphorus
TRI -- Toxic Release Inventory
TSCA -- Toxic Substances Control Act
TSDF -- Treatment, Storage, and Disposal Facility
TSP -- Total Suspended Particulate
UATMP -- Urban Air Toxic Monitoring Program
U.S. ACE -- U.S. Army Corps of Engineers
U.S. EPA -- United States Environmental Protection Agency
USGS -- U.S. Geological Survey
UST -- Underground Storage Tank
VOC -- Volatile Organic Compound
VOM -- Volatile Organic Matter

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

Action Levels -- A term used by Federal agencies such as EPA, NIOSH, OSHA for guidance purposes in establishing quantitative levels of toxicants at which actions need to be taken to prevent or reduce exposure or contact. For example, the term refers to EPA guidance levels for the amount of lead and/or copper in public water supplies used for human consumption.

AIRS/AFS -- Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS) -- computerized data base that contains emissions and compliance data on air pollution point sources regulated by EPA, State, and/or local air regulatory agencies.

AIRS/AQS -- **(Aerometric Information Retrieval System Air Quality Subsystem)** -- contains information on air quality such as measurements of ambient concentrations of air pollutants and associated meteorological data. AQS is used by EPA to assess the overall status of the Nation's air quality and to prepare Reports to Congress as mandated by the CAA.

Ambient Air -- Surrounding air. Any unconfined portion of the atmosphere.

Ambient Water Quality -- The existing water quality of a stream or lake.

Anthropogenic Insults -- Environmental alterations resulting from the presence or activities of humans.

AOC -- Specific areas of concern to the Great Lakes with water quality-related problems as designated by the International Joint Commission of the Great Lakes.

Aquifer Systems -- Subsurface geologic formations that yield economically important amounts of water to wells or springs.

Area Sources -- Small sources of air pollution that individually emit below certain threshold quantities for criteria pollutants. For this study, area sources include: volatile organic liquid transfer (ship and barge); gasoline distribution (tank truck unloading, vehicle fueling, USTs breathing, etc.); stationary source solvent usage (architectural surface coatings, dry cleaning, solvent degreasing, etc.); biogenics; municipal waste incineration; industrial, commercial, and residential fuel combustion; and open burning.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

ARIP (Accidental Release Information Program) -- Contains information on the causes of accidents as well as industry prevention practices. Supplements information found in ERNS. Targets accidental releases from facilities that resulted in off-site impact or environmental damage.

Atmospheric Deposition -- Pollutants that fall from or are deposited by the atmosphere, whether solid, liquid or gas. Settling or "deposition" of suspended particles from the air onto the ground surface or structures.

Bathymetric Surveys -- Surveys of underwater depths, primarily ocean floors.

Benthic Species -- Flora and fauna found on the bottom of lakes, rivers, or oceans. The presence or absence of certain benthic organisms is sometimes used as an indicator of water quality.

Bioaccumulate -- The process of concentration of substances by living organisms as they breathe contaminated air, drink contaminated water, or eat contaminated food. Chemicals move through the food chain and tend to concentrate in organisms at the upper end of the food chain.

Biological Oxygen Demand (BOD) -- A measure of the oxygen required to break down organic materials in water. Higher organic loads require larger quantities of oxygen, which in turn may reduce the amount available for aquatic life resulting in unacceptable levels.

BRS (Biennial Reporting System) -- National system that contains data on the generation, management, and minimization of hazardous waste from facilities regulated under RCRA.

BTEX (Benzene, ethyl benzene, toluene, and xylenes) -- Hazardous constituents of petroleum products.

Carcinogenic -- Capable of causing or contributing to the development of cancer.

CERCLIS (Comprehensive Environmental, Response, Compensation and Liability Information System) --Computerized data base of contaminated sites. Contains information on hazardous waste sites investigated for consideration for Superfund remedial activities. Sites included are either NPL or non-NPL sites that have received some degree of investigation or action to remedy hazards.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

Chlorofluorocarbons (CFCs) -- A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation or as solvents and aerosol propellants. CFCs drift into the stratosphere where they take part in chemical reactions, which result in reduction of the ozone layer.

Childhood Lead Poisoning Prevention Programs -- In most cities and towns, counties and states, lead poisoning prevention programs are run through the state health department. The primary focus is surveillance, screening, and ensuring medical or environmental follow up to children identified as lead poisoned. The programs also provide public education activities.

