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The public data method: an alternative procedure for estimating toxic releases in the production of petrochemicals for the materials production stage of a life-cycle inventory

Lawrence C. Lasher

To the Graduate Council:

I am submitting herewith a thesis written by Lawrence C. Lasher entitled "The public data method: an alternative procedure for estimating toxic releases in the production of petrochemicals for the materials production stage of a life-cycle inventory." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Chemical Engineering.

Fred Weber, Major Professor

We have read this thesis and recommend its acceptance:

Robert M. Cowell, George C. Frazier

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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The Public Data Method: An Alternative Procedure for Estimating Toxic Releases in the Production of Petrochemicals for the Materials Production Stage of a Life-Cycle Inventory

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Lawrence C. Lasher, Jr.

August 2000

DEDICATION

This thesis is dedicated to my parents,

Evelyn Roop Lasher and the late Lawrence Carl Lasher, Sr

and to the glory of God

"Every one to whom much is given, of him will much be required "

- Luke 12:48

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ABSTRACT

An alternative technique for estimating toxic releases in the production of petrochemicals for the materials production stage of a life-cycle inventory was developed This procedure is called the Public Data Method and is based on data sources available from the public domain· the Toxic Release Inventory, the Chemical Guide to United States, selected literature sources, Chemical Marketing Reporter chemical profiles, and the Environmental Protection Agency's *Sector Facility Indexing Project* notebook on petroleum refining Petrochemical databases for polystyrene, high-density polyethylene, polyvinyl chloride, polycarbonate, and ethylene glycol were created by the Public Data Method and presented as examples of this methodology.

Results were mixed, with the positive result of speciation of toxic releases, but negative result of inconsistent datum values when compared to values from other data sources.

Advantages of the Public Data Method are generation of speciated data of toxic chemical emissions, less aggregation than is found in the data sources of conventional life-cycle inventories, data that is current and date-specific, and less labor-intensive than current methods,

Although the Public Data Method as presented in this study was applied to petrochemicals, it could be used for other materials based on sector facility reports of other industries such as, aluminum, copper, lead, or zinc refining, the iron and steel industry, metal mining extraction, glass and other industries

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FIGURE **PAGE**

LIST OF ABBREVIATIONS

AAMA	American Automobile Manufacturers Association
ABS	Acrylonitrile-Butadiene Rubber
AC	Atlantic Consulting
APC	American Plastics Council
API	American Petroleum Institute
APME	Association of Plastics Manufacturers in Europe
BHT	Butylated Hydroxytoluene
BUWAL	Swiss Agency for the Environment, Forests and Landscape
CCPCT	Center for Clean Products Clean Technologies
CDP	Computer Display Project
CFC	Chlorofluorocarbon
CGUS	Chemical Guide to the United States
CMR	Chemical Marketing Reporter
CSG	Council of State Governments
CMC	Carboxymethyl Cellulose
CRT	Cathode Ray Tube
DDT	Dichlorodiphenyltrichloroethane
DfE	Design for the Environment
EDIP	Environmental Design of Industrial Products
EIA	Energy Information Administration

EIME	Environmental Information and Management Explorer
EP	Ethylene-Propylene
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
HC	Hydrocarbon
HD	High Density
HDPE	High-Density Polyethylene
HIPS	High Impact Polystyrene
ID	Identification
IDEMAT	Industrial Design Materials
IPU	Institute for Product Development
LCA	Life-cycle Assessment
LCI	Life-cycle Inventory
LDPE	Low-Density Polyethylene
LD	Low Density
NJIT	New Jersey Institute of Technology
PC	Polycarbonate
PCB	Polychlorinated Biphenyls
PDM	Public Data Method
PET	Polyethylene Terephthalate
POTWs	Publicly Owned Treatment Works
PP	Polypropylene
PS	Polystyrene

PTA/DMT	Purified Terephthalic Acid and Dimethyl Terephthalate
PVC	Polyvinyl Chloride
RSV	Revised Standard Version
RTK	Right-to-Know
RTK NET	Right-to-Know Network
SETAC	Society of Environmental Toxicology and Chemistry
SFIP	Sector Facility Indexing Project
TRI	Toxic Release Inventory
SB	Styrene Butadiene
SBR	Styrene Butadiene Rubber
STPP	Sodium Tripolyphosphate
TKPP	Tetrapotassium Pyrophosphate
USAMP	United States Automotive Materials Partnership

CHAPTER 1

INTRODUCTION

The subject for this thesis involves the estimating of the toxic releases for upstream petrochemicals a of life-cycle inventory (LCI) The LCI is one part of a life-cycle assessment (LCA), which is a tool that is used to evaluate the environmental effects associated with the manufacture of a given product The LCA evaluates the product or process from the "cradle to the grave," essentially doing mass and energy balances on the product It is a tool that is now being used today more and more by the engineer to provide a better understanding of the effects on the environment associated with the decisions of how to make a product and what materials are used to make that product

1.1. OBJECTIVE

The objective of this work is to develop a method based on data obtained from the public domain that will determine the amount of toxic chemicals released per pound of product produced for an upstream material of an LCI The database should generate more speciated data on toxic chemical emissions than is found in conventional life-cycle inventories It is also desirable that this method be less time-consuming and less labor-intensive than present methods of producing upstream inventory data

1.2. METHODOLOGY

The approach method used in this paper is to review the conventional methodology used in LCIs, then to present an alternative method that may be utilized to obtain data and to make the appropriate estimations needed for a given LCI. The new method is then compared to existing data sources and conclusions concerning the applicability of this method are made

CHAPTER 2

BACKGROUND

2.1. STEWARDSHIP

There is a saying in American popular culture, "I shop like a bull – I charge everything " This philosophy in a way reflects the path modern society has taken in respect to its environment. At times, mankind has used the resources of its environment with no regard to the impact that a wasteful lifestyle has on future generations In short, we "buy now," and subsequent generations "pay later "

A more responsible approach to our environment involves the concept of stewardship A steward is a person who manages things that belong to someone else Moreover, in regard to the world and all the resources it avails to mankind – from non-renewable resources such as minerals of the earth, to renewable resources such as plant and animal life – mankind is, for better or worse, a steward of the world's resources

A steward can manage the things that belong to someone else well, or he/she can manage them poorly A pertinent saying from the Bible admonishes the reader to be a responsible steward, "Every one to whom much is given, of him will much be required" (Luke 12.48) Mankind has been given much. We have been given abundant assets within our environment and the cognizance to utilize these resources for our betterment Our society has a responsibility to manage our environment effectively or else we could

lose or destroy these invaluable resources, not only for the present but also for future generations

2.2. SUSTAINABLE DEVELOPMENT

An idea in environmentalism that encompasses this idea of being a good steward is "sustainable development " Sustainable development was defined in the 1987 Commission on Environment and Development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Wenzel, Hauschild, and Alting, 1997) In other words, managing our environment in such a way that it can continue to meet our present and future needs Robert Gilman, President of Context Institute, wrote, "Sustainability refers to the ability of a society, ecosystem, or any such ongoing system to continue functioning into the indefinite future without being forced into decline through exhaustion of key resources" (Gilman, accessed March 2000)

The concept of sustainable development can be applied to our communities.

> The focus and scale of sustainability efforts depend on local conditions, including resources, politics, individual actions, and the unique features of the community. The sustainable communities approach has been applied to issues as varied as urban sprawl, inner-city and brownfield redevelopment, economic development and growth, ecosystem management, agriculture, biodiversity, green buildings, energy conservation, watershed management, and pollution prevention. Many of these issues and other community problems cannot easily be addressed by

traditional approaches or traditional elements within our society (*Linking Sustainable Community Activities to Pollution Prevention A Sourcebook*, April 1997).

Sustainable development is something of a philosophy or doctrine that links the environmental and economic concerns of our society.

> Sustainability is the [emerging] doctrine that economic growth and development must take place, and be maintained over time, within the limits set by ecology in the broadest sense - by the interrelations of human beings and their works, the biosphere and the physical and chemical laws that govern it It follows that environmental protection and economic development are complementary rather than antagonistic processes (Ruckelshaus, September 1989)

In the last few centuries with the advent of the industrial revolution, the impact of humans upon the environment has grown from local to regional, and sometimes even global The population growth of our species, the introduction of new chemicals into the environment, and mankind's use of larger parts of the earth, have all contributed to man's impact upon the environment Global impacts include the introduction of CO_2, CFCs (chlorofluorocarbons), mercury, DDT (dichlorodiphenyltrichloroethane), PCB's (polychlorinated biphenyls), dioxins and furans into the environment These chemicals exhibit characteristics of long life and thus wide dispersal into the environment (Wenzel, Hauschild, and Alting, 1997) Also of concern is the effect of these and other toxics released into the environment and their affect on plant and animal life Some species

become endangered with extinction, while humankind sometimes faces health hazards due to these toxic chemical releases

2.3. LIFE-CYCLE ASSESSMENT

With these concerns for the effect mankind has on his environment and also on human health, a tool has been developed to help gauge the impact on the environment from a product, process or activity This device is referred to as a life-cycle assessment, or LCA

SETAC (Society of Environmental Toxicology and Chemistry) defined the life-cycle assessment as (SETAC, 1991)

> an objective process to evaluate the environmental burdens associated with a product, process, or activity by identifying and quantifying energy and materials used and wastes released to the environment, to assess the impact of those energy and materials uses and releases on the environment, and to evaluate and implement opportunities to affect environmental improvements The assessment includes the entire life cycle of the product, process or activity, encompassing extraction and processing of raw materials, manufacturing, transportation and distribution, use/re-use/maintenance, recycling, and final disposal "

An LCA gives professionals a way to holistically look at the effects on the environment of a process or product throughout its cradle-to-grave life cycle (SETAC, 1991)

The LCA is used as an environmental analysis tool that can help identify, assess, and solve the environmental concerns associated with the product in question and to help reduce the environmental burdens associated with the production, usage and end of life of a given product (SETAC, 1991)

According to SETAC (1991), there are typically three main parts to an LCA

1) Life-Cycle Inventory – An objective data-based process of quantifying energy and raw material requirements, air emissions, waterborne effluents, solid waste, and other environmental releases throughout the life cycle of a product, process, or activity
2) Life-Cycle Impact Analysis – A technical, quantitative, and/or qualitative process to characterize and assess the effects of the environmental loadings identified in the inventory component The assessment should address both ecological and human health considerations, as well as such other effects as habit modification and noise pollution
3) Life-Cycle Improvement Analysis – A systematic evaluation of the needs and opportunities to reduce the environmental burden associated with energy and raw materials use and environmental releases throughout the whole life-cycle of the a product, process, or activity This analysis may include both quantitative measures of improvements, such as changes in product, process, or activity design; raw material use, industrial processing, customer use, and waste management.

Wenzel, Hauschild, and Altıng (1997) presented a slıghtly dıfferent LCA method descrıbed as the Envıronmental Desıgn of Industrıal Products method, or the EDIP method Thıs method of performıng an LCA breaks down the LCA ınto four phases:

1) goal defınıtıon
2) scope defınıtıon
3) ınventory
4) ımpact assessment

The objectıve of the LCA ıs laıd out ın the goal defınıtıon The scope defınıtıon determınes how large a part of the product's lıfe-cycle ıs to be ıncluded The ınventory ıs once agaın the gatherıng of ınput and output ınformatıon on the product. Fınally, the ımpact assessment ıs the ınterpretatıon of thıs ınventory data (Wenzel, Hauschıld, and Altıng, 1997)

2.4. LIFE-CYCLE INVENTORY

Of the three maın parts of an LCA, thıs paper ıs ınterested ın the lıfe-cycle ınventory. In *Lıfe-cycle assessment· Inventory Guidelines and Prıncıples*, Boguskı et al (1993) summarızed the key aspects of a lıfe-cycle ınventory wıth the followıng statements·

> Lıfe-cycle ınventorıes may be used both ınternally by organızatıons to support decısıons ın ımplementıng ımprovements and externally to ınform decısıons, wıth external applıcatıons requırıng a hıgher standard of accountabılıty Lıfe-cycle ınventory analyses can be used ın process analysıs, materıal selectıon, product evaluatıon, product comparıson, and

policy-making.. The specificity of a life-cycle inventory may range from completely generic to entirely product-specific, with most studies falling somewhere in between. Data collection and results interpretation are strongly influenced by study specificity In life-cycle inventory analysis, the term "system" refers to a collection of operations that together perform some defined function.. .A broad-based life-cycle inventory begins with raw materials and continues through final disposition, accounting for every significant step in a product system. Each subsystem requires input of materials and energy, requires transportation of product produced, and has outputs of products, coproducts/by-products, solid waste, atmospheric emissions, waterborne wastes and other releases

An inventory provides a quantitative catalog of the inputs (energy and raw materials) and outputs (including environmental releases) for a specific product, process, or activity. The inventory collects environmentally relevant information from the processes delineated in the scope definition One then establishes unit data and sets up unit processes, inventories the relevant environmental exchanges, and organizes the data – usually into tables and/or as a database (Wenzel, Hauschild, and Alting, 1997)

2.4.1. PRODUCT LIFE STAGES

In a life-cycle inventory the life of the product is broken down into different phases or stages of the product Material and energy balances are conducted on these subsystems, and then the system as a whole is considered According to SETAC (1991), there are six stages that should be considered when developing a life-cycle inventory

1) raw materials acquisition

2) manufacturing, processing and formulation

3) distribution and transportation

4) use/re-use/maintenance

5) recycling

6) waste management

Each stage has inputs of materials and energy, and outputs of products and various forms of waste

The EDIP method (Wenzel, Hauschild, and Alting, 1997) divides these product life stages or process types into seven similar stages:

1) extraction of raw materials

2) materials production

3) product manufacturing

4) use

5) disposal

6) transport

7) energy systems

The focus of this paper will be on materials production, as described in the EDIP method This stage includes such categories of materials as metals, glass, wood and paper, and plastics In particular, various plastics that are common to upstream inventories of LCAs will be investigated. Note that "upstream inventory" commonly refers to the materials (as stated above for the materials production stage) before they are

later machined, molded or processed in some way in the product manufacturing stage, or the materials before they are involved in the use stage (e g , oil, gasoline, antifreeze, etc)

2.4.2. PRODUCT SPECIFICITY

With each stage the specificity of the data must be considered Data ranges in three levels, from the most specific to least specific, are as follows (Wenzel, Hauschild, and Alting, 1997)

1) Product specific data – data comes directly from processes involved with the reference product
2) Site-specific data – data that comes from the actual site of production of a certain product, but that cannot be exclusively associated with that product only
3) General data – general data for a process stage or type that is not specifically product or site-specific

So, what type of specificity is required for each life stage of a product? Table 1 illustrates the different ranges of specificity for each inventory stage. Note that the specificity of Materials Production is less stringent, only requiring either site-specific data or general data.

2.4.3. DATA COLLECTION

According to Wenzel, Hauschild, and Alting (1997), data collection is the most time-consuming part of an LCA One must take time to gather qualitative and quantitative information on the many processes of a product system When the

Table 1 Requirements for Specificity of Data

Product System	Product-specific Data	Site-specific Data	General Data	Required Specificity
Extraction of Raw Materials		X	X	Often, the raw material originates from large parts of the world and the precise source is not known, as in the case of metal ore. In other cases, e g , natural gas from the North Sea, the source is well defined For practical purposes, representative averages are often used which means mainly general data, or in certain cases, site- or region-specific data
Materials Production		X	X	Same as above, however, in many the cases the companies have regular suppliers, e g , "steel form a specific steelworks" or "Norwegian aluminum " This allows the use of site-specific data
Manufacturing	X	X	X	Certain processes are specific to a product, e g , a particular surface treatment or assembly process Others are more common such as an injection molding of a plastic For some processes, data should therefore be specific to processing of the actual product For others, extrapolation from general data for the process is permissible
Use	X			This stage is unique for the product and should, as far as possible, be product-specific
Disposal	X	X	X	Same points as for the manufacturing processes above, but with a predominance of site-specific data, e.g , incineration, shredding and recycling of metals or representative data Certain disassembly processes should be product specific
Transport	X	X	X	Means of transportation and distances are specifically defined by the actual product, as is the degree of driving in urban areas, on highways, etc Data for the environmental exchanges from the transport processes must be general
Energy Systems		X	X	The product concerned specifies the site or region where the energy system is situated, while the data are general for the particular site/region

(Source. adapted from *Environmental Assessment of Products, Volume 1 Methodology, Tools and Case Studies in Product Development* , by Wenzel, Henrik, Michael Hauschild and Leo Alting, 1997 New York Chapman & Hall)

appropriate data has been collected, it establishes a fundamental base of environmental knowledge for the company.

2.4.3.1. DATA SOURCES

Boguski et al (1993) states that "many data sources are available to use in inventories Well-characterized data from industry are best for production processes " The data collection phase utilizes data from many types of data sources that have already been established. Wenzel, Hauschild, and Alting (1997) identified four types of inventory data sources to be utilized in data collection·

1) electronic databases
2) literature data – LCA reports, scientific and public reports, etc
3) unreported data – from manufacturers, labs, etc.
4) measurements and/or computations – where data are non-existent and need to be improved

Electronic data and literature data usually provide the most inexpensive avenue for obtaining needed information on the product. This data is secured through LCA centers and specialist centers, while other databases are available over the web. Sometimes the data measurements involve the actual product or process in the product system. In other situations a different technology is used with the same product so that calculations must be done Other times, extrapolation from the same process or technology is required for a different, though comparable, material (Wenzel, Hauschild, and Alting, 1997)

Unreported data describes data that comes from manufacturers that is not available to the public for proprietary reasons Boguski et al (1993) cautions, "when collecting data (and later, when reporting the results), protection of confidential business information should be balanced with the need for full and detailed analysis or disclosure " If the LCA is only to be used by the manufacturer, then this type data is readily available. If, however, the LCA may possibly be shared with others, then conditions must be agreed upon on how the data can be used

Measurements/computations normally come from the actual processes of the product system and although this data gives the most accurate representation of the product system, collecting this type of data tends to be the most time-consuming and expensive. Questionnaires are utilized to obtain this data from the appropriate vendors (Wenzel, Hauschild, and Alting, 1997)

The focus of this paper will be to establish a method to use existing, publicly available electronic and literature data in upstream LCIs that have not been utilized in life-cycle assessments previously

2.4.3.2. DATA PROVIDERS

Who are the providers of the data used in LCAs? Traditionally, the answer has depended upon the product life stage in question For raw materials and material production, data comes from associations of material producers and raw materials companies; for example, the Association of Plastics Manufacturers in Europe (APME), or raw materials suppliers, such as oil companies. For the product manufacturing, use, and disposal stages, the companies themselves are the most common providers Some

international databases exist for manufacturing processes, and for disposal processes such as incineration and landfilling, data can be found through authorities, and through research institutes Data for the transport and energy systems stages are usually acquired through specialized information centers

The trend of the future appears to be data networks, which maintain current databases of information for each stage by interfacing with the appropriate data providers and requiring regular updates from the providers for each part of the database (Wenzel, Hauschild, and Alting, 1997) Each provider then has current databases not only in their area of commerce, but also in the other stages

The scheme to be presented in this paper utilizes an electronic database that thus allows for periodic updates. This is important, because static databases are limited in the time span of their applicability, with parts (if not all) of the data eventually becoming obsolete

2.5. TOXIC RELEASES

Having become familiarized with the various aspects of the life-cycle inventory the purpose of this study must now be explained, viz , the estimation of toxic releases Toxic releases are the emissions to the environment by the product or process In life-cycle analyses, it is vitally important to have adequate speciation of the chemicals emitted by the product in order to perform environmental and health impact studies. But this is a major problem with LCAs today – they clump together chemicals into categories and thus limit the thoroughness of the impact analyses This leaves the practitioners of the LCA with the unenviable task of collecting the data directly from the sources or a

representative source This route is expensive and time consuming, in addition to the fact that the data may not be easily obtained or incorporated with other data obtained for the LCI from other sources

CHAPTER 3

THE PUBLIC DATA LCI METHOD FOR ESTIMATING TOXIC RELEASES

This paper endeavors to provide an alternative method for estimating toxic releases per pound of product for upstream materials of a life-cycle inventory. This study proposes to accomplish this objective by incorporating the use of publicly obtainable data

This chapter examines the reasons to use public data, the alternative method of collecting LCI data called the Public Data Method, details of the Public Data Method, and related databases based on materials from an automobile case study

3.1. REASONS TO USE PUBLIC DATA

Why use public data in life-cycle inventories? The answer can be illustrated by considering as an example, polystyrene, a petrochemical with such general uses as packaging and containers, appliance parts, toys and recreation equipment, housewares and automobile parts (Hatch and Matar, 1981) According to the EDIP method there are seven stages to consider in the life-cycle of the polystyrene In this example the focus will be on the second stage, materials production, because this is the life-cycle stage for which the public databases to be examined are particularly applicable The focus will be further narrowed to certain particular inputs and outputs The only inputs to be considered here will be the materials that are used to make polystyrene. Outputs to be

considered will be limited to the products that the facility is producing and the environmental releases associated with the facility

Having narrowed the scope of the polystyrene inputs and outputs basically to the product itself and disregarding ancillary materials, the next task is to determine data for the LCI in the form of quantifiable amounts of toxic chemicals that are released into the environment when polystyrene is made. These toxic chemicals are to be reported per pound of product produced (in this case, polystyrene) To adequately collect this type of data, the best-case scenario would be to go to a chemical plant that produced polystyrene and have them carefully measure the throughput and all releases over a period of time Then, one could calculate the pounds of toxics released per pound of product produced for each toxic chemical. If one could compare these results with other similar results of other upstream plastics that were on a same unit basis, one would be able to determine the impact that one upstream material has on the environment as compared to another

However, there are two problems that immediately present themselves when we try to proceed in the above manner

1) Canvassing plants with questionnaires for this type of data is expensive and time-consuming It is desirable to use data for the LCI that is easily attainable and affordable, such as publicly available data from government databases and literature sources.
2) Unreported data is difficult to obtain One must find a polystyrene plant that would be willing to provide the data outlined above In particular, the throughput of polystyrene is information that many companies would hesitate to divulge.

To avoid the problems listed above of conducting a labor intensive, time-consuming on-site facility survey, LCI practitioners turn to secondary data sources to obtain environmental release data However, a third major problem is encountered when data from these previously conducted LCIs is used, viz , LCI studies do not provide speciated data on toxic chemicals Chemicals in these studies are aggregated into general categories that cannot be used in the subsequent impact analysis performed in an LCA Thus, it is desirable to develop an alternate method of obtaining toxic emissions data that provides speciated data and avoids the problems inherent in conducting an on-site facility survey

3.2. AN ALTERNATIVE – THE PUBLIC DATA METHOD

This study in fact has discovered several publicly available sources that together can be used for this purpose of providing speciated toxic release data, and proposes an alternative method for generating data for upstream LCIs For the remainder of this paper this alternative method will thus be referred to as the Public Data LCI Method for the Materials Production Stage, or simply the Public Data Method (PDM) This study grew out of a research project for Saturn Corporation that the author participated in on behalf of the University of Tennessee's Center for Clean Products and Clean Technologies (*CCPCT*), namely, their "Life-Cycle Design for the Automobile." This project is described at the *CCPCT*'s web site under the heading, "Life-Cycle Design for the Automobile."

> The University of Tennessee Center for Clean Products and Clean Technologies received a major grant through the United States Environmental Technology Initiative to develop cleaner designs for the

automobile in partnership with the Saturn Corporation and the Environmental Protection Agency. The goal of the project is to develop an interactive design toolkit that will allow automobile designers to take the environment into account as part of the design process The toolkit will rely upon life-cycle assessment, which is the process of determining the full environmental impacts of products or materials in each stage of their life cycle (from extraction of raw materials, to manufacturing, to use, and ultimate disposal), as well as other DfE [Design for the Environment] tools The life-cycle design toolkit will allow designers to make environmental tradeoffs among materials, alternative designs, and manufacturing technologies in conjunction with existing design criteria for cost, safety, and performance The Center is working directly with Saturn to develop the toolkit and to demonstrate it with Saturn designs The life-cycle design toolkit developed and demonstrated in the project will also be available to other U S manufacturers The life-cycle design tool is incorporating life-cycle impact assessment, which will include both an environmental and occupational component, and is also incorporating total cost assessment for the Saturn plant. (*CCPCT*, accessed February 2000)

Research involved identifying and collating data sources and data providers for upstream materials related to an automobile life-cycle assessment, and relating toxic releases to upstream materials production using public data

3.3. DATA SOURCES FOR THE PUBLIC DATA METHOD

A survey of available databases to be used for upstream inventories was conducted for *CCPCT*, and as a result it was determined that there are several sources that together can be utilized in making estimates of environmental releases None of the other data providers surveyed appeared to have used the information sources that are to be presented in this paper for data estimation Listed below are the information sources that are utilized in the PDM

1) Toxic Release Inventory – database of facility environmental releases
2) Chemical Guide to United States – products linked to a facility
3) Selected Literature Sources – determining inputs through the production process
4) Chemical Marketing Reporter Chemical Profiles – computing the throughput
5) Sector Notebook – releases attributed to refineries

The following is a brief explanation of how each of these sources is used to develop a database of information that can be used in an LCI.

3.3.1. TOXIC RELEASE INVENTORY – DATABASE OF FACILITY ENVIRONMENTAL RELEASES

The most important database used in the PDM was actually born out of disaster In 1984 a Union Carbide facility that produced the pesticide methyl isocyanate leaked onto the densely populated region of Bhopal, central India. Of the 800,000 people living in Bhopal at the time, 2,000 died immediately, 300,000 became ill and many later died The cause of the leak was a series of mechanical and human errors. City health officials

had not been informed by Union Carbide about the toxicity of the chemicals used at the facility No emergency plans or procedures were in place and there was no information of how to deal with the poisonous cloud (*Earthbase*, accessed February 2000)

After the Bhopal tragedy the Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted to avoid a similar accident in the United States EPCRA establishes emergency planning for communities and provides public information on the environmental releases of all facilities of significant size This public government database is known as the Toxic Release Inventory (TRI) TRI provides the public with a database of information about releases and transfers of toxic chemicals from manufacturing facilities in the United States The facilities report environmental releases of a toxic chemical to TRI if they meet four criteria (*RTK NET*, accessed November 1999a):

1) They must be a manufacturing facility
2) They must have the equivalent of 10 or more full-time workers
3) They must either manufacture or process more than 25,000 lbs. of the chemical or use more than 10,000 lbs during the year
4) The chemical must be on the TRI list of over 600 specific toxic chemicals or chemical categories

In the PDM, toxic release data from the TRI database are obtained for each chemical plant or oil refinery through the web site known as *RTK NET*, or the *Right-to-Know Network* (*RTK NET*, accessed November 1999b) At this web site different types of releases and transfers are distinguished by their environmental medium, also termed disposition

- Releases on-site
    1) Fugitive Air
    2) Stack Air
    3) Water
    4) Underground Injection
    5) Land
- Transfers off-site
    6) To Publicly Owned Treatment Works (POTWs)
    7) Other Off-site Transfers

In the PDM databases fugitive air and stack air will be combined into one environmental medium category that will be termed "air", reducing the types of dispositions from seven to six The TRI is updated annually and previous years are archived.

The TRI is the primary database source to be used in the alternate method proposed in this paper However, a major obstacle to utilizing this database is lack of product information for the given facility that one may be focusing on for data. In particular, the throughput for the given product and knowledge of other products the facility might be producing are important to know if one is going to be able to apply the information that the RTK database freely provides

3.3.2. CHEMICAL GUIDE TO THE UNITED STATES – PRODUCTS LINKED TO A FACILITY

A second major source that helps solve this problem of lack of facility information is the *Chemical Guide to the United States* (*CGUS*) This is a directory of U S companies that lists the specific chemical(s) that is made at a particular plant location. Finding a current source that provides this type of information was difficult The *CGUS* was the newest resource uncovered even though it was dated to 1989-1990, or ten years ago. Information from this resource is important because it is used to determine whether all the releases at a plant that are retrieved from the RTK database can be attributed to the production of just the chemical product in question, or if there are other products that must be considered

If another product is being made by the facility there are two ways this second product might be produced The first way another product might be produced is as a byproduct of first product. The second alternative is that the facility may make another product that is produced by an entirely different chemical reaction than the process for the first product The secondary process may use the same feedstock as used by the first product, or there may be other feedstocks involved. There may even be a completely different production line for each product.

The *CGUS* helps to determine the number of useful products that are produced by the facility in question Also, without actually obtaining data from the plant in question, it is not possible to know for a certainty the chemical inputs that go into a plant However, by using the *CGUS* to find out all the product outputs, one can deduce which

chemicals must be used to make those products and thus determine the main chemical inputs of the plant

3.3.3. SELECTED LITERATURE SOURCES – DETERMINING INPUTS THROUGH THE PRODUCTION PROCESS

When estimating the chemicals used to make a product there are several literature sources that can be reviewed to understand what chemical process is involved In some cases there is only one predominant process in the industry used to make that product and thus the inputs are easy to determine For this situation the inputs are estimated to be simply the feedstocks needed for the predominant process However, there may be more than one way that the product is produced by industry. Literature sources describing production processes for the specific chemical disclose which process is most likely to be used Five works on petrochemical processes were consulted to determine the product inputs in the PDM

- *Chemicals from Petroleum* (Waddams, 1980)
- *From Hydrocarbons to Petrochemicals* (Hatch and Matar, 1981)
- *Chemistry of Petrochemical Processes* (Matar and Hatch, 1994)
- *Petrochemical Technology* (List, 1986)
- *Petrochemical Technology Assessment* (Rudd, et al , 1981)

3.3.4. CHEMICAL MARKETING REPORTER – COMPUTING THE THOUGHPUT

Knowing the amounts of environmental releases of a facility does little good if it cannot be related to the product in question. The *CGUS* only reveals what products are made at a facility, not how much of a product is made The throughput of the chemical product (e g , polystyrene) is determined through its chemical profile from *the Chemical Marketing Reporter* (*CMR*) that is archived at the *ChemExpo* web site (*ChemExpo*, accessed November 1999a). This site provides a chemical profile of the given material that includes the product capacity of a particular plant This value is used as an estimate of the amount of product produced

Also the *CMR* chemical profiles provide the annual U S. demand of a chemical, which is assumed to approximate the annual U S production This value is useful in calculating the percentage of a chemical that comes from crude by dividing the annual U S demand of the chemical by the annual amount of crude used. It is important to note that each U S demand value reported in the CMR chemical profiles includes the amount of chemical exported to other countries, but excludes the amount imported from other countries By not including the amount imported, the U S demand value represents the amount produced in the United States alone Thus, the U.S demand value represents the amount of the chemical produced only in U.S facilities

3.3.5. SECTOR NOTEBOOK – RELEASES ATTRIBUTED TO REFINERIES

With these sources TRIs released per pound of product can be calculated. However, in considering the releases that can be attributed to the production of a pound of product,

we have thus far only considered releases at the facility that produces this product What one should also consider are the releases that come about during the production of the petroleum feedstocks which are subsequently shipped from petroleum refineries to the chemical plant that makes the product This is accomplished in the PDM by first totaling the releases of the ten largest refineries (by capacity) for the petroleum refining industry

Determining the ten largest refineries is accomplished through the Environmental Protection Agency (EPA) *Sector Facility Indexing Project* web site at the homepage entitled, "Petroleum Refining Data" (*SFIP*, accessed October 1999) This web site contains several reports on various industrial categories that are called "Sector Notebooks" The *SFIP* has TRI pollutant release data for five industry sectors petroleum refining, iron and steel production, primary smelting and refining of nonferrous metals, pulp manufacturing, and automobile assembly Values obtained from the petroleum refining Sector Notebook are subsequently divided by the total of the capacities for the ten refineries to obtain the pounds of release per pound of crude Thus for petroleum-based chemicals, an estimate of the TRI releases is made by adding the releases attributed to the refineries and the releases attributed to the chemical plant which produces the product in question

3.4. THE PDM USED IN A TYPICAL LCA

In order to understand how the PDM can be used to estimate toxic releases in the production of petrochemicals for the materials production stage of an LCI, an automobile LCA will be used as an example It is important to keep in mind that the data for the petrochemical databases can be applied to the LCAs of other products besides an

automobile. Since these estimates are for the upstream materials production stage and do not include inputs and outputs of later stages that are specific to the production of an automobile, the data can be used in any upstream LCI that lists these five petrochemicals

Figure 1 shows a schematic representation the life-cycle of an automobile (Keoleian, et al , 1997). This diagram divides the life-cycle into four broad stages, and illustrates the many facets of the LCA of an automobile that are typically evaluated in an LCI. The Materials Production stage contains the chemicals of that may be used in the PDM. The materials listed in this stage comprise the general categories of materials that make the upstream inventory of an LCI. From the diagram one can see why they are termed "upstream" materials, because the subsequent columns describe manufactured components that are made from the upstream materials.

Table 2, lists several of the upstream materials that are typically used in the manufacture and use of an automobile Almost all of the organics listed are primarily derived from the feedstocks of petroleum From these upstream materials, five petrochemicals will be singled out for the this study

- Polystyrene (PS)
- High-Density Polyethylene (HDPE)
- Polyvinyl Chloride (PVC)
- Polycarbonate (PC)
- Ethylene Glycol

Materials P End-of-Life Management

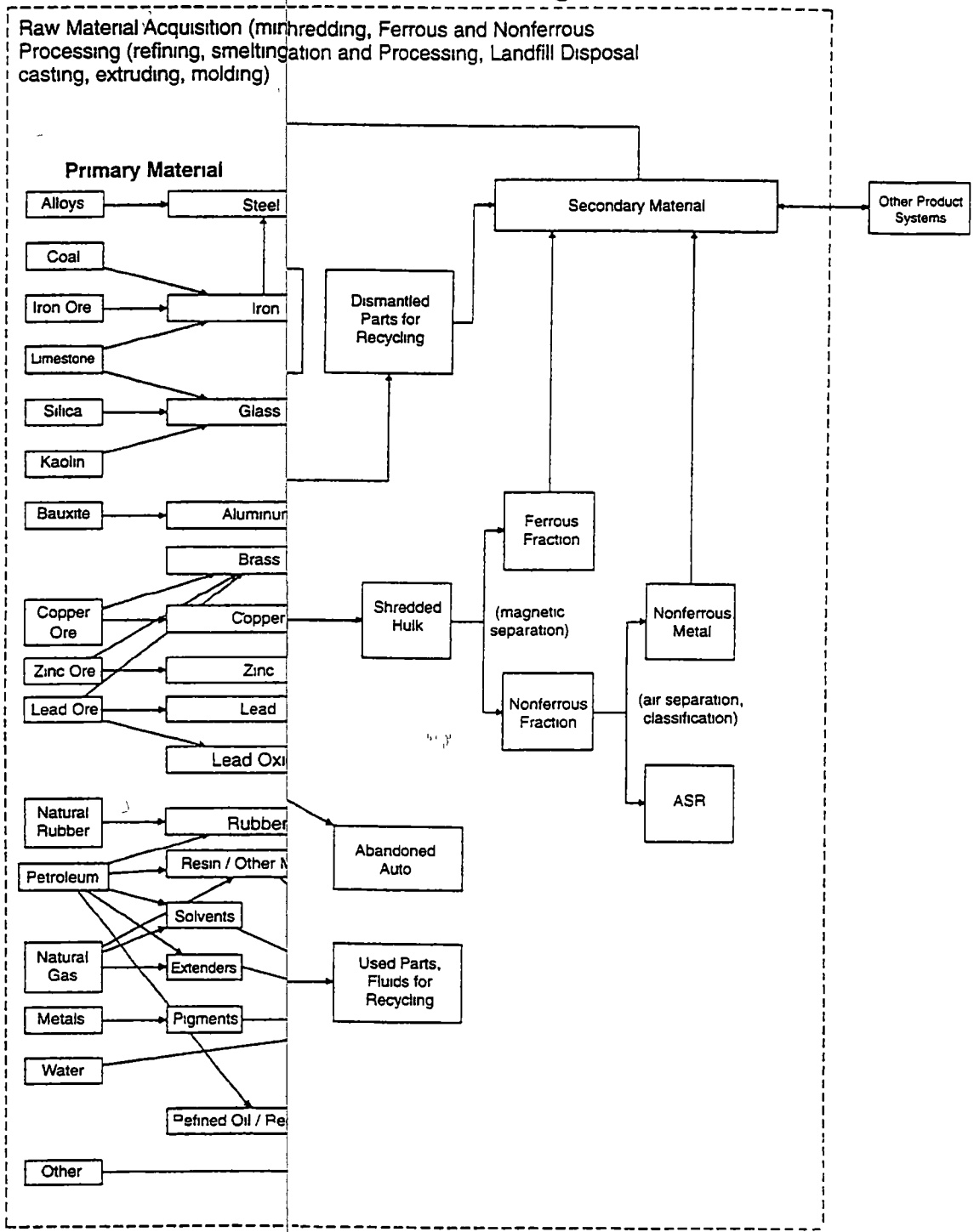


Table 2. Some Upstream Materials of an Automobile LCI

ORGANICS
1 ACRYLIC
2 ACRYLONITRILE (used in blends; eg , acrylonitrile-butadiene-styrene, ABS)
3. BUTADIENE (used in polymer blends such as ABS)
4. FLUIDS:
A. GASOLINE
B. BRAKE FLUID
C ENGINE OIL
D AUTOMATIC TRANSMISSION FLUID
E ETHYLENE GLYCOL (antifreeze coolant)
F. METHANOL (windshield washer fluid)
G AIR CONDITIONER FLUID
5 HDPE (high-density polyethylene)
6. NYLONS
7 POLYCARBONATE (PC)
8 POLYPROPYLENE (PP)
9 POLYESTERS
10 POLYSTYRENE (used in polymer blends)
11 POLYURETHANES
12 POLYVINYL CHLORIDE (PVC)
13 RUBBER (typically SBR, or styrene-butadiene rubber - used to make tires)
14 STYRENE (used in polymer blends)
INORGANICS
15 ALUMINUM
16 COPPER
17 GLASS
18 IRON
19 H_2SO_4 (battery)
20 LEAD (battery)
21 MAGNESIUM
22 STEEL
23 ZINC

(Source adapted from Saturn Corporation personal communication with Rajive Dhingra, University of Tennessee, 1998)

Table 3 (AAMA, 1994) illustrates where these petrochemicals would fit into an automobile LCI This table lists the material composition of an automobile by weight, obtained from the American Automobile Manufacturers Association (AAMA) Notice that plastics and plastic composites comprise 8% of the car, or 246 lbs The ethylene glycol is the antifreeze used by the automobile. It falls within the fluids and lubricants category, which is 6% of the automobile However, this amount is deceptive since this is a fluid that is replaced a number of times during the life of the vehicle, thus increasing its amount and impact over the life of the car Notice that the largest percentage of the automobile by weight is in some form of steel or iron. Although the PDM as developed in this paper applies only to petroleum-based materials, note iron and steel is another category of upstream materials that a PDM database could be used for This is because there is a sector notebook on the iron & steel industry that would make it possible to attribute releases to iron and steel mills

Figures 2 and 3 show general derivatives of ethylene and benzene Note that Polyethylene (HDPE and low-density polyethylene (LDPE)), PVC, and ethylene glycol are all derivatives of ethylene Derivatives of benzene include polycarbonate and polystyrene Actually, polystyrene is derived from both ethylene and benzene, as will be seen in more detail later in the paper Ethylene and Benzene are the two primary feedstocks of petroleum from which these five petrochemicals are derived.