CMB (Chemical Mass Balance) -- An approach requiring that the quantities of contaminants entering a system, less the quantities stored or transformed, should be equal to the quantities leaving a system.

CN (Curve number) -- A numerical value related to the infiltration rate of a soil.

Carbon Monoxide (CO) -- A colorless, odorless, poisonous gas, produced by incomplete burning of carbon-based fuels, including gasoline, oil, and wood.

Chemical Oxygen Demand (COD) -- A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

Community System -- A public water supplier that serves a year round residential population such as a group of homes receiving water from the same source.

Cradle-to-Grave -- The documentation of the management of hazardous wastes from the time when they are first generated through final disposal (including treatment, storage, and transportation).

Criteria Air Pollutants -- A group of very common air pollutants regulated by EPA on the basis of criteria (information on health and/or environmental effects of pollution). Criteria pollutants include carbon monoxide, sulfur dioxide, nitrogen dioxide, volatile organic compounds, particulate matter, and lead.

CSO (Combined Sewer Overflow)-- Can be caused by intense storm events in regions served by combined sewers. These overflows discharge source runoff and untreated sewage into water bodies.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

DDE (dichlorodiphenyldichloroethene) -- A breakdown product of DDT.

DDT (dichlorodiphenyltrichloroethane) -- A pesticide which has been banned from registration and interstate sale for virtually all but emergency uses due to its persistence in the environment and accumulation in the food chain.

Demographics -- The statistical study of populations with reference to natality, mortality, migratory movements, age, and sex, among other social, ethnic, and economic factors.

Dissolved Oxygen (DO) --Oxygen that is freely available in water to sustain the lives of fish and other aquatic organisms.. Traditionally, the level of dissolved oxygen has been accepted as the single most important indicator of a water body's ability to support desirable aquatic life.

EHS (Extremely Hazardous Substance) -- Any of the chemicals identified by EPA on the basis of toxicity and listed under § 302 of SARA (subject to revisions).

EMCs (Event Mean Concentrations) -- The average concentrations of contaminants in runoff water.

Effluents -- Wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Emission Rates -- The rate at which a substance is discharged or emitted.

EPCRA (Emergency Planning and Community Right-to-Know Act) -- This law also known as Title III of SARA is the national law on community safety. The Act requires each state to appoint a State Emergency Response Commission (SERC) that in turn divides their districts into Local Emergency Planning Committees (LEPC). EPCRA is designed to protect the public health, safety and environment of local communities from chemical hazards.

ERNS (Emergency Response Notification System) -- A data base that contains records of all telephone calls made to the National Response Center as a result of many different types of spills or releases of hazardous substances.

Eutrophication -- The deterioration of the esthetic and life-supporting qualities of lakes and estuaries, caused by excessive fertilization from point and nonpoint loadings, high in phosphorus, nitrogen, and organic growth substances.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

Exceedances -- Measurements of EPA criteria pollutants above the levels set for that pollutant by NAAQS. An area is not necessarily in violation of NAAQS when an exceedance is reported. For example, an area can have up to 3 carbon monoxide s over a 3-year time frame and still be in compliance. If a 4th is measured, then the area would be in violation.

Exposure Routes -- Ways that an individual may be exposed to harmful chemicals or pollutants. The three major exposure routes include: inhalation (breathing in pollutants from the air); ingestion (eating or drinking contaminated foods and water); and dermal contact (pollutants contacting the surface of the skin).

Fecal Coliform Bacteria -- Bacteria found in the intestinal tract of humans and other warm-blooded animals. The presence of fecal coliforms in water or sludge is an indicator of pollution and possible contamination by disease-causing microorganisms.

Fugitive Air Emissions -- Unintentional releases of air pollution (as opposed to controlled releases from an exhaust stack or a vent). Fugitive emissions can result from leaks in plant equipment such as valves, pump seals, flanges, and sampling connections, etc.

Grab Samples -- A single sample of soil or of water taken without regard to time or flow.

Green Metro Index -- An environmental ranking system for 75 major metro areas complied by the World Resources Institute. Combines eight measures of environmental quality such as average air quality, acute air quality, water quality violations, toxic releases, Superfund sites, mass transit use, residential energy use, and gasoline and electricity prices.

Groundwater -- Water beneath the surface of the Earth, usually found in porous rock formations. Groundwater is the source of water found in wells and springs, and is sometimes used for drinking. As it moves through regional flow systems, its physical and chemical characteristics are modified by the environments and constituents encountered.