Tables A1 through A5 in Appendix A show the five petrochemical databases generated using the PDM Due to the large size of each database in the number of columns and rows, each table is anywhere from 12 to 16 pages long. The page order of each table is down, then over In the automobile LCI example, four of these chemicals

Table 3. Estimated Average Material Composition (lbs) for a 1994 U S.-Built Car

MATERIAL	1994
Conventional Steel (includes cold rolled and precoated)	1389
High-strength Steel	263
Stainless Steel	45
Other Steels	43
Iron	408
Aluminum	182
Rubber	134
Plastics and Plastic Composites	246
Glass	89
Copper and Brass	42
Zinc Die Castings	16
Powder Metal Parts	27
Fluids and Lubricants	190
Other Materials	99
TOTAL	3171
Note total differs from sum of column because of rounding	

(Source: *AAMA Motor Vehicle Facts and Figures*, 1994 Detroit: American Automobile Manufacturers Association)

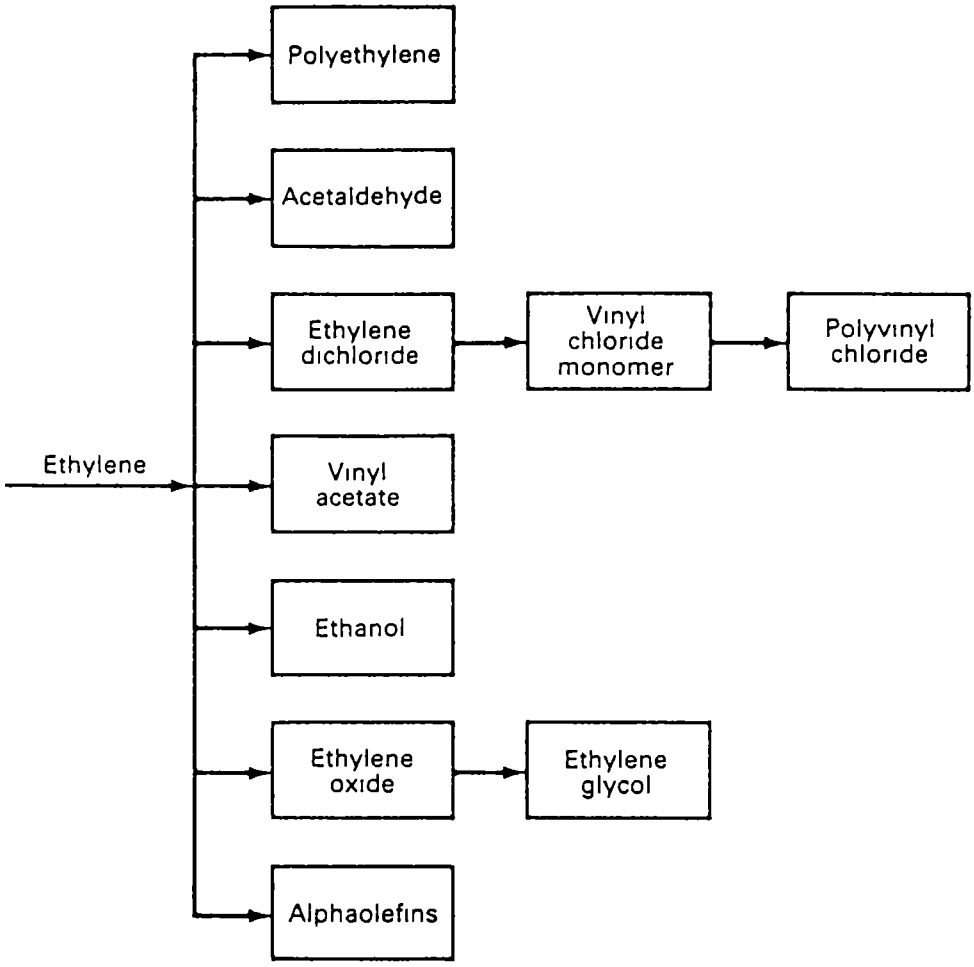


Figure 2. Ethylene Derivatives

(Source. *Petrochemical Technology*, by H L List, 1986
Englewood Cliffs, New Jersey· Prentice-Hall)

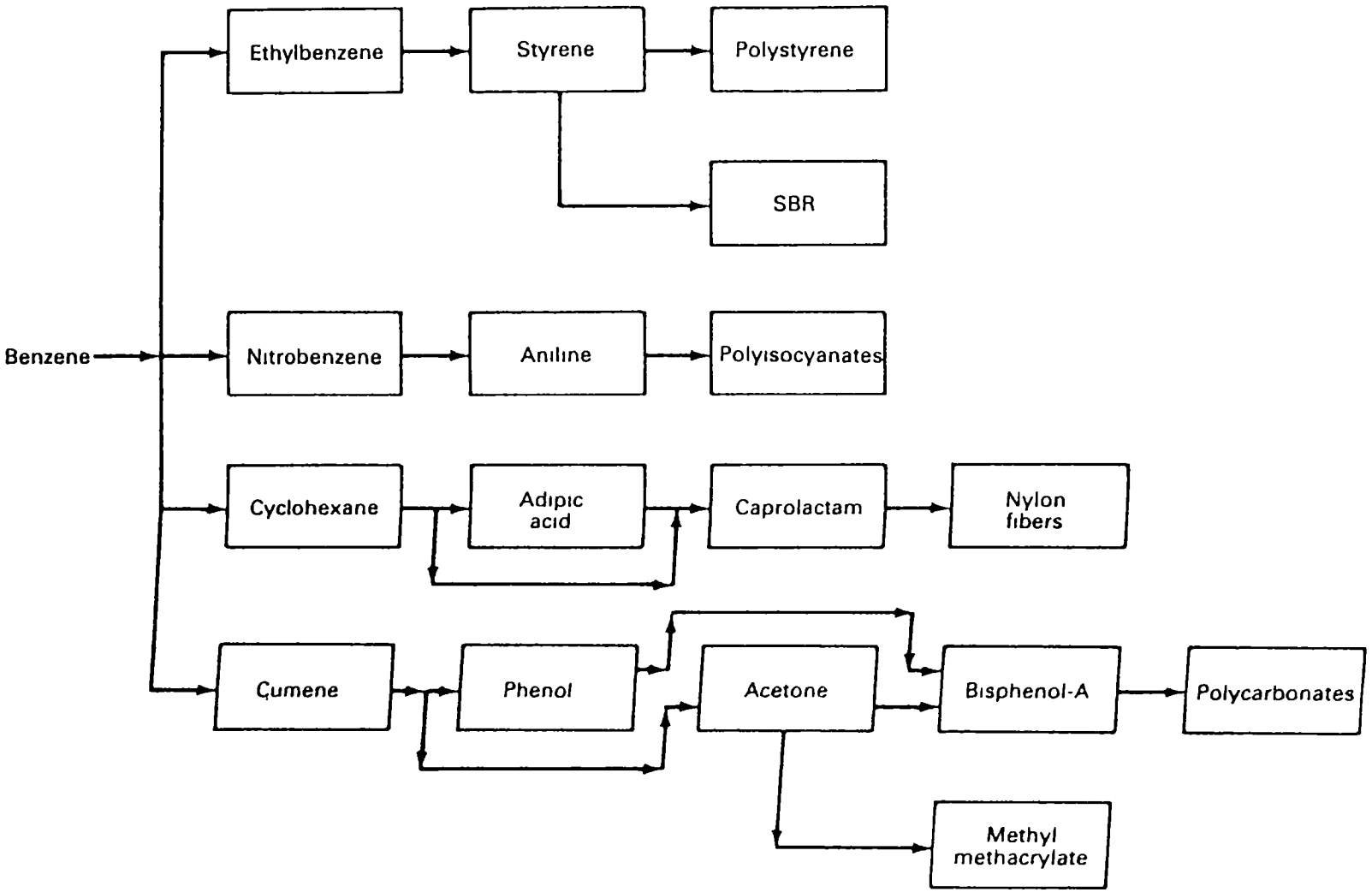


Figure 3 Benzene Derivatives
(Source: *Petrochemical Technology*, by H L List, 1986 Englewood Cliffs, New Jersey. Prentice-Hall)

are plastics that are manufactured into parts for the automobile; whereas, ethylene glycol is a fluid that is primarily utilized in the "Use" stage of an automobile, as described earlier in the seven stages of the EDIP LCI method However, these PDM databases could be used to estimate toxic releases in any LCI that has any of these five petrochemicals in its upstream inventory.

3.5. CREATION OF THE POLYSTYRENE DATABASE USING THE PDM

To better understand the PDM, the database for polystyrene will be examined in table A1 The columns of data are divided into three major sections TRI contribution from refining of petroleum, TRI contribution from the polystyrene chemical plant, and the total of TRI releases.

3.5.1. TRI CONTRIBUTION FROM REFINING OF PETROLEUM

In the first column of this table one finds a list of fifty-nine chemicals The number of chemicals is so great that this column extends for four pages These are the toxic chemicals that were reported by the ten largest refineries (by capacity) in the U S petroleum industry to the Toxic Release Inventory and retrieved from the RTK NET web site.

The second column shows the dispositions of the releases for each toxic chemical. For example, ammonia has releases reported in five of the six environmental mediums (dispositions) discussed earlier, viz , air, water, underground, land, POTW transfer, and off-site transfer

The remaining columns on the first page of Table A1 represent releases from the ten largest refineries in the petroleum industry (by capacity) Information indicating the ten largest facilities by capacity for the petroleum refining industry comes from the *SFIP* web site (*SFIP*, accessed October 1999). The TRI release data for each facility comes from the *Right-to-Know Network* environmental database for facility TRIs (*RTK NET*, accessed November 1999b)

Although emissions data were available for all U.S. refineries, only the ten largest refineries were used because it was noticed that many of the smaller refineries did not report releases adequately, with some apparently shut down or not running at full capacity

In order to follow along in the table more easily, observe the first row of data that represents the air releases for ammonia Notice that on the fifth page of Table A1 the air releases of ammonia are totaled for the ten refineries to give 746,277 lbs/yr The next column calculates the pounds of chemical released per bbl of crude in.

$$\frac{\text{x lbs of TRI chemical / yr}}{(365 \text{ days / yr})\ (3{,}689{,}000 \text{ bbls of crude in / day})\ (0.8600)} = \frac{\text{lbs of TRI chemical}}{\text{bbl of crude in}}$$

The 3,689,000 barrels of crude in/day value shown above is the total refining capacity for the ten refineries. The individual refining capacities are shown in Table 4 for each of the ten largest facilities along with the facility names, locations and TRI identification numbers for each facility

Table 4 The Ten Largest U S Refineries (by Capacity)

	1	2	3	4	5
[a]Facility Name	AMERADA HESS	AMOCO OIL	EXXON CORP	AMOCO OIL CO	EXXON CORP
[a]City, State	ST CROIX, VI	TEXAS CITY, TX	BATON ROUGE, LA	WHITING, IN	BAYTOWN, TX
[a]TRI ID	00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D
[a]Refining Capacity (barrels/day)	495,000	433,000	424,000	410,000	396,000
Percentage of Total U S Crude In Processed by the Refinery	3 0%	2 6%	2 6%	2 5%	2 4%

	6	7	8	9	10
[a]Facility Name	SUN COMPANY	MOBIL OIL CORP	CITGO PETROLEUM	PHILLIPS PETROLEUM	CHEVRON USA INC
[a]City, State	PHILADELPHIA, PA	BEAUMONT, TX	LAKE CHARLES, LA	SWEENY, TX	PASCAGOULA, MS
[a]TRI ID	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A	39567CHVRNPOBOX
[a]Refining Capacity (barrels/day)	315,000	315,000	305,000	301,000	295,000
Percentage of Total U S Crude In Processed by the Refinery	1 9%	1 9%	1 8%	1 8%	1.8%

Percentage of Total U S Crude In Processed by the Ten Largest Refineries --->	22 3%

([a]Source Adapted from *SFIP* (Sector Facility Indexing Report) website, accessed 1999 Obtained from homepage entitled "Petroleum Refining Data Access," Under headings "TRI Comparative Spreadsheet," "Select file format to download," "MS Excel 4 0," available at <http //es epa.gov/oeca/sfi/petdata.htm>)

In general, a facility normally does not run at full capacity. This is why the capacity in the equation above is multiplied by a factor to give the actual throughput The Ô 8600 (or 86%) value is the refining capacity factor that represents percentage of capacity at which the refinery is actually operating. Table 5 shows the data used in the calculation of this average refining capacity factor It was calculated by taking each yearly U S. refinery throughput divided by each yearly U S refining capacity for the years 1987-1993, and averaging the values (*International Petroleum Encyclopedia*, 1995) These were the only years that U S refinery throughput and capacity values were both available in the source that was used, and were thus used to estimate the rate at which the ten refineries were actually operating The throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days " It was assumed that these terms each referred to a 365-day year

Table 5 Calculation of Refining Capacity Factor

Year	[a]Refinery Throughput (barrels/calendar day)	[a]Refining Capacity (barrels/day)	Capacity Factor (throughput/capacity)
1987	12,855,000	15,258,000	0.8425
1988	13,245,000	15,288,000	0 8664
1989	13,400,000	15,557,000	0 8613
1990	13,410,000	16,244,000	0.8255
1991	13,300,000	15,559,000	0.8548
1992	13,410,000	15,327,000	0 8749
1993	13,610,000	15,210,000	0 8948
Average Refining Capacity Factor--->			0 8600

([a]Source adapted from *International Petroleum Encyclopedia*, 1995 Tulsa, OK Pennwell Publishing Co)

The next column with the heading "TRI lbs/lb of crude in" simply converts the barrels of crude to pounds of crude. The conversion factor was calculated using the density of crude

$$\left(\frac{42\ \text{U S gal}}{\text{bbl of crude in}}\right)\left(\frac{3.785 \times 10^{3}\ \text{cm}^{3}}{\text{gal}}\right)\left(\frac{0\ 8692\ \text{g crude in}}{\text{cm}^{3}}\right)\left(\frac{\text{lb}}{454\ \text{g}}\right)=\frac{304\ \text{lb crude in}}{\text{bbl crude in}}$$

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries As seen in Table 6, this resulted in an average gravity of 31 7 ° API (American Petroleum Institute), or equivalent specific gravity of 0 8692 (*Chemical and Process Technology Encyclopedia*, 1974) Conversion to specific gravity was accomplished using the relation,

$$^{\circ}\text{API}=\left(\frac{141.5}{\text{specific gravity @ 60/60}}\right)-131\ 5$$

International crudes were averaged together along with domestic samples of crude as an estimate because according to the EIA (Energy Information Administration) 53% of the crude processed at U S refineries in 1996 was imported (EIA, June 1997)

On the basis of 304 lbs crude in/bbl crude in, the ten refineries processed a total of 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

$$(3{,}689{,}000\ \text{bbls crude in/day})(0.86)(304\ \text{lbs/bbl crude})(365\ \text{days/yr})=\frac{352 \times 10^{12}\ \text{lbs}}{\text{yr}}$$

The total amount of crude processed by U.S. refineries in 1996 was 14 195 million barrels per day, or 1.575 trillion pounds per year (EIA, June 1997) Table 4 shows the percentage of total U.S. crude in that was processed by each refinery, ranging

Table 6. Calculation of Average Density of Crude

Location[a]	Gravity[a] (degrees API)	Specific Gravity
McComb, MS	40.7	0.8217
SW Texas	36 5	0.8423
East Texas	39.1	0.8294
Wyoming	17 9	0.9471
New Mexico	37.5	0.8373
N Kenai Peninsula, Alaska	25.9	0.8990
San Ardo, California	13 3	0.9772
Ospelousas, LA	38.2	0 8338
Velma, OK	29 1	0.8811
Arabian	30.0	0 8762
Minas, Central Sumatra	35 3	0 8483
Putomayo, Columbia	35.0	0 8498
Gulf Nigeria	34.7	0.8514
Zulia, Venezuela	25.2	0 9030
Iran	36.6	0.8418
Kuwait	31.5	0 8681
Average:	31.7	0.8692

([a]Source: adapted from *Chemical and Process Technology Encyclopedia,* 1974. New York: McGraw-Hill Book Co.)

from 1 8% to 3.0% The ten largest refineries processed a total of 22 3% of all the crude used by U S refineries.

Now that the pounds of toxic chemical per pound of crude has been determined, the next step is to compute the amount of the toxic released from the refineries (e.g , ammonia) that is attributed to the making of polystyrene This is accomplished by deciding on the most common or probable process for which the polystyrene is produced and using it as a guide to estimate the amount of toxic release attributed to the refining production process per pound of product (in this case, polystyrene). After consulting the selected literature sources mentioned in Section 3 3 3 and Section 3 3.4, it was decided that the schematic flowchart of the chemicals derived from crude shown in figure 4 was a good representation of how polystyrene is made

Looking once again at Table A1, in the next column it is estimated that 3.07% of crude from refineries is used to produced ethylene. This estimate was made by taking the total U S ethylene demand in 1996 (*ChemExpo*, accessed November 1999b) and dividing it by the total amount of crude processed by U S. refineries in 1996 (EIA, June 1997)

$$\left(\frac{48{,}400{,}000{,}000\ \text{lbs/yr ethylene}}{1{,}575{,}000{,}000{,}000\ \text{lbs crude/yr.}}\right) x\,100 = 3.07\%$$

This gives an approximation of the how much of the crude that goes into a refinery actually ends up as ethylene feedstock.

The next column in Table A1 entitled "7% of ethylene to ethylbenzene," multiplies the ammonia value by 7% for the amount of ethylene that goes to ethylbenzene This value was stated in the *CMR* chemical profile of ethylene (*ChemExpo*, accessed November 1999b)

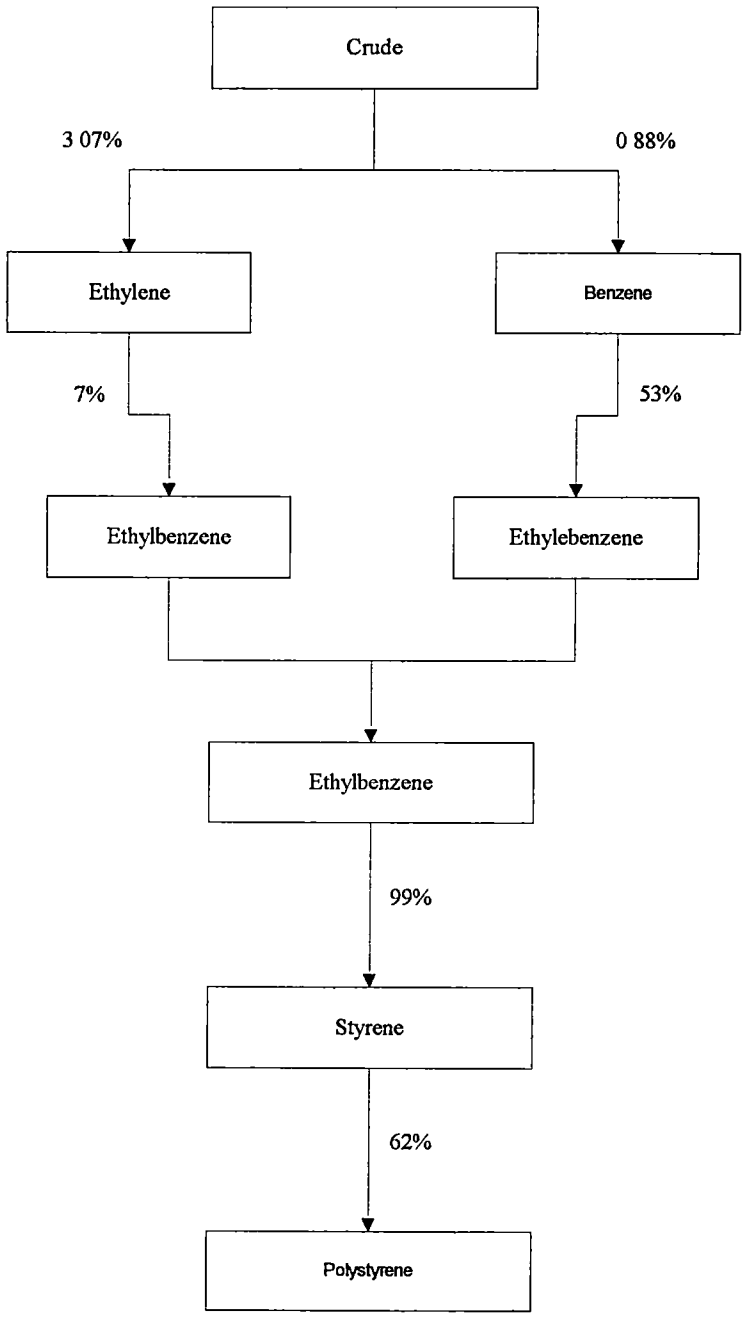


Figure 4 Polystyrene Schematic Diagram

The next two columns calculate the percentage of toxic that is released due to the production of ethylbenzene from the feedstock benzene Looking at Table A1 again, in the next column it is estimated that 0 88% of crude from refineries is used to produced benzene. This estimate was made by taking the total U S. benzene demand in 1996 (*ChemExpo*, accessed November 1999c) and dividing it by the total amount of crude processed by U S refineries in 1996 (EIA, June 1997)·

$$\left(\frac{(1{,}900{,}000\ \text{gal/yr benzene})/(7\ 314\ \text{lbs benzene/gallon})}{1{,}575{,}000{,}000{,}000\ \text{lbs crude/yr}}\right)\text{x}100 = 0\ 88\%$$

The density of benzene (0 8765 kg/l or 7.314 lb/gal) was used to convert gallons to pounds (*CRC Handbook of Chemistry and Physics*, 1980).

The next column in Table A1 entitled "53% of benzene to ethylbenzene," multiplies the ammonia value by 0 53 for the amount of benzene that goes to ethylbenzene This value was stated in the *CMR* chemical profile of benzene (*ChemExpo*, accessed November 1999c).

Now that the amounts for ethylene and benzene have been estimated, they are added together in the final column in Table A1 for that page The ethylene stream represents 32% and the benzene stream 68% of the total ethylbenzene contribution In order to continue to the next column for the air releases of ammonia, one must now turn ahead four pages in Table A1. The next column for consideration calculates 99% of ethylbenzene to styrene and is so titled (*ChemExpo*, accessed November 1999d). The following column computes 62% of styrene to polystyrene. This percentage was obtained from the *CMR* chemical profile of styrene (*ChemExpo*, accessed November 1999e)

Finally, in the next column the TRI lbs/ lb of polystyrene is computed. First, a conversion factor was calculated and used in the spreadsheet·

$$\frac{1{,}575{,}000{,}000{,}000 \text{ lbs/yr crude in}}{6{,}100{,}000{,}000 \text{ lbs polystyrene}} = \frac{258.2 \text{ lbs/yr crude in}}{\text{lb polystyrene}}$$

The 1 575 trillion lbs value is the total amount of crude processed in the United States, and the 6.1 billion lbs value is the 1996 U S polystyrene demand that came from the *CMR* chemical profile on polystyrene (*ChemExpo*, accessed November 1999f). As stated earlier in Section 3.3 4, this value includes the amount of polystyrene made in the United States and exported to other countries, but does not include polystyrene imported from other countries and used in the United States The 1996 U S. polystyrene demand value is thus assumed to approximate the amount of polystyrene produced in the United States in 1996.

Now that the conversion factor from crude to polystyrene has been calculated, TRI lbs/ lb of polystyrene is computed

$$\left(\frac{\text{x lbs of TRI chemical}}{\text{lb/yr crude in}}\right)\left(\frac{258.2 \text{ lbs/yr crude in}}{\text{lb polystyrene}}\right) = \frac{\text{lbs of TRI chemical}}{\text{lb polystyrene}}$$

3.5.2. TRI CONTRIBUTION FROM THE POLYSTYRENE CHEMICAL PLANT

Note that the value calculated in this last column only represents the amount of toxic release attributed to the refineries In other words, the values calculated in this column are the amounts of toxic releases from the refineries that can be traced to polystyrene All the calculations up to this point give us a value that represents the amount of toxic releases per pound of polystyrene that are released from the refineries.

However, it is important to consider the releases that are attributed to the making of the polystyrene in the polystyrene facility that uses the petrochemical feedstocks from the refineries As seen in Table 7, the refining industry represents 3% of all the releases by industry, whereas, the chemicals industry is 33% and the plastics industry is 5%. This implies that releases from facilities subsequent to the refineries should be included in the LCI

When considering the petrochemicals that go in to making polystyrene it is assumed that there is only one facility that takes the petrochemicals and produces polystyrene With the PDM, one only knows what a facility produces and has no idea about what inputs are going into the plant Thus a major assumption is made In tracing the derivation of a target petrochemical such as polystyrene it is assumed that all the feedstocks are made at the refineries and that all subsequent chemicals derived from the feedstocks are made at one facility that produces the target chemical The shortfall of this assumption is that if a chemical has an intermediate facility that is unaccounted for, then related toxic releases will be unaccounted for. The Public Data Method assumes that there is only one facility beyond the refineries Thus, the PDM will consider the releases attributed to the oil refineries, and add these to the TRI contributions from a polystyrene chemical plant

In order to compute the TRI contribution from the polystyrene chemical facility, one must first identify a facility that produces polystyrene. This is accomplished by first consulting the *CGUS* For polystyrene, it was determined that the Huntsman facility in Chesapeake, Virginia, was listed as producing only one product, polystyrene This is desirable, because if a facility produces other products, then only a portion of the TRI

Table 7 Major Industries' Releases of TRI Chemicals by Medium: 1995

Industry	Amount	Air Releases On-site (%)	Water Releases On-site (%)	Land Releases On-site (%)	Underground Injection Releases On-site (%)	Releases Off-site (%)	Share of Total (%)
Chemicals	817,482	50%	11%	8%	28%	4%	33%
Primary metals	500,594	27%	2%	37%	0%	34%	20%
Paper	236,243	90%	7%	1%	0%	1%	9%
Plastics	123,975	90%	0%	0%	0%	9%	5%
Transportaion equipment	120,593	91%	0%	0%	0%	9%	5%
Fabricated metals	95,664	85%	0%	1%	0%	14%	4%
Food	86,712	85%	7%	6%	0%	1%	3%
Petroleum refining	78,210	81%	8%	2%	5%	4%	3%
Stone/Clay/Glass	42,074	82%	0%	3%	0%	14%	2%
Furniture	41,068	100%	0%	0%	0%	0%	2%
All other industries	360,438	83%	3%	4%	1%	9%	14%
Total	2,503,053	63%	6%	11%	9%	11%	100%
Petroleum refining's share	n/a	4%	5%	1%	2%	1%	3%

(Source *6th Annual Petroleum Industry Environmental Performance Report* Accessed at the web site *API* (American Petroleum Institute), October 21, 1998, under headings "Environmental Performance," download of PDF file, <http.//www api org/step/piep htm>)

releases are linked to the polystyrene, and determination of the exact fraction would prove difficult

Now that a facility has been identified, its capacity must now be determined This is accomplished by referring once again to the ChemExpo profile on polystyrene (*ChemExpo*, accessed November 1999f), which has a listing of all the major facilities making polystyrene An example of this listing can be seen in figure B1. Turning to Table A1 once more, note that the facility capacity is listed as 450,000,000 lbs/yr

Next, the toxic releases were looked up on the *RTK NET* web site and entered into the column entitled, "annual TRI releases from facility producing polystyrene " Note that the first chemical listed is antimony compounds, which has 800 pounds of off-site transfer releases listed Most chemical facilities examined in this study reported far fewer chemical releases than the refinery facilities. This may in part be due to the size and complexity of a refinery as compared to the more specialized chemical facilities This polystyrene plant only reported releases on six different chemicals, thirteen values total when considering the dispositions

In order to look up the facility on the *RTK NET* web site, one first needs the TRI Facility ID that can then be used on the *RTK NET* site to access the data for that particular facility The TRI facility ID is determined by entering the name of the facility into the Toxic Releases Query Form web site (EPA *Envirofacts Warehouse,* accessed November 1999).

When using the *RTK NET* web site there are several fields for information to be entered, as seen in figure 5 There are only three fields that need to be addressed to retrieve the desired information on the chemical facility of interest. The first

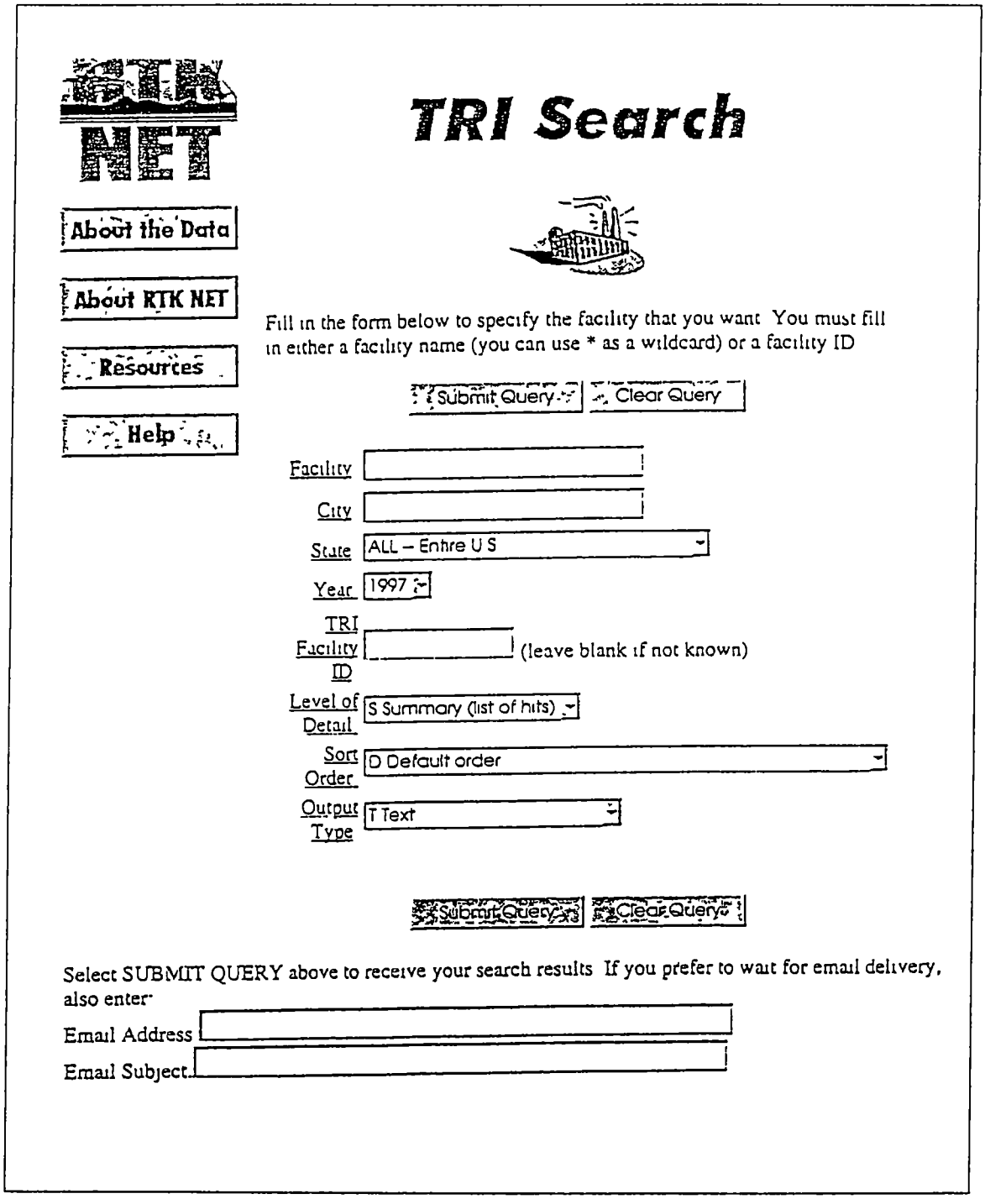


Figure 5 Copy of TRI Facility Search Fields at RTK NET Web Site

(Source RTK NET, accessed November 1999b Available from *TRI Search*, <http //www rtk net/triinputfacility html>)

field to consider is the "year" Since this study was done for a base year of 1996, the year "1996" was entered for polystyrene and the other chemical facilities of this study Next, the Facility ID is entered. Finally is the field entitled, "level of detail" The four choices in this field to choose from are summary, low, medium, and high "Summary" and "low" do not differentiate between the dispositions of the releases, and "high" has so much information on the chemicals that it is difficult to group the disposition data values together The "medium" level of detail succinctly lists the dispositions of each chemical release together and thus was found to be the best level of detail for listing the toxic releases of the facility. Thus, entering the appropriate information in these three fields results in the listing of toxics released from the facility in question.

Back again to Table A1, the next column is entitled, "TRI lbs per lb of polystyrene" This value is calculated by dividing the TRI chemical amount by the facility capacity and also by the facility capacity factor

$$\frac{\text{x lbs/yr TRI chemical}}{(450{,}000{,}000\ \text{lbs/yr polystyrene})(0\ 8616)} = \frac{\text{lbs TRI chemical}}{\text{lb polystyrene}}$$

The 0.8616 (or ~ 86%) value is the facility capacity factor that represents the percentage of capacity at which the facility is actually operating As seen in Table B1, the facility capacity factor was calculated by taking each annual U S demand value (considered to approximate the throughput) for 141 different chemicals, dividing by each annual U S capacity for 141 different chemicals, and averaging the values (*ChemExpo*, accessed November 1999a).

Notice in Table B1 that the capacity factor for polystyrene was 0 8401. This value represents the capacity factor for all the U.S. polystyrene plants and could have

been used as the capacity factor instead of the average for the whole chemical industry. However, the chemical industry average capacity factor was used for two reasons. First, the polystyrene value is only for the year 1997, whereas, the chemical industry value spans four years. This spread is desirable because in only one year the market demand may have been up or down or several plants may have been shut down, thus skewing the data. The second reason is that the polystyrene value is only based on 31 facilities as compared to the several thousand facilities that the chemical industry value is based on.

3.5.3. TOTAL OF TRI RELEASES

The final column of the polystyrene spreadsheet adds the pounds of TRI chemical per pound of polystyrene attributed to the oil refineries to the pounds of TRI chemical per pound of polystyrene attributed to the polystyrene chemical facility. This column of data represents the PDM estimation of the amounts of toxic chemicals released when one pound of polystyrene is made. Note down at the bottom row of Table A1 that there are the total releases and transfers that are the sum of each column. The final column has a total of 0 00016 pounds total TRI releases/pound polystyrene

CHAPTER 4

ANALYSIS OF DATABASES

Having become familiar with the steps to generate the polystyrene PDM database, attention is now turned to the data itself for all five databases. First, it is beneficial to examine the data for the ten largest refineries as compared to the industry as a whole. In Figure 6, the fifteen largest amounts of TRI releases for the refinery industry (*API*, accessed October 21, 1998) are compared to the totals for the ten largest refineries examined in this study. As mentioned earlier, the ten largest refineries processed 22.3% of all crude used by U S refineries. The percentage that a given chemical released when compared to the given chemical's industry value ranges from 14% to 67%, with the ten largest refineries on average releasing 31% as much as the industry as a whole for these fifteen chemicals The overall trend observed in Figure 6 implies that the ten refineries chosen give approximate representation of the TRI releases of a U.S. refinery.

In *API's 6th Annual Petroleum Industry Environmental Performance Report* (*API*, accessed October 21, 1998) it was stated that of the 118 chemicals in the TRI that are considered carcinogens, fifteen were released by refineries. Of these, the ten greatest refinery releases of TRI carcinogens for the industry in 1996 were compared in Figure 7 with the corresponding values totaled from the ten largest refineries examined in the PDM.

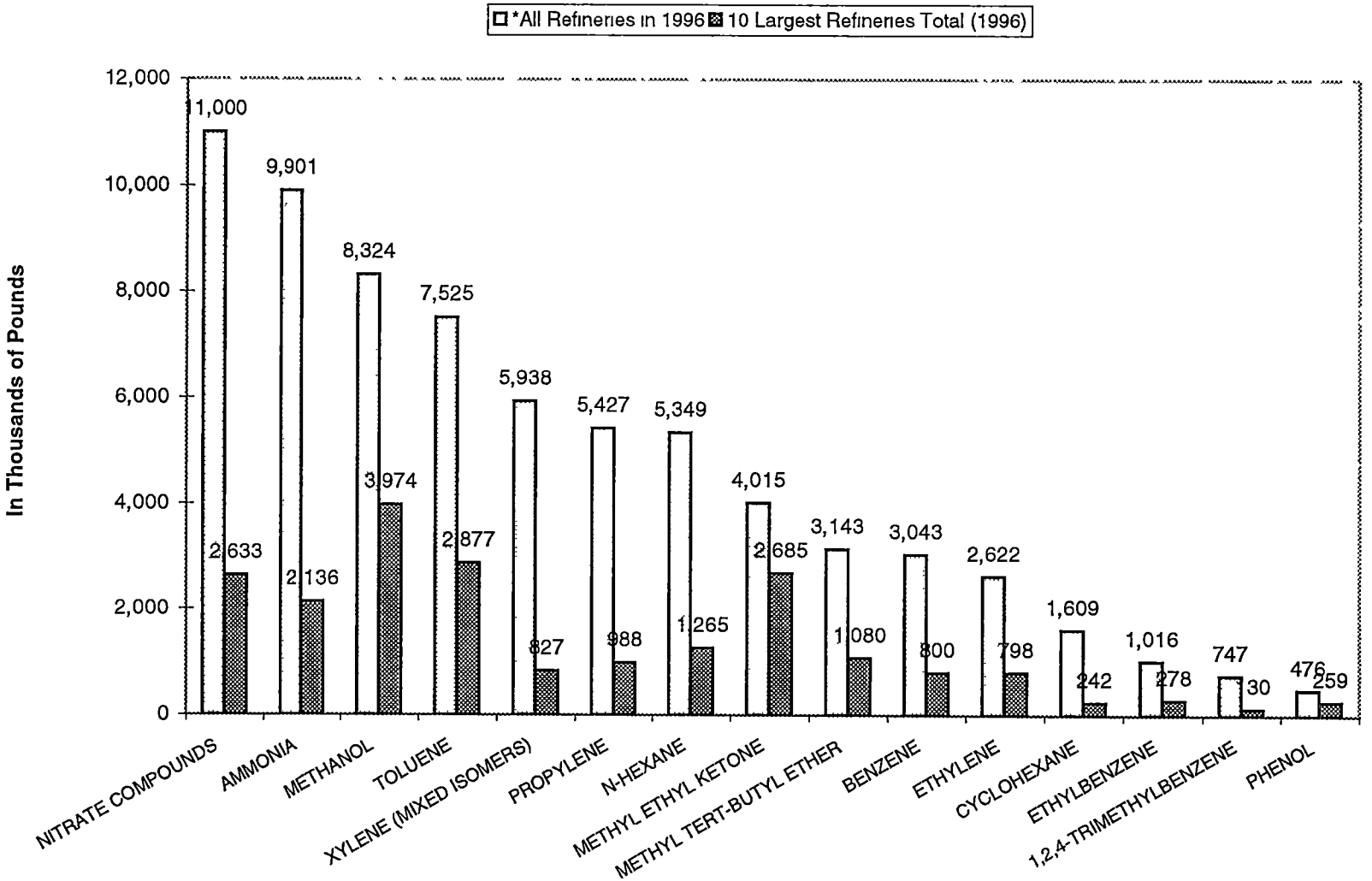


Figure 6 Fifteen TRI Chemicals with the Largest Releases in Refinery Industry in 1996
(*Source. 6th Annual Petroleum Industry Environmental Performance Report Accessed at API, 1998, <http //www api org/step/piep htm>)

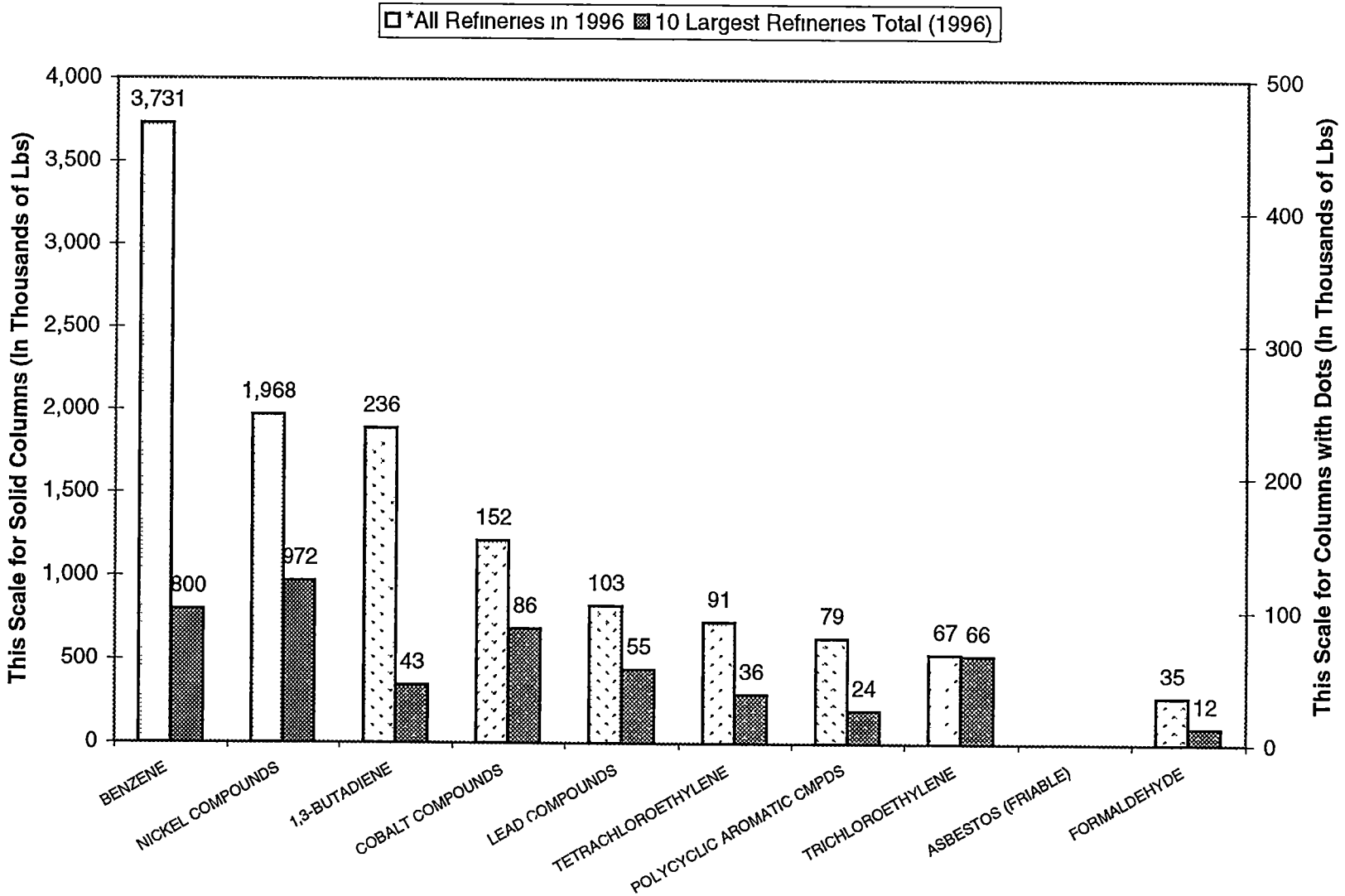


Figure 7 Ten TRI Carcinogens with the Larges Releases in Refinery Industry in 1996
(*Source. Adapted from SFIP web site, accessed 1999 <http //es epa gov/oeca/sfi/petdata htm>)

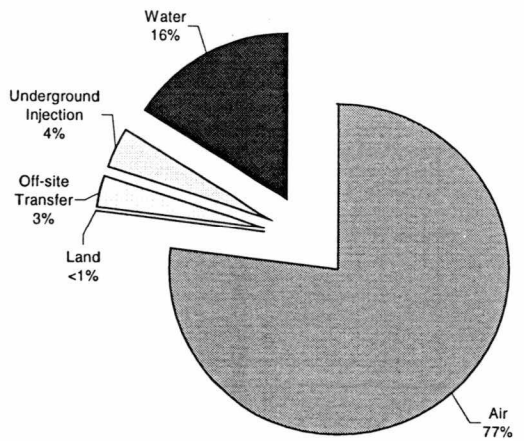
The TRI carcinogen values for the industry were obtained from the *SFIP* spreadsheet that lists the total releases and transfers for each reporting refinery in the United States in 1996 (*SFIP*, accessed October 1999) The corresponding values totaled for the ten largest refineries were obtained from the PDM database.

Note that there are no asbestos values reported. Although the API report listed asbestos as the ninth largest carcinogen released by the petroleum refining industry, neither the *SFIP* spreadsheet nor the TRI database used in the PDM reported asbestos releases These values apparently are not reported to the TRI, but rather reported in another manner that was not determined in this study

The remaining nine chemicals in Figure 8 are consistent with amounts expected considering the percentage of the industry that the ten refineries represent. The speciation of these carcinogens by the PDM is important for subsequent health impact analyses performed in LCAs.

The approximate representation of the U S. refinery industry by the ten largest refineries is further confirmed by comparing the disposition totals for all refineries (*API*, accessed October 21, 1998) with the totals for the ten largest refineries, as seen in Figure 8 One would expect that the values for the ten largest refineries would proportionately resemble the national values and this is indeed the case Note that only five of the six dispositions are shown in the pie charts. This is because that the sixth medium, POTW off-site transfer, was less than one percent for the total of the ten largest refineries and for the nation's refineries as a whole. It is also of interest that the predominant release for refineries in 1996 by environmental medium was air The air releases totaled 70% for the ten largest refineries

(a)



(b)

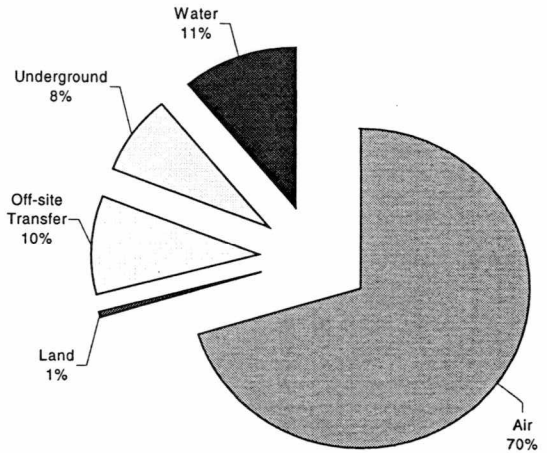


Figure 8. Disposition Totals

(a) Disposition Totals for All Refineries in 1996 (Source*: 6th Annual Petroleum Industry Environmental Performance Report*. Accessed at API, 1998; <http://www.api.org/step/piep.htm>)

(b) Disposition Totals for PDM Ten Largest Refineries Total (1996)

In looking at each individual facility chosen for the five databases, the second column of Table 8 shows the number of TRI chemicals reported by each chemical facility Ethylene glycol has the most chemicals by far with 24 reported. It is interesting to note that of the five chemical facilities chosen, the Chemical Guide to the United States indicated that ethylene glycol had six coproducts and the HDPE plant had one co-product (LDPE). Also, the polycarbonate facility reported the product as "polycarbonate resins", which may mean that significant additives or blends are used The values in column three show these three chemicals, ethylene glycol, HDPE, and polycarbonate, with the highest values This illustrates the importance of making allowances for co-products In the databases reported in this study, co-product allocation was not applied to the data However, this could be accomplished by determining the capacities for the coproducts found in the *CMR* reports, and then estimating the percentage of releases that should be allocated to the target product.

Table 8 Total Releases and Transfers for the Five Databases

Chemical Database	Number of TRI chemicals reported by facility	TRI lbs/lb product, attributed to refineries	TRI lbs/lb product, attributed to chemical facility	TRI lbs/lb product, attributed to refineries & chemical facility
Polystyrene	6	7 8642E-05	8 2859E-05	1 6150E-04
HDPE	7	7.0503E-05	5 3735E-03	5 4440E-03
PVC	4	3 9757E-05	2 5172E-04	2 9148E-04
Polycarbonate	11	5.2969E-05	3 6895E-03	3 7425E-03
Ethylene Glycol	24	4 4173E-05	2 8912E-02	2 8956E-02

Looking again at Table 8, it is observed that the third column of data represents the TRI releases attributed to the ten largest refineries for each of the five target chemical products Of note is the fact that all five values are on the same order of magnitude. The fourth column shows the totals attributed to the releases reported by the one product facility chosen The fifth column totals columns three and four for the total releases of the products Some facility values vary significantly from the refinery values, but in general it can be concluded that the releases attributed to the refineries and the releases attributed to the facilities have the potential to be of the same order of magnitude (as is the case with the polystyrene values shown in Table 8). Thus, neither the refinery value nor the facility value can be neglected in calculations

CHAPTER 5

COMPARISON TO OTHER DATA SOURCES

Now that the results generated by the PDM have been examined, it is of interest to see how the PDM data compares with other studies Table 9 shows the gross air emissions associated with the production of polystyrene (HIPS) from the commonly known LCI data source, referred to simply as "APME," or the Association of Plastic Manufacturers in Europe (APME, 1997) Note that there are five stages listed The process stage is mostly analogous to the materials production stage covered by the PDM. It is of special interest to observe that the chemicals are aggregated into broad categories such as "metals" or "aromatic HCs " As stated earlier, there are at least 59 chemicals listed in each of the PDM databases. Table 9 illustrates how most data sources tend to aggregate the raw data into these vague categories

In Table 10, specific chemical values generated by the PDM are compared with values found in other data sources. The first two chemicals listed, CO and CO_2 for air emissions for polystyrene, are listed in order to compare the consistency between the LCIs As seen, there is a wide variance This may be due to the boundaries of the stages for which the data is reported

The remaining chemicals are listed so that the results of the PDM can be compared with the other LCIs The APME data source value (APME, 1997) is two orders of magnitude greater than the PDM value for polycyclic aromatic compounds for air emissions for polystyrene This may be due to additional chemicals that may be

Table 9 Gross Air Emissions Associated with the Production of High Impact Polystyrene from APME Data Source						
	Fuel Production	Fuel Use	Transport	Process	Biomass	Total
	(lb release/lb PS)	(lb/lb)	(lb/lb)	(lb/lb)	(lb/lb)	(lb/lb)
Dust	1 40E-03	6 50E-04	1 00E-05	1.80E-05	-	2 00E-03
CO	2.60E-04	8 00E-04	1 10E-04	2 10E-05	-	1 20E-03
CO2	5 30E-01	2 20E+00	2 10E-02	4.60E-03	-	2 80E+00
SOx	3 70E-03	8 20E-03	2.30E-04	8 30E-05	-	1 20E-02
NOx	4 30E-03	7.90E-03	1 90E-04	8 30E-05	-	1 20E-02
HCL	3 40E-05	1 00E-06	-	-	-	3 50E-05
Methane	8 40E-03	2 60E-03	-	2.00E-04	-	1 10E-02
Hydrocarbon	8 60E-04	4 70E-04	5 30E-05	2 50E-03	-	3.80E-03
Aromatic HCs	-	-	-	2 00E-04	-	2 00E-04
Polycyclic HCs	-	-	-	3 00E-06	-	3 00E-06
Hydrogen	-	-	-	1 00E-05	-	1 00E-05
Metals	1 00E-06	9 00E-06	-	-	-	1.00E-05
Organics	-	-	-	2 40E-02	-	2 40E-05

(Source. *Eco-profiles of the European Plastics Industry Report 4: Polystyrene (Second Edition),* by APME (Association of Plastic Manufacturers in Europe), 1997. Brussels: APME)

Table 10 Comparison of PDM Values with Other Data Sources

	Data Source-->		PDM	APME[a]	CSG/Tellus[b]	Data Source A	IDEMAT[c]	BUWAL[d]
			(lb release/lb product)	(lb/lb)	(lb/lb)	(lb/lb)	(lb/lb)	(lb/lb)
		Stage --->	Materials Production	Process	Production of Intermediates	From Process Operations	Output	Processes
CHEMICAL	**Disposition**	**Product**						
CO2	Air	PS		4 60E-03		6 20E-05	2 11E+00	4 60E-03
CO	Air	PS		2 10E-05	1 30E-05	2 20E-06		2 10E-05
Polycyclic Aromatic Compounds	Air	PS	4 63E-08					
Polycyclic HCs	Air	PS		3 00E-06				
Benzene	Air	PS	1 90E-06		2 50E-05			
Biphenyl	Air	PS	5 80E-09		2 10E-06			
Ethylebenzene	Air	PS	7 00E-06		2 00E-04			
Naphthalene	Air	PS	3 10E-07		1 10E-04			
Toluene	Air	PS	8 20E-06		4 30E-05			
Chlorine	Air	PS	1 40E-07			4 70E-12		
Lead Compounds	Air	PS	2 40E-10					
Lead	Air	PS				3 30E-11		
Chlorine	Air	HDPE	1 20E-07			5 00E-05		
Lead Compounds	Air	HDPE	2 10E-10					
Lead	Air	HDPE				1 30E-11		
Chlorine	Air	EG	7 80E-08			5 90E-12		
Lead Compounds	Air	EG	1 40E-10					
Lead	Air	EG				4 20E-11		
Benzene	Air	PC	1 30E-06				2 20E-06	
Toluene	Air	PC	5 50E-06				5 40E-06	
Phenol	Water	PC	8 20E-09				6 00E-05	

([a]Source adapted from *Eco-profiles of the European Plastics Industry Report 4 Polystyrene (Second Edition)*, by APME (Association of Plastic Manufacturers in Europe), 1997 Brussels APME)

([b]Source adapted from *CSG / Tellus Packaging Study*, 1992 Prepared for the Council of State Governments (CSG), U S Environmental Protection Agency and New Jersey Department of Environmental Protection and Energy Boston Tellus Institute for Resource and Environmental Studies)

([c]Source adapted from *Industrial Design Materials Software*, by IDEMAT, 1995 Delft, the Netherlands Delft University of Technology)

([d]Source adapted from *BUWAL*, accessed 1999 Available from <http //www buwal ch/>)

included in the more inclusive "polycyclic compounds" chemical category used by APME

The next data source is the *CSG/Tellus Packaging Study*, which is a study that examines the production and disposal of packaging (*CSG/Tellus Packaging Study*, 1992) Comparing with the *CSG/Tellus* data source, the PDM values of the five chemicals listed are anywhere from one to three orders of magnitude less than the *CSG/Tellus* values. This gap in values is also seen in the comparison of the two chemicals found in data source A, Chlorine and Lead Due to a proprietary agreement that the University of Tennessee's *CCPCT* has with the data source, data source A is not identified Note that data source A provides values not only for polystyrene, but also HDPE and ethylene glycol This provides the opportunity to observe any variations in values when the product is different The lead values are nearly the same between the different products, but the chlorine values for data source A show significant variance between products.

The data source IDEMAT (IDEMAT, 1995) contained some values from its polycarbonate database that could be compared to the PDM values Benzene and toluene compared very favorably with the values for IDEMAT However there was considerable difference between the phenol values (a water emission)

What Table 10 illustrates is that even among established LCIs there can be a wide variance in data This is due to the different boundaries used in the stages of a data source For example, Table 10 lists the stages of the data sources The boundary of a given stage may be quite specific and only include the production of the chemicals that go into making a product, but another study might include the emissions related to extraction, transport, or machining of the product

The wide variance in the data of Table 10 might also be caused by how the chemicals are grouped together. In Table 10 one observes two different descriptions for the lead category, "lead," and "lead compounds." The latter category implies that compounds of lead are included, whereas as it is uncertain whether the "lead" category is inclusive of such compounds or not

In the comparison of the toxic emissions data generated through the PDM with other data sources, it must be kept in mind that the goal of the PDM is only to provide data that is related to toxic releases emitted in the production of the product in question The narrow focus upon this type data comes about primarily due to the aggregation of data in many life-cycle inventories available today, which results in data that does not show the specific chemicals desired for impact analyses. However, there are several standards for comparison (or criteria) that must be considered

As an example, Table 11 illustrates criteria considered in choosing a data source for a life-cycle inventory In addition to the PDM, this table includes several data sources that were considered for an LCA on computer displays being developed at the University of Tennessee's Center for Clean Products and Clean Technologies (Lasher and Socolof, July 12, 1999). Nine different data sources (not including PDM) were evaluated for the Computer Display Project, or CDP. The descriptions described below provide an example of some of the data sources available when one is preparing an LCI (Lasher and Socolof, July 12, 1999)

- American Plastics Council (APC)

  The APC is a major trade association for the U.S plastics industry APC is comprised of 24 of the leading plastics manufacturers in the United

Table 11 Selected Criteria of Upstream Data Sources

	PDM	APC	APME	Boustead	BUWAL 250	EIME	IDEMAT	NJIT LCA	PC Ecolabel	USAMP
Geographic boundaries	U S	U S	Europe	Europe	Europe	U S and Europe	Netherlands and Europe	U S	Europe	U S
Origin of data	Secondary	Unknown	Primary	Primary	Secondary	Majority is primary, some secondary	Unknown	Secondary	Secondary	Unknown
Currency of data	Updated annually	1990s	1990s (varies per material)	Unknown	1996	1990s (varies)	Second Student version, released in 1995	1970s -1990s	Not completely determined, but most appear to be 1990s	1990s
Public availability	Public	Public	Public	Public	Public	Public	Public (student version), unknown for complete version	Public	Public	Private
Cost	No cost (Dollars in manhours to generate the database estimated to be ~$340	No cost	No cost	~ $10,000	~ $250	~ $7,500, >$5,700 for universities (negotiable)	No cost, unknown for complete version	No cost	Version 1 11 no cost, ~$75 for final report	Not available to public
Upstream life-cycle stages	Materials Production	Unknown	Raw material extraction, material processing, transport	Process operations (including fuel production) and transport operations	Pre-combustion, combustion + processes, transports	Extraction, processing, transportation	Production, which includes transportation when noted, and not clear if extraction included	Material extraction and material synthesis	Material production manufacturing, transport, use, EOL	Unknown
Aggregation of data	No aggregation	Unknown	Some data presented as process-specific (e g , fuel production, transport, process)	Often classified into several processes fuel production, fuel use, transport operations, process operations	Aggregated as 'LCI or "energy consumption," latter subclassified (e g , final energy source, energy supply, final process energy, transport)	Aggregated over all upstream life-cycle stages for each module (material) into impact categories, system administrator can access LCI data separately	Each material aggregated for all life-cycle stages for the following categories processes, thermal energy, electrical energy, and tranports	Process specific, sometimes a few subprocesses are aggregated	Aggregated by major computer components (e g , monitor) for each life-cycle stage, not process or material specific	Unknown
Input/output categories	Emissions categorized into six dispositions air, water, underground injection, land, POTW, and off-site transfer	Unknown	Energy, primary fuels, and raw material inputs, air, water, and solid waste emissions, outputs mostly unspeciated	Gross energy, primary fuels & feedstocks, raw materials, water use, air, water, solid waste emissions, outputs provided as chemical categories and several speciated chemicals	Commercial fuels resources, feedstock resources, materials used in final stage, main product, co-products, usable wastes, waste treatment, outputs provided as chemical categories and as some speciated chemicals	Natural resources, energy, water inputs, air, water, hazardous waste outputs, outputs relatively well speciated	Material inputs (including water), energy inputs, air, water, and solid outputs, mostly unspeciated outputs	Raw material and energy inputs, solid, air, and waterborne waste outputs, outputs as chemical categories and some speciation	Resource consumption (raw materials), air emissions, water emissions, and waste, includes chemical categories but also very well speciated	Unknown
Data quality indicators	Not provided, but follows the reporting guidelines as set forth by EPA for the Toxic Release Inventory	Unknown	All calculations were referred back to participating companies before being used	Not provided, but data quality believed to be moderately good (above average as compared to other available sources)	Unknown	Provides high, medium, and low measures of reliability of the data	Unknown	Data were gathered on each material, carefully citing notes and references which document the original sources	Unknown	Unknown

(Source adapted from the draft of a technical memorandum to Dipti Singh entitled, *Computer Display Project Life-Cycle Inventory Approach for Materials Extraction and Materials Processing Life-Cycle Stages,* by Chip Lasher and Maria Leet Socolof, July 12, 1999 Knoxville University of Tennessee's Center for Clean Products Clean Technologies)

States with many members having a strong global market presence

APC's membership represents 80% of the U S resin production capacity.

- Association of Plastics Manufacturers in Europe (APME)

  APME is an industry body that has published inventory data on olefins, polystyrene (PS), PE, PP, PVC, PET and polymethanes, as well as ABS, Plexiglas, polycarbonate, polyester, and polyimide.

- Boustead

  Dr Ian Boustead is a well known LCA practitioner who developed the Boustead model and database that allows users to produce LCI's of complete systems Boustead's focus areas are aerosols, automotive products, beverage containers, building materials, and the plastics industry The organization is based in the United Kingdom

- BUWAL

  BUWAL is the Swiss Agency for the Environment, Forests and Landscape They have several published reports on LCAs.

- Environmental Information and Management Explorer (EIME)

  This software design tool was developed by the *Ecobilan* group in conjunction with IBM, Alcatel, Legrand, Schneider, and Thompson *Ecobilan* was founded in 1990 and has offices in Europe and in the United States. Version 1.4 of EIME has been released and the embedded database contains 170 modules on the most commonly used materials and subcomponents of the electronic and electric industry

- Industrial DEsign MATerials (IDEMAT)

  Dr J A M. Remmerswaal and J Rombouts of the Delft University of Technology's Section for Environmental Product Development produced this software with a database of LCI data for various industrial materials.

- New Jersey Institute of Technology (NJIT) Report

  NJIT's "Lifecycle Assessment of Television CRTs," report is not a database of upstream inventory data *per se*; however, it is a preliminary LCA that includes LCI data for a CRT and therefore it was considered for use

- Personal Computer Ecolabel Report

  This study was developed by Atlantic Consulting and IPU (Institute for Product Development of the Technical University of Denmark) for the Ecolabel Unit of the European Commission The purpose of the report was to study personal computers so that an ecolabel could possibly be established Similar to the NJIT report, this is an LCA with inventory data applicable to the CDP, but it is not a traditional database of upstream inventory data

- United States Automotive Materials Partnership (USAMP)

  Formed in June 1993, this partnership set out to conduct vehicle-oriented research and development in materials and materials processing to improve the competitiveness of the U S auto industry. The USAMP is conducting joint research to further the development of lightweight materials for improved automotive fuel economy. The major technology

groups being studied are polymer composites, light metals (including aluminum, magnesium, etc), engineered plastics, cast iron, steel and ceramics. The aluminum, plastics, steel and automotive industries are participating in a collaborative LCI project to produce a quantitative database of information regarding all the resources used to make, operate and dispose of a generic 3200-pound vehicle.

It is observed that some sources are a consortium of several companies, some are governmental agencies or reports, some are individuals, while other sources are associations of an industry.

In Table 11 there are several criteria listed that are important factors in determining the usefulness of a data source for an LCI. Below is a description of each of the criterion considered in choosing one of these data sources (Lasher and Socolof, July 12, 1999)

1. **Geographic boundaries** – Describes whether the data are representative of Europe and/or the United States, or another country Where the product is made determines which country is preferred.
2. **Origin of data** – Describes whether or not the data originate from primary or secondary sources. Primary sources are normally preferred
3. **Currency of data** – This refers to the dates that represent the actual inventory data More recent data are preferred. If the date of the inventory data is not known, the date the database was released was considered
4. **Public availability** – Data are categorized as either public or private Publicly available data is not necessarily free

5. **Cost** – Cost is an important factor for determining which upstream data should be obtained.
6. **Upstream life-cycle stages** – Which upstream life-cycle stages are included from each data source are identified, if possible. In some cases, the databases or reports address more than only upstream stages and other stages included are noted under this criterion
7. **Aggregation of data** – This describes whether or not the data from the various life-cycle stages are aggregated into one set of inventory numbers or how the data are aggregated. With less aggregation, an LCA will better be able to predict impacts particular to a specific life-cycle stage Therefore, less aggregation is preferred For some of the reports considered in this analysis, processes may also be aggregated for an entire product or component and therefore it is difficult to separate out the inventory for one particular material. The advantage of material-specific LCI databases is that the data are not aggregated into a larger component or product
8. **Input/output categories** – This lists which categories of inputs and outputs are included in the database or report (e g , non-renewable resources, fuel and energy inputs, water use, air emissions, water effluents, solid/hazardous wastes) Ideally, the input and output categories would match those defined for the LCA that will be used to calculate the impacts Also of interest is whether the outputs within each category are chemical specific The more speciated the chemicals, the more desirable the data. In some cases, chemical

groups or categories of chemicals are provided The CDP methodology required chemical-speciated data to calculate most impacts

9. **Data quality indicators** – If the data source provides an indication of its data quality, this will be an aid to determine the data quality for the LCA.

Note that of these nine criteria the PDM holds the advantage of having currency of data, public availability, a reasonable cost, and less aggregation of data.

Looking at these four criteria in more detail, the advantage of using the Toxic Release Inventory in the PDM to obtain emissions data is that the database is updated annually and thus provides current data

Also, the PDM uses publicly available data. Public data sometimes comes at a cost, but in the case of the Public Data Method, it is based on the government TRI database, which is free

In regard to cost, if the database is already set up with data from the ten largest refineries and the LCI practitioner is familiar with the steps to developing the PDM, it is conservatively estimated that the cost in man-hours for developing a database for one petrochemical (researching reaction steps, related chemical facility and developing the database) would be about 16 hours of work. As one would become familiar with using the PDM, it would take less time to prepare databases and the cost would go down even more

The alternative to using the PDM would be to make a plant trip to a facility or facilities in question and gather the data It is difficult to estimate this cost in man-hours A facility that makes the product that one is interested in will typically not even be nearby or willing to divulge information A facility may have to be outfitted with special

monitoring devices, increasing man-hours, too. There is also the cost incurred in taking up the time of the employees of the facility Say that six employees from the facility have to spend 20 hours of work each, and that the LCI practitioner spends a total of one week, then the cost in man-hours would be 160 man-hours

The final advantageous criterion that the PDM has is less aggregation of data Less aggregation of data implies more speciation of the individual chemicals, therefore allowing one to better predict impacts particular to a specific life-cycle stage

Table 12 shows the preferred criteria for upstream data sources of toxic releases. The PDM clearly holds more advantages than the other eight data sources. The key criterion is speciated data. The only other data source listed that can provide the degree of speciation as the PDM is the time consuming and expensive method of surveying a facility representative of the target product. Table 12 also illustrates the unique advantage that the PDM has of being able to choose the specific year for the data In addition, not many of the other data sources contain a database that is active and updated regularly.

Table 12. Preferred Criteria for Upstream Data Sources

	PDM	On-site Facility Survey	[a]APC	[b]APME	[c]Boustead	[d]BUWAL 250	[e]EIME	[f]IDEMAT	[g]USAMP
Database has speciated data on toxic chemical emissions (less aggregation)	X	X					UNKNOWN		UNKNOWN
Data is primary (rather than secondary)		X	X	X	X		X		UNKNOWN
Database is active and updated regularly (not static)	X						X		UNKNOWN
Database can target specific years for data	X								
Database is already prepared or can be estimated quickly	X		X	X	X	X	X	X	X
Database is publicly available	X		X	X	X	X	X	X	
Cost in manhours is inexpensive	X		X	X		X			

[a] Source adapted from *APC* (American Plastics Council), accessed 1999 Available at <http //www ameriplas org/apcorg/about_apc/about_apc html>

[b] Source adapted from *Eco profiles of the European Plastics Industry Report 4 Polystyrene (Second Edition)* , by APME (Association of Plastic Manufacturers in Europe) 1997 Brussels APME.

[c] Source adapted from *Boustead Consulting* , accessed 1999 Available at <http://www boustead-consulting co.uk/>

[d] Source adapted from *BUWAL*, accessed 1999 Available at <http //www buwal.ch/>

[e] Source adapted from *EIME* (Environmental Information and management Explorer), accessed 1999 Available at <http://www ecobalance com/software/eime/eime_ovr htm>

[f] Source adapted from *Industrial Design Materials Software* , by IDEMAT, 1995 Delft, the Netherlands Delft University of Technology

[g] Source adapted from *USAMP* (United States Automotive Materials Partnership), accessed 1999 Available at <http://www uscar org/index.htm>

CHAPTER 6

SUMMARY AND CONCLUSIONS

To summarize, advantages to using the PDM are:

- Generates speciated data for toxic chemicals This data can then be used in environmental and health impact studies.
- Less aggregation There are hardly any LCIs that list the toxic releases separately and in the speciated detail that the PDM provides
- It takes less time than conventional methods of obtaining toxic release information
- Less cost in man-hours due to public availability of data and the amount of time it takes to make the database.
- The database is made up of current data and can even target a specific year of data
- The database is active and is updated regularly

However there are certain limitations to the PDM Disadvantages of the Public Data Method can be summarized as

- Data is secondary rather than primary
- PDM is based on U S data only
- The only viable application of the PDM is to generate speciated data on toxic chemicals. The PDM only generates data on toxic emissions that is

normalized per pound of product Data on other inputs and outputs is not possible with this method

- PDM does not include the toxic emissions related to energy, transport and extraction stages
- Data attributed to the chemical plant is based on only one facility
- PDM assumes no co-product allocation in the facility chosen.
- *CGUS* is ten years old and may not accurately list all products of a facility

In addition, it may be helpful to the reader to view a general summary of the actions needed to create a PDM database The steps involved in preparing a PDM database can be condensed into the following·

1 Identify chemicals in the product that are petrochemicals.

2 Research reactions involved from the crude to the final chemical

3. Choose a facility that is representative of the chemical and its reaction steps by using the *CGUS*. Make allowances for co-product allocation if needed.

4 Look up toxic release data on the facility in the TRI database.

5 Set up the PDM database based on a template that already includes data on the ten largest refineries

The PDM is a method that generates speciated data on toxic releases in the production of petrochemicals for the materials production stage of an LCI. This speciated data is less aggregated than data obtained from conventional sources, and takes less time and cost to generate than conventional methods The PDM accomplishes this task by incorporating data available in the public domain, available from five data sources the Toxic Release Inventory, the Chemical Guide to United States, selected

literature sources, the Chemical Marketing Reporter chemical profiles, and the Environmental Protection Agency's *Sector Facility Indexing Project* notebook on petroleum refining

Petrochemical databases for polystyrene, HDPE, PVC, polycarbonate, and ethylene glycol were created by the Public Data Method and presented as examples of this methodology. The five petrochemicals were presented in the context of an automobile LCI, but these chemicals are used in many other products and are thus applicable to the LCIs of many other products that contain petrochemicals in their upstream inventories, from packaging materials to plastic toys This study applied the PDM to petrochemicals. However, there are other sector facility reports that could be used that would enable one to set up a PDM-based database founded upon another industry, such as aluminum, copper, lead, or zinc refining, the iron and steel industry, metal mining extraction, glass and other industries.

Results were mixed, with the positive result of speciation of toxic releases, but the negative result of inconsistent datum values when compared to values from other data sources.

Suggestions for the future development and use of the PDM include first that the LCI practitioner may want to base the data attributed to the chemical plant on more than one facility It is not uncommon for an LCI to base its data on information from 5 to 40 facilities in that industry. The problem with taking this supplementary step of collecting this additional data is that it takes more time and thus adds to the expense of producing the database Another suggestion is to compute the co-product allocation of the individual facility chosen

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APPENDICES

APPENDIX A: FIVE PDM DATABASES

Table A1. Polystyrene Database Generated by the Public Data Method (page order: down, then over)

IN THE PRODUCTION OF POLYSTYRENE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM								Assumption: Refineries operate all			
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries1 (by Capacity) - 1996									365	days of the year	
(Data obtained from the RTK Network on 10/25/99)											
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9	Facility 10
FACILITY ID --->		00851HSBLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A	39567CHVRNPOBOX
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000	295000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
AMMONIA	Air	60,962	160	71,376	436	49,128	505	440,000	3,500	10,000	110,210
AMMONIA	Water	24,767	25,000	2,822	2,400	13,134	2,162	0	7,350	3,600	8,700
AMMONIA	Underground	0	1,300,000	0	0	0	0	0	0	0	0
AMMONIA	POTW Transfer	0	0	0	0	0	104	0	0	0	0
AMMONIA	Off-site Transfer	0	0	0	23	0	0	0	0	0	0
ANTHRACENE	Air	0	0	1,029	0	895	0	0	524	0	0
ANTHRACENE	Land	0	0	0	0	162	0	0	0	0	0
ANTHRACENE	Off-site Transfer	0	0	0	0	11	0	0	0	0	0
ANTIMONY COMPOUNDS	Air	0	0	0	200	0	0	0	0	1,100	0
ANTIMONY COMPOUNDS	Land	0	0	0	0	0	0	0	0	2,500	0
ANTIMONY COMPOUNDS	Off-site Transfer	0	0	0	5,312	0	0	0	0	0	0
BARIUM COMPOUNDS	Water	0	0	0	0	1,892	0	0	0	0	0
BARIUM COMPOUNDS	Land	0	160	0	0	2,152	0	0	0	0	0
BARIUM COMPOUNDS	Off-site Transfer	0	70	0	0	185	0	0	0	0	0
BENZENE	Air	58,853	145,000	33,614	11,400	34,184	51,619	60,000	90,000	56,000	68,000
BENZENE	Water	15	1	43	13	11	0	0	2	0	21
BENZENE	Underground	0	170,000		0	0	0	0	0	0	0
BENZENE	Land	0	950	101	46	22	0	0	0	0	2
BENZENE	POTW Transfer	0	0	0	0	0	51	0	0	0	0
BENZENE	Off-site Transfer	4,533	4,189	357	4,666	2,390	2,010	44	1	833	588
BIPHENYL	Air	0	0	0	0	0	0	0	1,900	0	0
1,3-BUTADIENE	Air	10,848	280	338	50	3,098	1,771	18,400	1,730	6,100	700
1,3-BUTADIENE	Off-site Transfer	0	0	0	0	0	0	0	0	120	0
CARBON DISULFIDE	Air	0	0	0	0	0	0	0	7,090	0	0
CARBON DISULFIDE	Off-site Transfer	0	0	0	0	0	0	0	256	0	0
CARBON TETRACHLORIDE	Air	16,653	250	0	0	0	0	340	6,192	0	0
CARBON TETRACHLORIDE	Off-site Transfer	0	956	0	0	0	0	0	0	0	0
CARBONYL SULFIDE	Air	0	0	0	0	0	0	0	110,000	0	71,300
CHLORINE	Air	0	2,500	0	0	702	255	5	24,000	18,000	0
CHLORINE	Water	0	0	0	0	198	32	0	13,000	0	0
CHLORODIFLUOROMETHANE	Off-site Transfer	0	0	0	0	0	0	0	0	0	23,000
CHROMIUM COMPOUNDS	Air	0	0	0	0	0	0	16	0	0	14
CHROMIUM COMPOUNDS	Water	0	52	0	0	4,096	0	0	0	0	4
CHROMIUM COMPOUNDS	Land	0	36	0	0	5,054	0	0	0	0	0
CHROMIUM COMPOUNDS	Off-site Transfer	0	102	0	0	260	0	1,834	0	0	23,674
COBALT COMPOUNDS	Air	1	0	0	0	106	0	0	0	0	0
COBALT COMPOUNDS	Land	0	2	0	0	2,283	0	0	0	0	0
COBALT COMPOUNDS	Off-site Transfer	72,840	8,950	403	0	63,687	0	4,526	0	0	0
COPPER COMPOUNDS	Air	0	0	0	0	0	0	36	0	0	250
COPPER COMPOUNDS	Water	0	0	0	0	296	0	0	0	0	81
COPPER COMPOUNDS	Land	0	0	0	0	9,392	0	0	0	0	70
COPPER COMPOUNDS	Off-site Transfer	0	1,600	0	0	2,915	0	7	0	0	162,122
CRESOL (MIXED ISOMERS)	Air	0	0	619	0	0	0	0	27,000	0	0
CRESOL (MIXED ISOMERS)	Water	0	0	9	0	0	0	0	2,700	0	0
CRESOL (MIXED ISOMERS)	Underground	0	90,000	0	0	0	0	0	0	0	0
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	0	63	0	0	0	0	15	0	0
CUMENE	Air	1,018	0	2,265	0	3,059	23,675	0	8,148	2	26,570
CUMENE	Water	0	0	4	0	0	0	0	0	0	21
CUMENE	Off-site Transfer	0	0	0	0	0	0	0	0	0	80
CYCLOHEXANE	Air	36,837	27,300	13,632	15,830	19,595	6,580	8,900	54,000	37,000	17,000

Table A1. (Continued)

IN THE PRODUCTION OF POLYSTYRENE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM								Assumption: Refineries operate all			
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries1 (by Capacity) - 1996									365	days of the year	
(Data obtained from the RTK Network on 10/25/99)											
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9	Facility 10
FACILITY ID -->		00851HSSLVLIMET	77580MCLCM24015	70805XXNBST4050S	46384MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A	39567CHVRNPOBOX
REFINING CAPACITY (Barrels/day)-->		495000	433000	424000	410000	396000	315000	315000	305000	301000	295000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
CYCLOHEXANE	Water	0	1	4	24	0	0	0	0	0	0
CYCLOHEXANE	Land	0	2,400	0	49	0	0	0	0	0	1
CYCLOHEXANE	Off-site Transfer	0	0		2,600	0	0	0	9	0	80
DECABROMODIPHENYL OXIDE	Off-site Transfer										
1,2-DIBROMOETHANE	Air	0	0	1,938	0	0	0	0	0	0	0
1,2-DIBROMOETHANE	Water	0	0	7	0	0	0	0	0	0	0
1,2-DICHLOROETHANE	Air	0	0	0	0	0	0	0	13,300	0	0
DIETHANOLAMINE	Air	0	0	0	0	0	276	9,600	0	0	34,000
DIETHANOLAMINE	Off-site Transfer	0	0	0	0	0	134,000	0	0	0	0
ETHYLBENZENE	Air	36,179	11,500	23,385	3,900	6,990	33,734	20,500	57,000	13,000	49,600
ETHYLBENZENE	Water	1	0	43	1	8	0	0	0	0	21
ETHYLBENZENE	Underground	0	1,700	0	0	0	0	0	0	0	0
ETHYLBENZENE	Land	0	490	0	42	117	0	0	0	0	12
ETHYLBENZENE	POTW Transfer	0	0	0	0	0	38	0	0	0	0
ETHYLBENZENE	Off-site Transfer	3,192	403	412	5,102	1,550	4,462	610	46	0	3,821
ETHYLENE	Air	277,061	110,000	1,254	2,500	83,530	27,177	31,400	37,088	163,000	65,000
ETHYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0	93
ETHYLENE GLYCOL	Air	0	250	600	80	3	5	0	0	0	17,200
ETHYLENE GLYCOL	Water	0	0	319	0	4	0	0	0	0	19,000
ETHYLENE GLYCOL	Off-site Transfer	0	0		800	0	0	0	0	0	0
FORMALDEHYDE	Air	0	0	11,562	0	0	0	0	0	0	0
FORMALDEHYDE	Water	0	0	115	0	0	0	0	0	0	0
FORMALDEHYDE	Off-site Transfer	0	0	259	0	0	0	0	0	0	0
GLYCOL ETHERS	Air	0	0	1,743	0	0	0	0	0	0	0
HYDROCHLORIC ACID	Air	0	37,000	19,901	16,000	22,653	0	19	0	0	0
HYDROGEN FLUORIDE	Air	0	2,800	0	0	0	255	0	0	79	0
LEAD COMPOUNDS	Air	0	0	25	54	0	0	0	0	0	0
LEAD COMPOUNDS	Water	0	0	732	40	47	0	0	0	0	0
LEAD COMPOUNDS	Land	0	0			7,889	0	0	0	0	0
LEAD COMPOUNDS	Off-site Transfer	0	0	652	41,725	426	0	2,280	73	0	1,252
MANGANESE COMPOUNDS	Air	0	0	0	16	0	0	0	0	0	0
MANGANESE COMPOUNDS	Water	0	0	0	1,800	0	0	0	0	0	0
MANGANESE COMPOUNDS	Off-site Transfer	0	0	0	9,330	0	0	0	0	0	0
METHANOL	Air	4,375	2,200,250	11,975	23,000	124,331	590	8,743	99,600	3,570	1,490,000
METHANOL	Water	0	0	7	0	0	0	0	1,200	0	0
METHANOL	Off-site Transfer	0	0	195	0	0	0	0	0	6,600	6
2-METHOXYETHANOL	Air	0	0	0	0	63	0	0	0	0	0
METHYL ETHYL KETONE	Air	0	0	201,068	358,000	133,888	0	1,556,000	410,000	0	0
METHYL ETHYL KETONE	Water	0	0	61	0	0	0	0	5,700	0	0
METHYL ETHYL KETONE	Underground	0	19,000	0	0	0	0	0	0	0	0
METHYL ETHYL KETONE	Land	0	0	0	0	5	0	0	0	0	0
METHYL ETHYL KETONE	Off-site Transfer	0	0	0	0	1,051	0	0	0	0	0
METHYL ISOBUTYL KETONE	Air	0	0	96,974	0	132,893	0	0	0	0	0
METHYL ISOBUTYL KETONE	Water	0	0	4	0	0	0	0	0	0	0
METHYL ISOBUTYL KETONE	Land	0	0	0	0	5	0	0	0	0	0
METHYL ISOBUTYL KETONE	Off-site Transfer	0	0	0	0	415	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Air	134,733	40,600	254,552	64,000	89,388	48,005	107,000	28,000	15,500	87,570
METHYL TERT-BUTYL ETHER	Water	0	42,000	30	8,200	0	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Air	0	0	0	0	267	0	0	0	0	181,000

Table A1. (Continued)

IN THE PRODUCTION OF POLYSTYRENE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM								Assumption: Refineries operate all			
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries1 (by Capacity) - 1996									365 days of the year		
(Data obtained from the RTK Network on 10/25/99)											
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9	Facility 10
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT40508	46384MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTQPTHIGHW	77480PHLLPSHI35A	39567CHVRNPOBOX
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000	295000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
MOLYBDENUM TRIOXIDE	Water	0	0	0	0	0	0	0	0	0	21
MOLYBDENUM TRIOXIDE	Land	0	0	0	0	0	0	0	0	0	95
MOLYBDENUM TRIOXIDE	Off-site Transfer	338,652	43,690	11,646	0	20,139	0	21,120	152,726	0	5,069
NAPHTHALENE	Air	9,324	47,014	6,427	660	779	11,790	4,380	15,990	0	5,170
NAPHTHALENE	Water	0	1	83	21	0	0	0	17	0	21
NAPHTHALENE	Land	17	490	0	41	94	0	0	0	0	1
NAPHTHALENE	Off-site Transfer	3,239	0	1,197	248	1,038	123	6	750	0	0
N-HEXANE	Air	180,829	93,000	47,248	51,500	116,432	18,105	133,000	96,000	216,000	303,000
N-HEXANE	Water	72	2	0	48	0	0	0	0	0	21
N-HEXANE	Land	0	3,500	0	100	0	0	0	0	0	2
N-HEXANE	Off-site Transfer	0	0	0	6,621	0	0	0	0	0	0
NICKEL COMPOUNDS	Air	98	0	374	0	216	21,405	1,200	200	3,000	280
NICKEL COMPOUNDS	Water	0	0	0	0	518	0	0	0	510	560
NICKEL COMPOUNDS	Land	6,412	110	0	0	6,914	69	0	0	7,500	0
NICKEL COMPOUNDS	Off-site Transfer	35,530	167,800	2,769	0	83,892	1,309	2	11,574	257,000	363,011
NITRATE COMPOUNDS	Water	5,275	84,000	2,005,479	70,000	174,310	0	0	73,800	0	220,000
N-METHYL-2-PYRROLIDONE	Air	0	0	73,240	11,000	15,869	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Land	0	0	0	700	0	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	0	0	0	160	0	0	0	0	0
O-XYLENE	Air	0	0	0	0	0	0	0	0	0	88,500
O-XYLENE	Water	0	0	0	0	0	0	0	0	0	21
O-XYLENE	Land	0	0	0	0	0	0	0	0	0	86
O-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0	5,349
P-XYLENE	Air	0	0	0	0	0	0	0	0	0	574,900
P-XYLENE	Water	0	0	0	0	0	0	0	0	0	21
P-XYLENE	Land	0	0	0	0	0	0	0	0	0	77
P-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0	5,369
PHENANTHRENE	Air	0	530	0	870	258	0	0	0	0	0
PHENANTHRENE	Water	0	1	0	22	0	0	0	0	0	0
PHENANTHRENE	Land	0	3,700	0	37	376	0	0	0	0	0
PHENANTHRENE	Off-site Transfer	0	1	0	150	58	0	0	0	0	0
PHENOL	Air	54,876	0	3,344	0	3,363	728	5,100	45,004	0	0
PHENOL	Water	1,504	950	115	0	267	193	0	920	0	0
PHENOL	Underground	0	140,000	0	0	0	0	0	0	0	0
PHENOL	Land	44	3	0	0	153	0	0	0	0	0
PHENOL	POTW Transfer	0	0	0	0	0	2,266	0	0	0	0
PHENOL	Off-site Transfer	0	0	16	0	28	1	0	0	0	0
PHOSPHORIC ACID	Off-site Transfer	0	0	0	0	0	74,750	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Air	809	2,920	0	1,710	339	7,517	24	1,790	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	3	0	1	0	0	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	7,600	0	110	995	0	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	0	0	430	11	0	0	0	0	0
PROPYLENE	Air	223,245	43,000	4,849	45,000	109,396	27,722	85,000	220,000	129,000	100,300
PROPYLENE	Water	0	0	95	0	0	0	0	0	0	0
STYRENE	Air	0	0	520	0	239	0	0	0	0	0
STYRENE	Land	0	0	0	0	5	0	0	0	0	0
STYRENE	POTW Transfer										
STYRENE	Off-site Transfer	0	0	0	0	36	0	0	0	0	0
SULFURIC ACID	Air	1,154	3,400	0	0	0	692	0	6,000	0	0
SULFURIC ACID	Off-site Transfer	0	0	0	0	0	0	0	12	0	0

Table A1. (Continued)