Group 5 Fish Advisory -- The highest level of fish advisory. It is defined as no consumption (do not eat) for all persons.

Habitats -- The natural abode or locality of an animal or plant.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

HAPs (Hazardous Air Pollutants) --Chemicals that can cause serious health and environmental effects. Unlike criteria pollutants, these pollutants are not covered by ambient air quality standards, as stated in the Clean Air Act. Examples include such pollutants as chlorofluorocarbons, lead, methylene chloride, asbestos, vinyl chloride, etc.

Heavy Metals -- Metallic elements whose specific gravity is approximately 5.0 or higher (e.g., mercury, chromium, cadmium, arsenic, and lead). They can damage organisms at low concentrations and tend to accumulate in the food chain.

HRS (Hazard Ranking System) -- The system used by EPA to evaluate the severity of contamination at hazardous waste sites. EPA scores the sites according to the type, amount, and toxicity of contaminants present at the site, and actual or potential pathways of human and environmental exposure. This score is the major criterion in determining if a site should be on the National Priorities List, and if so, what ranking it should have compared to other sites on the list.

HSDB (Hazardous Substance Data Base) -- Data base developed by ATSDR to study relationships between exposures to hazardous substances and the occurrences of cancer, deaths, birth defects, and other health issues.

ICMS (Integrated Chemical Management System) -- A computer system developed to manage data for the CCRI Environmental Loadings Profile. It contains data on sources/loadings of air emissions, hazardous wastes, toxic chemicals, and related information. Built on SAS, it displays graphs, maps and tables in a user-friendly interface.

Indicator Parameters -- Used to evaluate the impact of human activities on groundwater quality and the resulting risk to human health and the environment.

Indoor Air Pollution -- An area of environmental concern. It includes pollution trapped inside a habitable structure. Major indoor air pollutants include radon, environmental tobacco smoke, biologicals, carbon monoxide, nitrogen dioxide, organic gases, respirable particles, formaldehyde, pesticides, asbestos, and lead.

Influent -- An input stream of fluid, such as water into a reservoir, basin, or treatment plant.

Inorganic Analytes -- Chemical substances of mineral origin, not of basically carbon structure.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

IOCs (Inorganic Chemicals) -- A group of naturally occurring metals and minerals of mineral origin, not of basically carbon structure.

Landfill -- Disposal of solid waste by burying in layers of earth in low ground.

Leachate -- A liquid that has percolated through wastes, agricultural pesticides, or fertilizers and has extracted dissolved or suspended materials from this process.

Lead -- An EPA criteria air pollutant. Exposure can occur through inhalation of air or ingestion of lead in food, water, soil, or dust. Acute lead poisoning can affect both adults and children. In children, elevated lead levels can cause nervous-system damage, resulting in irreversible mental and developmental defects.

Lead Poisoning -- A condition identified by elevated blood lead levels which can cause IQ deficiencies, reading and learning disabilities, impaired hearing, reduced attention spans, hyperactivity, and antisocial behavior.

LEPC (Local Emergency Planning Committee) -- Committee appointed by a State Emergency Response Commission (SERC) to develop comprehensive emergency plans for Local Emergency Planning Districts.

Loadings -- The quantities of emissions/releases to air, water, etc.

Long and Mac Donald's (L&M) Effects Range -- Method for determining effects of sediment concentrations. Utilizes the Effects Range-Low (ER-L), which corresponds to the lower 10th percentile of the effects data for each chemical and the Effects Range-Median (ER-M), which corresponds to the median, or 50th percentile of the effects data for each chemical. Concentrations that fall below the ER-L are believed to rarely cause effects. Concentrations greater than ER-L, but less than ER-M, represent a possible-effects range where effects would occasionally occur; concentrations above the ER-M represent a probable-effects where effects would frequently occur.

LQGs (Large Quantity Generators) -- Facilities that generate more than 1,000 kilograms of hazardous waste per month.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

MCLs (Maximum Contaminant Levels) -- Regulatory limits for concentrations of various constituents in public water systems that distribute water for human consumption. MCLs are derived on the basis of human health criteria, as well as technological and economic considerations.

Media -- Specific environments such as air, water, soil, sediments, tissue, etc.

Microbiological Contaminants -- Microorganisms such as coliform bacteria found in contaminated water.

Migrate -- To move from one area to another.