IN THE PRODUCTION OF POLYSTYRENE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM								Assumption: Refineries operate all			
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries1 (by Capacity) - 1996									365 days of the year		
(Data obtained from the RTK Network on 10/25/99)											
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9	Facility 10
FACILITY ID —>		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A	39567CHVRNPOBOX
REFINING CAPACITY (Barrels/day)—>		495000	433000	424000	410000	396000	315000	315000	305000	301000	295000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
TERT-BUTYL ALCOHOL	Air	0	0	0	0	0	0	0	300	0	0
TETRACHLOROETHYLENE	Air	29,612	250	568	0	5	0	1,700	0	0	3,522
TETRACHLOROETHYLENE	Land	0	0	0	11	0	0	0	0	0	0
TETRACHLOROETHYLENE	Off-site Transfer	0	580	0	95	36	0	0	0	0	0
TOLUENE	Air	158,398	80,000	94,542	252,000	213,327	61,869	1,033,000	562,000	0	211,000
TOLUENE	Water	62	2	39	55	63	0	0	17	0	21
TOLUENE	Underground	0	160,000	0	0	0	0	0	0	0	0
TOLUENE	Land	1	2,800	0	180	65	0	0	0	0	19
TOLUENE	POTW Transfer	0	0	0	0	0	214	0	0	0	0
TOLUENE	Off-site Transfer	6,958	756	1,407	18,809	12,876	3,342	2,137	60	0	726
TRICHLOROETHYLENE	Air	0	11,000	0	0	54,724	0	0	0	0	0
TRICHLOROETHYLENE	Off-site Transfer	0	0	0	0	27	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Air	10,474	22,300	11,222	4,844	274	13,726	20,300	22,340	0	22,100
1,2,4-TRIMETHYLBENZENE	Water	0	1	0	38	0	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Land	0	1,100	0	82	0	0	0	0	0	6
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	0	21	0	688	0	0	0	0	0	21
VANADIUM (FUME OR DUST)	Land	0	11	0	0	0	0	0	0	0	0
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	0	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Air	161,546	82,000	64,534	21,500	37,389	51,098	87,000	224,000	0	0
XYLENE (MIXED ISOMERS)	Water	24	3	0	57	202	0	0	2	0	0
XYLENE (MIXED ISOMERS)	Underground	0	31,000	0	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Land	52	3,900	0	300	372	0	0	0	0	0
XYLENE (MIXED ISOMERS)	POTW Transfer	0	0	0	0	0	330	0	0	0	0
XYLENE (MIXED ISOMERS)	Off-site Transfer	14,267	1,238	4,819	9,556	14,769	13,608	3,096	598	0	0
ZINC COMPOUNDS	Air	0	0	954	6,801	0	63	190	0	0	2,600
ZINC COMPOUNDS	Water	0	1,500	7,686	1,700	1,219	1,179	0	0	0	1,100
ZINC COMPOUNDS	Land	0	57	0	0	51,227	0	0	0	0	1,400
ZINC COMPOUNDS	POTW Transfer	0	0	0	0	0	89	0	0	0	0
ZINC COMPOUNDS	Off-site Transfer	0	0	1,603	8,660	1,019	27,069	36	0	0	148,147
TOTAL RELEASES & TRANSFERS (LBS)		1,985,342	5,453,186	3,099,268	1,092,284	1,747,909	676,563	3,667,551	2,443,524	950,014	4,523,599

Table A1. (Continued)

		Totals									
REFINING CAPACITY (Barrels/day)--->		3689000									
Chemical	Disposition[2]	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	7% of ethylene to ethylbenzene[6]:		0.88% of crude to benzene[7]:	53% of benzene to ethylbenzene[8]:		Addition of ethylene and benzene contributions to ethylbenzene:
AMMONIA	Air	746,277	0.000644466	2.11995E-06	6.50826E-08	4.55578E-09		1.86556E-08	9.88747E-09		1.44432E-08
AMMONIA	Water	89,935	7.76656E-05	2.55479E-07	7.8432E-09	5.49024E-10		2.24822E-09	1.19155E-09		1.74058E-09
AMMONIA	Underground	1,300,000	0.001122647	3.69292E-06	1.13373E-07	7.93608E-09		3.24977E-08	1.72238E-08		2.51599E-08
AMMONIA	POTW Transfer	104	8.98118E-08	2.95434E-10	9.06981E-12	6.34887E-13		2.59982E-12	1.3779E-12		2.01279E-12
AMMONIA	Off-site Transfer	23	1.98622E-08	6.53363E-11	2.00582E-12	1.40408E-13		5.74959E-13	3.04728E-13		4.45136E-13
ANTHRACENE	Air	2,448	2.11403E-06	6.95405E-09	2.13489E-10	1.49443E-11		6.11956E-11	3.24337E-11		4.73779E-11
ANTHRACENE	Land	162	1.39899E-07	4.60195E-10	1.4128E-11	9.88958E-13		4.04971E-12	2.14635E-12		3.13531E-12
ANTHRACENE	Off-site Transfer	11	9.49932E-09	3.12478E-11	9.59307E-13	6.71515E-14		2.7498E-13	1.4574E-13		2.12891E-13
ANTIMONY COMPOUNDS	Air	1,300	1.12265E-06	3.69292E-09	1.13373E-10	7.93608E-12		3.24977E-11	1.72238E-11		2.51599E-11
ANTIMONY COMPOUNDS	Land	2,500	2.15894E-06	7.10177E-09	2.18024E-10	1.52617E-11		6.24956E-11	3.31226E-11		4.83843E-11
ANTIMONY COMPOUNDS	Off-site Transfer	5,312	4.58731E-06	1.50898E-08	4.63258E-10	3.24281E-11		1.32791E-10	7.0379E-11		1.02807E-10
BARIUM COMPOUNDS	Water	1,892	1.63388E-06	5.37462E-09	1.65001E-10	1.15501E-11		4.72966E-11	2.50672E-11		3.66173E-11
BARIUM COMPOUNDS	Land	2,312	1.99659E-06	6.56771E-09	2.01629E-10	1.4114E-11		5.77959E-11	3.06318E-11		4.47458E-11
BARIUM COMPOUNDS	Off-site Transfer	255	2.20212E-07	7.2438E-10	2.22385E-11	1.55669E-12		6.37455E-12	3.37851E-12		4.9352E-12
BENZENE	Air	608,670	0.000525632	1.72905E-06	5.30819E-08	3.71574E-09		1.52157E-08	8.0643E-09		1.178E-08
BENZENE	Water	106	9.15389E-08	3.01115E-10	9.24423E-12	6.47096E-13		2.64981E-12	1.4044E-12		2.0515E-12
BENZENE	Underground	170,000	0.000146808	4.8292E-07	1.48256E-08	1.0378E-09		4.2497E-09	2.25234E-09		3.29014E-09
BENZENE	Land	1,121	9.68068E-07	3.18443E-09	9.77621E-11	6.84335E-12		2.8023E-11	1.48522E-11		2.16955E-11
BENZENE	POTW Transfer	51	4.40423E-08	1.44876E-10	4.44769E-12	3.11339E-13		1.27491E-12	6.75702E-13		9.87041E-13
BENZENE	Off-site Transfer	19,611	1.69356E-05	5.57091E-08	1.71027E-09	1.19719E-10		4.9024E-10	2.59827E-10		3.79546E-10
BIPHENYL	Air	1,900	1.64079E-06	5.39734E-09	1.65698E-10	1.15989E-11		4.74966E-11	2.51732E-11		3.67721E-11
1,3-BUTADIENE	Air	43,315	3.74057E-05	1.23045E-07	3.77749E-09	2.64424E-10		1.0828E-09	5.73883E-10		8.38307E-10
1,3-BUTADIENE	Off-site Transfer	120	1.03629E-07	3.40885E-10	1.04652E-11	7.32562E-13		2.99979E-12	1.58989E-12		2.32245E-12
CARBON DISULFIDE	Air	7,090	6.12275E-06	2.01406E-08	6.18317E-10	4.32822E-11		1.77237E-10	9.39358E-11		1.37218E-10
CARBON DISULFIDE	Off-site Transfer	256	2.21075E-07	7.27221E-10	2.23257E-11	1.5628E-12		6.39954E-12	3.39176E-12		4.95456E-12
CARBON TETRACHLORIDE	Air	23,435	2.02379E-05	6.6572E-08	2.04376E-09	1.43063E-10		5.85833E-10	3.10492E-10		4.53555E-10
CARBON TETRACHLORIDE	Off-site Transfer	956	8.25578E-07	2.71572E-09	8.33725E-11	5.83607E-12		2.38983E-11	1.26661E-11		1.85022E-11
CARBONYL SULFIDE	Air	181,300	0.000156566	5.1502E-07	1.58111E-08	1.10678E-09		4.53218E-09	2.40205E-09		3.50883E-09
CHLORINE	Air	45,462	3.92598E-05	1.29144E-07	3.96473E-09	2.77531E-10		1.13647E-09	6.02329E-10		8.7986E-10
CHLORINE	Water	13,230	1.14251E-05	3.75826E-08	1.15378E-09	8.07649E-11		3.30726E-10	1.75285E-10		2.5605E-10
CHLORODIFLUOROMETHANE	Off-site Transfer	23,000	1.98622E-05	6.53363E-08	2.00582E-09	1.40408E-10		5.74959E-10	3.04728E-10		4.45136E-10
CHROMIUM COMPOUNDS	Air	30	2.59072E-08	8.52212E-11	2.61629E-12	1.8314E-13		7.49947E-13	3.97472E-13		5.80612E-13
CHROMIUM COMPOUNDS	Water	4,152	3.58556E-06	1.17946E-08	3.62095E-10	2.53466E-11		1.03793E-10	5.50101E-11		8.03567E-11
CHROMIUM COMPOUNDS	Land	5,090	4.3956E-06	1.44592E-08	4.43897E-10	3.10728E-11		1.27241E-10	6.74377E-11		9.85105E-11
CHROMIUM COMPOUNDS	Off-site Transfer	25,870	2.23407E-05	7.34891E-08	2.25612E-09	1.57928E-10		6.46704E-10	3.42753E-10		5.00681E-10
COBALT COMPOUNDS	Air	107	9.24025E-08	3.03956E-10	9.33144E-12	6.53201E-13		2.67481E-12	1.41765E-12		2.07085E-12
COBALT COMPOUNDS	Land	2,285	1.97327E-06	6.49102E-09	1.99274E-10	1.39492E-11		5.71209E-11	3.02741E-11		4.42233E-11
COBALT COMPOUNDS	Off-site Transfer	150,406	0.000129887	4.27259E-07	1.31169E-08	9.1818E-10		3.75988E-09	1.99274E-09		2.91092E-09
COPPER COMPOUNDS	Air	286	2.46982E-07	8.12442E-10	2.4942E-11	1.74594E-12		7.14949E-12	3.78923E-12		5.53517E-12
COPPER COMPOUNDS	Water	377	3.25568E-07	1.07095E-09	3.28781E-11	2.30146E-12		9.42433E-12	4.99489E-12		7.29636E-12
COPPER COMPOUNDS	Land	9,462	8.17115E-06	2.68788E-08	8.25178E-10	5.77625E-11		2.36533E-10	1.25363E-10		1.83125E-10
COPPER COMPOUNDS	Off-site Transfer	166,644	0.00014391	4.73387E-07	1.4533E-08	1.01731E-09		4.1658E-09	2.20788E-09		3.22518E-09
CRESOL (MIXED ISOMERS)	Air	27,619	2.38511E-05	7.84575E-08	2.40864E-09	1.68605E-10		6.90426E-10	3.65926E-10		5.34531E-10
CRESOL (MIXED ISOMERS)	Water	2,709	2.33942E-06	7.69548E-09	2.36251E-10	1.65376E-11		6.77202E-11	3.58917E-11		5.24293E-11
CRESOL (MIXED ISOMERS)	Underground	90,000	7.77217E-05	2.55664E-07	7.84887E-09	5.49421E-10		2.24984E-09	1.19242E-09		1.74184E-09
CRESOL (MIXED ISOMERS)	Off-site Transfer	78	6.73588E-08	2.21575E-10	6.80236E-12	4.76165E-13		1.94986E-12	1.03343E-12		1.50959E-12
CUMENE	Air	64,737	5.59053E-05	1.83899E-07	5.64569E-09	3.95199E-10		1.61831E-09	8.57704E-10		1.2529E-09
CUMENE	Water	25	2.15894E-08	7.10177E-11	2.18024E-12	1.52617E-13		6.24956E-13	3.31226E-13		4.83843E-13
CUMENE	Off-site Transfer	80	6.9086E-08	2.27257E-10	6.97678E-12	4.88374E-13		1.99986E-12	1.05992E-12		1.5483E-12
CYCLOHEXANE	Air	236,674	0.000204386	6.72321E-07	2.06403E-08	1.44482E-09		5.91643E-09	3.13571E-09		4.58053E-09

Table A1 (Continued)

		Totals									
REFINING CAPACITY (Barrels/day)-->		3689000									
Chemical	Disposition[2]	LBS/YR	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]	3 07% of crude to ethylene[5]	7% of ethylene to ethylbenzene[6]		0 88% of crude to benzene[7]	53% of benzene to ethylbenzene[8]		Addition of ethylene and benzene contributions to ethylbenzene
CYCLOHEXANE	Water	29	2 50437E-08	8 23805E-11	2 52908E-12	1 77036E-13		7 24948E-13	3 84223E-13		5 61258E-13
CYCLOHEXANE	Land	2,450	2 11576E-06	6 95973E-09	2 13664E-10	1 49565E 11		6 12456E 11	3 24602E 11		4 74167E 11
CYCLOHEXANE	Off site Transfer	2 689	2 32215E-06	7 63866E-09	2 34507E 10	1 64155E 11		6 72202E-11	3 56267E-11		5 20422E-11
DECABROMODIPHENYL OXIDE	Off site Transfer		0								
1,2 DIBROMOETHANE	Air	1,938	1 67361E-06	5 50529E-09	1 69012E 10	1 18309E-11		4 84466E-11	2 56767E 11		3 75075E-11
1 2 DIBROMOETHANE	Water	7	6 04502E-09	1 98849E 11	6 10468E-13	4 27328E 14		1 74988E-13	9 27434E 14		1 35476E 13
1 2 DICHLOROETHANE	Air	13 300	1 14855E 05	3 77814E 08	1 15989E-09	8 11922E 11		3 32476E-10	1 76212E 10		2 57405E-10
DIETHANOLAMINE	Air	43 876	3 78902E-05	1 24639E 07	3 82641E-09	2 67849E 10		1 09682E-09	5 81316E 10		8 49165E-10
DIETHANOLAMINE	Off-site Transfer	134 000	0 000115719	3 80655E-07	1 16861E-08	8 18027E-10		3 34976E-09	1 77537E-09		2 5934E-09
ETHYLBENZENE	Air	255 788	0 000220892	7 26619E-07	2 23072E 08	1 5615E 09		6 39425E-09	3 38895E 09		4 95045E-09
ETHYLBENZENE	Water	74	6 39045E-08	2 10212E 10	6 45352E-12	4 51746E 13		1 84987E-12	9 8043E-13		1 43218E 12
ETHYLBENZENE	Underground	1 700	1 46808E-06	4 8292E-09	1 48256E-10	1 0378E-11		4 2497E-11	2 25234E-11		3 29014E-11
ETHYLBENZENE	Land	661	5 70823E 07	1 87771E-09	5 76456E 11	4 03519E 12		1 65238E 11	8 75763E-12		1 27928E 11
ETHYLBENZENE	POTW Transfer	38	3 28158E 08	1 07947E 10	3 31397E-12	2 31978E-13		9 49932E 13	5 03464E-13		7 35442E 13
ETHYLBENZENE	Off site Transfer	19 598	1 69243E 05	5 56722E 08	1 70914E 09	1 1964E 10		4 89915E 10	2 59655E 10		3 79295E 10
ETHYLENE	Air	798,010	0 000689141	2 26691E 06	6 95942E-08	4 8716E-09		1 99488E 08	1 05729E 08		1 54445E-08
ETHYLENE	Off site Transfer	93	8 03125E-08	2 64186E 10	8 1105E-12	5 67735E 13		2 32483E-12	1 23216E-12		1 7999E-12
ETHYLENE GLYCOL	Air	18 138	1 56635E 05	5 15247E 08	1 58181E 09	1 10727E 10		4 53418E-10	2 40311E-10		3 51038E-10
ETHYLENE GLYCOL	Water	19 323	1 66869E 05	5 4891E 08	1 68515E-09	1 17961E 10		4 83041E 10	2 56012E-10		3 73972E 10
ETHYLENE GLYCOL	Off site Transfer	800	6 90866 07	2 27257E-09	6 97678E-11	4 88374E-12		1 99986E 11	1 05992E 11		1 5483E-11
FORMALDEHYDE	Air	11 562	9 98465E-06	3 28443E-08	1 00832E-09	7 05823E-11		2 89029E-10	1 53186E-10		2 23768E-10
FORMALDEHYDE	Water	115	9 93111E 08	3 26681E 10	1 00291E 11	7 02038E 13		2 8748E 12	1 52364E 12		2 22568E-12
FORMALDEHYDE	Off site Transfer	259	2 23666E-07	7 35743E-10	2 25873E 11	1 58111E 12		6 47454E-12	3 43151E-12		5 01262E-12
GLYCOL ETHERS	Air	1 743	1 50521E 06	4 95135E-09	1 52007E-10	1 06405E 11		4 35719E 11	2 30931E-11		3 37336E-11
HYDROCHLORIC ACID	Air	95,573	8 25344E 05	2 71495E-07	8 33489E-09	5 83443E-10		2 38916E-09	1 26625E-09		1 84969E-09
HYDROGEN FLUORIDE	Air	3 134	2 70644E 06	8 90278E 09	2 73315E-10	1 91321E-11		7 83444E-11	4 15225E 11		6 06546E 11
LEAD COMPOUNDS	Air	79	6 82224E-08	2 24416E 10	6 88957E-12	4 8227E-13		1 97486E-12	1 04668E-12		1 52895E-12
LEAD COMPOUNDS	Water	819	7 07268E 07	2 32654E 09	7 14247E 11	4 99973E 12		2 04735E 11	1 0851E-11		1 58507E 11
LEAD COMPOUNDS	Land	7,889	6 81274E-06	2 24103E 08	6 87997E-10	4 81598E-11		1 97211E 10	1 04522E-10		1 52682E-10
LEAD COMPOUNDS	Off site Transfer	46,408	4 00768E-05	1 31832E-07	4 04723E 09	2 83306E-10		1 16012E 09	6 14862E 10		8 98168E-10
MANGANESE COMPOUNDS	Air	16	1 38172E-08	4 54513E 11	1 39536E-12	9 76749E-14		3 99972E-13	2 11985E 13		3 0966E-13
MANGANESE COMPOUNDS	Water	1 800	1 55443E 06	5 11327E 09	1 56977E 10	1 09884E 11		4 49968E-11	2 38483E 11		3 48367E-11
MANGANESE COMPOUNDS	Off site Transfer	9 330	8 05715E-06	2 65038E 08	8 13667E 10	5 69567E 11		2 33233E 10	1 23614E-10		1 8057E-10
METHANOL	Air	3,966 434	0 003425313	1 12675E 05	3 45912E-07	2 42138E-08		9 91538E-08	5 25515E-08		7 67653E-08
METHANOL	Water	1,207	1 04233E-06	3 42873E-09	1 05262E-10	7 36835E-12		3 01729E 11	1 59916E 11		2 336E-11
METHANOL	Off site Transfer	6,801	5 87317E 06	1 93196E 08	5 93113E 10	4 15179E 11		1 70013E-10	9,01068E 11		1 31625E 10
2 METHOXYETHANOL	Air	63	5 44052E 08	1 78965E 10	5 49421E 12	3 84595E 13		1 57489E 12	8 34691E-13		1 21929E 12
METHYL ETHYL KETONE	Air	2,658 956	0 002296208	7 55331E 06	2 31887E 07	1 62321E 08		6 64692E 08	3 52287E 08		5 14607E 08
METHYL ETHYL KETONE	Water	5,761	4 97506E 06	1 63653E-08	5 02415E-10	3 51691E-11		1 44015E 10	7 63278E 11		1 11497E-10
METHYL ETHYL KETONE	Underground	19,000	1 64079E-05	5 39734E 08	1 65698E-09	1 15989E 10		4 74966E-10	2 51732E 10		3 67721E 10
METHYL ETHYL KETONE	Land	5	4 31787E-09	1 42035E-11	4 36049E-13	3 05234E 14		1 24991E-13	6 62453E-14		9 67687E 14
METHYL ETHYL KETONE	Off site Transfer	1,051	9 07617E-07	2 98558E 09	9 16574E 11	6 41602E 12		2 62731E 11	1 39248E-11		2 03408E-11
METHYL ISOBUTYL KETONE	Air	229 867	0 000198507	6 52985E-07	2 00466E-08	1 40326E-09		5 74627E-09	3 04552E 09		4 44879E 09
METHYL ISOBUTYL KETONE	Water	4	3 4543E-09	1 13628E 11	3 48839E-13	2 44187E-14		9 99929E 14	5 29962E 14		7 74149E-14
METHYL ISOBUTYL KETONE	Land	5	4 31787E 09	1 42035E 11	4 36049E-13	3 05234E 14		1 24991E-13	6 62453E 14		9 67687E-14
METHYL ISOBUTYL KETONE	Off site Transfer	415	3 58384E 07	1 17889E 09	3 6192E 11	2 53344E 12		1 03743E-11	5 49836E-12		8 0318E 12
METHYL TERT-BUTYL ETHER	Air	869 348	0 000750747	2 46956E-06	7 58156E-08	5 30709E-09		2 17322E-08	1 15188 08		1 68251E-08
METHYL TERT BUTYL ETHER	Water	50 230	4 33774E-05	1 42689E 07	4 38054E 09	3 06638E 10		1 25566E 09	6 655E 10		9 72138E 10
METHYL TERT-BUTYL ETHER	Underground	160,000	0 000138172	4 54513E-07	1 39536E-08	9 76749E 10		3 99972E-09	2 11985E 09		3 0966E-09
MOLYBDENUM TRIOXIDE	Air	181,267	0 000156538	5 14926E 07	1 58082E 08	1 10658E 09		4 53135E 09	2 40162E 09		3 50819E-09

Table A1. (Continued)

		Totals									
REFINING CAPACITY (Barrels/day)—>		3689000									
Chemical	Disposition[2]	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	7% of ethylene to ethylbenzene[6]:		0.88% of crude to benzene[7]:	53% of benzene to ethylbenzene[8]:		Addition of ethylene and benzene contributions to ethylbenzene:
MOLYBDENUM TRIOXIDE	Water	21	1.81351E-08	5.96548E-11	1.8314E-12	1.28198E-13		5.24963E-13	2.7823E-13		4.06428E-13
MOLYBDENUM TRIOXIDE	Land	95	8.20396E-08	2.69867E-10	8.28492E-12	5.79945E-13		2.37483E-12	1.25866E-12		1.83861E-12
MOLYBDENUM TRIOXIDE	Off-site Transfer	593,042	0.000512136	1.68466E-06	5.1719E-08	3.62033E-09		1.4825E-08	7.85725E-09		1.14776E-08
NAPHTHALENE	Air	101,534	8.76822E-05	2.88428E-07	8.85475E-09	6.19833E-10		2.53817E-09	1.34523E-09		1.96506E-09
NAPHTHALENE	Water	143	1.23491E-07	4.06221E-10	1.2471E-11	8.72969E-13		3.57475E-12	1.89462E-12		2.76758E-12
NAPHTHALENE	Land	643	5.55279E-07	1.82657E-09	5.60758E-11	3.92531E-12		1.60739E-11	8.51914E-12		1.24445E-11
NAPHTHALENE	Off-site Transfer	6,601	5.70046E-06	1.87515E-08	5.75671E-10	4.0297E-11		1.65013E-10	8.7457E-11		1.27754E-10
N-HEXANE	Air	1,255,114	0.001083885	3.56541E-06	1.09458E-07	7.66207E-09		3.13756E-08	1.66291E-08		2.42911E-08
N-HEXANE	Water	143	1.23491E-07	4.06221E-10	1.2471E-11	8.72969E-13		3.57475E-12	1.89462E-12		2.76758E-12
N-HEXANE	Land	3,602	3.1106E-06	1.02322E-08	3.14129E-10	2.19891E-11		9.00436E-11	4.77231E-11		6.97122E-11
N-HEXANE	Off-site Transfer	6,621	5.71773E-06	1.88083E-08	5.77415E-10	4.04191E-11		1.65513E-10	8.7722E-11		1.28141E-10
NICKEL COMPOUNDS	Air	26,773	2.31205E-05	7.60542E-08	2.33487E-09	1.63441E-10		6.69277E-10	3.54717E-10		5.18158E-10
NICKEL COMPOUNDS	Water	1,588	1.37136E-06	4.51104E-09	1.38489E-10	9.69423E-12		3.96972E-11	2.10395E-11		3.07337E-11
NICKEL COMPOUNDS	Land	21,005	1.81394E-05	5.96691E-08	1.83184E-09	1.28229E-10		5.25088E-10	2.78296E-10		4.06525E-10
NICKEL COMPOUNDS	Off-site Transfer	922,887	0.000796982	2.62165E-06	8.04847E-08	5.63393E-09		2.30705E-08	1.22274E-08		1.78613E-08
NITRATE COMPOUNDS	Water	2,632,864	0.002273675	7.4792E-06	2.29611E-07	1.60728E-08		6.58169E-08	3.4883E-08		5.09558E-08
N-METHYL-2-PYRROLIDONE	Air	100,109	8.64516E-05	2.8438E-07	8.73048E-09	6.11133E-10		2.50255E-09	1.32635E-09		1.93748E-09
N-METHYL-2-PYRROLIDONE	Land	700	6.04502E-07	1.98849E-09	6.10468E-11	4.27328E-12		1.74988E-11	9.27434E-12		1.35476E-11
N-METHYL-2-PYRROLIDONE	Off-site Transfer	160	1.38172E-07	4.54513E-10	1.39536E-11	9.76749E-13		3.99972E-12	2.11985E-12		3.0966E-12
O-XYLENE	Air	88,500	7.64264E-05	2.51403E-07	7.71806E-09	5.40264E-10		2.21234E-09	1.17254E-09		1.71281E-09
O-XYLENE	Water	21	1.81351E-08	5.96548E-11	1.8314E-12	1.28198E-13		5.24963E-13	2.7823E-13		4.06428E-13
O-XYLENE	Land	86	7.42674E-08	2.44301E-10	7.50003E-12	5.25002E-13		2.14985E-12	1.13942E-12		1.66442E-12
O-XYLENE	Off-site Transfer	5,349	4.61926E-06	1.51949E-08	4.66485E-10	3.26539E-11		1.33715E-10	7.08692E-11		1.03523E-10
P-XYLENE	Air	574,900	0.000496469	1.63312E-06	5.01369E-08	3.50958E-09		1.43715E-08	7.61688E-09		1.11265E-08
P-XYLENE	Water	21	1.81351E-08	5.96548E-11	1.8314E-12	1.28198E-13		5.24963E-13	2.7823E-13		4.06428E-13
P-XYLENE	Land	77	6.64953E-08	2.18734E-10	6.71515E-12	4.7006E-13		1.92486E-12	1.02018E-12		1.49024E-12
P-XYLENE	Off-site Transfer	5,369	4.63653E-06	1.52518E-08	4.68229E-10	3.2776E-11		1.34215E-10	7.11342E-11		1.0391E-10
PHENANTHRENE	Air	1,658	1.43181E-06	4.70989E-09	1.44594E-10	1.01216E-11		4.14471E-11	2.19669E-11		3.20885E-11
PHENANTHRENE	Water	23	1.98622E-08	6.53363E-11	2.00582E-12	1.40408E-13		5.74959E-13	3.04728E-13		4.45136E-13
PHENANTHRENE	Land	4,113	3.55188E-06	1.16838E-08	3.58694E-10	2.51085E-11		1.02818E-10	5.44934E-11		7.96019E-11
PHENANTHRENE	Off-site Transfer	209	1.80487E-07	5.93708E-10	1.82268E-11	1.27588E-12		5.22463E-12	2.76905E-12		4.04493E-12
PHENOL	Air	112,415	9.70788E-05	3.19338E-07	9.80368E-09	6.86258E-10		2.81018E-09	1.48939E-09		2.17565E-09
PHENOL	Water	3,949	3.41026E-06	1.1218E-08	3.44391E-10	2.41074E-11		9.8718E-11	5.23205E-11		7.64279E-11
PHENOL	Underground	140,000	0.0001209	3.97699E-07	1.22094E-08	8.54655E-10		3.49975E-09	1.85487E-09		2.70952E-09
PHENOL	Land	200	1.72715E-07	5.68141E-10	1.74419E-11	1.22094E-12		4.99964E-12	2.64981E-12		3.87075E-12
PHENOL	POTW Transfer	2,266	1.95686E-06	6.43704E-09	1.97617E-10	1.38332E-11		5.6646E-11	3.00224E-11		4.38556E-11
PHENOL	Off-site Transfer	45	3.88609E-08	1.27832E-10	3.92444E-12	2.74711E-13		1.12492E-12	5.96208E-13		8.70918E-13
PHOSPHORIC ACID	Off-site Transfer	74,750	6.45522E-05	2.12343E-07	6.51893E-09	4.56325E-10		1.86862E-09	9.90367E-10		1.44669E-09
POLYCYCLIC AROMATIC COMPOUNDS	Air	15,109	1.30478E-05	4.29202E-08	1.31765E-09	9.22356E-11		3.77698E-10	2.0018E-10		2.92416E-10
POLYCYCLIC AROMATIC COMPOUNDS	Water	4	3.4543E-09	1.13628E-11	3.48839E-13	2.44187E-14		9.99929E-14	5.29962E-14		7.74149E-14
POLYCYCLIC AROMATIC COMPOUNDS	Land	8,705	7.51742E-06	2.47284E-08	7.5916E-10	5.31412E-11		2.1761E-10	1.15333E-10		1.68474E-10
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	441	3.80837E-07	1.25275E-09	3.84595E-11	2.69216E-12		1.10242E-11	5.84283E-12		8.535E-12
PROPYLENE	Air	987,512	0.000852791	2.80523E-06	8.61206E-08	6.02844E-09		2.4686E-08	1.30836E-08		1.9112E-08
PROPYLENE	Water	95	8.20396E-08	2.69867E-10	8.28492E-12	5.79945E-13		2.37483E-12	1.25866E-12		1.83861E-12
STYRENE	Air	759	6.55453E-07	2.1561E-09	6.61922E-11	4.63345E-12		1.89737E-11	1.0056E-11		1.46895E-11
STYRENE	Land	5	4.31787E-09	1.42035E-11	4.36049E-13	3.05234E-14		1.24991E-13	6.62453E-14		9.67687E-14
STYRENE	POTW Transfer		0								
STYRENE	Off-site Transfer	36	3.10887E-08	1.02265E-10	3.13955E-12	2.19768E-13		8.99936E-13	4.76966E-13		6.96735E-13
SULFURIC ACID	Air	11,246	9.71176E-06	3.19466E-08	9.8076E-10	6.86532E-11		2.8113E-10	1.48999E-10		2.17652E-10
SULFURIC ACID	Off-site Transfer	12	1.03629E-08	3.40885E-11	1.04652E-12	7.32562E-14		2.99979E-13	1.58989E-13		2.32245E-13

Table A1. (Continued)

		Totals									
REFINING CAPACITY (Barrels/day)—>		3689000									
Chemical	Disposition[2]	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	7% of ethylene to ethylbenzene[6]:		0.88% of crude to benzene[7]:	53% of benzene to ethylbenzene[8]:		Addition of ethylene and benzene contributions to ethylbenzene:
TERT-BUTYL ALCOHOL	Air	300	2.59072E-07	8.52212E-10	2.61629E-11	1.8314E-12		7.49947E-12	3.97472E-12		5.80612E-12
TETRACHLOROETHYLENE	Air	35,657	3.07925E-05	1.01291E-07	3.10964E-09	2.17675E-10		8.91362E-10	4.72422E-10		6.90096E-10
TETRACHLOROETHYLENE	Land	11	9.49932E-09	3.12478E-11	9.59307E-13	6.71515E-14		2.7498E-13	1.4574E-13		2.12891E-13
TETRACHLOROETHYLENE	Off-site Transfer	711	6.14002E-07	2.01974E-09	6.20061E-11	4.34043E-12		1.77737E-11	9.42008E-12		1.37605E-11
TOLUENE	Air	2,666,136	0.002302408	7.57371E-06	2.32513E-07	1.62759E-08		6.66487E-08	3.53238E-08		5.15997E-08
TOLUENE	Water	259	2.23666E-07	7.35743E-10	2.25873E-11	1.58111E-12		6.47454E-12	3.43151E-12		5.01262E-12
TOLUENE	Underground	160,000	0.000138172	4.54513E-07	1.39536E-08	9.76749E-10		3.99972E-09	2.11985E-09		3.0966E-09
TOLUENE	Land	3,065	2.64686E-06	8.70677E-09	2.67298E-10	1.87108E-11		7.66195E-11	4.06084E-11		5.93192E-11
TOLUENE	POTW Transfer	214	1.84805E-07	6.07911E-10	1.86629E-11	1.3064E-12		5.34962E-12	2.8353E-12		4.1417E-12
TOLUENE	Off-site Transfer	47,071	4.06493E-05	1.33715E-07	4.10505E-09	2.87353E-10		1.17669E-09	6.23646E-10		9.11E-10
TRICHLOROETHYLENE	Air	65,724	5.67576E-05	1.86703E-07	5.73177E-09	4.01224E-10		1.64298E-09	8.70781E-10		1.27201E-09
TRICHLOROETHYLENE	Off-site Transfer	27	2.33165E-08	7.66991E-11	2.35466E-12	1.64826E-13		6.74952E-13	3.57725E-13		5.22551E-13
1,2,4-TRIMETHYLBENZENE	Air	127,580	0.000110175	3.62417E-07	1.11262E-08	7.78835E-10		3.18927E-09	1.69031E-09		2.46915E-09
1,2,4-TRIMETHYLBENZENE	Water	39	3.36794E-08	1.10788E-10	3.40118E-12	2.38082E-13		9.74931E-13	5.16713E-13		7.54796E-13
1,2,4-TRIMETHYLBENZENE	Land	1,188	1.02593E-06	3.37476E-09	1.03605E-10	7.25236E-12		2.96979E-11	1.57399E-11		2.29922E-11
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	730	6.3041E-07	2.07372E-09	6.36631E-11	4.45642E-12		1.82487E-11	9.67181E-12		1.41282E-11
VANADIUM (FUME OR DUST)	Land	11	9.49932E-09	3.12478E-11	9.59307E-13	6.71515E-14		2.7498E-13	1.4574E-13		2.12891E-13
VANADIUM (FUME OR DUST)	Off-site Transfer	7,000	6.04502E-06	1.98849E-08	6.10468E-10	4.27328E-11		1.74988E-10	9.27434E-11		1.35476E-10
XYLENE (MIXED ISOMERS)	Air	729,067	0.000629604	2.07107E-06	6.35817E-08	4.45072E-09		1.82254E-08	9.65945E-09		1.41102E-08
XYLENE (MIXED ISOMERS)	Water	288	2.4871E-07	8.18124E-10	2.51164E-11	1.75815E-12		7.19949E-12	3.81573E-12		5.57388E-12
XYLENE (MIXED ISOMERS)	Underground	31,000	2.67708E-05	8.80619E-08	2.7035E-09	1.89245E-10		7.74945E-10	4.10721E-10		5.99966E-10
XYLENE (MIXED ISOMERS)	Land	4,624	3.99317E-06	1.31354E-08	4.03258E-10	2.8228E-11		1.15592E-10	6.12636E-11		8.94917E-11
XYLENE (MIXED ISOMERS)	POTW Transfer	330	2.8498E-07	9.37433E-10	2.87792E-11	2.01454E-12		8.24941E-12	4.37219E-12		6.38673E-12
XYLENE (MIXED ISOMERS)	Off-site Transfer	61,951	5.34993E-05	1.75985E-07	5.40273E-09	3.78191E-10		1.54866E-09	8.20792E-10		1.19898E-09
ZINC COMPOUNDS	Air	10,608	9.1608E-06	3.01342E-08	9.25121E-10	6.47584E-11		2.65181E-10	1.40546E-10		2.05304E-10
ZINC COMPOUNDS	Water	14,384	1.24217E-05	4.08607E-08	1.25442E-09	8.78097E-11		3.59574E-10	1.90574E-10		2.78384E-10
ZINC COMPOUNDS	Land	52,684	4.54966E-05	1.4966E-07	4.59456E-09	3.21619E-10		1.31701E-09	6.98013E-10		1.01963E-09
ZINC COMPOUNDS	POTW Transfer	89	7.68582E-08	2.52823E-10	7.76166E-12	5.43316E-13		2.22484E-12	1.17917E-12		1.72248E-12
ZINC COMPOUNDS	Off-site Transfer	186,534	0.000161086	5.29888E-07	1.62676E-08	1.13873E-09		4.66302E-09	2.4714E-09		3.61013E-09
TOTAL RELEASES & TRANSFERS (LBS)		25,639,240	0.022141405	7.28336E-05	2.23599E-06	1.56519E-07		6.40935E-07	3.39696E-07		4.96215E-07

Table A1. (Continued)

					TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
					FACILITY ID -->	PS FACILITY[13] 23320HNT3M5100B		
					FACILITY CAPACITY[12] (LBS/YR)-->	450,000,000		
				TRI Releases for Polystyrene				
Chemical	Disposition[2]	99% of ethylbenzene to styrene[9]:	62% of styrene to polystyrene[10]:	TRI lbs/ lb of polystyrene[11] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing polystyrene	TRI lbs per lb of polystyrene [14] (attributed to polystyrene chemical plant):	TRI lbs per lb of polystyrene (attributed to oil refineries and polystyrene chemical plant):
AMMONIA	Air	1.42988E-08	8.86527E-09	2.28901E-06				2.28901E-06
AMMONIA	Water	1.72317E-09	1.06837E-09	2.75852E-07				2.75852E-07
AMMONIA	Underground	2.49083E-08	1.54431E-08	3.98741E-06				3.98741E-06
AMMONIA	POTW Transfer	1.99266E-12	1.23545E-12	3.18993E-10				3.18993E-10
AMMONIA	Off-site Transfer	4.40685E-13	2.73224E-13	7.05466E-11				7.05466E-11
ANTHRACENE	Air	4.69042E-11	2.90806E-11	7.50861E-09				7.50861E-09
ANTHRACENE	Land	3.10395E-12	1.92445E-12	4.96893E-10				4.96893E-10
ANTHRACENE	Off-site Transfer	2.10762E-13	1.30673E-13	3.37397E-11				3.37397E-11
ANTIMONY COMPOUNDS	Air	2.49083E-11	1.54431E-11	3.98741E-09				3.98741E-09
ANTIMONY COMPOUNDS	Land	4.79005E-11	2.96983E-11	7.6681E-09				7.6681E-09
ANTIMONY COMPOUNDS	Off-site Transfer	1.01779E-10	6.3103E-11	1.62932E-08		800	2.06334E-06	2.07964E-06
BARIUM COMPOUNDS	Water	3.62511E-11	2.24757E-11	5.80322E-09				5.80322E-09
BARIUM COMPOUNDS	Land	4.42984E-11	2.7465E-11	7.09146E-09				7.09146E-09
BARIUM COMPOUNDS	Off-site Transfer	4.88585E-12	3.02923E-12	7.82147E-10				7.82147E-10
BENZENE	Air	1.16622E-08	7.23059E-09	1.86694E-06				1.86694E-06
BENZENE	Water	2.03098E-12	1.25921E-12	3.25128E-10				3.25128E-10
BENZENE	Underground	3.25723E-09	2.01949E-09	5.21431E-07				5.21431E-07
BENZENE	Land	2.14786E-11	1.33167E-11	3.43838E-09				3.43838E-09
BENZENE	POTW Transfer	9.7717E-13	6.05846E-13	1.56429E-10				1.56429E-10
BENZENE	Off-site Transfer	3.75751E-10	2.32965E-10	6.01517E-08				6.01517E-08
BIPHENYL	Air	3.64044E-11	2.25707E-11	5.82776E-09				5.82776E-09
1,3-BUTADIENE	Air	8.29924E-10	5.14553E-10	1.32858E-07				1.32858E-07
1,3-BUTADIENE	Off-site Transfer	2.29922E-12	1.42552E-12	3.68069E-10				3.68069E-10
CARBON DISULFIDE	Air	1.35846E-10	8.42244E-11	2.17467E-08				2.17467E-08
CARBON DISULFIDE	Off-site Transfer	4.90501E-12	3.04111E-12	7.85214E-10				7.85214E-10
CARBON TETRACHLORIDE	Air	4.49019E-10	2.78392E-10	7.18808E-08				7.18808E-08
CARBON TETRACHLORIDE	Off-site Transfer	1.83172E-11	1.13566E-11	2.93228E-09				2.93228E-09
CARBONYL SULFIDE	Air	3.47374E-09	2.15372E-09	5.56091E-07				5.56091E-07
CHLORINE	Air	8.71061E-10	5.40058E-10	1.39443E-07				1.39443E-07
CHLORINE	Water	2.53489E-10	1.57163E-10	4.05796E-08				4.05796E-08
CHLORODIFLUOROMETHANE	Off-site Transfer	4.40685E-10	2.73224E-10	7.05466E-08				7.05466E-08
CHROMIUM COMPOUNDS	Air	5.74806E-13	3.5638E-13	9.20172E-11				9.20172E-11
CHROMIUM COMPOUNDS	Water	7.95531E-11	4.9323E-11	1.27352E-08				1.27352E-08
CHROMIUM COMPOUNDS	Land	9.75254E-11	6.04658E-11	1.56123E-08				1.56123E-08
CHROMIUM COMPOUNDS	Off-site Transfer	4.95674E-10	3.07318E-10	7.93495E-08				7.93495E-08
COBALT COMPOUNDS	Air	2.05014E-12	1.27109E-12	3.28195E-10				3.28195E-10
COBALT COMPOUNDS	Land	4.37811E-11	2.71443E-11	7.00865E-09				7.00865E-09
COBALT COMPOUNDS	Off-site Transfer	2.88181E-09	1.78672E-09	4.61332E-07				4.61332E-07
COPPER COMPOUNDS	Air	5.47982E-12	3.39749E-12	8.77231E-10				8.77231E-10
COPPER COMPOUNDS	Water	7.2234E-12	4.47851E-12	1.15635E-09				1.15635E-09
COPPER COMPOUNDS	Land	1.81294E-10	1.12402E-10	2.90222E-08				2.90222E-08
COPPER COMPOUNDS	Off-site Transfer	3.19293E-09	1.97962E-09	5.11137E-07				5.11137E-07
CRESOL (MIXED ISOMERS)	Air	5.29186E-10	3.28095E-10	8.47141E-08				8.47141E-08
CRESOL (MIXED ISOMERS)	Water	5.1905E-11	3.21811E-11	8.30916E-09				8.30916E-09
CRESOL (MIXED ISOMERS)	Underground	1.72442E-09	1.06914E-09	2.76052E-07				2.76052E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer	1.4945E-12	9.26587E-13	2.39245E-10				2.39245E-10
CUMENE	Air	1.24037E-09	7.69032E-10	1.98564E-07				1.98564E-07
CUMENE	Water	4.79005E-13	2.96983E-13	7.6681E-11				7.6681E-11
CUMENE	Off-site Transfer	1.53282E-12	9.50346E-13	2.45379E-10				2.45379E-10
CYCLOHEXANE	Air	4.53472E-09	2.81153E-09	7.25936E-07				7.25936E-07

Table A1. (Continued)

					TRI CONTRIBUTION FROM PS CHEMICAL PLANT				TOTAL
						PS FACILITY[13]			
					FACILITY ID --->	2332HNT3M5100B			
					FACILITY CAPACITY[12] (LBS/YR)--->	450,000,000			
				TRI Releases for Polystyrene					
Chemical	Disposition[2]	99% of ethylbenzene to styrene[9]:	62% of styrene to polystyrene[10]:	TRI lbs/ lb of polystyrene[11] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing polystyrene	TRI lbs per lb of polystyrene [14] (attributed to polystyrene chemical plant):	TRI lbs per lb of polystyrene (attributed to oil refineries and polystyrene chemical plant):
CYCLOHEXANE	Water	5.55646E-13	3.445E-13	8.895E-11				8.895E-11
CYCLOHEXANE	Land	4.69425E-11	2.91043E-11	7.51474E-09				7.51474E-09
CYCLOHEXANE	Off-site Transfer	5.15218E-11	3.19435E-11	8.24781E-09				8.24781E-09
DECABROMODIPHENYL OXIDE	Off-site Transfer					400	1.03167E-06	1.03167E-06
1,2-DIBROMOETHANE	Air	3.71325E-11	2.30221E-11	5.94431E-09				5.94431E-09
1,2-DIBROMOETHANE	Water	1.34121E-13	8.31553E-14	2.14707E-11				2.14707E-11
1,2-DICHLOROETHANE	Air	2.54831E-10	1.57995E-10	4.07943E-08				4.07943E-08
DIETHANOLAMINE	Air	8.40673E-10	5.21217E-10	1.34578E-07				1.34578E-07
DIETHANOLAMINE	Off-site Transfer	2.56747E-09	1.59183E-09	4.1101E-07				4.1101E-07
ETHYLBENZENE	Air	4.90095E-09	3.03859E-09	7.84564E-07		2,421	6.2442E-06	7.02876E-06
ETHYLBENZENE	Water	1.41785E-12	8.7907E-13	2.26976E-10				2.26976E-10
ETHYLBENZENE	Underground	3.25723E-11	2.01949E-11	5.21431E-09				5.21431E-09
ETHYLBENZENE	Land	1.26649E-11	7.85223E-12	2.02745E-09				2.02745E-09
ETHYLBENZENE	POTW Transfer	7.28088E-13	4.51414E-13	1.16555E-10		5	1.28959E-08	1.30125E-08
ETHYLBENZENE	Off-site Transfer	3.75502E-10	2.32811E-10	6.01118E-08		188	4.84886E-07	5.44998E-07
ETHYLENE	Air	1.529E-08	9.47982E-09	2.44769E-06				2.44769E-06
ETHYLENE	Off-site Transfer	1.7819E-12	1.10478E-12	2.85253E-10				2.85253E-10
ETHYLENE GLYCOL	Air	3.47528E-10	2.15467E-10	5.56336E-08				5.56336E-08
ETHYLENE GLYCOL	Water	3.70233E-10	2.29544E-10	5.92683E-08				5.92683E-08
ETHYLENE GLYCOL	Off-site Transfer	1.53282E-11	9.50346E-12	2.45379E-09				2.45379E-09
FORMALDEHYDE	Air	2.2153E-10	1.37349E-10	3.54634E-08				3.54634E-08
FORMALDEHYDE	Water	2.20342E-12	1.36612E-12	3.52733E-10				3.52733E-10
FORMALDEHYDE	Off-site Transfer	4.96249E-12	3.07674E-12	7.94416E-10				7.94416E-10
GLYCOL ETHERS	Air	3.33962E-11	2.07057E-11	5.3462E-09				5.3462E-09
HYDROCHLORIC ACID	Air	1.8312E-09	1.13534E-09	2.93145E-07				2.93145E-07
HYDROGEN FLUORIDE	Air	6.00481E-11	3.72298E-11	9.61273E-09				9.61273E-09
LEAD COMPOUNDS	Air	1.51366E-12	9.38467E-13	2.42312E-10				2.42312E-10
LEAD COMPOUNDS	Water	1.56922E-11	9.72917E-12	2.51207E-09				2.51207E-09
LEAD COMPOUNDS	Land	1.51155E-10	9.3716E-11	2.41975E-08				2.41975E-08
LEAD COMPOUNDS	Off-site Transfer	8.89187E-10	5.51296E-10	1.42345E-07				1.42345E-07
MANGANESE COMPOUNDS	Air	3.06563E-13	1.90069E-13	4.90759E-11				4.90759E-11
MANGANESE COMPOUNDS	Water	3.44884E-11	2.13828E-11	5.52103E-09				5.52103E-09
MANGANESE COMPOUNDS	Off-site Transfer	1.78765E-10	1.10834E-10	2.86174E-08				2.86174E-08
METHANOL	Air	7.59977E-08	4.71186E-08	1.2166E-05				1.2166E-05
METHANOL	Water	2.31264E-11	1.43383E-11	3.70216E-09				3.70216E-09
METHANOL	Off-site Transfer	1.30309E-10	8.07913E-11	2.08603E-08				2.08603E-08
2-METHOXYETHANOL	Air	1.20709E-12	7.48397E-13	1.93236E-10				1.93236E-10
METHYL ETHYL KETONE	Air	5.09461E-08	3.15866E-08	8.15566E-06				8.15566E-06
METHYL ETHYL KETONE	Water	1.10382E-10	6.84368E-11	1.76704E-08				1.76704E-08
METHYL ETHYL KETONE	Underground	3.64044E-10	2.25707E-10	5.82776E-08				5.82776E-08
METHYL ETHYL KETONE	Land	9.5801E-14	5.93966E-14	1.53362E-11				1.53362E-11
METHYL ETHYL KETONE	Off-site Transfer	2.01374E-11	1.24852E-11	3.22367E-09				3.22367E-09
METHYL ISOBUTYL KETONE	Air	4.4043E-09	2.73066E-09	7.05058E-07				7.05058E-07
METHYL ISOBUTYL KETONE	Water	7.66408E-14	4.75173E-14	1.2269E-11				1.2269E-11
METHYL ISOBUTYL KETONE	Land	9.5801E-14	5.93966E-14	1.53362E-11				1.53362E-11
METHYL ISOBUTYL KETONE	Off-site Transfer	7.95148E-12	4.92992E-12	1.27291E-09				1.27291E-09
METHYL TERT-BUTYL ETHER	Air	1.66569E-08	1.03273E-08	2.6665E-06				2.6665E-06
METHYL TERT-BUTYL ETHER	Water	9.62417E-10	5.96698E-10	1.54068E-07				1.54068E-07
METHYL TERT-BUTYL ETHER	Underground	3.06563E-09	1.90069E-09	4.90759E-07				4.90759E-07
MOLYBDENUM TRIOXIDE	Air	3.47311E-09	2.15333E-09	5.5599E-07				5.5599E-07

Table A1. (Continued)

					TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
						PS FACILITY[13]		
					FACILITY ID -->	23320HNTSM5100B		
					FACILITY CAPACITY[12] (LBS/YR)-->	450,000,000		
				TRI Releases for Polystyrene				
Chemical	Disposition[2]	99% of ethylbenzene to styrene[9]:	62% of styrene to polystyrene[10]:	TRI lbs/ lb of polystyrene[11] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing polystyrene	TRI lbs per lb of polystyrene [14] (attributed to polystyrene chemical plant):	TRI lbs per lb of polystyrene (attributed to oil refineries and polystyrene chemical plant):
MOLYBDENUM TRIOXIDE	Water	4.02364E-13	2.49466E-13	6.44121E-11				6.44121E-11
MOLYBDENUM TRIOXIDE	Land	1.82022E-12	1.12854E-12	2.91388E-10				2.91388E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer	1.13628E-08	7.04494E-09	1.819E-06				1.819E-06
NAPHTHALENE	Air	1.94541E-09	1.20616E-09	3.11429E-07				3.11429E-07
NAPHTHALENE	Water	2.73991E-12	1.69874E-12	4.38616E-10				4.38616E-10
NAPHTHALENE	Land	1.232E-11	7.63841E-12	1.97224E-09				1.97224E-09
NAPHTHALENE	Off-site Transfer	1.26476E-10	7.84154E-11	2.02469E-08				2.02469E-08
N-HEXANE	Air	2.40482E-08	1.49099E-08	3.84974E-06				3.84974E-06
N-HEXANE	Water	2.73991E-12	1.69874E-12	4.38616E-10				4.38616E-10
N-HEXANE	Land	6.9015E-11	4.27893E-11	1.10482E-08				1.10482E-08
N-HEXANE	Off-site Transfer	1.2686E-10	7.8653E-11	2.03082E-08				2.03082E-08
NICKEL COMPOUNDS	Air	5.12976E-10	3.18045E-10	8.21193E-08				8.21193E-08
NICKEL COMPOUNDS	Water	3.04264E-11	1.88644E-11	4.87078E-09				4.87078E-09
NICKEL COMPOUNDS	Land	4.0246E-10	2.49525E-10	6.44274E-08				6.44274E-08
NICKEL COMPOUNDS	Off-site Transfer	1.76827E-08	1.09633E-08	2.83072E-06				2.83072E-06
NITRATE COMPOUNDS	Water	5.04462E-08	3.12766E-08	8.07563E-06				8.07563E-06
N-METHYL-2-PYRROLIDONE	Air	1.91811E-09	1.18923E-09	3.07058E-07				3.07058E-07
N-METHYL-2-PYRROLIDONE	Land	1.34121E-11	8.31553E-12	2.14707E-09				2.14707E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer	3.06563E-12	1.90069E-12	4.90759E-10				4.90759E-10
O-XYLENE	Air	1.69568E-09	1.05132E-09	2.71451E-07				2.71451E-07
O-XYLENE	Water	4.02364E-13	2.49466E-13	6.44121E-11				6.44121E-11
O-XYLENE	Land	1.64778E-12	1.02162E-12	2.63783E-10				2.63783E-10
O-XYLENE	Off-site Transfer	1.02488E-10	6.35425E-11	1.64067E-08				1.64067E-08
P-XYLENE	Air	1.10152E-08	6.82942E-09	1.76336E-06				1.76336E-06
P-XYLENE	Water	4.02364E-13	2.49466E-13	6.44121E-11				6.44121E-11
P-XYLENE	Land	1.47534E-12	9.14708E-13	2.36178E-10				2.36178E-10
P-XYLENE	Off-site Transfer	1.02871E-10	6.37801E-11	1.6468E-08				1.6468E-08
PHENANTHRENE	Air	3.17676E-11	1.96959E-11	5.08549E-09				5.08549E-09
PHENANTHRENE	Water	4.40685E-13	2.73224E-13	7.05466E-11				7.05466E-11
PHENANTHRENE	Land	7.88059E-11	4.88597E-11	1.26156E-08				1.26156E-08
PHENANTHRENE	Off-site Transfer	4.00448E-12	2.48278E-12	6.41053E-10				6.41053E-10
PHENOL	Air	2.15389E-09	1.33541E-09	3.44804E-07				3.44804E-07
PHENOL	Water	7.56636E-11	4.69114E-11	1.21125E-08				1.21125E-08
PHENOL	Underground	2.68243E-09	1.66311E-09	4.29414E-07				4.29414E-07
PHENOL	Land	3.83204E-12	2.37586E-12	6.13448E-10				6.13448E-10
PHENOL	POTW Transfer	4.3417E-11	2.69185E-11	6.95037E-09				6.95037E-09
PHENOL	Off-site Transfer	8.62209E-13	5.3457E-13	1.38026E-10				1.38026E-10
PHOSPHORIC ACID	Off-site Transfer	1.43222E-09	8.87979E-10	2.29276E-07				2.29276E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air	2.89491E-10	1.79485E-10	4.6343E-08				4.6343E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water	7.66408E-14	4.75173E-14	1.2269E-11				1.2269E-11
POLYCYCLIC AROMATIC COMPOUNDS	Land	1.6679E-10	1.0341E-10	2.67003E-08				2.67003E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	8.44965E-12	5.23878E-12	1.35265E-09				1.35265E-09
PROPYLENE	Air	1.89209E-08	1.1731E-08	3.02894E-06				3.02894E-06
PROPYLENE	Water	1.82022E-12	1.12854E-12	2.91388E-10				2.91388E-10
STYRENE	Air	1.45426E-11	9.01641E-12	2.32804E-09		8,998	2.32075E-05	2.32098E-05
STYRENE	Land	9.5801E-14	5.93966E-14	1.53362E-11				1.53362E-11
STYRENE	POTW Transfer					164	4.22986E-07	4.22986E-07
STYRENE	Off-site Transfer	6.89767E-13	4.27656E-13	1.10421E-10		6,004	1.54854E-05	1.54855E-05
SULFURIC ACID	Air	2.15476E-10	1.33595E-10	3.44942E-08				3.44942E-08
SULFURIC ACID	Off-site Transfer	2.29922E-13	1.42552E-13	3.68069E-11				3.68069E-11

Table A1. (Continued)

					TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
					FACILITY ID --->	PS FACILITY[13] 23320HNT3M5100B		
					FACILITY CAPACITY[12] (LBS/YR)--->	450,000,000		
				TRI Releases for Polystyrene				
Chemical	Disposition[2]	99% of ethylbenzene to styrene[9]:	62% of styrene to polystyrene[10]:	TRI lbs/ lb of polystyrene[11] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing polystyrene	TRI lbs per lb of polystyrene [14] (attributed to polystyrene chemical plant):	TRI lbs per lb of polystyrene (attributed to oil refineries and polystyrene chemical plant):
TERT-BUTYL ALCOHOL	Air	5.74806E-12	3.5638E-12	9.20172E-10				9.20172E-10
TETRACHLOROETHYLENE	Air	6.83195E-10	4.23581E-10	1.09369E-07				1.09369E-07
TETRACHLOROETHYLENE	Land	2.10762E-13	1.30673E-13	3.37397E-11				3.37397E-11
TETRACHLOROETHYLENE	Off-site Transfer	1.36229E-11	8.4462E-12	2.18081E-09				2.18081E-09
TOLUENE	Air	5.10837E-08	3.16719E-08	8.17768E-06				8.17768E-06
TOLUENE	Water	4.96249E-12	3.07674E-12	7.94416E-10				7.94416E-10
TOLUENE	Underground	3.06563E-09	1.90069E-09	4.90759E-07				4.90759E-07
TOLUENE	Land	5.8726E-11	3.64101E-11	9.40109E-09				9.40109E-09
TOLUENE	POTW Transfer	4.10028E-12	2.54218E-12	6.5639E-10				6.5639E-10
TOLUENE	Off-site Transfer	9.0189E-10	5.59172E-10	1.44378E-07				1.44378E-07
TRICHLOROETHYLENE	Air	1.25928E-09	7.80757E-10	2.01591E-07				2.01591E-07
TRICHLOROETHYLENE	Off-site Transfer	5.17325E-13	3.20742E-13	8.28155E-11				8.28155E-11
1,2,4-TRIMETHYLBENZENE	Air	2.44446E-09	1.51556E-09	3.91319E-07				3.91319E-07
1,2,4-TRIMETHYLBENZENE	Water	7.47248E-13	4.63294E-13	1.19622E-10				1.19622E-10
1,2,4-TRIMETHYLBENZENE	Land	2.27623E-11	1.41126E-11	3.64388E-09				3.64388E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	1.39869E-11	8.67191E-12	2.23909E-09				2.23909E-09
VANADIUM (FUME OR DUST)	Land	2.10762E-13	1.30673E-13	3.37397E-11				3.37397E-11
VANADIUM (FUME OR DUST)	Off-site Transfer	1.34121E-10	8.31553E-11	2.14707E-08				2.14707E-08
XYLENE (MIXED ISOMERS)	Air	1.39691E-08	8.66082E-09	2.23622E-06		680	1.75384E-06	3.99007E-06
XYLENE (MIXED ISOMERS)	Water	5.51814E-12	3.42125E-12	8.83366E-10				8.83366E-10
XYLENE (MIXED ISOMERS)	Underground	5.93966E-10	3.68259E-10	9.50845E-08				9.50845E-08
XYLENE (MIXED ISOMERS)	Land	8.85968E-11	5.493E-11	1.41829E-08				1.41829E-08
XYLENE (MIXED ISOMERS)	POTW Transfer	6.32287E-12	3.92018E-12	1.01219E-09		5	1.28959E-08	1.39081E-08
XYLENE (MIXED ISOMERS)	Off-site Transfer	1.18699E-09	7.35936E-10	1.90019E-07		188	4.84886E-07	6.74905E-07
ZINC COMPOUNDS	Air	2.03251E-10	1.26016E-10	3.25373E-08		12,099	3.12055E-05	3.1238E-05
ZINC COMPOUNDS	Water	2.756E-10	1.70872E-10	4.41192E-08				4.41192E-08
ZINC COMPOUNDS	Land	1.00944E-09	6.2585E-10	1.61595E-07				1.61595E-07
ZINC COMPOUNDS	POTW Transfer	1.70526E-12	1.05726E-12	2.72984E-10		174	4.48777E-07	4.4905E-07
ZINC COMPOUNDS	Off-site Transfer	3.57403E-09	2.2159E-09	5.72145E-07				5.72145E-07
TOTAL RELEASES & TRANSFERS (LBS)		4.91253E-07	3.04577E-07	7.86417E-05		32126	8.28588E-05	0.000161501

Table A1. (Continued)

FOOTNOTES

[1] Info on the top ten facilities by capacity for the petroleum refining industry comes from the website for the Sector Facility Indexing Project: Petroleum Refining Data Access, <http.//es epa.gov/oeca/sfi/petdata.htm>, obtained October 1999. The TRI release data for each facility comes from the Right-to-Know Network environmental database for facility TRIs, <http://www.rtknet.org/triinputfacility.html>, obtained October 1999.

[2] Under the "Disposition" column, the category "air" includes fugitive and stack emissions.

[3] TRI lbs/barrel of crude in was computed by: (?? lbs/yr of the TRI chemical totaled for the ten refineries) divided by (365 days/yr) divided by (3,689,000 bbl of crude in/day - total of the plant capacities for the ten refineries) divided by (0.8600).

The 0.8600 (or 86%) value is the refining capacity factor which represents % of capacity at which the refinery is actually operating. It was calculated by taking each annual total U.S. refinery throughput divided by each yearly U S. refining total capacity for the years 1987 -1993, and averaging the values. These values were obtained from the International Petroleum Encyclopedia, 1995 edition. These were the only years that U.S. refinery throughput and capacity values were both available, and were thus used to estimate the actual rate at which the ten refineries were actually operating. Note that the throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days " It was assumed that these terms each refer to a 365 day year. See further Table 1 in the bottom right corner of this worksheet (starting at cell AE221) for the calculation of the facility capacity factor.

[4] Note. Conversion of "bbls of crude" to "lbs of crude", using the density of crude: bbls of crude in X 42 US gal/bbl X 3.785ee3 cm3/gal X 0.8673 g crude in/cm3 X 1 lb/ 453.6 g; or, a factor of 304.0 lbs of crude in/bbl of crude in. On this basis, the ten refineries processed 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

Table A1. (Continued)

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries. this resulted in an average API (American Petroleum Institute) gravity of 31.7 degrees, or specific gravity of 0.8692 The data came from Tables P-13 and P-14 on pages 851-2 of Chemical and Process Technology Encyclopedia, Douglas M. Considine, editor-in-chief, McGraw-Hill Book Company, New York. 1974. The data from the tables was copyrighted to the Universal Oil Products Company, 1973. (API , in degrees = [141.5/specific gravity @ 60/60] - 131.5).

[5]Calculating the 3.07% value: 48.4 billion lbs/yr ethylene divided by 1.575 trillion lbs crude/yr. The ethylene value comes from CMR (1997), demand for 1996

[6] From the Chemical Profile of Ethylene found in the Chemical Marketing Reporter (CMR), 1997.
<http://chemexpo.com/news/newsframe.cfm?framebody=/news/profile.cfm>

[7] Calculating the 0.88% value: 13.9 billion lbs/yr benzene divided by 1.575 trillion lbs crude/yr The benzene value comes from CMR, 1 9 billion gallons benzene demand for 1996, and using the density of benzene (0.8765 kg/l or 7.314 lb/gal, obtained from the 61st edition of the CRC handbook of Chemistry and Physics) to convert to lbs

[8] From the Chemical Profile of Benzene found in the Chemical Marketing Reporter (CMR), 1996
<http://chemexpo.com/news/newsframe.cfm?framebody=/news/profile cfm>

[9] From the Chemical Profile of Ethylbenzene found in the Chemical Marketing Reporter (CMR), 1995.
<http.//chemexpo com/news/newsframe cfm?framebody=/news/profile.cfm>

[10] From the Chemical Profile of Styrene found in the Chemical Marketing Reporter (CMR), 1998.
<http·//chemexpo.com/news/newsframe.cfm?framebody=/news/profile.cfm>

Table A1. (Continued)

[11] Calculation for TRI lbs/lb polystyrene: "lbs of TRI chemical lbs/lb of crude in" multiplied by "1.575 trillion lbs/yr crude" divided by "6.1 billion lbs polystyrene (from CMR, 1997 - this value is the demand for 1996)"; or in other words, a factor of "258.2 lbs of crude/lb of product".

[12] Facility Capacity obtained from CMR report on polystyrene, 1997.

[13] The TRI release data for this facility comes from the Right-to-Know Network environmental database for facility TRIs. <http·//www.rtknet.org/triinputfacility.html>

[14] TRI lbs/lb of PS was computed by: (?? lbs/yr of the TRI chemical attributed to the PS chemical plant) divided by (450,000,000 lbs/yr - facility capacity) divided by (0.8616 - the facility capacity factor). The 0.8616 (or ~ 86%) value is the facility capacity factor which represents % of capacity at which the facility is actually operating. It was calculated by taking each yearly U.S demand value (considered to approximate the throughput) divided by each yearly U.S capacity for 141 different chemicals, and averaging the values. These values were obtained from ChemExpo, accessed November 1999, available from <http://www chemexpo com>, and make up all the chemicals listed in the "chemical profile archives." See further Table 2 in the bottom right corner of this worksheet (starting at cell AJ232) for the calculation of the facility capacity factor.

Table A2. HDPE Database Generated by the Public Data Method (page order: down, then over)

IN THE PRODUCTION OF HDPE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
AMMONIA	Air	60,962	160	71,376	436	49,128	505	440,000	3,500	10,000
AMMONIA	Water	24,767	25,000	2,822	2,400	13,134	2,162	0	7,350	3,600
AMMONIA	Underground	0	1,300,000	0	0	0	0	0	0	0
AMMONIA	POTW Transfer	0	0	0	0	0	104	0	0	0
AMMONIA	Off-site Transfer	0	0	0	23	0	0	0	0	0
ANTHRACENE	Air	0	0	1,029	0	895	0	0	524	0
ANTHRACENE	Land	0	0	0	0	162	0	0	0	0
ANTHRACENE	Off-site Transfer	0	0	0	0	11	0	0	0	0
ANTIMONY COMPOUNDS	Air	0	0	0	200	0	0	0	0	1,100
ANTIMONY COMPOUNDS	Land	0	0	0	0	0	0	0	0	2,500
ANTIMONY COMPOUNDS	Off-site Transfer	0	0	0	5,312	0	0	0	0	0
BARIUM COMPOUNDS	Water	0	0	0	0	1,892	0	0	0	0
BARIUM COMPOUNDS	Land	0	160	0	0	2,152	0	0	0	0
BARIUM COMPOUNDS	Off-site Transfer	0	70	0	0	185	0	0	0	0
BENZENE	Air	58,853	145,000	33,614	11,400	34,184	51,619	60,000	90,000	56,000
BENZENE	Water	15	1	43	13	11	0	0	2	0
BENZENE	Underground	0	170,000		0	0	0	0	0	0
BENZENE	Land	0	950	101	46	22	0	0	0	0
BENZENE	POTW Transfer	0	0	0	0	0	51	0	0	0
BENZENE	Off-site Transfer	4,533	4,189	357	4,666	2,390	2,010	44	1	833
BIPHENYL	Air	0	0	0	0	0	0	0	1,900	0
1,3-BUTADIENE	Air	10,848	280	338	50	3,098	1,771	18,400	1,730	6,100
1,3-BUTADIENE	Off-site Transfer	0	0	0	0	0	0	0	0	120
BUTYL ACRYLATE	Air									
BUTYL ACRYLATE	Off-site Transfer									
CARBON DISULFIDE	Air	0	0	0	0	0	0	0	7,090	0
CARBON DISULFIDE	Off-site Transfer	0	0	0	0	0	0	0	256	0
CARBON TETRACHLORIDE	Air	16,653	250	0	0	0	0	340	6,192	0
CARBON TETRACHLORIDE	Off-site Transfer	0	956	0	0	0	0	0	0	0
CARBONYL SULFIDE	Air	0	0	0	0	0	0	0	110,000	0
CHLORINE	Air	0	2,500	0	0	702	255	5	24,000	18,000
CHLORINE	Water	0	0	0	0	198	32	0	13,000	0
CHLORODIFLUOROMETHANE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CHROMIUM COMPOUNDS	Air	0	0	0	0	0	0	16	0	0
CHROMIUM COMPOUNDS	Water	0	52	0	0	4,096	0	0	0	0
CHROMIUM COMPOUNDS	Land	0	36	0	0	5,054	0	0	0	0
CHROMIUM COMPOUNDS	Off-site Transfer	0	102	0	0	260	0	1,834	0	0
COBALT COMPOUNDS	Air	1	0	0	0	106	0	0	0	0
COBALT COMPOUNDS	Land	0	2	0	0	2,283	0	0	0	0
COBALT COMPOUNDS	Off-site Transfer	72,840	8,950	403	0	63,687	0	4,526	0	0
COPPER COMPOUNDS	Air	0	0	0	0	0	0	36	0	0
COPPER COMPOUNDS	Water	0	0	0	0	296	0	0	0	0
COPPER COMPOUNDS	Land	0	0	0	0	9,392	0	0	0	0
COPPER COMPOUNDS	Off-site Transfer	0	1,600	0	0	2,915	0	7	0	0
CRESOL (MIXED ISOMERS)	Air	0	0	619	0	0	0	0	27,000	0
CRESOL (MIXED ISOMERS)	Water	0	0	9	0	0	0	0	2,700	0
CRESOL (MIXED ISOMERS)	Underground	0	90,000	0	0	0	0	0	0	0

Table A2. (Continued)

IN THE PRODUCTION OF HDPE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	0	63	0	0	0	0	15	0
CUMENE	Air	1,018	0	2,265	0	3,059	23,675	0	8,148	2
CUMENE	Water	0	0	4	0	0	0	0	0	0
CUMENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CYCLOHEXANE	Air	36,837	27,300	13,632	15,830	19,595	6,580	8,900	54,000	37,000
CYCLOHEXANE	Water	0	1	4	24	0	0	0	0	0
CYCLOHEXANE	Land	0	2,400	0	49	0	0	0	0	0
CYCLOHEXANE	Off-site Transfer	0	0		2,600	0	0	0	9	0
1,2-DIBROMOETHANE	Air	0	0	1,938	0	0	0	0	0	0
1,2-DIBROMOETHANE	Water	0	0	7	0	0	0	0	0	0
1,2-DICHLOROETHANE	Air	0	0	0	0	0	0	0	13,300	0
DIETHANOLAMINE	Air	0	0	0	0	0	276	9,600	0	0
DIETHANOLAMINE	Off-site Transfer	0	0	0	0	0	134,000	0	0	0
ETHYLBENZENE	Air	36,179	11,500	23,385	3,900	6,990	33,734	20,500	57,000	13,000
ETHYLBENZENE	Water	1	0	43	1	8	0	0	0	0
ETHYLBENZENE	Underground	0	1,700	0	0	0	0	0	0	0
ETHYLBENZENE	Land	0	490	0	42	117	0	0	0	0
ETHYLBENZENE	POTW Transfer	0	0	0	0	0	38	0	0	0
ETHYLBENZENE	Off-site Transfer	3,192	403	412	5,102	1,550	4,462	610	46	0
ETHYLENE	Air	277,061	110,000	1,254	2,500	83,530	27,177	31,400	37,088	163,000
ETHYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
ETHYLENE GLYCOL	Air	0	250	600	80	3	5	0	0	0
ETHYLENE GLYCOL	Water	0	0	319	0	4	0	0	0	0
ETHYLENE GLYCOL	Off-site Transfer	0	0		800	0	0	0	0	0
FORMALDEHYDE	Air	0	0	11,562	0	0	0	0	0	0
FORMALDEHYDE	Water	0	0	115	0	0	0	0	0	0
FORMALDEHYDE	Off-site Transfer	0	0	259	0	0	0	0	0	0
GLYCOL ETHERS	Air	0	0	1,743	0	0	0	0	0	0
HYDROCHLORIC ACID	Air	0	37,000	19,901	16,000	22,653	0	19	0	0
HYDROGEN FLUORIDE	Air	0	2,800	0	0	0	255	0	0	79
LEAD COMPOUNDS	Air	0	0	25	54	0	0	0	0	0
LEAD COMPOUNDS	Water	0	0	732	40	47	0	0	0	0
LEAD COMPOUNDS	Land	0	0			7,889	0	0	0	0
LEAD COMPOUNDS	Off-site Transfer	0	0	652	41,725	426	0	2,280	73	0
MANGANESE COMPOUNDS	Air	0	0	0	16	0	0	0	0	0
MANGANESE COMPOUNDS	Water	0	0	0	1,800	0	0	0	0	0
MANGANESE COMPOUNDS	Off-site Transfer	0	0	0	9,330	0	0	0	0	0
METHANOL	Air	4,375	2,200,250	11,975	23,000	124,331	590	8,743	99,600	3,570
METHANOL	Water	0	0	7	0	0	0	0	1,200	0
METHANOL	Off-site Transfer	0	0	195	0	0	0	0	0	6,600
2-METHOXYETHANOL	Air	0	0	0	0	63	0	0	0	0
METHYL ACRYLATE	Air									
METHYL ACRYLATE	Off-site Transfer									
METHYL ETHYL KETONE	Air	0	0	201,068	358,000	133,888	0	1,556,000	410,000	0
METHYL ETHYL KETONE	Water	0	0	61	0	0	0	0	5,700	0
METHYL ETHYL KETONE	Underground	0	19,000	0	0	0	0	0	0	0
METHYL ETHYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ETHYL KETONE	Off-site Transfer	0	0	0	0	1,051	0	0	0	0

Table A2. (Continued)

IN THE PRODUCTION OF HDPE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
METHYL ISOBUTYL KETONE	Air	0	0	96,974	0	132,893	0	0	0	0
METHYL ISOBUTYL KETONE	Water	0	0	4	0	0	0	0	0	0
METHYL ISOBUTYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ISOBUTYL KETONE	Off-site Transfer	0	0	0	0	415	0	0	0	0
METHYL TERT-BUTYL ETHER	Air	134,733	40,600	254,552	64,000	89,388	48,005	107,000	28,000	15,500
METHYL TERT-BUTYL ETHER	Water	0	42,000	30	8,200	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Air	0	0	0	0	267	0	0	0	0
MOLYBDENUM TRIOXIDE	Water	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Land	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Off-site Transfer	338,652	43,690	11,646	0	20,139	0	21,120	152,726	0
NAPHTHALENE	Air	9,324	47,014	6,427	660	779	11,790	4,380	15,990	0
NAPHTHALENE	Water	0	1	83	21	0	0	0	17	0
NAPHTHALENE	Land	17	490	0	41	94	0	0	0	0
NAPHTHALENE	Off-site Transfer	3,239	0	1,197	248	1,038	123	6	750	0
N-HEXANE	Air	180,829	93,000	47,248	51,500	116,432	18,105	133,000	96,000	216,000
N-HEXANE	Water	72	2	0	48	0	0	0	0	0
N-HEXANE	Land	0	3,500	0	100	0	0	0	0	0
N-HEXANE	Off-site Transfer	0	0	0	6,621	0	0	0	0	0
NICKEL COMPOUNDS	Air	98	0	374	0	216	21,405	1,200	200	3,000
NICKEL COMPOUNDS	Water	0	0	0	0	518	0	0	0	510
NICKEL COMPOUNDS	Land	6,412	110	0	0	6,914	69	0	0	7,500
NICKEL COMPOUNDS	Off-site Transfer	35,530	167,800	2,769	0	83,892	1,309	2	11,574	257,000
NITRATE COMPOUNDS	Water	5,275	84,000	2,005,479	70,000	174,310	0	0	73,800	0
N-METHYL-2-PYRROLIDONE	Air	0	0	73,240	11,000	15,869	0	0	0	0
N-METHYL-2-PYRROLIDONE	Land	0	0	0	700	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	0	0	0	160	0	0	0	0
O-XYLENE	Air	0	0	0	0	0	0	0	0	0
O-XYLENE	Water	0	0	0	0	0	0	0	0	0
O-XYLENE	Land	0	0	0	0	0	0	0	0	0
O-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
P-XYLENE	Air	0	0	0	0	0	0	0	0	0
P-XYLENE	Water	0	0	0	0	0	0	0	0	0
P-XYLENE	Land	0	0	0	0	0	0	0	0	0
P-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
PHENANTHRENE	Air	0	530	0	870	258	0	0	0	0
PHENANTHRENE	Water	0	1	0	22	0	0	0	0	0
PHENANTHRENE	Land	0	3,700	0	37	376	0	0	0	0
PHENANTHRENE	Off-site Transfer	0	1	0	150	58	0	0	0	0
PHENOL	Air	54,876	0	3,344	0	3,363	728	5,100	45,004	0
PHENOL	Water	1,504	950	115	0	267	193	0	920	0
PHENOL	Underground	0	140,000	0	0	0	0	0	0	0
PHENOL	Land	44	3	0	0	153	0	0	0	0
PHENOL	POTW Transfer	0	0	0	0	0	2,266	0	0	0
PHENOL	Off-site Transfer	0	0	16	0	28	1	0	0	0
PHOSPHORIC ACID	Off-site Transfer	0	0	0	0	0	74,750	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Air	809	2,920	0	1,710	339	7,517	24	1,790	0
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	3	0	1	0	0	0	0	0

Table A2. (Continued)

IN THE PRODUCTION OF HDPE, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	7,600	0	110	995	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	0	0	430	11	0	0	0	0
PROPYLENE	Air	223,245	43,000	4,849	45,000	109,396	27,722	85,000	220,000	129,000
PROPYLENE	Water	0	0	95	0	0	0	0	0	0
STYRENE	Air	0	0	520	0	239	0	0	0	0
STYRENE	Land	0	0	0	0	5	0	0	0	0
STYRENE	Off-site Transfer	0	0	0	0	36	0	0	0	0
SULFURIC ACID	Air	1,154	3,400	0	0	0	692	0	6,000	0
SULFURIC ACID	Off-site Transfer	0	0	0	0	0	0	0	12	0
TERT-BUTYL ALCOHOL	Air	0	0	0	0	0	0	0	300	0
TERT-BUTYL ALCOHOL	Off-site Transfer									
TETRACHLOROETHYLENE	Air	29,612	250	568	0	5	0	1,700	0	0
TETRACHLOROETHYLENE	Land	0	0	0	11	0	0	0	0	0
TETRACHLOROETHYLENE	Off-site Transfer	0	580	0	95	36	0	0	0	0
TOLUENE	Air	158,398	80,000	94,542	252,000	213,327	61,869	1,033,000	562,000	0
TOLUENE	Water	62	2	39	55	63	0	0	17	0
TOLUENE	Underground	0	160,000	0	0	0	0	0	0	0
TOLUENE	Land	1	2,800	0	180	65	0	0	0	0
TOLUENE	POTW Transfer	0	0	0	0	0	214	0	0	0
TOLUENE	Off-site Transfer	6,958	756	1,407	18,809	12,876	3,342	2,137	60	0
TRICHLOROETHYLENE	Air	0	11,000	0	0	54,724	0	0	0	0
TRICHLOROETHYLENE	Off-site Transfer	0	0	0	0	27	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Air	10,474	22,300	11,222	4,844	274	13,726	20,300	22,340	0
1,2,4-TRIMETHYLBENZENE	Water	0	1	0	38	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Land	0	1,100	0	82	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	0	21	0	688	0	0	0	0	0
VANADIUM (FUME OR DUST)	Land	0	11	0	0	0	0	0	0	0
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	0	0	0	0	0	0	0
VINYL ACETATE	Air									
VINYL ACETATE	Off-site Transfer									
XYLENE (MIXED ISOMERS)	Air	161,546	82,000	64,534	21,500	37,389	51,098	87,000	224,000	0
XYLENE (MIXED ISOMERS)	Water	24	3	0	57	202	0	0	2	0
XYLENE (MIXED ISOMERS)	Underground	0	31,000	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Land	52	3,900	0	300	372	0	0	0	0
XYLENE (MIXED ISOMERS)	POTW Transfer	0	0	0	0	0	330	0	0	0
XYLENE (MIXED ISOMERS)	Off-site Transfer	14,267	1,238	4,819	9,556	14,769	13,608	3,096	598	0
ZINC COMPOUNDS	Air	0	0	954	6,801	0	63	190	0	0
ZINC COMPOUNDS	Water	0	1,500	7,686	1,700	1,219	1,179	0	0	0
ZINC COMPOUNDS	Land	0	57	0	0	51,227	0	0	0	0
ZINC COMPOUNDS	POTW Transfer	0	0	0	0	0	89	0	0	0
ZINC COMPOUNDS	Off-site Transfer	0	0	1,603	8,660	1,019	27,069	36	0	0
TOTAL RELEASES & TRANSFERS (LBS)		1,985,342	5,453,186	3,099,268	1,092,284	1,747,909	676,563	3,667,551	2,443,524	950,014

Table A2. (Continued)