Model -- A mathematical or physical system, programmed to follow certain specified conditions. Results are used to understand/predict a physical, biological, or social pattern that is analogous in some way.

MSDS (Material Safety Data Sheet) A worksheet required by OSHA that contains information about hazardous chemicals in the workplace. Information described includes exposure limits, and precautionary details. MSDSs are used to fulfill part of the hazardous chemical inventory reporting requirements under EPCRA.

NAAQS (National Ambient Air Quality Standards) -- Standards set by the EPA for the allowable concentrations of criteria pollutants in the air.

National Cooperative Inner City Asthma Study -- Funded by the National Institutes of Health, this study is aimed at identifying risk factors for children with severe asthma in eight major inner city areas, including Chicago.

NHEXAS (National Human Exposure Assessment Survey) -- A Federal interagency research project that is focused on examining total human exposure to multiple chemicals as experienced by individuals in their everyday lives.

National Primary Drinking Water Regulations -- Regulations that call for periodic monitoring of public water supplies for the specific contaminants and notification to water users when any standards are exceeded.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

NO_2 (Nitrogen Dioxide) -- A criteria air pollutant that is emitted by combustion sources including power plants, steel mills, automobiles, etc. It plays a major role in the formation of smog. NO_2 belongs to the family of poisonous highly reactive gases called oxides of nitrogen (NO_x).

NPDES (National Pollutant Discharge Elimination System)-- Permit program established by the CWA, that regulates direct discharges from municipal and industrial facilities into the navigable waters of the United States.

Nonattainment Areas -- A geographic area in which concentrations of one or more of EPA's criteria air pollutants violates levels allowed by the National Ambient Air Quality Standards.

Noncarcinogenic -- A substance that is not known to cause cancer.

Nonpoint Sources -- Sources of pollution that cannot be attributed to a single discharge point, such as rainwater, runoff from agricultural lands, etc. For surface water, most nonpoint source pollution is caused by compounds that have settled on the ground and are mobilized by stormwater runoff.

Non-community System -- A public water supplier that serves a non-residential population such as businesses, schools, or restaurants.

NPL (National Priorities List) -- List of the most seriously contaminated uncontrolled or abandoned hazardous waste sites in the country that have been identified for remedial action under Superfund.

NURP (Nationwide Urban Runoff Program) -- A national program that has established a comprehensive data base of runoff coefficients for a number of different land uses and 10 parameters including total suspended solids; biological oxygen demand, chemical oxygen demand, total phosphorus, soluble phosphorous, total Kjeldahl nitrogen, nitrates and nitrites, copper, lead, and zinc.

Nutrients -- Substances that promote growth such as nitrogen and phosphorous.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

Ontario's Provincial Sediment Quality Guidelines -- Three levels developed by the Ontario Ministry of Environment to provide guidance for making freshwater sediment-related decisions. Three guidelines are No Effect Level (NEL); Lowest Effect Level (LEL); and Severe Effect Level (SEL). SEL is the level at which pronounced disturbance of the sediment dwelling community can be expected. A compound found at, or above, this concentration would be considered to be detrimental to the majority of the benthic species.

Organochlorine Compounds -- Contaminants such as PCBs and pesticides. Human exposure comes primarily from the food supply including contaminated fish.

Ozone -- One of EPA's criteria pollutants that is created when sunlight causes a reaction to occur with nitrogen oxides and hydrocarbons in the air. It is a powerful oxidant capable of destroying organic matter. Has been called the Nation's most widespread air pollution problem. Causes respiratory problems and may aggravate asthma.

Ozone Precursors -- Volatile organic compounds and nitrogen oxides that react in the atmosphere under certain concentrations (heat and sunlight) to create ozone.

PAHs (Polynuclear Aromatic Hydrocarbons) -- A family of organic chemicals based on benzene. Sources include discharges from coke production in the iron and steel industry; catalytic cracking in the petroleum industry; manufacture of carbon black, coal tar pitch, and asphalt; heating and power generation; controlled refuse incineration; and open burning.

Parent Water Supplier -- A public water supplier that sells drinking water to satellite water suppliers.

Particulate Matter -- Sometimes referred to as total suspended particulates (TSP) and includes an array of atmospheric materials varying in size, composition, and origin (e.g., soot, ashes, metals, pollen, and windblown dirt, sand, and soil dust. PM_{10} are particulate matter with a diameter of less than 10 microns and $PM_{2.5}$ have diameters less than 2.5 microns, and are subsets of TSP.