		Facility 10	Totals					
FACILITY ID --->		39567CHVRNPOBOX						
REFINING CAPACITY (Barrels/day)--->		295000	3689000					
								TRI Releases for HDPE
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	25% of ethylene to HDPE[6]:	TRI lbs/ lb of HDPE[7] (attributed to oil refineries):
AMMONIA	Air	110,210	746,277	0.000644466	2.11995E-06	6.51465E-08	1.62866E-08	2.05212E-06
AMMONIA	Water	8,700	89,935	7.76656E-05	2.55479E-07	7.85091E-09	1.96273E-09	2.47304E-07
AMMONIA	Underground	0	1,300,000	0.001122647	3.69292E-06	1.13484E-07	2.8371E-08	3.57475E-06
AMMONIA	POTW Transfer	0	104	8.98118E-08	2.95434E-10	9.07872E-12	2.26968E-12	2.8598E-10
AMMONIA	Off-site Transfer	0	23	1.98622E-08	6.53363E-11	2.00779E-12	5.01948E-13	6.32455E-11
ANTHRACENE	Air	0	2,448	2.11403E-06	6.95405E-09	2.13699E-10	5.34248E-11	6.73152E-09
ANTHRACENE	Land	0	162	1.39899E-07	4.60195E-10	1.41419E-11	3.53546E-12	4.45468E-10
ANTHRACENE	Off-site Transfer	0	11	9.49932E-09	3.12478E-11	9.60249E-13	2.40062E-13	3.02478E-11
ANTIMONY COMPOUNDS	Air	0	1,300	1.12265E-06	3.69292E-09	1.13484E-10	2.8371E-11	3.57475E-09
ANTIMONY COMPOUNDS	Land	0	2,500	2.15894E-06	7.10177E-09	2.18238E-10	5.45596E-11	6.87451E-09
ANTIMONY COMPOUNDS	Off-site Transfer	0	5,312	4.58731E-06	1.50898E-08	4.63713E-10	1.15928E-10	1.4607E-08
BARIUM COMPOUNDS	Water	0	1,892	1.63388E-06	5.37462E-09	1.65163E-10	4.12907E-11	5.20263E-09
BARIUM COMPOUNDS	Land	0	2,312	1.99659E-06	6.56771E-09	2.01827E-10	5.04567E-11	6.35755E-09
BARIUM COMPOUNDS	Off-site Transfer	0	255	2.20212E-07	7.2438E-10	2.22603E-11	5.56508E-12	7.012E-10
BENZENE	Air	68,000	608,670	0.000525632	1.72905E-06	5.31341E-08	1.32835E-08	1.67372E-06
BENZENE	Water	21	106	9.15389E-08	3.01115E-10	9.25331E-12	2.31333E-12	2.91479E-10
BENZENE	Underground	0	170,000	0.000146808	4.8292E-07	1.48402E-08	3.71005E-09	4.67467E-07
BENZENE	Land	2	1,121	9.68068E-07	3.18443E-09	9.78581E-11	2.44645E-11	3.08253E-09
BENZENE	POTW Transfer	0	51	4.40423E-08	1.44876E-10	4.45206E-12	1.11302E-12	1.4024E-10
BENZENE	Off-site Transfer	588	19,611	1.69356E-05	5.57091E-08	1.71195E-09	4.27987E-10	5.39264E-08
BIPHENYL	Air	0	1,900	1.64079E-06	5.39734E-09	1.65861E-10	4.14653E-11	5.22463E-09
1,3-BUTADIENE	Air	700	43,315	3.74057E-05	1.23045E-07	3.7812E-09	9.453E-10	1.19108E-07
1,3-BUTADIENE	Off-site Transfer	0	120	1.03629E-07	3.40885E-10	1.04754E-11	2.61886E-12	3.29977E-10
BUTYL ACRYLATE	Air			0		0	0	0
BUTYL ACRYLATE	Off-site Transfer			0		0	0	0
CARBON DISULFIDE	Air	0	7,090	6.12275E-06	2.01406E-08	6.18924E-10	1.54731E-10	1.94961E-08
CARBON DISULFIDE	Off-site Transfer	0	256	2.21075E-07	7.27221E-10	2.23476E-11	5.5869E-12	7.0395E-10
CARBON TETRACHLORIDE	Air	0	23,435	2.02379E-05	6.6572E-08	2.04577E-09	5.11442E-10	6.44417E-08
CARBON TETRACHLORIDE	Off-site Transfer	0	956	8.25578E-07	2.71572E-09	8.34544E-11	2.08636E-11	2.62881E-09
CARBONYL SULFIDE	Air	71,300	181,300	0.000156566	5.1502E-07	1.58267E-08	3.95666E-09	4.9854E-07
CHLORINE	Air	0	45,462	3.92598E-05	1.29144E-07	3.96862E-09	9.92156E-10	1.25012E-07
CHLORINE	Water	0	13,230	1.14251E-05	3.75826E-08	1.15492E-09	2.88729E-10	3.63799E-08
CHLORODIFLUOROMETHANE	Off-site Transfer	23,000	23,000	1.98622E-05	6.53363E-08	2.00779E-09	5.01948E-10	6.32455E-08
CHROMIUM COMPOUNDS	Air	14	30	2.59072E-08	8.52212E-11	2.61886E-12	6.54715E-13	8.24941E-11
CHROMIUM COMPOUNDS	Water	4	4,152	3.58556E-06	1.17946E-08	3.6245E-10	9.06126E-11	1.14172E-08
CHROMIUM COMPOUNDS	Land	0	5,090	4.3956E-06	1.44592E-08	4.44333E-10	1.11083E-10	1.39965E-08
CHROMIUM COMPOUNDS	Off-site Transfer	23,674	25,870	2.23407E-05	7.34891E-08	2.25833E-09	5.64583E-10	7.11374E-08
COBALT COMPOUNDS	Air	0	107	9.24025E-08	3.03956E-10	9.34061E-12	2.33515E-12	2.94229E-10
COBALT COMPOUNDS	Land	0	2,285	1.97327E-06	6.49102E-09	1.9947E-10	4.98675E-11	6.2833E-09
COBALT COMPOUNDS	Off-site Transfer	0	150,406	0.000129887	4.27259E-07	1.31297E-08	3.28244E-09	4.13587E-07
COPPER COMPOUNDS	Air	250	286	2.46982E-07	8.12442E-10	2.49665E-11	6.24162E-12	7.86444E-10
COPPER COMPOUNDS	Water	81	377	3.25568E-07	1.07095E-09	3.29104E-11	8.22759E-12	1.03668E-09
COPPER COMPOUNDS	Land	70	9,462	8.17115E-06	2.68788E-08	8.25989E-10	2.06497E-10	2.60186E-08
COPPER COMPOUNDS	Off-site Transfer	162,122	166,644	0.00014391	4.73387E-07	1.45473E-08	3.63681E-09	4.58238E-07
CRESOL (MIXED ISOMERS)	Air	0	27,619	2.38511E-05	7.84575E-08	2.41101E-09	6.02753E-10	7.59468E-08
CRESOL (MIXED ISOMERS)	Water	0	2,709	2.33942E-06	7.69548E-09	2.36483E-10	5.91208E-11	7.44922E-09
CRESOL (MIXED ISOMERS)	Underground	0	90,000	7.77217E-05	2.55664E-07	7.85658E-09	1.96415E-09	2.47482E-07

Table A2. (Continued)

		Facility 10	Totals					
FACILITY ID --->		39567CHVRNPOBOX						
REFINING CAPACITY (Barrels/day)--->		295000	3689000					
								TRI Releases for HDPE
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	25% of ethylene to HDPE[6]:	TRI lbs/ lb of HDPE[7] (attributed to oil refineries):
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	78	6.73588E-08	2.21575E-10	6.80904E-12	1.70226E-12	2.14485E-10
CUMENE	Air	26,570	64,737	5.59053E-05	1.83899E-07	5.65124E-09	1.41281E-09	1.78014E-07
CUMENE	Water	21	25	2.15894E-08	7.10177E-11	2.18238E-12	5.45596E-13	6.87451E-11
CUMENE	Off-site Transfer	80	80	6.9086E-08	2.27257E-10	6.98363E-12	1.74591E-12	2.19984E-10
CYCLOHEXANE	Air	17,000	236,674	0.000204386	6.72321E-07	2.06605E-08	5.16514E-09	6.50807E-07
CYCLOHEXANE	Water	0	29	2.50437E-08	8.23805E-11	2.53157E-12	6.32891E-13	7.97443E-11
CYCLOHEXANE	Land	1	2,450	2.11576E-06	6.95973E-09	2.13874E-10	5.34684E-11	6.73702E-09
CYCLOHEXANE	Off-site Transfer	80	2,689	2.32215E-06	7.63866E-09	2.34737E-10	5.86843E-11	7.39422E-09
1,2-DIBROMOETHANE	Air	0	1,938	1.67361E-06	5.50529E-09	1.69178E-10	4.22946E-11	5.32912E-09
1,2-DIBROMOETHANE	Water	0	7	6.04502E-09	1.98849E-11	6.11068E-13	1.52767E-13	1.92486E-11
1,2-DICHLOROETHANE	Air	0	13,300	1.14855E-05	3.77814E-08	1.16103E-09	2.90257E-10	3.65724E-08
DIETHANOLAMINE	Air	34,000	43,876	3.78902E-05	1.24639E-07	3.83017E-09	9.57543E-10	1.2065E-07
DIETHANOLAMINE	Off-site Transfer	0	134,000	0.000115719	3.80655E-07	1.16976E-08	2.9244E-09	3.68474E-07
ETHYLBENZENE	Air	49,600	255,788	0.000220892	7.26619E-07	2.23291E-08	5.58228E-09	7.03367E-07
ETHYLBENZENE	Water	21	74	6.39045E-08	2.10212E-10	6.45986E-12	1.61496E-12	2.03486E-10
ETHYLBENZENE	Underground	0	1,700	1.46808E-06	4.8292E-09	1.48402E-10	3.71005E-11	4.67467E-09
ETHYLBENZENE	Land	12	661	5.70823E-07	1.87771E-09	5.77022E-11	1.44256E-11	1.81762E-09
ETHYLBENZENE	POTW Transfer	0	38	3.28158E-08	1.07947E-10	3.31722E-12	8.29306E-13	1.04493E-10
ETHYLBENZENE	Off-site Transfer	3,821	19,598	1.69243E-05	5.56722E-08	1.71081E-09	4.27704E-10	5.38907E-08
ETHYLENE	Air	65,000	798,010	0.000689141	2.26691E-06	6.96626E-08	1.74156E-08	2.19437E-06
ETHYLENE	Off-site Transfer	93	93	8.03125E-08	2.64186E-10	8.11847E-12	2.02962E-12	2.55732E-10
ETHYLENE GLYCOL	Air	17,200	18,138	1.56635E-05	5.15247E-08	1.58336E-09	3.95841E-10	4.9876E-08
ETHYLENE GLYCOL	Water	19,000	19,323	1.66869E-05	5.4891E-08	1.68681E-09	4.21702E-10	5.31345E-08
ETHYLENE GLYCOL	Off-site Transfer	0	800	6.9086E-07	2.27257E-09	6.98363E-11	1.74591E-11	2.19984E-09
FORMALDEHYDE	Air	0	11,562	9.98465E-06	3.28443E-08	1.00931E-09	2.52327E-10	3.17932E-08
FORMALDEHYDE	Water	0	115	9.93111E-08	3.26681E-10	1.0039E-11	2.50974E-12	3.16228E-10
FORMALDEHYDE	Off-site Transfer	0	259	2.23666E-07	7.35743E-10	2.26095E-11	5.65238E-12	7.12199E-10
GLYCOL ETHERS	Air	0	1,743	1.50521E-06	4.95135E-09	1.52156E-10	3.8039E-11	4.79291E-09
HYDROCHLORIC ACID	Air	0	95,573	8.25344E-05	2.71495E-07	8.34308E-09	2.08577E-09	2.62807E-07
HYDROGEN FLUORIDE	Air	0	3,134	2.70644E-06	8.90278E-09	2.73584E-10	6.83959E-11	8.61789E-09
LEAD COMPOUNDS	Air	0	79	6.82224E-08	2.24416E-10	6.89633E-12	1.72408E-12	2.17235E-10
LEAD COMPOUNDS	Water	0	819	7.07268E-07	2.32654E-09	7.14949E-11	1.78737E-11	2.25209E-09
LEAD COMPOUNDS	Land	0	7,889	6.81274E-06	2.24103E-08	6.88673E-10	1.72168E-10	2.16932E-08
LEAD COMPOUNDS	Off-site Transfer	1,252	46,408	4.00768E-05	1.31832E-07	4.0512E-09	1.0128E-09	1.27613E-07
MANGANESE COMPOUNDS	Air	0	16	1.38172E-08	4.54513E-11	1.39673E-12	3.49182E-13	4.39969E-11
MANGANESE COMPOUNDS	Water	0	1,800	1.55443E-06	5.11327E-09	1.57132E-10	3.92829E-11	4.94965E-09
MANGANESE COMPOUNDS	Off-site Transfer	0	9,330	8.05715E-06	2.65038E-08	8.14466E-10	2.03616E-10	2.56557E-08
METHANOL	Air	1,490,000	3,966,434	0.003425313	1.12675E-05	3.46251E-07	8.65628E-08	1.09069E-05
METHANOL	Water	0	1,207	1.04233E-06	3.42873E-09	1.05366E-10	2.63414E-11	3.31901E-09
METHANOL	Off-site Transfer	6	6,801	5.87317E-06	1.93196E-08	5.93696E-10	1.48424E-10	1.87014E-08
2-METHOXYETHANOL	Air	0	63	5.44052E-08	1.78965E-10	5.49961E-12	1.3749E-12	1.73238E-10
METHYL ACRYLATE	Air			0		0	0	0
METHYL ACRYLATE	Off-site Transfer			0		0	0	0
METHYL ETHYL KETONE	Air	0	2,658,956	0.002296208	7.55331E-06	2.32115E-07	5.80286E-08	7.31161E-06
METHYL ETHYL KETONE	Water	0	5,761	4.97506E-06	1.63653E-08	5.02909E-10	1.25727E-10	1.58416E-08
METHYL ETHYL KETONE	Underground	0	19,000	1.64079E-05	5.39734E-08	1.65861E-09	4.14653E-10	5.22463E-08
METHYL ETHYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	1.09119E-13	1.3749E-11
METHYL ETHYL KETONE	Off-site Transfer	0	1,051	9.07617E-07	2.98558E-09	9.17474E-11	2.29369E-11	2.89004E-09

Table A2. (Continued)

		Facility 10	Totals					
FACILITY ID --->		39567CHVRNPOBOX						
REFINING CAPACITY (Barrels/day)--->		295000	3689000					
								TRI Releases for HDPE
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	25% of ethylene to HDPE[6]:	TRI lbs/ lb of HDPE[7] (attributed to oil refineries):
METHYL ISOBUTYL KETONE	Air	0	229,867	0.000198507	6.52985E-07	2.00663E-08	5.01658E-09	6.32089E-07
METHYL ISOBUTYL KETONE	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	8.72954E-14	1.09992E-11
METHYL ISOBUTYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	1.09119E-13	1.3749E-11
METHYL ISOBUTYL KETONE	Off-site Transfer	0	415	3.58384E-07	1.17889E-09	3.62276E-11	9.0569E-12	1.14117E-09
METHYL TERT-BUTYL ETHER	Air	87,570	869,348	0.000750747	2.46956E-06	7.58901E-08	1.89725E-08	2.39054E-06
METHYL TERT-BUTYL ETHER	Water	0	50,230	4.33774E-05	1.42689E-07	4.38485E-09	1.09621E-09	1.38123E-07
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	3.49182E-09	4.39969E-07
MOLYBDENUM TRIOXIDE	Air	181,000	181,267	0.000156538	5.14926E-07	1.58238E-08	3.95594E-09	4.98449E-07
MOLYBDENUM TRIOXIDE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	4.58301E-13	5.77459E-11
MOLYBDENUM TRIOXIDE	Land	95	95	8.20396E-08	2.69867E-10	8.29306E-12	2.07327E-12	2.61231E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer	5,069	593,042	0.000512136	1.68466E-06	5.17698E-08	1.29425E-08	1.63075E-06
NAPHTHALENE	Air	5,170	101,534	8.76822E-05	2.88428E-07	8.86345E-09	2.21586E-09	2.79199E-07
NAPHTHALENE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	3.12081E-12	3.93222E-10
NAPHTHALENE	Land	1	643	5.55279E-07	1.82657E-09	5.61309E-11	1.40327E-11	1.76812E-09
NAPHTHALENE	Off-site Transfer	0	6,601	5.70046E-06	1.87515E-08	5.76237E-10	1.44059E-10	1.81515E-08
N-HEXANE	Air	303,000	1,255,114	0.001083885	3.56541E-06	1.09566E-07	2.73914E-08	3.45132E-06
N-HEXANE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	3.12081E-12	3.93222E-10
N-HEXANE	Land	2	3,602	3.1106E-06	1.02322E-08	3.14438E-10	7.86095E-11	9.9048E-09
N-HEXANE	Off-site Transfer	0	6,621	5.71773E-06	1.88083E-08	5.77983E-10	1.44496E-10	1.82065E-08
NICKEL COMPOUNDS	Air	280	26,773	2.31205E-05	7.60542E-08	2.33716E-09	5.8429E-10	7.36205E-08
NICKEL COMPOUNDS	Water	560	1,588	1.37136E-06	4.51104E-09	1.38625E-10	3.46563E-11	4.36669E-09
NICKEL COMPOUNDS	Land	0	21,005	1.81394E-05	5.96691E-08	1.83364E-09	4.5841E-10	5.77596E-08
NICKEL COMPOUNDS	Off-site Transfer	363,011	922,887	0.000796982	2.62165E-06	8.05638E-08	2.01409E-08	2.53776E-06
NITRATE COMPOUNDS	Water	220,000	2,632,864	0.002273675	7.4792E-06	2.29837E-07	5.74592E-08	7.23986E-06
N-METHYL-2-PYRROLIDONE	Air	0	100,109	8.64516E-05	2.8438E-07	8.73905E-09	2.18476E-09	2.7528E-07
N-METHYL-2-PYRROLIDONE	Land	0	700	6.04502E-07	1.98849E-09	6.11068E-11	1.52767E-11	1.92486E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	160	1.38172E-07	4.54513E-10	1.39673E-11	3.49182E-12	4.39969E-10
O-XYLENE	Air	88,500	88,500	7.64264E-05	2.51403E-07	7.72564E-09	1.93141E-09	2.43358E-07
O-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	4.58301E-13	5.77459E-11
O-XYLENE	Land	86	86	7.42674E-08	2.44301E-10	7.5074E-12	1.87685E-12	2.36483E-10
O-XYLENE	Off-site Transfer	5,349	5,349	4.61926E-06	1.51949E-08	4.66943E-10	1.16736E-10	1.47087E-08
P-XYLENE	Air	574,900	574,900	0.000496469	1.63312E-06	5.01861E-08	1.25465E-08	1.58086E-06
P-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	4.58301E-13	5.77459E-11
P-XYLENE	Land	77	77	6.64953E-08	2.18734E-10	6.72174E-12	1.68044E-12	2.11735E-10
P-XYLENE	Off-site Transfer	5,369	5,369	4.63653E-06	1.52518E-08	4.68689E-10	1.17172E-10	1.47637E-08
PHENANTHRENE	Air	0	1,658	1.43181E-06	4.70989E-09	1.44736E-10	3.61839E-11	4.55918E-09
PHENANTHRENE	Water	0	23	1.98622E-08	6.53363E-11	2.00779E-12	5.01948E-13	6.32455E-11
PHENANTHRENE	Land	0	4,113	3.55188E-06	1.16838E-08	3.59046E-10	8.97615E-11	1.13099E-08
PHENANTHRENE	Off-site Transfer	0	209	1.80487E-07	5.93708E-10	1.82447E-11	4.56118E-12	5.74709E-10
PHENOL	Air	0	112,415	9.70788E-05	3.19338E-07	9.81331E-09	2.45333E-09	3.09119E-07
PHENOL	Water	0	3,949	3.41026E-06	1.1218E-08	3.44729E-10	8.61824E-11	1.0859E-08
PHENOL	Underground	0	140,000	0.0001209	3.97699E-07	1.22214E-08	3.05534E-09	3.84973E-07
PHENOL	Land	0	200	1.72715E-07	5.68141E-10	1.74591E-11	4.36477E-12	5.49961E-10
PHENOL	POTW Transfer	0	2,266	1.95686E-06	6.43704E-09	1.97811E-10	4.94528E-11	6.23106E-09
PHENOL	Off-site Transfer	0	45	3.88609E-08	1.27832E-10	3.92829E-12	9.82073E-13	1.23741E-10
PHOSPHORIC ACID	Off-site Transfer	0	74,750	6.45522E-05	2.12343E-07	6.52533E-09	1.63133E-09	2.05548E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air	0	15,109	1.30478E-05	4.29202E-08	1.31895E-09	3.29736E-10	4.15468E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	8.72954E-14	1.09992E-11

Table A2. (Continued)

		Facility 10	Totals					
FACILITY ID --->		39567CHVRNPOBOX						
REFINING CAPACITY (Barrels/day)--->		295000	3689000					
								TRI Releases for HDPE
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	25% of ethylene to HDPE[6]:	TRI lbs/ lb of HDPE[7] (attributed to oil refineries):
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	8,705	7.51742E-06	2.47284E-08	7.59906E-10	1.89977E-10	2.3937E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	441	3.80837E-07	1.25275E-09	3.84973E-11	9.62432E-12	1.21266E-09
PROPYLENE	Air	100,300	987,512	0.000852791	2.80523E-06	8.62052E-08	2.15513E-08	2.71546E-06
PROPYLENE	Water	0	95	8.20396E-08	2.69867E-10	8.29306E-12	2.07327E-12	2.61231E-10
STYRENE	Air	0	759	6.55453E-07	2.1561E-09	6.62572E-11	1.65643E-11	2.0871E-09
STYRENE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	1.09119E-13	1.3749E-11
STYRENE	Off-site Transfer	0	36	3.10887E-08	1.02265E-10	3.14263E-12	7.85658E-13	9.8993E-11
SULFURIC ACID	Air	0	11,246	9.71176E-06	3.19466E-08	9.81724E-10	2.45431E-10	3.09243E-08
SULFURIC ACID	Off-site Transfer	0	12	1.03629E-08	3.40885E-11	1.04754E-12	2.61886E-13	3.29977E-11
TERT-BUTYL ALCOHOL	Air	0	300	2.59072E-07	8.52212E-10	2.61886E-11	6.54715E-12	8.24941E-10
TERT-BUTYL ALCOHOL	Off-site Transfer			0		0	0	0
TETRACHLOROETHYLENE	Air	3,522	35,657	3.07925E-05	1.01291E-07	3.11269E-09	7.78173E-10	9.80498E-08
TETRACHLOROETHYLENE	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	2.40062E-13	3.02478E-11
TETRACHLOROETHYLENE	Off-site Transfer	0	711	6.14002E-07	2.01974E-09	6.2067E-11	1.55168E-11	1.95511E-09
TOLUENE	Air	211,000	2,666,136	0.002302408	7.57371E-06	2.32741E-07	5.81853E-08	7.33135E-06
TOLUENE	Water	21	259	2.23666E-07	7.35743E-10	2.26095E-11	5.65238E-12	7.12199E-10
TOLUENE	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	3.49182E-09	4.39969E-07
TOLUENE	Land	19	3,065	2.64686E-06	8.70677E-09	2.6756E-10	6.68901E-11	8.42815E-09
TOLUENE	POTW Transfer	0	214	1.84805E-07	6.07911E-10	1.86812E-11	4.6703E-12	5.88458E-10
TOLUENE	Off-site Transfer	726	47,071	4.06493E-05	1.33715E-07	4.10908E-09	1.02727E-09	1.29436E-07
TRICHLOROETHYLENE	Air	0	65,724	5.67576E-05	1.86703E-07	5.7374E-09	1.43435E-09	1.80728E-07
TRICHLOROETHYLENE	Off-site Transfer	0	27	2.33165E-08	7.66991E-11	2.35698E-12	5.89244E-13	7.42447E-11
1,2,4-TRIMETHYLBENZENE	Air	22,100	127,580	0.000110175	3.62417E-07	1.11371E-08	2.78429E-09	3.5082E-07
1,2,4-TRIMETHYLBENZENE	Water	0	39	3.36794E-08	1.10788E-10	3.40452E-12	8.5113E-13	1.07242E-10
1,2,4-TRIMETHYLBENZENE	Land	6	1,188	1.02593E-06	3.37476E-09	1.03707E-10	2.59267E-11	3.26677E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	21	730	6.3041E-07	2.07372E-09	6.37256E-11	1.59314E-11	2.00736E-09
VANADIUM (FUME OR DUST)	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	2.40062E-13	3.02478E-11
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	6.04502E-06	1.98849E-08	6.11068E-10	1.52767E-10	1.92486E-08
VINYL ACETATE	Air			0		0	0	0
VINYL ACETATE	Off-site Transfer			0		0	0	0
XYLENE (MIXED ISOMERS)	Air	0	729,067	0.000629604	2.07107E-06	6.36442E-08	1.5911E-08	2.00479E-06
XYLENE (MIXED ISOMERS)	Water	0	288	2.4871E-07	8.18124E-10	2.51411E-11	6.28527E-12	7.91944E-10
XYLENE (MIXED ISOMERS)	Underground	0	31,000	2.67708E-05	8.80619E-08	2.70616E-09	6.76539E-10	8.52439E-08
XYLENE (MIXED ISOMERS)	Land	0	4,624	3.99317E-06	1.31354E-08	4.03654E-10	1.00913E-10	1.27151E-08
XYLENE (MIXED ISOMERS)	POTW Transfer	0	330	2.8498E-07	9.37433E-10	2.88075E-11	7.20187E-12	9.07435E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer	0	61,951	5.34993E-05	1.75985E-07	5.40804E-09	1.35201E-09	1.70353E-07
ZINC COMPOUNDS	Air	2,600	10,608	9.1608E-06	3.01342E-08	9.26029E-10	2.31507E-10	2.91699E-08
ZINC COMPOUNDS	Water	1,100	14,384	1.24217E-05	4.08607E-08	1.25566E-09	3.13914E-10	3.95532E-08
ZINC COMPOUNDS	Land	1,400	52,684	4.54966E-05	1.4966E-07	4.59907E-09	1.14977E-09	1.44871E-07
ZINC COMPOUNDS	POTW Transfer	0	89	7.68582E-08	2.52823E-10	7.76929E-12	1.94232E-12	2.44733E-10
ZINC COMPOUNDS	Off-site Transfer	148,147	186,534	0.000161086	5.29888E-07	1.62836E-08	4.07089E-09	5.12932E-07
TOTAL RELEASES & TRANSFERS (LBS)		4,523,599	25,639,240	0.022141405	7.28336E-05	2.23819E-06	5.59547E-07	7.05029E-05

Table A2. (Continued)

	TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
		HDPE		
		FACILITY [9]		
	FACILITY ID --->	77580MNTBL13330		
	FACILITY CAPACITY [8] (LBS/YR)--->	620,000,000		
Chemical		Annual TRI releases (lbs/yr) from facility producing HDPE:	TRI lbs per lb of HDPE [10] (attributed to HDPE chemical plant):	TRI lbs per lb of HDPE (attributed to oil refineries and HDPE chemical plant):
AMMONIA				2.05212E-06
AMMONIA				2.47304E-07
AMMONIA				3.57475E-06
AMMONIA				2.8598E-10
AMMONIA				6.32455E-11
ANTHRACENE				6.73152E-09
ANTHRACENE				4.45468E-10
ANTHRACENE				3.02478E-11
ANTIMONY COMPOUNDS				3.57475E-09
ANTIMONY COMPOUNDS				6.87451E-09
ANTIMONY COMPOUNDS				1.4607E-08
BARIUM COMPOUNDS				5.20263E-09
BARIUM COMPOUNDS				6.35755E-09
BARIUM COMPOUNDS				7.012E-10
BENZENE				1.67372E-06
BENZENE				2.91479E-10
BENZENE				4.67467E-07
BENZENE				3.08253E-09
BENZENE				1.4024E-10
BENZENE				5.39264E-08
BIPHENYL				5.22463E-09
1,3-BUTADIENE				1.19108E-07
1,3-BUTADIENE				3.29977E-10
BUTYL ACRYLATE		260	4.86716E-07	4.86716E-07
BUTYL ACRYLATE		63,400	0.000118684	0.000118684
CARBON DISULFIDE				1.94961E-08
CARBON DISULFIDE				7.0395E-10
CARBON TETRACHLORIDE				6.44417E-08
CARBON TETRACHLORIDE				2.62881E-09
CARBONYL SULFIDE				4.9854E-07
CHLORINE				1.25012E-07
CHLORINE				3.63799E-08
CHLORODIFLUOROMETHANE				6.32455E-08
CHROMIUM COMPOUNDS				8.24941E-11
CHROMIUM COMPOUNDS				1.14172E-08
CHROMIUM COMPOUNDS				1.39965E-08
CHROMIUM COMPOUNDS				7.11374E-08
COBALT COMPOUNDS				2.94229E-10
COBALT COMPOUNDS				6.2833E-09
COBALT COMPOUNDS				4.13587E-07
COPPER COMPOUNDS				7.86444E-10
COPPER COMPOUNDS				1.03668E-09
COPPER COMPOUNDS				2.60186E-08
COPPER COMPOUNDS				4.58238E-07
CRESOL (MIXED ISOMERS)				7.59468E-08
CRESOL (MIXED ISOMERS)				7.44922E-09
CRESOL (MIXED ISOMERS)				2.47482E-07

Table A2. (Continued)

	TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
		HDPE		
		FACILITY [9]		
	FACILITY ID --->	77580MNTBL13330		
	FACILITY CAPACITY [8] (LBS/YR)--->	620,000,000		
Chemical		Annual TRI releases (lbs/yr) from facility producing HDPE:	TRI lbs per lb of HDPE [10] (attributed to HDPE chemical plant):	TRI lbs per lb of HDPE (attributed to oil refineries and HDPE chemical plant):
CRESOL (MIXED ISOMERS)				2.14485E-10
CUMENE				1.78014E-07
CUMENE				6.87451E-11
CUMENE				2.19984E-10
CYCLOHEXANE				6.50807E-07
CYCLOHEXANE				7.97443E-11
CYCLOHEXANE				6.73702E-09
CYCLOHEXANE				7.39422E-09
1,2-DIBROMOETHANE				5.32912E-09
1,2-DIBROMOETHANE				1.92486E-11
1,2-DICHLOROETHANE				3.65724E-08
DIETHANOLAMINE				1.2065E-07
DIETHANOLAMINE				3.68474E-07
ETHYLBENZENE				7.03367E-07
ETHYLBENZENE				2.03486E-10
ETHYLBENZENE				4.67467E-09
ETHYLBENZENE				1.81762E-09
ETHYLBENZENE				1.04493E-10
ETHYLBENZENE				5.38907E-08
ETHYLENE		784,000	0.001467637	0.001469831
ETHYLENE				2.55732E-10
ETHYLENE GLYCOL				4.9876E-08
ETHYLENE GLYCOL				5.31345E-08
ETHYLENE GLYCOL				2.19984E-09
FORMALDEHYDE				3.17932E-08
FORMALDEHYDE				3.16228E-10
FORMALDEHYDE				7.12199E-10
GLYCOL ETHERS				4.79291E-09
HYDROCHLORIC ACID				2.62807E-07
HYDROGEN FLUORIDE				8.61789E-09
LEAD COMPOUNDS				2.17235E-10
LEAD COMPOUNDS				2.25209E-09
LEAD COMPOUNDS				2.16932E-08
LEAD COMPOUNDS				1.27613E-07
MANGANESE COMPOUNDS				4.39969E-11
MANGANESE COMPOUNDS				4.94965E-09
MANGANESE COMPOUNDS				2.56557E-08
METHANOL		5,400	1.01087E-05	2.10156E-05
METHANOL				3.31901E-09
METHANOL		177,000	0.000331342	0.00033136
2-METHOXYETHANOL				1.73238E-10
METHYL ACRYLATE		2,600	4.86716E-06	4.86716E-06
METHYL ACRYLATE		158,100	0.000295961	0.000295961
METHYL ETHYL KETONE				7.31161E-06
METHYL ETHYL KETONE				1.58416E-08
METHYL ETHYL KETONE				5.22463E-08
METHYL ETHYL KETONE				1.3749E-11
METHYL ETHYL KETONE				2.89004E-09

Table A2. (Continued)

	TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
		HDPE FACILITY [9]		
	FACILITY ID --->	77580MNTBL13330		
	FACILITY CAPACITY [8] (LBS/YR)--->	620,000,000		
Chemical		Annual TRI releases (lbs/yr) from facility producing HDPE:	TRI lbs per lb of HDPE [10] (attributed to HDPE chemical plant):	TRI lbs per lb of HDPE (attributed to oil refineries and HDPE chemical plant):
METHYL ISOBUTYL KETONE				6.32089E-07
METHYL ISOBUTYL KETONE				1.09992E-11
METHYL ISOBUTYL KETONE				1.3749E-11
METHYL ISOBUTYL KETONE				1.14117E-09
METHYL TERT-BUTYL ETHER				2.39054E-06
METHYL TERT-BUTYL ETHER				1.38123E-07
METHYL TERT-BUTYL ETHER				4.39969E-07
MOLYBDENUM TRIOXIDE				4.98449E-07
MOLYBDENUM TRIOXIDE				5.77459E-11
MOLYBDENUM TRIOXIDE				2.61231E-10
MOLYBDENUM TRIOXIDE				1.63075E-06
NAPHTHALENE				2.79199E-07
NAPHTHALENE				3.93222E-10
NAPHTHALENE				1.76812E-09
NAPHTHALENE				1.81515E-08
N-HEXANE		2,350	4.39917E-06	7.85049E-06
N-HEXANE				3.93222E-10
N-HEXANE				9.9048E-09
N-HEXANE		26,100	4.88588E-05	4.8877E-05
NICKEL COMPOUNDS				7.36205E-08
NICKEL COMPOUNDS				4.36669E-09
NICKEL COMPOUNDS				5.77596E-08
NICKEL COMPOUNDS				2.53776E-06
NITRATE COMPOUNDS				7.23986E-06
N-METHYL-2-PYRROLIDONE				2.7528E-07
N-METHYL-2-PYRROLIDONE				1.92486E-09
N-METHYL-2-PYRROLIDONE				4.39969E-10
O-XYLENE				2.43358E-07
O-XYLENE				5.77459E-11
O-XYLENE				2.36483E-10
O-XYLENE				1.47087E-08
P-XYLENE				1.58086E-06
P-XYLENE				5.77459E-11
P-XYLENE				2.11735E-10
P-XYLENE				1.47637E-08
PHENANTHRENE				4.55918E-09
PHENANTHRENE				6.32455E-11
PHENANTHRENE				1.13099E-08
PHENANTHRENE				5.74709E-10
PHENOL				3.09119E-07
PHENOL				1.0859E-08
PHENOL				3.84973E-07
PHENOL				5.49961E-10
PHENOL				6.23106E-09
PHENOL				1.23741E-10
PHOSPHORIC ACID				2.05548E-07
POLYCYCLIC AROMATIC COMPOUNDS				4.15468E-08
POLYCYCLIC AROMATIC COMPOUNDS				1.09992E-11

Table A2. (Continued)

	TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
		HDPE		
		FACILITY [9]		
	FACILITY ID --->	77580MNTBL13330		
	FACILITY CAPACITY [8] (LBS/YR)--->	620,000,000		
Chemical		Annual TRI releases (lbs/yr) from facility producing HDPE:	TRI lbs per lb of HDPE [10] (attributed to HDPE chemical plant):	TRI lbs per lb of HDPE (attributed to oil refineries and HDPE chemical plant):
POLYCYCLIC AROMATIC COMPOUNDS				2.3937E-08
POLYCYCLIC AROMATIC COMPOUNDS				1.21266E-09
PROPYLENE				2.71546E-06
PROPYLENE				2.61231E-10
STYRENE				2.0871E-09
STYRENE				1.3749E-11
STYRENE				9.8993E-11
SULFURIC ACID				3.09243E-08
SULFURIC ACID				3.29977E-11
TERT-BUTYL ALCOHOL		2	3.74397E-09	4.56891E-09
TERT-BUTYL ALCOHOL		29,700	5.5598E-05	5.5598E-05
TETRACHLOROETHYLENE				9.80498E-08
TETRACHLOROETHYLENE				3.02478E-11
TETRACHLOROETHYLENE				1.95511E-09
TOLUENE				7.33135E-06
TOLUENE				7.12199E-10
TOLUENE				4.39969E-07
TOLUENE				8.42815E-09
TOLUENE				5.88458E-10
TOLUENE				1.29436E-07
TRICHLOROETHYLENE				1.80728E-07
TRICHLOROETHYLENE				7.42447E-11
1,2,4-TRIMETHYLBENZENE				3.5082E-07
1,2,4-TRIMETHYLBENZENE				1.07242E-10
1,2,4-TRIMETHYLBENZENE				3.26677E-09
1,2,4-TRIMETHYLBENZENE				2.00736E-09
VANADIUM (FUME OR DUST)				3.02478E-11
VANADIUM (FUME OR DUST)				1.92486E-08
VINYL ACETATE		22,950	4.29621E-05	4.29621E-05
VINYL ACETATE		1,598,600	0.002992557	0.002992557
XYLENE (MIXED ISOMERS)				2.00479E-06
XYLENE (MIXED ISOMERS)				7.91944E-10
XYLENE (MIXED ISOMERS)				8.52439E-08
XYLENE (MIXED ISOMERS)				1.27151E-08
XYLENE (MIXED ISOMERS)				9.07435E-10
XYLENE (MIXED ISOMERS)				1.70353E-07
ZINC COMPOUNDS				2.91699E-08
ZINC COMPOUNDS				3.95532E-08
ZINC COMPOUNDS				1.44871E-07
ZINC COMPOUNDS				2.44733E-10
ZINC COMPOUNDS				5.12932E-07
TOTAL RELEASES & TRANSFERS (LBS)		2870462	0.005373465	0.005443968

Table A2. (Continued)

FOOTNOTES

[1] Info on the top ten facilities by capacity for the petroleum refining industry comes from the website for the Sector Facility Indexing Project: Petroleum Refining Data Access, <http://es.epa.gov/oeca/sfi/petdata.htm>, obtained October 1999. The TRI release data for each facility comes from the Right-to-Know Network environmental database for facility TRIs, <http://www.rtknet org/triinputfacility.html>, obtained October 1999.

[2] Under the "Disposition" column, the category "air" includes fugitive and stack emissions.

[3] TRI lbs/barrel of crude in was computed by: (?? lbs/yr of the TRI chemical totaled for the ten refineries) divided by (365 days/yr) divided by (3,689,000 bbl of crude in/day - total of the plant capacities for the ten refineries) divided by (0.8600).

The 0.8600 (or 86%) value is the refining capacity factor which represents % of capacity at which the refinery is actually operating. It was calculated by taking each annual total U.S. refinery throughput divided by each yearly U.S. refining total capacity for the years 1987 -1993, and averaging the values. These values were obtained from the International Petroleum Encyclopedia, 1995 edition. These were the only years that U.S. refinery throughput and capacity values were both available, and were thus used to estimate the actual rate at which the ten refineries were actually operating. Note that the throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days." It was assumed that these terms each refer to a 365 day year. See further Table 1 in the bottom right corner of this worksheet (starting at cell X217) for the calculation of the facility capacity factor.

[4] Conversion of "bbls of crude" to "lbs of crude", using the density of crude: bbls of crude in X 42 US gal/bbl X 3.785ee3 cm3/gal X 0.8673 g crude in/cm3 X 1 lb/ 453.6 g; or, a factor of 304.0 lbs of crude in/bbl of crude in. On this basis, the ten refineries processed 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

Table A2. (Continued)

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries. this resulted in an average API (American Petroleum Institute) gravity of 31.7 degrees, or specific gravity of 0.8692. The data came from Tables P-13 and P-14 on pages 851-2 of Chemical and Process Technology Encyclopedia, Douglas M. Considine, editor-in-chief, McGraw-Hill Book Company, New York: 1974. The data from the tables was copyrighted to the Universal Oil Products Company, 1973. (API , in degrees = [141.5/specific gravity @ 60/60] - 131.5).

[5] 48.4ee9 lbs ethylene (1996 demand from CMR, 1997) divided by 1.575ee12 lbs crude in = 0.0307

[6] From CMR report on ethylene, 1997

[7] Calculation for TRI lbs/lb HDPE: "lbs of TRI chemical lbs/lb of crude in" multiplied by "1.575 trillion lbs/yr crude" divided by "12 5 billion lbs HDPE" (from CMR, 1998 - this value is the demand for 1997)"; or in other words, a factor of "126 lbs of crude/lb of product".

[8] Facility Capacity obtained from CMR report on Polyethylene - HD, 1998.

[9] The TRI release data for this facility comes from the Right-to-Know Network environmental database for facility TRIs. <http://www.rtknet.org/triinputfacility.html>

[10] TRI lbs/lb of HDPE was computed by: (?? lbs/yr of the TRI chemical attributed to the HDPE chemical plant) divided by (620,000,000 lbs/yr - facility capacity) divided by (0.8616 - the facility capacity factor). The 0.8616 (or ~ 86%) value is the facility capacity factor which represents % of capacity at which the facility is actually operating. It was calculated by taking each yearly U.S. demand value (considered to approximate the throughput) divided by each yearly U.S. capacity for 141 different chemicals, and averaging the values. These values were obtained from ChemExpo, accessed November 1999, available from <http://www.chemexpo.com>, and make up all the chemicals listed in the "chemical profile archives." See further Table 2 in the bottom right corner of this worksheet (starting at cell AC228) for the calculation of the facility capacity factor.

Table A3. PVC Database Generated by the Public Data Method (page order: down, then over)

IN THE PRODUCTION OF POLYVINYL CHLORIDE (PVC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
AMMONIA	Air	60,962	160	71,376	436	49,128	505	440,000	3,500	10,000
AMMONIA	Water	24,767	25,000	2,822	2,400	13,134	2,162	0	7,350	3,600
AMMONIA	Underground	0	1,300,000	0	0	0	0	0	0	0
AMMONIA	POTW Transfer	0	0	0	0	0	104	0	0	0
AMMONIA	Off-site Transfer	0	0	0	23	0	0	0	0	0
ANTHRACENE	Air	0	0	1,029	0	895	0	0	524	0
ANTHRACENE	Land	0	0	0	0	162	0	0	0	0
ANTHRACENE	Off-site Transfer	0	0	0	0	11	0	0	0	0
ANTIMONY COMPOUNDS	Air	0	0	0	200	0	0	0	0	1,100
ANTIMONY COMPOUNDS	Land	0	0	0	0	0	0	0	0	2,500
ANTIMONY COMPOUNDS	Off-site Transfer	0	0	0	5,312	0	0	0	0	0
BARIUM COMPOUNDS	Water	0	0	0	0	1,892	0	0	0	0
BARIUM COMPOUNDS	Land	0	160	0	0	2,152	0	0	0	0
BARIUM COMPOUNDS	Off-site Transfer	0	70	0	0	185	0	0	0	0
BENZENE	Air	58,853	145,000	33,614	11,400	34,184	51,619	60,000	90,000	56,000
BENZENE	Water	15	1	43	13	11	0	0	2	0
BENZENE	Underground	0	170,000		0	0	0	0	0	0
BENZENE	Land	0	950	101	46	22	0	0	0	0
BENZENE	POTW Transfer	0	0	0	0	0	51	0	0	0
BENZENE	Off-site Transfer	4,533	4,189	357	4,666	2,390	2,010	44	1	833
BIPHENYL	Air	0	0	0	0	0	0	0	1,900	0
1,3-BUTADIENE	Air	10,848	280	338	50	3,098	1,771	18,400	1,730	6,100
1,3-BUTADIENE	Off-site Transfer	0	0	0	0	0	0	0	0	120
CARBON DISULFIDE	Air	0	0	0	0	0	0	0	7,090	0
CARBON DISULFIDE	Off-site Transfer	0	0	0	0	0	0	0	256	0
CARBON TETRACHLORIDE	Air	16,653	250	0	0	0	0	340	6,192	0
CARBON TETRACHLORIDE	Off-site Transfer	0	956	0	0	0	0	0	0	0
CARBONYL SULFIDE	Air	0	0	0	0	0	0	0	110,000	0
CHLORINE	Air	0	2,500	0	0	702	255	5	24,000	18,000
CHLORINE	Water	0	0	0	0	198	32	0	13,000	0
CHLORODIFLUOROMETHANE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CHROMIUM COMPOUNDS	Air	0	0	0	0	0	0	16	0	0
CHROMIUM COMPOUNDS	Water	0	52	0	0	4,096	0	0	0	0
CHROMIUM COMPOUNDS	Land	0	36	0	0	5,054	0	0	0	0
CHROMIUM COMPOUNDS	Off-site Transfer	0	102	0	0	260	0	1,834	0	0
COBALT COMPOUNDS	Air	1	0	0	0	106	0	0	0	0
COBALT COMPOUNDS	Land	0	2	0	0	2,283	0	0	0	0
COBALT COMPOUNDS	Off-site Transfer	72,840	8,950	403	0	63,687	0	4,526	0	0
COPPER COMPOUNDS	Air	0	0	0	0	0	0	36	0	0
COPPER COMPOUNDS	Water	0	0	0	0	296	0	0	0	0
COPPER COMPOUNDS	Land	0	0	0	0	9,392	0	0	0	0
COPPER COMPOUNDS	Off-site Transfer	0	1,600	0	0	2,915	0	7	0	0
CRESOL (MIXED ISOMERS)	Air	0	0	619	0	0	0	0	27,000	0
CRESOL (MIXED ISOMERS)	Water	0	0	9	0	0	0	0	2,700	0
CRESOL (MIXED ISOMERS)	Underground	0	90,000	0	0	0	0	0	0	0
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	0	63	0	0	0	0	15	0

Table A3. (Continued)

IN THE PRODUCTION OF POLYVINYL CHLORIDE (PVC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
CUMENE	Air	1,018	0	2,265	0	3,059	23,675	0	8,148	2
CUMENE	Water	0	0	4	0	0	0	0	0	0
CUMENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CYCLOHEXANE	Air	36,837	27,300	13,632	15,830	19,595	6,580	8,900	54,000	37,000
CYCLOHEXANE	Water	0	1	4	24	0	0	0	0	0
CYCLOHEXANE	Land	0	2,400	0	49	0	0	0	0	0
CYCLOHEXANE	Off-site Transfer	0	0		2,600	0	0	0	9	0
1,2-DIBROMOETHANE	Air	0	0	1,938	0	0	0	0	0	0
1,2-DIBROMOETHANE	Water	0	0	7	0	0	0	0	0	0
1,2-DICHLOROETHANE	Air	0	0	0	0	0	0	0	13,300	0
DIETHANOLAMINE	Air	0	0	0	0	0	276	9,600	0	0
DIETHANOLAMINE	Off-site Transfer	0	0	0	0	0	134,000	0	0	0
ETHYLBENZENE	Air	36,179	11,500	23,385	3,900	6,990	33,734	20,500	57,000	13,000
ETHYLBENZENE	Water	1	0	43	1	8	0	0	0	0
ETHYLBENZENE	Underground	0	1,700	0	0	0	0	0	0	0
ETHYLBENZENE	Land	0	490	0	42	117	0	0	0	0
ETHYLBENZENE	POTW Transfer	0	0	0	0	0	38	0	0	0
ETHYLBENZENE	Off-site Transfer	3,192	403	412	5,102	1,550	4,462	610	46	0
ETHYLENE	Air	277,061	110,000	1,254	2,500	83,530	27,177	31,400	37,088	163,000
ETHYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
ETHYLENE GLYCOL	Air	0	250	600	80	3	5	0	0	0
ETHYLENE GLYCOL	Water	0	0	319	0	4	0	0	0	0
ETHYLENE GLYCOL	Off-site Transfer	0	0		800	0	0	0	0	0
FORMALDEHYDE	Air	0	0	11,562	0	0	0	0	0	0
FORMALDEHYDE	Water	0	0	115	0	0	0	0	0	0
FORMALDEHYDE	Off-site Transfer	0	0	259	0	0	0	0	0	0
GLYCOL ETHERS	Air	0	0	1,743	0	0	0	0	0	0
HYDROCHLORIC ACID	Air	0	37,000	19,901	16,000	22,653	0	19	0	0
HYDROGEN FLUORIDE	Air	0	2,800	0	0	0	255	0	0	79
LEAD COMPOUNDS	Air	0	0	25	54	0	0	0	0	0
LEAD COMPOUNDS	Water	0	0	732	40	47	0	0	0	0
LEAD COMPOUNDS	Land	0	0			7,889	0	0	0	0
LEAD COMPOUNDS	Off-site Transfer	0	0	652	41,725	426	0	2,280	73	0
MANGANESE COMPOUNDS	Air	0	0	0	16	0	0	0	0	0
MANGANESE COMPOUNDS	Water	0	0	0	1,800	0	0	0	0	0
MANGANESE COMPOUNDS	Off-site Transfer	0	0	0	9,330	0	0	0	0	0
METHANOL	Air	4,375	2,200,250	11,975	23,000	124,331	590	8,743	99,600	3,570
METHANOL	Water	0	0	7	0	0	0	0	1,200	0
METHANOL	Off-site Transfer	0	0	195	0	0	0	0	0	6,600
2-METHOXYETHANOL	Air	0	0	0	0	63	0	0	0	0
METHYL ETHYL KETONE	Air	0	0	201,068	358,000	133,888	0	1,556,000	410,000	0
METHYL ETHYL KETONE	Water	0	0	61	0	0	0	0	5,700	0
METHYL ETHYL KETONE	Underground	0	19,000	0	0	0	0	0	0	0
METHYL ETHYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ETHYL KETONE	Off-site Transfer	0	0	0	0	1,051	0	0	0	0
METHYL ISOBUTYL KETONE	Air	0	0	96,974	0	132,893	0	0	0	0

Table A3. (Continued)

IN THE PRODUCTION OF POLYVINYL CHLORIDE (PVC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
METHYL ISOBUTYL KETONE	Water	0	0	4	0	0	0	0	0	0
METHYL ISOBUTYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ISOBUTYL KETONE	Off-site Transfer	0	0	0	0	415	0	0	0	0
METHYL TERT-BUTYL ETHER	Air	134,733	40,600	254,552	64,000	89,388	48,005	107,000	28,000	15,500
METHYL TERT-BUTYL ETHER	Water	0	42,000	30	8,200	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Air	0	0	0	0	267	0	0	0	0
MOLYBDENUM TRIOXIDE	Water	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Land	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Off-site Transfer	338,652	43,690	11,646	0	20,139	0	21,120	152,726	0
NAPHTHALENE	Air	9,324	47,014	6,427	660	779	11,790	4,380	15,990	0
NAPHTHALENE	Water	0	1	83	21	0	0	0	17	0
NAPHTHALENE	Land	17	490	0	41	94	0	0	0	0
NAPHTHALENE	Off-site Transfer	3,239	0	1,197	248	1,038	123	6	750	0
N-HEXANE	Air	180,829	93,000	47,248	51,500	116,432	18,105	133,000	96,000	216,000
N-HEXANE	Water	72	2	0	48	0	0	0	0	0
N-HEXANE	Land	0	3,500	0	100	0	0	0	0	0
N-HEXANE	Off-site Transfer	0	0	0	6,621	0	0	0	0	0
NICKEL COMPOUNDS	Air	98	0	374	0	216	21,405	1,200	200	3,000
NICKEL COMPOUNDS	Water	0	0	0	0	518	0	0	0	510
NICKEL COMPOUNDS	Land	6,412	110	0	0	6,914	69	0	0	7,500
NICKEL COMPOUNDS	Off-site Transfer	35,530	167,800	2,769	0	83,892	1,309	2	11,574	257,000
NITRATE COMPOUNDS	Water	5,275	84,000	2,005,479	70,000	174,310	0	0	73,800	0
N-METHYL-2-PYRROLIDONE	Air	0	0	73,240	11,000	15,869	0	0	0	0
N-METHYL-2-PYRROLIDONE	Land	0	0	0	700	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	0	0	0	160	0	0	0	0
O-XYLENE	Air	0	0	0	0	0	0	0	0	0
O-XYLENE	Water	0	0	0	0	0	0	0	0	0
O-XYLENE	Land	0	0	0	0	0	0	0	0	0
O-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
P-XYLENE	Air	0	0	0	0	0	0	0	0	0
P-XYLENE	Water	0	0	0	0	0	0	0	0	0
P-XYLENE	Land	0	0	0	0	0	0	0	0	0
P-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
PHENANTHRENE	Air	0	530	0	870	258	0	0	0	0
PHENANTHRENE	Water	0	1	0	22	0	0	0	0	0
PHENANTHRENE	Land	0	3,700	0	37	376	0	0	0	0
PHENANTHRENE	Off-site Transfer	0	1	0	150	58	0	0	0	0
PHENOL	Air	54,876	0	3,344	0	3,363	728	5,100	45,004	0
PHENOL	Water	1,504	950	115	0	267	193	0	920	0
PHENOL	Underground	0	140,000	0	0	0	0	0	0	0
PHENOL	Land	44	3	0	0	153	0	0	0	0
PHENOL	POTW Transfer	0	0	0	0	0	2,266	0	0	0
PHENOL	Off-site Transfer	0	0	16	0	28	1	0	0	0
PHOSPHORIC ACID	Off-site Transfer	0	0	0	0	0	74,750	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Air	809	2,920	0	1,710	339	7,517	24	1,790	0

Table A3. (Continued)

IN THE PRODUCTION OF POLYVINYL CHLORIDE (PVC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	3	0	1	0	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	7,600	0	110	995	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	0	0	430	11	0	0	0	0
PROPYLENE	Air	223,245	43,000	4,849	45,000	109,396	27,722	85,000	220,000	129,000
PROPYLENE	Water	0	0	95	0	0	0	0	0	0
STYRENE	Air	0	0	520	0	239	0	0	0	0
STYRENE	Land	0	0	0	0	5	0	0	0	0
STYRENE	Off-site Transfer	0	0	0	0	36	0	0	0	0
SULFURIC ACID	Air	1,154	3,400	0	0	0	692	0	6,000	0
SULFURIC ACID	Off-site Transfer	0	0	0	0	0	0	0	12	0
TERT-BUTYL ALCOHOL	Air	0	0	0	0	0	0	0	300	0
TETRACHLOROETHYLENE	Air	29,612	250	568	0	5	0	1,700	0	0
TETRACHLOROETHYLENE	Land	0	0	0	11	0	0	0	0	0
TETRACHLOROETHYLENE	Off-site Transfer	0	580	0	95	36	0	0	0	0
TOLUENE	Air	158,398	80,000	94,542	252,000	213,327	61,869	1,033,000	562,000	0
TOLUENE	Water	62	2	39	55	63	0	0	17	0
TOLUENE	Underground	0	160,000	0	0	0	0	0	0	0
TOLUENE	Land	1	2,800	0	180	65	0	0	0	0
TOLUENE	POTW Transfer	0	0	0	0	0	214	0	0	0
TOLUENE	Off-site Transfer	6,958	756	1,407	18,809	12,876	3,342	2,137	60	0
TRICHLOROETHYLENE	Air	0	11,000	0	0	54,724	0	0	0	0
TRICHLOROETHYLENE	Off-site Transfer	0	0	0	0	27	0	0	0	0
TRICHLOROETHYLENE	POTW Transfer									
1,2,4-TRIMETHYLBENZENE	Air	10,474	22,300	11,222	4,844	274	13,726	20,300	22,340	0
1,2,4-TRIMETHYLBENZENE	Water	0	1	0	38	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Land	0	1,100	0	82	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	0	21	0	688	0	0	0	0	0
VANADIUM (FUME OR DUST)	Land	0	11	0	0	0	0	0	0	0
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	0	0	0	0	0	0	0
VINYL ACETATE	Air									
VINYL ACETATE	POTW Transfer									
VINYL CHLORIDE	Air									
VINYL CHLORIDE	POTW Transfer									
XYLENE (MIXED ISOMERS)	Air	161,546	82,000	64,534	21,500	37,389	51,098	87,000	224,000	0
XYLENE (MIXED ISOMERS)	Water	24	3	0	57	202	0	0	2	0
XYLENE (MIXED ISOMERS)	Underground	0	31,000	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Land	52	3,900	0	300	372	0	0	0	0
XYLENE (MIXED ISOMERS)	POTW Transfer	0	0	0	0	0	330	0	0	0
XYLENE (MIXED ISOMERS)	Off-site Transfer	14,267	1,238	4,819	9,556	14,769	13,608	3,096	598	0
ZINC COMPOUNDS	Air	0	0	954	6,801	0	63	190	0	0
ZINC COMPOUNDS	Water	0	1,500	7,686	1,700	1,219	1,179	0	0	0
ZINC COMPOUNDS	Land	0	57	0	0	51,227	0	0	0	0
ZINC COMPOUNDS	POTW Transfer	0	0	0	0	0	89	0	0	0
ZINC COMPOUNDS	Off-site Transfer	0	0	1,603	8,660	1,019	27,069	36	0	0
TOTAL RELEASES & TRANSFERS (LBS)		1,985,342	5,453,186	3,099,268	1,092,284	1,747,909	676,563	3,667,551	2,443,524	950,014

Table A3. (Continued)

FACILITY ID --->		Facility 10	Totals							
		39567CHVRNPOBOX								
REFINING CAPACITY (Barrels/day)--->		295000	3689000							
										TRI Releases for PVC
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	15% of ethylene to ethylene dichloride (EDC)[6]:	100% of EDC to Vinyl Chloride monomer (VCM)[7]:	98% of VCM to Polyvinyl Chloride (PVC)[8]:	TRI lbs/ lb of PVC[9] (attributed to oil refineries):
AMMONIA	Air	110,210	746,277	0.000644466	2.11995E-06	6.51465E-08	9.77198E-09	9.77198E-09	9.57654E-09	1.15721E-06
AMMONIA	Water	8,700	89,935	7.76656E-05	2.55479E-07	7.85091E-09	1.17764E-09	1.17764E-09	1.15408E-09	1.39457E-07
AMMONIA	Underground	0	1,300,000	0.001122647	3.69292E-06	1.13484E-07	1.70226E-08	1.70226E-08	1.66821E-08	2.01583E-06
AMMONIA	POTW Transfer	0	104	8.98118E-08	2.95434E-10	9.07872E-12	1.36181E-12	1.36181E-12	1.33457E-12	1.61267E-10
AMMONIA	Off-site Transfer	0	23	1.98622E-08	6.53363E-11	2.00779E-12	3.01169E-13	3.01169E-13	2.95146E-13	3.56648E-11
ANTHRACENE	Air	0	2,448	2.11403E-06	6.95405E-09	2.13699E-10	3.20549E-11	3.20549E-11	3.14138E-11	3.79597E-09
ANTHRACENE	Land	0	162	1.39899E-07	4.60195E-10	1.41419E-11	2.12128E-12	2.12128E-12	2.07885E-12	2.51204E-10
ANTHRACENE	Off-site Transfer	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.44037E-13	1.44037E-13	1.41157E-13	1.70571E-11
ANTIMONY COMPOUNDS	Air	0	1,300	1.12265E-06	3.69292E-09	1.13484E-10	1.70226E-11	1.70226E-11	1.66821E-11	2.01583E-09
ANTIMONY COMPOUNDS	Land	0	2,500	2.15894E-06	7.10177E-09	2.18238E-10	3.27358E-11	3.27358E-11	3.20811E-11	3.8766E-09
ANTIMONY COMPOUNDS	Off-site Transfer	0	5,312	4.58731E-06	1.50898E-08	4.63713E-10	6.9557E-11	6.9557E-11	6.81658E-11	8.23701E-09
BARIUM COMPOUNDS	Water	0	1,892	1.63388E-06	5.37462E-09	1.65163E-10	2.47744E-11	2.47744E-11	2.42789E-11	2.93381E-09
BARIUM COMPOUNDS	Land	0	2,312	1.99659E-06	6.56771E-09	2.01827E-10	3.0274E-11	3.0274E-11	2.96686E-11	3.58508E-09
BARIUM COMPOUNDS	Off-site Transfer	0	255	2.20212E-07	7.2438E-10	2.22603E-11	3.33905E-12	3.33905E-12	3.27227E-12	3.95414E-10
BENZENE	Air	68,000	608,670	0.000525632	1.72905E-06	5.31341E-08	7.97011E-09	7.97011E-09	7.81071E-09	9.43829E-07
BENZENE	Water	21	106	9.15389E-08	3.01115E-10	9.25331E-12	1.388E-12	1.388E-12	1.36024E-12	1.64368E-10
BENZENE	Underground	0	170,000	0.000146808	4.8292E-07	1.48402E-08	2.22603E-09	2.22603E-09	2.18151E-09	2.63609E-07
BENZENE	Land	2	1,121	9.68068E-07	3.18443E-09	9.78581E-11	1.46787E-11	1.46787E-11	1.43851E-11	1.73827E-09
BENZENE	POTW Transfer	0	51	4.40423E-08	1.44876E-10	4.45206E-12	6.6781E-13	6.6781E-13	6.54453E-13	7.90827E-11
BENZENE	Off-site Transfer	588	19,611	1.69356E-05	5.57091E-08	1.71195E-09	2.56792E-10	2.56792E-10	2.51657E-10	3.04096E-08
BIPHENYL	Air	0	1,900	1.64079E-06	5.39734E-09	1.65861E-10	2.48792E-11	2.48792E-11	2.43816E-11	2.94622E-09
1,3-BUTADIENE	Air	700	43,315	3.74057E-05	1.23045E-07	3.7812E-09	5.6718E-10	5.6718E-10	5.55836E-10	6.7166E-08
1,3-BUTADIENE	Off-site Transfer	0	120	1.03629E-07	3.40885E-10	1.04754E-11	1.57132E-12	1.57132E-12	1.53989E-12	1.86077E-10
CARBON DISULFIDE	Air	0	7,090	6.12275E-06	2.01406E-08	6.18924E-10	9.28386E-11	9.28386E-11	9.09819E-11	1.0994E-08
CARBON DISULFIDE	Off-site Transfer	0	256	2.21075E-07	7.27221E-10	2.23476E-11	3.35214E-12	3.35214E-12	3.2851E-12	3.96964E-10
CARBON TETRACHLORIDE	Air	0	23,435	2.02379E-05	6.6572E-08	2.04577E-09	3.06865E-10	3.06865E-10	3.00728E-10	3.63393E-08
CARBON TETRACHLORIDE	Off-site Transfer	0	956	8.25578E-07	2.71572E-09	8.34544E-11	1.25182E-11	1.25182E-11	1.22678E-11	1.48241E-09
CARBONYL SULFIDE	Air	71,300	181,300	0.000156566	5.1502E-07	1.58267E-08	2.374E-09	2.374E-09	2.32652E-09	2.81131E-07
CHLORINE	Air	0	45,462	3.92598E-05	1.29144E-07	3.96862E-09	5.95293E-10	5.95293E-10	5.83388E-10	7.04953E-08
CHLORINE	Water	0	13,230	1.14251E-05	3.75826E-08	1.15492E-09	1.73238E-10	1.73238E-10	1.69773E-10	2.0515E-08
CHLORODIFLUOROMETHANE	Off-site Transfer	23,000	23,000	1.98622E-05	6.53363E-08	2.00779E-09	3.01169E-10	3.01169E-10	2.95146E-10	3.56648E-08
CHROMIUM COMPOUNDS	Air	14	30	2.59072E-08	8.52212E-11	2.61886E-12	3.92829E-13	3.92829E-13	3.84973E-13	4.65192E-11
CHROMIUM COMPOUNDS	Water	4	4,152	3.58556E-06	1.17946E-08	3.6245E-10	5.43676E-11	5.43676E-11	5.32802E-11	6.43826E-09
CHROMIUM COMPOUNDS	Land	0	5,090	4.3956E-06	1.44592E-08	4.44333E-10	6.665E-11	6.665E-11	6.5317E-11	7.89277E-09
CHROMIUM COMPOUNDS	Off-site Transfer	23,674	25,870	2.23407E-05	7.34891E-08	2.25833E-09	3.3875E-10	3.3875E-10	3.31975E-10	4.01151E-08
COBALT COMPOUNDS	Air	0	107	9.24025E-08	3.03956E-10	9.34061E-12	1.40109E-12	1.40109E-12	1.37307E-12	1.65919E-10
COBALT COMPOUNDS	Land	0	2,285	1.97327E-06	6.49102E-09	1.9947E-10	2.99205E-11	2.99205E-11	2.93221E-11	3.54322E-09
COBALT COMPOUNDS	Off-site Transfer	0	150,406	0.000129887	4.27259E-07	1.31297E-08	1.96946E-09	1.96946E-09	1.93007E-09	2.33226E-07
COPPER COMPOUNDS	Air	250	286	2.46982E-07	8.12442E-10	2.49665E-11	3.74497E-12	3.74497E-12	3.67007E-12	4.43483E-10
COPPER COMPOUNDS	Water	81	377	3.25568E-07	1.07095E-09	3.29104E-11	4.93655E-12	4.93655E-12	4.83782E-12	5.84592E-10
COPPER COMPOUNDS	Land	70	9,462	8.17115E-06	2.68788E-08	8.25989E-10	1.23898E-10	1.23898E-10	1.2142E-10	1.46722E-08
COPPER COMPOUNDS	Off-site Transfer	162,122	166,644	0.00014391	4.73387E-07	1.45473E-08	2.18209E-09	2.18209E-09	2.13845E-09	2.58405E-07
CRESOL (MIXED ISOMERS)	Air	0	27,619	2.38511E-05	7.84575E-08	2.41101E-09	3.61652E-10	3.61652E-10	3.54419E-10	4.28272E-08
CRESOL (MIXED ISOMERS)	Water	0	2,709	2.33942E-06	7.69548E-09	2.36483E-10	3.54725E-11	3.54725E-11	3.4763E-11	4.20069E-09
CRESOL (MIXED ISOMERS)	Underground	0	90,000	7.77217E-05	2.55664E-07	7.85658E-09	1.17849E-09	1.17849E-09	1.15492E-09	1.39558E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	78	6.73588E-08	2.21575E-10	6.80904E-12	1.02136E-12	1.02136E-12	1.00093E-12	1.2095E-10

Table A3. (Continued)

FACILITY ID --->		Facility 10 39567CHVRNPOBOX	Totals							
REFINING CAPACITY (Barrels/day)--->		295000	3689000							
										TRI Releases for PVC
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	15% of ethylene to ethylene dichloride (EDC)[6]:	100% of EDC to Vinyl Chloride monomer (VCM)[7]:	98% of VCM to Polyvinyl Chloride (PVC)[8]:	TRI lbs/ lb of PVC[9] (attributed to oil refineries):
CUMENE	Air	26,570	64,737	5.59053E-05	1.83899E-07	5.65124E-09	8.47686E-10	8.47686E-10	8.30732E-10	1.00384E-07
CUMENE	Water	21	25	2.15894E-08	7.10177E-11	2.18238E-12	3.27358E-13	3.27358E-13	3.20811E-13	3.8766E-11
CUMENE	Off-site Transfer	80	80	6.9086E-08	2.27257E-10	6.98363E-12	1.04754E-12	1.04754E-12	1.02659E-12	1.24051E-10
CYCLOHEXANE	Air	17,000	236,674	0.000204386	6.72321E-07	2.06605E-08	3.09908E-09	3.09908E-09	3.0371E-09	3.66997E-07
CYCLOHEXANE	Water	0	29	2.50437E-08	8.23805E-11	2.53157E-12	3.79735E-13	3.79735E-13	3.7214E-13	4.49686E-11
CYCLOHEXANE	Land	1	2,450	2.11576E-06	6.95973E-09	2.13874E-10	3.20811E-11	3.20811E-11	3.14394E-11	3.79907E-09
CYCLOHEXANE	Off-site Transfer	80	2,689	2.32215E-06	7.63866E-09	2.34737E-10	3.52106E-11	3.52106E-11	3.45064E-11	4.16968E-09
1,2-DIBROMOETHANE	Air	0	1,938	1.67361E-06	5.50529E-09	1.69178E-10	2.53768E-11	2.53768E-11	2.48692E-11	3.00514E-09
1,2-DIBROMOETHANE	Water	0	7	6.04502E-09	1.98849E-11	6.11068E-13	9.16601E-14	9.16601E-14	8.98269E-14	1.08545E-11
1,2-DICHLOROETHANE	Air	0	13,300	1.14855E-05	3.77814E-08	1.16103E-09	1.74154E-10	1.74154E-10	1.70671E-10	2.06235E-08
DIETHANOLAMINE	Air	34,000	43,876	3.78902E-05	1.24639E-07	3.83017E-09	5.74526E-10	5.74526E-10	5.63035E-10	6.80359E-08
DIETHANOLAMINE	Off-site Transfer	0	134,000	0.000115719	3.80655E-07	1.16976E-08	1.75464E-09	1.75464E-09	1.71954E-09	2.07786E-07
ETHYLBENZENE	Air	49,600	255,788	0.000220892	7.26619E-07	2.23291E-08	3.34937E-09	3.34937E-09	3.28238E-09	3.96636E-07
ETHYLBENZENE	Water	21	74	6.39045E-08	2.10212E-10	6.45986E-12	9.68979E-13	9.68979E-13	9.49599E-13	1.14747E-10
ETHYLBENZENE	Underground	0	1,700	1.46808E-06	4.8292E-09	1.48402E-10	2.22603E-11	2.22603E-11	2.18151E-11	2.63609E-09
ETHYLBENZENE	Land	12	661	5.70823E-07	1.87771E-09	5.77022E-11	8.65534E-12	8.65534E-12	8.48223E-12	1.02497E-09
ETHYLBENZENE	POTW Transfer	0	38	3.28158E-08	1.07947E-10	3.31722E-12	4.97584E-13	4.97584E-13	4.87632E-13	5.89244E-11
ETHYLBENZENE	Off-site Transfer	3,821	19,598	1.69243E-05	5.56722E-08	1.71081E-09	2.56622E-10	2.56622E-10	2.5149E-10	3.03895E-08
ETHYLENE	Air	65,000	798,010	0.000689141	2.26691E-06	6.96626E-08	1.04494E-08	1.04494E-08	1.02404E-08	1.23743E-06
ETHYLENE	Off-site Transfer	93	93	8.03125E-08	2.64186E-10	8.11847E-12	1.21777E-12	1.21777E-12	1.19342E-12	1.4421E-10
ETHYLENE GLYCOL	Air	17,200	18,138	1.56635E-05	5.15247E-08	1.58336E-09	2.37505E-10	2.37505E-10	2.32754E-10	2.81255E-08
ETHYLENE GLYCOL	Water	19,000	19,323	1.66869E-05	5.4891E-08	1.68681E-09	2.53021E-10	2.53021E-10	2.47961E-10	2.9963E-08
ETHYLENE GLYCOL	Off-site Transfer	0	800	6.9086E-07	2.27257E-09	6.98363E-11	1.04754E-11	1.04754E-11	1.02659E-11	1.24051E-09
FORMALDEHYDE	Air	0	11,562	9.98465E-06	3.28443E-08	1.00931E-09	1.51396E-10	1.51396E-10	1.48368E-10	1.79285E-08
FORMALDEHYDE	Water	0	115	9.93111E-08	3.26681E-10	1.0039E-11	1.50585E-12	1.50585E-12	1.47573E-12	1.78324E-10
FORMALDEHYDE	Off-site Transfer	0	259	2.23666E-07	7.35743E-10	2.26095E-11	3.39143E-12	3.39143E-12	3.3236E-12	4.01616E-10
GLYCOL ETHERS	Air	0	1,743	1.50521E-06	4.95135E-09	1.52156E-10	2.28234E-11	2.28234E-11	2.23669E-11	2.70277E-09
HYDROCHLORIC ACID	Air	0	95,573	8.25344E-05	2.71495E-07	8.34308E-09	1.25146E-09	1.25146E-09	1.22643E-09	1.48199E-07
HYDROGEN FLUORIDE	Air	0	3,134	2.70644E-06	8.90278E-09	2.73584E-10	4.10376E-11	4.10376E-11	4.02168E-11	4.85971E-09
LEAD COMPOUNDS	Air	0	79	6.82224E-08	2.24416E-10	6.89633E-12	1.03445E-12	1.03445E-12	1.01376E-12	1.22501E-10
LEAD COMPOUNDS	Water	0	819	7.07268E-07	2.32654E-09	7.14949E-11	1.07242E-11	1.07242E-11	1.05098E-11	1.26998E-09
LEAD COMPOUNDS	Land	0	7,889	6.81274E-06	2.24103E-08	6.88673E-10	1.03301E-10	1.03301E-10	1.01235E-10	1.2233E-08
LEAD COMPOUNDS	Off-site Transfer	1,252	46,408	4.00768E-05	1.31832E-07	4.0512E-09	6.07681E-10	6.07681E-10	5.95527E-10	7.19622E-08
MANGANESE COMPOUNDS	Air	0	16	1.38172E-08	4.54513E-11	1.39673E-12	2.09509E-13	2.09509E-13	2.05319E-13	2.48103E-11
MANGANESE COMPOUNDS	Water	0	1,800	1.55443E-06	5.11327E-09	1.57132E-10	2.35698E-11	2.35698E-11	2.30984E-11	2.79115E-09
MANGANESE COMPOUNDS	Off-site Transfer	0	9,330	8.05715E-06	2.65038E-08	8.14466E-10	1.2217E-10	1.2217E-10	1.19726E-10	1.44675E-08
METHANOL	Air	1,490,000	3,966,434	0.003425313	1.12675E-05	3.46251E-07	5.19377E-08	5.19377E-08	5.08989E-08	6.15052E-06
METHANOL	Water	0	1,207	1.04233E-06	3.42873E-09	1.05366E-10	1.58048E-11	1.58048E-11	1.54887E-11	1.87162E-09
METHANOL	Off-site Transfer	6	6,801	5.87317E-06	1.93196E-08	5.93696E-10	8.90544E-11	8.90544E-11	8.72733E-11	1.05459E-08
2-METHOXYETHANOL	Air	0	63	5.44052E-08	1.78965E-10	5.49961E-12	8.24941E-13	8.24941E-13	8.08442E-13	9.76904E-11
METHYL ETHYL KETONE	Air	0	2,658,956	0.002296208	7.55331E-06	2.32115E-07	3.48172E-08	3.48172E-08	3.41208E-08	4.12309E-06
METHYL ETHYL KETONE	Water	0	5,761	4.97506E-06	1.63653E-08	5.02909E-10	7.54363E-11	7.54363E-11	7.39276E-11	8.93325E-09
METHYL ETHYL KETONE	Underground	0	19,000	1.64079E-05	5.39734E-08	1.65861E-09	2.48792E-10	2.48792E-10	2.43816E-10	2.94622E-08
METHYL ETHYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	6.54715E-14	6.54715E-14	6.41621E-14	7.75321E-12
METHYL ETHYL KETONE	Off-site Transfer	0	1,051	9.07617E-07	2.98558E-09	9.17474E-11	1.37621E-11	1.37621E-11	1.34869E-11	1.62972E-09
METHYL ISOBUTYL KETONE	Air	0	229,867	0.000198507	6.52985E-07	2.00663E-08	3.00995E-09	3.00995E-09	2.94975E-09	3.56441E-07
METHYL ISOBUTYL KETONE	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	5.23772E-14	5.23772E-14	5.13297E-14	6.20257E-12

Table A3. (Continued)

FACILITY ID --->		Facility 10	Totals								
		39567CHVRNPOBOX									
REFINING CAPACITY (Barrels/day)--->		295000	3689000								
											TRI Releases for PVC
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	15% of ethylene to ethylene dichloride (EDC)[6]:	100% of EDC to Vinyl Chloride monomer (VCM)[7]:	98% of VCM to Polyvinyl Chloride (PVC)[8]:	TRI lbs/ lb of PVC[9] (attributed to oil refineries):
METHYL ISOBUTYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	6.54715E-14	6.54715E-14	6.41621E-14	7.75321E-12
METHYL ISOBUTYL KETONE	Off-site Transfer	0	415	3.58384E-07	1.17889E-09	3.62276E-11	5.43414E-12	5.43414E-12	5.32545E-12	6.43516E-10
METHYL TERT-BUTYL ETHER	Air	87,570	869,348	0.000750747	2.46956E-06	7.58901E-08	1.13835E-08	1.13835E-08	1.11558E-08	1.34805E-06
METHYL TERT-BUTYL ETHER	Water	0	50,230	4.33774E-05	1.42689E-07	4.38485E-09	6.57727E-10	6.57727E-10	6.44572E-10	7.78887E-08
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	2.09509E-09	2.09509E-09	2.05319E-09	2.48103E-07
MOLYBDENUM TRIOXIDE	Air	181,000	181,267	0.000156538	5.14926E-07	1.58238E-08	2.37357E-09	2.37357E-09	2.32609E-09	2.8108E-07
MOLYBDENUM TRIOXIDE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.7498E-13	2.7498E-13	2.69481E-13	3.25635E-11
MOLYBDENUM TRIOXIDE	Land	95	95	8.20396E-08	2.69867E-10	8.29306E-12	1.24396E-12	1.24396E-12	1.21908E-12	1.47311E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer	5,069	593,042	0.000512136	1.68466E-06	5.17698E-08	7.76547E-09	7.76547E-09	7.61016E-09	9.19596E-07
NAPHTHALENE	Air	5,170	101,534	8.76822E-05	2.88428E-07	8.86345E-09	1.32952E-09	1.32952E-09	1.30293E-09	1.57443E-07
NAPHTHALENE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	1.87249E-12	1.87249E-12	1.83504E-12	2.21742E-10
NAPHTHALENE	Land	1	643	5.55279E-07	1.82657E-09	5.61309E-11	8.41964E-12	8.41964E-12	8.25125E-12	9.97063E-10
NAPHTHALENE	Off-site Transfer	0	6,601	5.70046E-06	1.87515E-08	5.76237E-10	8.64355E-11	8.64355E-11	8.47068E-11	1.02358E-08
N-HEXANE	Air	303,000	1,255,114	0.001083885	3.56541E-06	1.09566E-07	1.64348E-08	1.64348E-08	1.61062E-08	1.94623E-06
N-HEXANE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	1.87249E-12	1.87249E-12	1.83504E-12	2.21742E-10
N-HEXANE	Land	2	3,602	3.1106E-06	1.02322E-08	3.14438E-10	4.71657E-11	4.71657E-11	4.62224E-11	5.58541E-09
N-HEXANE	Off-site Transfer	0	6,621	5.71773E-06	1.88083E-08	5.77983E-10	8.66974E-11	8.66974E-11	8.49635E-11	1.02668E-08
NICKEL COMPOUNDS	Air	280	26,773	2.31205E-05	7.60542E-08	2.33716E-09	3.50574E-10	3.50574E-10	3.43562E-10	4.15153E-08
NICKEL COMPOUNDS	Water	560	1,588	1.37136E-06	4.51104E-09	1.38625E-10	2.07938E-11	2.07938E-11	2.03779E-11	2.46242E-09
NICKEL COMPOUNDS	Land	0	21,005	1.81394E-05	5.96691E-08	1.83364E-09	2.75046E-10	2.75046E-10	2.69545E-10	3.25712E-08
NICKEL COMPOUNDS	Off-site Transfer	363,011	922,887	0.000796982	2.62165E-06	8.05638E-08	1.20846E-08	1.20846E-08	1.18429E-08	1.43107E-06
NITRATE COMPOUNDS	Water	220,000	2,632,864	0.002273675	7.4792E-06	2.29837E-07	3.44755E-08	3.44755E-08	3.3786E-08	4.08263E-06
N-METHYL-2-PYRROLIDONE	Air	0	100,109	8.64516E-05	2.8438E-07	8.73905E-09	1.31086E-09	1.31086E-09	1.28464E-09	1.55233E-07
N-METHYL-2-PYRROLIDONE	Land	0	700	6.04502E-07	1.98849E-09	6.11068E-11	9.16601E-12	9.16601E-12	8.98269E-12	1.08545E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	160	1.38172E-07	4.54513E-10	1.39673E-11	2.09509E-12	2.09509E-12	2.05319E-12	2.48103E-10
O-XYLENE	Air	88,500	88,500	7.64264E-05	2.51403E-07	7.72564E-09	1.15885E-09	1.15885E-09	1.13567E-09	1.37232E-07
O-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.7498E-13	2.7498E-13	2.69481E-13	3.25635E-11
O-XYLENE	Land	86	86	7.42674E-08	2.44301E-10	7.5074E-12	1.12611E-12	1.12611E-12	1.10359E-12	1.33355E-10
O-XYLENE	Off-site Transfer	5,349	5,349	4.61926E-06	1.51949E-08	4.66943E-10	7.00414E-11	7.00414E-11	6.86406E-11	8.29438E-09
P-XYLENE	Air	574,900	574,900	0.000496469	1.63312E-06	5.01861E-08	7.52792E-09	7.52792E-09	7.37736E-09	8.91464E-07
P-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.7498E-13	2.7498E-13	2.69481E-13	3.25635E-11
P-XYLENE	Land	77	77	6.64953E-08	2.18734E-10	6.72174E-12	1.00826E-12	1.00826E-12	9.88096E-13	1.19399E-10
P-XYLENE	Off-site Transfer	5,369	5,369	4.63653E-06	1.52518E-08	4.68689E-10	7.03033E-11	7.03033E-11	6.88973E-11	8.32539E-09
PHENANTHRENE	Air	0	1,658	1.43181E-06	4.70989E-09	1.44736E-10	2.17104E-11	2.17104E-11	2.12762E-11	2.57096E-09
PHENANTHRENE	Water	0	23	1.98622E-08	6.53363E-11	2.00779E-12	3.01169E-13	3.01169E-13	2.95146E-13	3.56648E-11
PHENANTHRENE	Land	0	4,113	3.55188E-06	1.16838E-08	3.59046E-10	5.38569E-11	5.38569E-11	5.27797E-11	6.37779E-09
PHENANTHRENE	Off-site Transfer	0	209	1.80487E-07	5.93708E-10	1.82447E-11	2.73671E-12	2.73671E-12	2.68198E-12	3.24084E-10
PHENOL	Air	0	112,415	9.70788E-05	3.19338E-07	9.81331E-09	1.472E-09	1.472E-09	1.44256E-09	1.74315E-07
PHENOL	Water	0	3,949	3.41026E-06	1.1218E-08	3.44729E-10	5.17094E-11	5.17094E-11	5.06752E-11	6.12348E-09
PHENOL	Underground	0	140,000	0.0001209	3.97699E-07	1.22214E-08	1.8332E-09	1.8332E-09	1.79654E-09	2.1709E-07
PHENOL	Land	0	200	1.72715E-07	5.68141E-10	1.74591E-11	2.61886E-12	2.61886E-12	2.56648E-12	3.10128E-10
PHENOL	POTW Transfer	0	2,266	1.95686E-06	6.43704E-09	1.97811E-10	2.96717E-11	2.96717E-11	2.90783E-11	3.51375E-09
PHENOL	Off-site Transfer	0	45	3.88609E-08	1.27832E-10	3.92829E-12	5.89244E-13	5.89244E-13	5.77459E-13	6.97789E-11
PHOSPHORIC ACID	Off-site Transfer	0	74,750	6.45522E-05	2.12343E-07	6.52533E-09	9.78799E-10	9.78799E-10	9.59223E-10	1.1591E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air	0	15,109	1.30478E-05	4.29202E-08	1.31895E-09	1.97842E-10	1.97842E-10	1.93885E-10	2.34286E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	5.23772E-14	5.23772E-14	5.13297E-14	6.20257E-12
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	8,705	7.51742E-06	2.47284E-08	7.59906E-10	1.13986E-10	1.13986E-10	1.11706E-10	1.34983E-08

Table A3. (Continued)