PCBs (Polychlorinated Biphenyls) -- A group of toxic, persistent chemicals that until banned from production in the United States, were used for insulating purposes in electrical transformers and for other purposes.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

PCS (Permit Compliance System) -- National computerized management information system that tracks surface water discharges under the National Pollutant Discharge Elimination System of the CWA. Contains data and tracks permit issuance, permit limits, and monitoring data pertaining to facilities regulated under NPDES.

Pica Child -- Refers to exposure assumptions made in the risk assessment process of children, looking as ingestion rates of non-food items such as soil, paint chips, or plaster.

Point Sources -- Stationary facilities that discharge pollutants from smoke stacks, pipes, etc. under permits issued by the Federal and/or local governments.

P2 (Pollution Prevention) -- The process of reducing the generation of hazardous wastes and other releases through recycling, reducing the use of toxic chemicals, and recovering energy resources.

PM_{10} -- Particulate matter with a diameter of less than 10 microns.

$PM_{2.5}$ -- Particulate matter with a diameter of less than 2.5 microns.

POTW (Publicly-owned treatment work) -- Wastewater treatment plant.

Prevalence Rate -- The total number of cases of a disease at a given time/the total population at risk at a given time.

Public Water Supplier -- Provides drinking water to the public either by having 15 or more connections or by serving at least 25 people per day for 60 days out of the year. Public water suppliers can be broken down into two types of systems: community and non-community.

QA/QC (Quality Assurance/Quality Control) -- The checks, audits and procedures performed in order to ensure that data are of desirable quality.

RCRIS (Resource Conservation and Recovery Information System) -- Tracks information on all phases (cradle-to-grave) of hazardous waste generation, storage, and disposal. Contains information on permitted facilities.

R_c -- Runoff Coefficients. A ratio used in calculation of stormwater runoff pollutant loads. It represents the total mass of pollutant that runs off/the total mass of pollutant that is dissolved in rainwater.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

SAS -- A statistical software package used to analyze data.

Satellite Water Supplier -- A public water supplier that purchases its water supply from a parent water supplier.

SDWA (Safe Drinking Water Act) -- Created in 1974 and amended in 1986 to protect the quality of drinking water in the United States. The law authorized EPA to establish drinking water standards, which represent the maximum contaminant levels allowable.

SDWIS (Safe Drinking Water Information System) -- Contains information on water suppliers and violations of the Safe Drinking Water Act. These violations may be due to the exceedance of MCLs and Action Levels or they could be due to administrative problems with the drinking water systems.

Sediments -- Repository for a variety of nutrients and contaminants. In some areas are the primary source of anthropogenic chemicals to the aquatic environment.

Sensitive Populations -- Groups of people/organisms, such as the elderly, children, or nursing mothers who may be at a higher risk from exposure to a specific pollutant.

SIC Codes (Standard Industrial Classification Codes) -- Assigned codes established by the U.S. Department of Commerce that group industries with similar products or services.

SIP (State Implementation Plan) -- A detailed description of the programs a State will employ in meeting its requirements under the Clean Air Act. These plans must be approved by EPA.

Siltation -- Filling or becoming obstructed with fine particles of sand or rock.

SLC Approach -- Screening level concentration approaches -- an effects-based approach to make sediment-related decisions. The approach uses field data on the co-occurrence of benthic infaunal species in sediments and different concentrations of contaminants.

Sludge -- A heavy, slimy deposit, sediment, or mass (e.g., waste resulting from oil refining, precipitate in a sewage tank, etc.).

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

SMCLs (Secondary Maximum Contaminant Levels) -- Suggested standards for various constituents in public drinking water systems that distribute water for human consumption. They are based on organoleptic (aesthetic) standards such as taste, color, and odor. Unlike MCLs, do not carry the weight of law.

Smog -- A mixture of pollutants, primarily ground-level ozone, produced by chemical reactions in the air of volatile organic.

SOC (Synthetic Organic Chemicals) -- Man-made organic chemicals such as solvents.

Soil Pathway -- Transfer of soil contamination to humans, via ingestion, inhalation, or dermal contact. This term is used in risk assessments, referring to the means by which people/organisms become exposed to contaminants in the soil.

SO_2 (Sulfur Dioxide) -- An EPA criteria pollutant formed primarily by industrial fossil fuel combustion. It is of primary concern because of its role in the formation of acid rain.

SQGs (Small Quantity Generators) -- Facilities that generate less than 1,000 kilograms of hazardous waste per month. Examples include auto shops, dry cleaners, photographic developers, and other small enterprises.

STORET (Storage and Retrieval of U.S. Waterways Parametric Data Base) -- A national data base for water quality information. Includes information on ambient, intrusive survey, effluent, and biological water quality measures for the United States.

Stormwater Runoff -- Stormwater that runs downhill and makes its way to a surface water body or a sewer.

Surface Water Quality -- An indicator of the condition of the environment. Human risk from contaminated surface waters can result from direct exposure through recreational use and ingestion of water, and indirectly through fish consumption.

Suspended Solids -- Matter that can contain many types of pollutants and may act physically on water bodies by reducing light penetration and altering sediments/habitats.

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

TARP (Tunnel and Reservoir Plan) -- System implemented to prevent sewer overflows from polluting rivers in Cook County, IL, and Lake Michigan. Consists of a series of tunnels that provide an excess storage capacity of about 1-billion gallons to accommodate overflows from significant rain storms.

305(b) Reports -- State Water Quality Reports prepared biennially to satisfy requirements under §305(b) of the Clean Water Act.

33/50 Program -- An EPA program to promote pollution prevention activities.

TRI (Toxic Release Inventory) -- A national inventory of annual toxic chemical releases from a specified group of manufacturing processes. The purpose is to provide information to the public about toxic chemicals in their communities.

TRI List -- A list of approximately 600 specific toxic chemicals and chemical categories that are subject to reporting. This list is subject to revisions.

TRIS (Toxic Release Inventory System) -- Contains information about releases and transfers of more than 300 toxic chemicals and compounds to the environment as reported to EPA under Section 313 of EPCRA.

TSDFs (Treatment, Storage, and Disposal Facilities) -- Facilities that treat, store, or dispose of hazardous waste. These facilities are regulated by EPA under RCRA.

TSP (Total Suspended Particulates) -- See Particulate matter.

Turbidity -- Cloudy or hazy appearance in a clear liquid caused by suspended silt or organic matter.

Urban Runoff -- Stormwater runoff in urban areas. Urban runoff transports relatively larger loads of pollution than rural runoff due to larger deposits of pollutants on the ground and less pervious ground surfaces.

Violations -- A pollutant-specific determination that a metropolitan statistical area is out of compliance with the NAAQS regulations. Depending on the pollutant, a violation may be based on the number of exceedances of the NAAQS levels, or it can be based on the concentration of a particular measurement (e.g., fourth highest reading at a monitoring station in one year).

GLOSSARY OF TERMS AND LIST OF ACRONYMS/ABBREVIATIONS (continued)

VOC (Volatile Organic Compounds) -- Organic compounds containing the element carbon and which produce vapors readily. Examples of VOCs include gasoline, benzene, toluene and tetrachloroethylene, the principal dry cleaning solvent.

Volatilization -- Evaporating rapidly; diffusing freely in the atmosphere.

Wastestreams -- Unwanted materials which are leftover from a manufacturing process, and are not a product or byproduct. Wastestreams can refer to all media including air, water and solid waste.

Water Quality Monitoring -- Assessment of water quality for use of the resource for drinking water consumption, fishing, and other purposes. Water is monitored for bacteria (fecal coliform and total coliform), conventional parameters (nutrients) and toxic pollutants (metals, pesticides, etc.).

Water Quality Assessments/Ratings -- Ratings for the quality of water in various water bodies and used in state 305(b) reports. Ratings include: "fully supported," "full/threatened," "partial/minor," "partial/moderate," and "nonsupporting".

FREQUENTLY USED UNITS

g/m^3 -- grams per cubic meter

kg/yr -- kilograms per year

km -- kilometers

lb/yr -- pounds per year

μg/dL -- microgram per deciliter

μg/ft^2 -- microgram per square foot

μg/g --microgram per gram

μg/kg -- microgram per kilogram

μg/L -- microgram per liter

μg/m^3 -- micrograms per cubic meter

mg/g -- milligram per gram

mg/kg -- milligrams per kilogram

ng/g - nanograms per gram

ng/m^3 -- nanograms per cubic meter

pg/g -- picograms per gram

pg/m^3 -- picograms per cubic meter

ppb -- parts per billion

ppbC -- parts per billion Carbon

ppbv -- volumetric parts per billion

ppm -- parts per million

yd^3 -- cubic yards