FACILITY ID --->		Facility 10 39567CHVRNPOBOX	Totals								
REFINING CAPACITY (Barrels/day)--->		295000	3689000								
											TRI Releases for PVC
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	15% of ethylene to ethylene dichloride (EDC)[6]:	100% of EDC to Vinyl Chloride monomer (VCM)[7]:	98% of VCM to Polyvinyl Chloride (PVC)[8]:	TRI lbs/ lb of PVC[9] (attributed to oil refineries):
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	441	3.80837E-07	1.25275E-09	3.84973E-11	5.77459E-12	5.77459E-12	5.6591E-12	6.83833E-10
PROPYLENE	Air	100,300	987,512	0.000852791	2.80523E-06	8.62052E-08	1.29308E-08	1.29308E-08	1.26722E-08	1.53128E-06
PROPYLENE	Water	0	95	8.20396E-08	2.69867E-10	8.29306E-12	1.24396E-12	1.24396E-12	1.21908E-12	1.47311E-10
STYRENE	Air	0	759	6.55453E-07	2.1561E-09	6.62572E-11	9.93858E-12	9.93858E-12	9.73981E-12	1.17694E-09
STYRENE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	6.54715E-14	6.54715E-14	6.41621E-14	7.75321E-12
STYRENE	Off-site Transfer	0	36	3.10887E-08	1.02265E-10	3.14263E-12	4.71395E-13	4.71395E-13	4.61967E-13	5.58231E-11
SULFURIC ACID	Air	0	11,246	9.71176E-06	3.19466E-08	9.81724E-10	1.47259E-10	1.47259E-10	1.44313E-10	1.74385E-08
SULFURIC ACID	Off-site Transfer	0	12	1.03629E-08	3.40885E-11	1.04754E-12	1.57132E-13	1.57132E-13	1.53989E-13	1.86077E-11
TERT-BUTYL ALCOHOL	Air	0	300	2.59072E-07	8.52212E-10	2.61886E-11	3.92829E-12	3.92829E-12	3.84973E-12	4.65192E-10
TETRACHLOROETHYLENE	Air	3,522	35,657	3.07925E-05	1.01291E-07	3.11269E-09	4.66904E-10	4.66904E-10	4.57566E-10	5.52912E-08
TETRACHLOROETHYLENE	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.44037E-13	1.44037E-13	1.41157E-13	1.70571E-11
TETRACHLOROETHYLENE	Off-site Transfer	0	711	6.14002E-07	2.01974E-09	6.2067E-11	9.31005E-12	9.31005E-12	9.12385E-12	1.10251E-09
TOLUENE	Air	211,000	2,666,136	0.002302408	7.57371E-06	2.32741E-07	3.49112E-08	3.49112E-08	3.4213E-08	4.13422E-06
TOLUENE	Water	21	259	2.23666E-07	7.35743E-10	2.26095E-11	3.39143E-12	3.39143E-12	3.3236E-12	4.01616E-10
TOLUENE	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	2.09509E-09	2.09509E-09	2.05319E-09	2.48103E-07
TOLUENE	Land	19	3,065	2.64686E-06	8.70677E-09	2.6756E-10	4.0134E-11	4.0134E-11	3.93314E-11	4.75272E-09
TOLUENE	POTW Transfer	0	214	1.84805E-07	6.07911E-10	1.86812E-11	2.80218E-12	2.80218E-12	2.74614E-12	3.31837E-10
TOLUENE	Off-site Transfer	726	47,071	4.06493E-05	1.33715E-07	4.10908E-09	6.16362E-10	6.16362E-10	6.04035E-10	7.29902E-08
TRICHLOROETHYLENE	Air	0	65,724	5.67576E-05	1.86703E-07	5.7374E-09	8.6061E-10	8.6061E-10	8.43398E-10	1.01914E-07
TRICHLOROETHYLENE	Off-site Transfer	0	27	2.33165E-08	7.66991E-11	2.35698E-12	3.53546E-13	3.53546E-13	3.46475E-13	4.18673E-11
TRICHLOROETHYLENE	POTW Transfer			0		0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Air	22,100	127,580	0.000110175	3.62417E-07	1.11371E-08	1.67057E-09	1.67057E-09	1.63716E-09	1.97831E-07
1,2,4-TRIMETHYLBENZENE	Water	0	39	3.36794E-08	1.10788E-10	3.40452E-12	5.10678E-13	5.10678E-13	5.00464E-13	6.0475E-11
1,2,4-TRIMETHYLBENZENE	Land	6	1,188	1.02593E-06	3.37476E-09	1.03707E-10	1.5556E-11	1.5556E-11	1.52449E-11	1.84216E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	21	730	6.3041E-07	2.07372E-09	6.37256E-11	9.55884E-12	9.55884E-12	9.36767E-12	1.13197E-09
VANADIUM (FUME OR DUST)	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.44037E-13	1.44037E-13	1.41157E-13	1.70571E-11
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	6.04502E-06	1.98849E-08	6.11068E-10	9.16601E-11	9.16601E-11	8.98269E-11	1.08545E-08
VINYL ACETATE	Air			0		0	0	0	0	0
VINYL ACETATE	POTW Transfer			0		0	0	0	0	0
VINYL CHLORIDE	Air			0		0	0	0	0	0
VINYL CHLORIDE	POTW Transfer			0		0	0	0	0	0
XYLENE (MIXED ISOMERS)	Air	0	729,067	0.000629604	2.07107E-06	6.36442E-08	9.54663E-09	9.54663E-09	9.35569E-09	1.13052E-06
XYLENE (MIXED ISOMERS)	Water	0	288	2.4871E-07	8.18124E-10	2.51411E-11	3.77116E-12	3.77116E-12	3.69574E-12	4.46585E-10
XYLENE (MIXED ISOMERS)	Underground	0	31,000	2.67708E-05	8.80619E-08	2.70616E-09	4.05924E-10	4.05924E-10	3.97805E-10	4.80699E-08
XYLENE (MIXED ISOMERS)	Land	0	4,624	3.99317E-06	1.31354E-08	4.03654E-10	6.05481E-11	6.05481E-11	5.93371E-11	7.17017E-09
XYLENE (MIXED ISOMERS)	POTW Transfer	0	330	2.8498E-07	9.37433E-10	2.88075E-11	4.32112E-12	4.32112E-12	4.2347E-12	5.11712E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer	0	61,951	5.34993E-05	1.75985E-07	5.40804E-09	8.11205E-10	8.11205E-10	7.94981E-10	9.60638E-08
ZINC COMPOUNDS	Air	2,600	10,608	9.1608E-06	3.01342E-08	9.26029E-10	1.38904E-10	1.38904E-10	1.36126E-10	1.64492E-08
ZINC COMPOUNDS	Water	1,100	14,384	1.24217E-05	4.08607E-08	1.25566E-09	1.88349E-10	1.88349E-10	1.84582E-10	2.23044E-08
ZINC COMPOUNDS	Land	1,400	52,684	4.54966E-05	1.4966E-07	4.59907E-09	6.8986E-10	6.8986E-10	6.76063E-10	8.1694E-08
ZINC COMPOUNDS	POTW Transfer	0	89	7.68582E-08	2.52823E-10	7.76929E-12	1.16539E-12	1.16539E-12	1.14209E-12	1.38007E-10
ZINC COMPOUNDS	Off-site Transfer	148,147	186,534	0.000161086	5.29888E-07	1.62836E-08	2.44253E-09	2.44253E-09	2.39368E-09	2.89247E-07
TOTAL RELEASES & TRANSFERS (LBS)		4,523,599	25,639,240	0.022141405	7.28336E-05	2.23819E-06	3.35728E-07	3.35728E-07	3.29014E-07	3.97573E-05

Table A3. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			PVC FACILITY [11]		
		FACILITY ID --->	91350KYSRC26000		
		FACILITY CAPACITY [10] (LBS/YR)--->	70,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing PVC:	TRI lbs per lb of PVC [12] (attributed to PVC chemical plant):	TRI lbs per lb of PVC (attributed to oil refineries and PVC chemical plant):
AMMONIA	Air		11,260	0.000186696	0.000187853
AMMONIA	Water				1.39457E-07
AMMONIA	Underground				2.01583E-06
AMMONIA	POTW Transfer				1.61267E-10
AMMONIA	Off-site Transfer				3.56648E-11
ANTHRACENE	Air				3.79597E-09
ANTHRACENE	Land				2.51204E-10
ANTHRACENE	Off-site Transfer				1.70571E-11
ANTIMONY COMPOUNDS	Air				2.01583E-09
ANTIMONY COMPOUNDS	Land				3.8766E-09
ANTIMONY COMPOUNDS	Off-site Transfer				8.23701E-09
BARIUM COMPOUNDS	Water				2.93381E-09
BARIUM COMPOUNDS	Land				3.58508E-09
BARIUM COMPOUNDS	Off-site Transfer				3.95414E-10
BENZENE	Air				9.43829E-07
BENZENE	Water				1.64368E-10
BENZENE	Underground				2.63609E-07
BENZENE	Land				1.73827E-09
BENZENE	POTW Transfer				7.90827E-11
BENZENE	Off-site Transfer				3.04096E-08
BIPHENYL	Air				2.94622E-09
1,3-BUTADIENE	Air				6.7166E-08
1,3-BUTADIENE	Off-site Transfer				1.86077E-10
CARBON DISULFIDE	Air				1.0994E-08
CARBON DISULFIDE	Off-site Transfer				3.96964E-10
CARBON TETRACHLORIDE	Air				3.63393E-08
CARBON TETRACHLORIDE	Off-site Transfer				1.48241E-09
CARBONYL SULFIDE	Air				2.81131E-07
CHLORINE	Air				7.04953E-08
CHLORINE	Water				2.0515E-08
CHLORODIFLUOROMETHANE	Off-site Transfer				3.56648E-08
CHROMIUM COMPOUNDS	Air				4.65192E-11
CHROMIUM COMPOUNDS	Water				6.43826E-09
CHROMIUM COMPOUNDS	Land				7.89277E-09
CHROMIUM COMPOUNDS	Off-site Transfer				4.01151E-08
COBALT COMPOUNDS	Air				1.65919E-10
COBALT COMPOUNDS	Land				3.54322E-09
COBALT COMPOUNDS	Off-site Transfer				2.33226E-07
COPPER COMPOUNDS	Air				4.43483E-10
COPPER COMPOUNDS	Water				5.84592E-10
COPPER COMPOUNDS	Land				1.46722E-08
COPPER COMPOUNDS	Off-site Transfer				2.58405E-07
CRESOL (MIXED ISOMERS)	Air				4.28272E-08
CRESOL (MIXED ISOMERS)	Water				4.20069E-09
CRESOL (MIXED ISOMERS)	Underground				1.39558E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer				1.2095E-10

Table A3. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			PVC FACILITY [11]		
		FACILITY ID --->	91350KYSRC26000		
		FACILITY CAPACITY [10] (LBS/YR)--->	70,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing PVC:	TRI lbs per lb of PVC [12] (attributed to PVC chemical plant):	TRI lbs per lb of PVC (attributed to oil refineries and PVC chemical plant):
CUMENE	Air				1.00384E-07
CUMENE	Water				3.8766E-11
CUMENE	Off-site Transfer				1.24051E-10
CYCLOHEXANE	Air				3.66997E-07
CYCLOHEXANE	Water				4.49686E-11
CYCLOHEXANE	Land				3.79907E-09
CYCLOHEXANE	Off-site Transfer				4.16968E-09
1,2-DIBROMOETHANE	Air				3.00514E-09
1,2-DIBROMOETHANE	Water				1.08545E-11
1,2-DICHLOROETHANE	Air				2.06235E-08
DIETHANOLAMINE	Air				6.80359E-08
DIETHANOLAMINE	Off-site Transfer				2.07786E-07
ETHYLBENZENE	Air				3.96636E-07
ETHYLBENZENE	Water				1.14747E-10
ETHYLBENZENE	Underground				2.63609E-09
ETHYLBENZENE	Land				1.02497E-09
ETHYLBENZENE	POTW Transfer				5.89244E-11
ETHYLBENZENE	Off-site Transfer				3.03895E-08
ETHYLENE	Air				1.23743E-06
ETHYLENE	Off-site Transfer				1.4421E-10
ETHYLENE GLYCOL	Air				2.81255E-08
ETHYLENE GLYCOL	Water				2.9963E-08
ETHYLENE GLYCOL	Off-site Transfer				1.24051E-09
FORMALDEHYDE	Air				1.79285E-08
FORMALDEHYDE	Water				1.78324E-10
FORMALDEHYDE	Off-site Transfer				4.01616E-10
GLYCOL ETHERS	Air				2.70277E-09
HYDROCHLORIC ACID	Air				1.48199E-07
HYDROGEN FLUORIDE	Air				4.85971E-09
LEAD COMPOUNDS	Air				1.22501E-10
LEAD COMPOUNDS	Water				1.26998E-09
LEAD COMPOUNDS	Land				1.2233E-08
LEAD COMPOUNDS	Off-site Transfer				7.19622E-08
MANGANESE COMPOUNDS	Air				2.48103E-11
MANGANESE COMPOUNDS	Water				2.79115E-09
MANGANESE COMPOUNDS	Off-site Transfer				1.44675E-08
METHANOL	Air				6.15052E-06
METHANOL	Water				1.87162E-09
METHANOL	Off-site Transfer				1.05459E-08
2-METHOXYETHANOL	Air				9.76904E-11
METHYL ETHYL KETONE	Air				4.12309E-06
METHYL ETHYL KETONE	Water				8.93325E-09
METHYL ETHYL KETONE	Underground				2.94622E-08
METHYL ETHYL KETONE	Land				7.75321E-12
METHYL ETHYL KETONE	Off-site Transfer				1.62972E-09
METHYL ISOBUTYL KETONE	Air				3.56441E-07
METHYL ISOBUTYL KETONE	Water				6.20257E-12

Table A3. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			PVC		
			FACILITY [11]		
		FACILITY ID --->	91350KYSRC26000		
		FACILITY CAPACITY [10] (LBS/YR)--->	70,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing PVC:	TRI lbs per lb of PVC [12] (attributed to PVC chemical plant):	TRI lbs per lb of PVC (attributed to oil refineries and PVC chemical plant):
METHYL ISOBUTYL KETONE	Land				7.75321E-12
METHYL ISOBUTYL KETONE	Off-site Transfer				6.43516E-10
METHYL TERT-BUTYL ETHER	Air				1.34805E-06
METHYL TERT-BUTYL ETHER	Water				7.78887E-08
METHYL TERT-BUTYL ETHER	Underground				2.48103E-07
MOLYBDENUM TRIOXIDE	Air				2.8108E-07
MOLYBDENUM TRIOXIDE	Water				3.25635E-11
MOLYBDENUM TRIOXIDE	Land				1.47311E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer				9.19596E-07
NAPHTHALENE	Air				1.57443E-07
NAPHTHALENE	Water				2.21742E-10
NAPHTHALENE	Land				9.97063E-10
NAPHTHALENE	Off-site Transfer				1.02358E-08
N-HEXANE	Air				1.94623E-06
N-HEXANE	Water				2.21742E-10
N-HEXANE	Land				5.58541E-09
N-HEXANE	Off-site Transfer				1.02668E-08
NICKEL COMPOUNDS	Air				4.15153E-08
NICKEL COMPOUNDS	Water				2.46242E-09
NICKEL COMPOUNDS	Land				3.25712E-08
NICKEL COMPOUNDS	Off-site Transfer				1.43107E-06
NITRATE COMPOUNDS	Water				4.08263E-06
N-METHYL-2-PYRROLIDONE	Air				1.55233E-07
N-METHYL-2-PYRROLIDONE	Land				1.08545E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer				2.48103E-10
O-XYLENE	Air				1.37232E-07
O-XYLENE	Water				3.25635E-11
O-XYLENE	Land				1.33355E-10
O-XYLENE	Off-site Transfer				8.29438E-09
P-XYLENE	Air				8.91464E-07
P-XYLENE	Water				3.25635E-11
P-XYLENE	Land				1.19399E-10
P-XYLENE	Off-site Transfer				8.32539E-09
PHENANTHRENE	Air				2.57096E-09
PHENANTHRENE	Water				3.56648E-11
PHENANTHRENE	Land				6.37779E-09
PHENANTHRENE	Off-site Transfer				3.24084E-10
PHENOL	Air				1.74315E-07
PHENOL	Water				6.12348E-09
PHENOL	Underground				2.1709E-07
PHENOL	Land				3.10128E-10
PHENOL	POTW Transfer				3.51375E-09
PHENOL	Off-site Transfer				6.97789E-11
PHOSPHORIC ACID	Off-site Transfer				1.1591E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air				2.34286E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water				6.20257E-12
POLYCYCLIC AROMATIC COMPOUNDS	Land				1.34983E-08

Table A3. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			PVC		
			FACILITY [11]		
		FACILITY ID --->	91350KYSRC26000		
		FACILITY CAPACITY [10] (LBS/YR)--->	70,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing PVC:	TRI lbs per lb of PVC [12] (attributed to PVC chemical plant):	TRI lbs per lb of PVC (attributed to oil refineries and PVC chemical plant):
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer				6.83833E-10
PROPYLENE	Air				1.53128E-06
PROPYLENE	Water				1.47311E-10
STYRENE	Air				1.17694E-09
STYRENE	Land				7.75321E-12
STYRENE	Off-site Transfer				5.58231E-11
SULFURIC ACID	Air				1.74385E-08
SULFURIC ACID	Off-site Transfer				1.86077E-11
TERT-BUTYL ALCOHOL	Air				4.65192E-10
TETRACHLOROETHYLENE	Air				5.52912E-08
TETRACHLOROETHYLENE	Land				1.70571E-11
TETRACHLOROETHYLENE	Off-site Transfer				1.10251E-09
TOLUENE	Air				4.13422E-06
TOLUENE	Water				4.01616E-10
TOLUENE	Underground				2.48103E-07
TOLUENE	Land				4.75272E-09
TOLUENE	POTW Transfer				3.31837E-10
TOLUENE	Off-site Transfer				7.29902E-08
TRICHLOROETHYLENE	Air		1,320	2.18862E-05	2.19881E-05
TRICHLOROETHYLENE	Off-site Transfer				4.18673E-11
TRICHLOROETHYLENE	POTW Transfer		8	1.32644E-07	1.32644E-07
1,2,4-TRIMETHYLBENZENE	Air				1.97831E-07
1,2,4-TRIMETHYLBENZENE	Water				6.0475E-11
1,2,4-TRIMETHYLBENZENE	Land				1.84216E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer				1.13197E-09
VANADIUM (FUME OR DUST)	Land				1.70571E-11
VANADIUM (FUME OR DUST)	Off-site Transfer				1.08545E-08
VINYL ACETATE	Air		1,303	2.16043E-05	2.16043E-05
VINYL ACETATE	POTW Transfer		410	6.79798E-06	6.79798E-06
VINYL CHLORIDE	Air		860	1.42592E-05	1.42592E-05
VINYL CHLORIDE	POTW Transfer		21	3.48189E-07	3.48189E-07
XYLENE (MIXED ISOMERS)	Air				1.13052E-06
XYLENE (MIXED ISOMERS)	Water				4.46585E-10
XYLENE (MIXED ISOMERS)	Underground				4.80699E-08
XYLENE (MIXED ISOMERS)	Land				7.17017E-09
XYLENE (MIXED ISOMERS)	POTW Transfer				5.11712E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer				9.60638E-08
ZINC COMPOUNDS	Air				1.64492E-08
ZINC COMPOUNDS	Water				2.23044E-08
ZINC COMPOUNDS	Land				8.1694E-08
ZINC COMPOUNDS	POTW Transfer				1.38007E-10
ZINC COMPOUNDS	Off-site Transfer				2.89247E-07
TOTAL RELEASES & TRANSFERS (LBS)			15182	0.000251724	0.000291482

Table A3. (Continued)

FOOTNOTES

[1] Info on the top ten facilities by capacity for the petroleum refining industry comes from the website for the Sector Facility Indexing Project: Petroleum Refining Data Access, <http://es.epa.gov/oeca/sfi/petdata htm>, obtained October 1999 The TRI release data for each facility comes from the Right-to-Know Network environmental database for facility TRIs, <http·//www.rtknet.org/triinputfacility.html>, obtained October 1999.

[2] Under the "Disposition" column, the category "air" includes fugitive and stack emissions.

[3] TRI lbs/barrel of crude in was computed by: (?? lbs/yr of the TRI chemical totaled for the ten refineries) divided by (365 days/yr) divided by (3,689,000 bbl of crude in/day - total of the plant capacities for the ten refineries) divided by (0.8600).

The 0.8600 (or 86%) value is the refining capacity factor which represents % of capacity at which the refinery is actually operating. It was calculated by taking each annual total U.S. refinery throughput divided by each yearly U.S. refining total capacity for the years 1987 -1993, and averaging the values. These values were obtained from the International Petroleum Encyclopedia, 1995 edition. These were the only years that U.S. refinery throughput and capacity values were both available, and were thus used to estimate the actual rate at which the ten refineries were actually operating. Note that the throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days." It was assumed that these terms each refer to a 365 day year. See further Table 1 in the bottom right corner of this worksheet (starting at cell Z 218) for the calculation of the facility capacity factor.

[4] Conversion of "bbls of crude" to "lbs of crude", using the density of crude: bbls of crude in X 42 US gal/bbl X 3 785ee3 cm3/gal X 0.8673 g crude in/cm3 X 1 lb/ 453.6 g; or, a factor of 304.0 lbs of crude in/bbl of crude in. On this basis, the ten refineries processed 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries. this resulted in an average API (American Petroleum Institute) gravity of 31.7 degrees, or specific gravity of 0 8692. The data came from Tables P-13 and P-14 on pages 851-2 of Chemical and Process Technology Encyclopedia, Douglas M. Considine, editor-in-chief, McGraw-Hill Book Company, New York: 1974. The data from the tables was copyrighted to the Universal Oil Products Company, 1973. (API , in degrees = [141.5/specific gravity @ 60/60] - 131.5).

Table A3. (Continued)

[5] Calculating the 3.07% value: 48.4 billion lbs/yr ethylene divided by 1.575 trillion lbs crude/yr. The ethylene value comes from CMR (1997), demand for 1996

[6] From the Chemical Profile of Ethylene found in the Chemical Marketing Reporter (CMR), 1997. From Chemical Marketing Reporter (CMR, 1997), which actually says that 15% of ethylene goes to Vinyl Chloride Monomer (VCM). But, according to the Chemical Profile of Ethylene Dichloride (EDC) found in CMR (1998), 98% of EDC goes to VCM and 2% goes to ethyleneamines and chlorinated solvents. Thus, for purposes of this report it was assumed that 100% of EDC goes on to make VCM, which implies that 15% of ethylene goes to EDC.
<http.//chemexpo.com/news/newsframe.cfm?framebody=/news/profile cfm>

[7] Ibid.

[8] From the Chemical Profile of Vinyl Chloride found in the Chemical Marketing Reporter (CMR), 1998. The other 2% goes to miscellaneous, including polyvinylidene chloride and chlorinated solvents.

[9] Calculation for TRI lbs/lb PVC· "lbs of TRI chemical lbs/lb of crude in" multiplied by "1.575 trillion lbs/yr crude" divided by "13.3 billion lbs PVC (from CMR, 1998 - this value is the demand for 1996)"; or in other words, a factor of "118 lbs of crude/lb of product".

[10] Facility Capacity obtained from CMR report on PVC, 1998.

[11] The TRI release data for this facility comes from the Right-to-Know Network environmental database for facility TRIs. <http://www.rtknet.org/triinputfacility.html>

Table A3. (Continued)

[12] TRI lbs/lb of PVC was computed by: (?? lbs/yr of the TRI chemical attributed to the PVC chemical plant) divided by (70,000,000 lbs/yr - facility capacity) divided by (0.8616 - the facility capacity factor). The 0.8616 (or ~ 86%) value is the facility capacity factor which represents % of capacity at which the facility is actually operating. It was calculated by taking each yearly U.S. demand value (considered to approximate the throughput) divided by each yearly U.S. capacity for 141 different chemicals, and averaging the values. These values were obtained from ChemExpo, accessed November 1999, available from <http://www.chemexpo.com>, and make up all the chemicals listed in the "chemical profile archives " See further Table 2 in the bottom right corner of this worksheet (starting at cell AJ373) for the calculation of the facility capacity factor.

Table A4. Polycarbonate Database Generated by the Public Data Method (page order: down, then over)

IN THE PRODUCTION OF POLYCARBONATE (PC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID -->		00851HSSLVLIMET	77580MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSHI35A
REFINING CAPACITY (Barrels/day)-->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
AMMONIA	Air	60,962	160	71,376	436	49,128	505	440,000	3,500	10,000
AMMONIA	Water	24,767	25,000	2,822	2,400	13,134	2,162	0	7,350	3,600
AMMONIA	Underground	0	1,300,000	0	0	0	0	0	0	0
AMMONIA	POTW Transfer	0	0	0	0	0	104	0	0	0
AMMONIA	Off-site Transfer	0	0	0	23	0	0	0	0	0
ANTHRACENE	Air	0	0	1,029	0	895	0	0	524	0
ANTHRACENE	Land	0	0	0	0	162	0	0	0	0
ANTHRACENE	Off-site Transfer	0	0	0	0	11	0	0	0	0
ANTIMONY COMPOUNDS	Air	0	0	0	200	0	0	0	0	1,100
ANTIMONY COMPOUNDS	Land	0	0	0	0	0	0	0	0	2,500
ANTIMONY COMPOUNDS	Off-site Transfer	0	0	0	5,312	0	0	0	0	0
BARIUM COMPOUNDS	Water	0	0	0	0	1,892	0	0	0	0
BARIUM COMPOUNDS	Land	0	160	0	0	2,152	0	0	0	0
BARIUM COMPOUNDS	Off-site Transfer	0	70	0	0	185	0	0	0	0
BENZENE	Air	58,853	145,000	33,614	11,400	34,184	51,619	60,000	90,000	56,000
BENZENE	Water	15	1	43	13	11	0	0	2	0
BENZENE	Underground	0	170,000		0	0	0	0	0	0
BENZENE	Land	0	950	101	46	22	0	0	0	0
BENZENE	POTW Transfer	0	0	0	0	0	51	0	0	0
BENZENE	Off-site Transfer	4,533	4,189	357	4,666	2,390	2,010	44	1	833
BIPHENYL	Air	0	0	0	0	0	0	0	1,900	0
1,3-BUTADIENE	Air	10,848	280	338	50	3,098	1,771	18,400	1,730	6,100
1,3-BUTADIENE	Off-site Transfer	0	0	0	0	0	0	0	0	120
CARBON DISULFIDE	Air	0	0	0	0	0	0	0	7,090	0
CARBON DISULFIDE	Off-site Transfer	0	0	0	0	0	0	0	256	0
CARBON TETRACHLORIDE	Air	16,653	250	0	0	0	0	340	6,192	0
CARBON TETRACHLORIDE	Water									
CARBON TETRACHLORIDE	Off-site Transfer	0	956	0	0	0	0	0	0	0
CARBONYL SULFIDE	Air	0	0	0	0	0	0	0	110,000	0
CHLORINE	Air	0	2,500	0	0	702	255	5	24,000	18,000
CHLORINE	Water	0	0	0	0	198	32	0	13,000	0
CHLORODIFLUOROMETHANE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CHROMIUM COMPOUNDS	Air	0	0	0	0	0	0	16	0	0
CHROMIUM COMPOUNDS	Water	0	52	0	0	4,096	0	0	0	0
CHROMIUM COMPOUNDS	Land	0	36	0	0	5,054	0	0	0	0
CHROMIUM COMPOUNDS	Off-site Transfer	0	102	0	0	260	0	1,834	0	0
COBALT COMPOUNDS	Air	1	0	0	0	106	0	0	0	0
COBALT COMPOUNDS	Land	0	2	0	0	2,283	0	0	0	0
COBALT COMPOUNDS	Off-site Transfer	72,840	8,950	403	0	63,687	0	4,526	0	0
COPPER COMPOUNDS	Air	0	0	0	0	0	0	36	0	0
COPPER COMPOUNDS	Water	0	0	0	0	296	0	0	0	0
COPPER COMPOUNDS	Land	0	0	0	0	9,392	0	0	0	0
COPPER COMPOUNDS	Off-site Transfer	0	1,600	0	0	2,915	0	7	0	0
CRESOL (MIXED ISOMERS)	Air	0	0	619	0	0	0	0	27,000	0
CRESOL (MIXED ISOMERS)	Water	0	0	9	0	0	0	0	2,700	0
CRESOL (MIXED ISOMERS)	Underground	0	90,000	0	0	0	0	0	0	0
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	0	63	0	0	0	0	15	0
CUMENE	Air	1,018	0	2,265	0	3,059	23,675	0	8,148	2
CUMENE	Water	0	0	4	0	0	0	0	0	0
CUMENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CYCLOHEXANE	Air	36,837	27,300	13,632	15,830	19,595	6,580	8,900	54,000	37,000

Table A4. (Continued)

IN THE PRODUCTION OF POLYCARBONATE (PC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID -->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46384MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70802CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)-->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
CYCLOHEXANE	Water	0	1	4	24	0	0	0	0	0
CYCLOHEXANE	Land	0	2,400	0	49	0	0	0	0	0
CYCLOHEXANE	Off-site Transfer	0	0		2,600	0	0	0	9	0
1,2-DIBROMOETHANE	Air	0	0	1,938	0	0	0	0	0	0
1,2-DIBROMOETHANE	Water	0	0	7	0	0	0	0	0	0
1,2-DICHLOROETHANE	Air	0	0	0	0	0	0	0	13,300	0
DICHLOROMETHANE	Air									
DICHLOROMETHANE	Water									
DICHLOROMETHANE	Off-site Transfer									
DIETHANOLAMINE	Air	0	0	0	0	0	276	9,600	0	0
DIETHANOLAMINE	Off-site Transfer	0	0	0	0	0	134,000	0	0	0
ETHYLBENZENE	Air	36,179	11,500	23,385	3,900	6,990	33,734	20,500	57,000	13,000
ETHYLBENZENE	Water	1	0	43	1	8	0	0	0	0
ETHYLBENZENE	Underground	0	1,700	0	0	0	0	0	0	0
ETHYLBENZENE	Land	0	490	0	42	117	0	0	0	0
ETHYLBENZENE	POTW Transfer	0	0	0	0	0	38	0	0	0
ETHYLBENZENE	Off-site Transfer	3,192	403	412	5,102	1,550	4,462	610	46	0
ETHYLENE	Air	277,061	110,000	1,254	2,500	83,530	27,177	31,400	37,088	163,000
ETHYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
ETHYLENE GLYCOL	Air	0	250	600	80	3	5	0	0	0
ETHYLENE GLYCOL	Water	0	0	319	0	4	0	0	0	0
ETHYLENE GLYCOL	Off-site Transfer	0	0		800	0	0	0	0	0
FORMALDEHYDE	Air	0	0	11,562	0	0	0	0	0	0
FORMALDEHYDE	Water	0	0	115	0	0	0	0	0	0
FORMALDEHYDE	Off-site Transfer	0	0	259	0	0	0	0	0	0
GLYCOL ETHERS	Air	0	0	1,743	0	0	0	0	0	0
HYDROCHLORIC ACID	Air	0	37,000	19,901	16,000	22,653	0	19	0	0
HYDROGEN FLUORIDE	Air	0	2,800	0	0	0	255	0	0	79
4,4'-ISOPROPYLIDENEDIPHENOL	Air									
4,4'-ISOPROPYLIDENEDIPHENOL	Water									
4,4'-ISOPROPYLIDENEDIPHENOL	Off-site Transfer									
LEAD COMPOUNDS	Air	0	0	25	54	0	0	0	0	0
LEAD COMPOUNDS	Water	0	0	732	40	47	0	0	0	0
LEAD COMPOUNDS	Land	0	0			7,889	0	0	0	0
LEAD COMPOUNDS	Off-site Transfer	0	0	652	41,725	426	0	2,280	73	0
MANGANESE COMPOUNDS	Air	0	0	0	16	0	0	0	0	0
MANGANESE COMPOUNDS	Water	0	0	0	1,800	0	0	0	0	0
MANGANESE COMPOUNDS	Off-site Transfer	0	0	0	9,330	0	0	0	0	0
METHANOL	Air	4,375	2,200,250	11,975	23,000	124,331	590	8,743	99,600	3,570
METHANOL	Water	0	0	7	0	0	0	0	1,200	0
METHANOL	Off-site Transfer	0	0	195	0	0	0	0	0	6,600
2-METHOXYETHANOL	Air	0	0	0	0	63	0	0	0	0
METHYL ETHYL KETONE	Air	0	0	201,068	358,000	133,888	0	1,556,000	410,000	0
METHYL ETHYL KETONE	Water	0	0	61	0	0	0	0	5,700	0
METHYL ETHYL KETONE	Underground	0	19,000	0	0	0	0	0	0	0
METHYL ETHYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ETHYL KETONE	Off-site Transfer	0	0	0	0	1,051	0	0	0	0
METHYL ISOBUTYL KETONE	Air	0	0	96,974	0	132,893	0	0	0	0
METHYL ISOBUTYL KETONE	Water	0	0	4	0	0	0	0	0	0
METHYL ISOBUTYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ISOBUTYL KETONE	Off-site Transfer	0	0	0	0	415	0	0	0	0

Table A4. (Continued)

IN THE PRODUCTION OF POLYCARBONATE (PC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID —>		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46384MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)—>		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
METHYL TERT-BUTYL ETHER	Air	134,733	40,600	254,552	64,000	89,388	48,005	107,000	28,000	15,500
METHYL TERT-BUTYL ETHER	Water	0	42,000	30	8,200	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Air	0	0	0	0	267	0	0	0	0
MOLYBDENUM TRIOXIDE	Water	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Land	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Off-site Transfer	338,652	43,690	11,646	0	20,139	0	21,120	152,726	0
NAPHTHALENE	Air	9,324	47,014	6,427	660	779	11,790	4,380	15,990	0
NAPHTHALENE	Water	0	1	83	21	0	0	0	17	0
NAPHTHALENE	Land	17	490	0	41	94	0	0	0	0
NAPHTHALENE	Off-site Transfer	3,239	0	1,197	248	1,038	123	6	750	0
N-HEXANE	Air	180,829	93,000	47,248	51,500	116,432	18,105	133,000	96,000	216,000
N-HEXANE	Water	72	2	0	48	0	0	0	0	0
N-HEXANE	Land	0	3,500	0	100	0	0	0	0	0
N-HEXANE	Off-site Transfer	0	0	0	6,621	0	0	0	0	0
NICKEL COMPOUNDS	Air	98	0	374	0	216	21,405	1,200	200	3,000
NICKEL COMPOUNDS	Water	0	0	0	0	518	0	0	0	510
NICKEL COMPOUNDS	Land	6,412	110	0	0	6,914	69	0	0	7,500
NICKEL COMPOUNDS	Off-site Transfer	35,530	167,800	2,769	0	83,892	1,309	2	11,574	257,000
NITRATE COMPOUNDS	Water	5,275	84,000	2,005,479	70,000	174,310	0	0	73,800	0
N-METHYL-2-PYRROLIDONE	Air	0	0	73,240	11,000	15,869	0	0	0	0
N-METHYL-2-PYRROLIDONE	Land	0	0	0	700	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	0	0	0	160	0	0	0	0
O-XYLENE	Air	0	0	0	0	0	0	0	0	0
O-XYLENE	Water	0	0	0	0	0	0	0	0	0
O-XYLENE	Land	0	0	0	0	0	0	0	0	0
O-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
P-XYLENE	Air	0	0	0	0	0	0	0	0	0
P-XYLENE	Water	0	0	0	0	0	0	0	0	0
P-XYLENE	Land	0	0	0	0	0	0	0	0	0
P-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
PHENANTHRENE	Air	0	530	0	870	258	0	0	0	0
PHENANTHRENE	Water	0	1	0	22	0	0	0	0	0
PHENANTHRENE	Land	0	3,700	0	37	376	0	0	0	0
PHENANTHRENE	Off-site Transfer	0	1	0	150	58	0	0	0	0
PHENOL	Air	54,876	0	3,344	0	3,363	728	5,100	45,004	0
PHENOL	Water	1,504	950	115	0	267	193	0	920	0
PHENOL	Underground	0	140,000	0	0	0	0	0	0	0
PHENOL	Land	44	3	0	0	153	0	0	0	0
PHENOL	POTW Transfer	0	0	0	0	0	2,266	0	0	0
PHENOL	Off-site Transfer	0	0	16	0	28	1	0	0	0
PHOSGENE	Air									
PHOSPHORIC ACID	Off-site Transfer	0	0	0	0	0	74,750	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Air	809	2,920	0	1,710	339	7,517	24	1,790	0
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	3	0	1	0	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	7,600	0	110	995	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	0	0	430	11	0	0	0	0
PROPYLENE	Air	223,245	43,000	4,849	45,000	109,396	27,722	85,000	220,000	129,000
PROPYLENE	Water	0	0	95	0	0	0	0	0	0
STYRENE	Air	0	0	520	0	239	0	0	0	0
STYRENE	Land	0	0	0	0	5	0	0	0	0

Table A4. (Continued)

IN THE PRODUCTION OF POLYCARBONATE (PC), THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID —>		00851HSBLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 281SI	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)—>		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
STYRENE	Off-site Transfer	0	0	0	0	36	0	0	0	0
SULFURIC ACID	Air	1,154	3,400	0	0	0	692	0	6,000	0
SULFURIC ACID	Off-site Transfer	0	0	0	0	0	0	0	12	0
TERT-BUTYL ALCOHOL	Air	0	0	0	0	0	0	0	300	0
TETRACHLOROETHYLENE	Air	29,612	250	568	0	5	0	1,700	0	0
TETRACHLOROETHYLENE	Land	0	0	0	11	0	0	0	0	0
TETRACHLOROETHYLENE	Off-site Transfer	0	580	0	95	36	0	0	0	0
TOLUENE	Air	158,398	80,000	94,542	252,000	213,327	61,869	1,033,000	562,000	0
TOLUENE	Water	62	2	39	55	63	0	0	17	0
TOLUENE	Underground	0	160,000	0	0	0	0	0	0	0
TOLUENE	Land	1	2,800	0	180	65	0	0	0	0
TOLUENE	POTW Transfer	0	0	0	0	0	214	0	0	0
TOLUENE	Off-site Transfer	6,958	756	1,407	18,809	12,876	3,342	2,137	60	0
TRICHLOROETHYLENE	Air	0	11,000	0	0	54,724	0	0	0	0
TRICHLOROETHYLENE	Off-site Transfer	0	0	0	0	27	0	0	0	0
TRIETHYLAMINE	Air									
1,2,4-TRIMETHYLBENZENE	Air	10,474	22,300	11,222	4,844	274	13,726	20,300	22,340	0
1,2,4-TRIMETHYLBENZENE	Water	0	1	0	38	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Land	0	1,100	0	82	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	0	21	0	688	0	0	0	0	0
VANADIUM (FUME OR DUST)	Land	0	11	0	0	0	0	0	0	0
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Air	161,546	82,000	64,534	21,500	37,389	51,098	87,000	224,000	0
XYLENE (MIXED ISOMERS)	Water	24	3	0	57	202	0	0	2	0
XYLENE (MIXED ISOMERS)	Underground	0	31,000	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Land	52	3,900	0	300	372	0	0	0	0
XYLENE (MIXED ISOMERS)	POTW Transfer	0	0	0	0	0	330	0	0	0
XYLENE (MIXED ISOMERS)	Off-site Transfer	14,267	1,238	4,819	9,556	14,769	13,608	3,096	598	0
ZINC COMPOUNDS	Air	0	0	954	6,801	0	63	190	0	0
ZINC COMPOUNDS	Water	0	1,500	7,686	1,700	1,219	1,179	0	0	0
ZINC COMPOUNDS	Land	0	57	0	0	51,227	0	0	0	0
ZINC COMPOUNDS	POTW Transfer	0	0	0	0	0	89	0	0	0
ZINC COMPOUNDS	Off-site Transfer	0	0	1,603	8,660	1,019	27,069	36	0	0
TOTAL RELEASES & TRANSFERS (LBS)		1,985,342	5,453,186	3,099,268	1,092,284	1,747,909	676,563	3,667,551	2,443,524	950,014

Table A4. (Continued)

		Facility 10	Totals								
FACILITY ID -->		39567CHVRNPOBOX									
REFINING CAPACITY (Barrels/day)-->		295000	3689000								
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	0.88% of crude to benzene[5]:	22% of benzene to cumene[6]	100% of cumene to cumene hydroperoxide[7]	37.9% of cumene hydroperoxide to acetone[8]		TRI lbs/lb of crude in:
AMMONIA	Air	110,210	746,277	0.000644466	2.11995E-06	1.86556E-08	4.10423E-09	4.10423E-09	1.5555E-09		2.11995E-06
AMMONIA	Water	8,700	89,935	7.76656E-05	2.55479E-07	2.24822E-09	4.94607E-10	4.94607E-10	1.87456E-10		2.55479E-07
AMMONIA	Underground	0	1,300,000	0.001122647	3.69292E-06	3.24977E-08	7.14949E-09	7.14949E-09	2.70966E-09		3.69292E-06
AMMONIA	POTW Transfer	0	104	8.98118E-08	2.95434E-10	2.59982E-12	5.71959E-13	5.71959E-13	2.16773E-13		2.95434E-10
AMMONIA	Off-site Transfer	0	23	1.98622E-08	6.53363E-11	5.74959E-13	1.26491E-13	1.26491E-13	4.79401E-14		6.53363E-11
ANTHRACENE	Air	0	2,448	2.11403E-06	6.95405E-09	6.11956E-11	1.3463E-11	1.3463E-11	5.10249E-12		6.95405E-09
ANTHRACENE	Land	0	162	1.39899E-07	4.60195E-10	4.04971E-12	8.90937E-13	8.90937E-13	3.37665E-13		4.60195E-10
ANTHRACENE	Off-site Transfer	0	11	9.49932E-09	3.12478E-11	2.7498E-13	6.04957E-14	6.04957E-14	2.29279E-14		3.12478E-11
ANTIMONY COMPOUNDS	Air	0	1,300	1.12265E-06	3.69292E-09	3.24977E-11	7.14949E-12	7.14949E-12	2.70966E-12		3.69292E-09
ANTIMONY COMPOUNDS	Land	0	2,500	2.15894E-06	7.10177E-09	6.24956E-11	1.3749E-11	1.3749E-11	5.21088E-12		7.10177E-09
ANTIMONY COMPOUNDS	Off-site Transfer	0	5,312	4.58731E-06	1.50898E-08	1.32791E-10	2.92139E-11	2.92139E-11	1.10721E-11		1.50898E-08
BARIUM COMPOUNDS	Water	0	1,892	1.63388E-06	5.37462E-09	4.72966E-11	1.04053E-11	1.04053E-11	3.94359E-12		5.37462E-09
BARIUM COMPOUNDS	Land	0	2,312	1.99659E-06	6.56771E-09	5.77959E-11	1.27151E-11	1.27151E-11	4.81902E-12		6.56771E-09
BARIUM COMPOUNDS	Off-site Transfer	0	255	2.20212E-07	7.2438E-10	6.37455E-12	1.4024E-12	1.4024E-12	5.3151E-13		7.2438E-10
BENZENE	Air	68,000	608,670	0.000525632	1.72905E-06	1.52157E-08	3.34745E-09	3.34745E-09	1.26868E-09		1.72905E-06
BENZENE	Water	21	106	9.15389E-08	3.01115E-10	2.64981E-12	5.82959E-13	5.82959E-13	2.20941E-13		3.01115E-10
BENZENE	Underground	0	170,000	0.000146808	4.8292E-07	4.2497E-09	9.34933E-10	9.34933E-10	3.5434E-10		4.8292E-07
BENZENE	Land	2	1,121	9.68068E-07	3.18443E-09	2.8023E-11	6.16506E-12	6.16506E-12	2.33656E-12		3.18443E-09
BENZENE	POTW Transfer	0	51	4.40423E-08	1.44876E-10	1.27491E-12	2.8048E-13	2.8048E-13	1.06302E-13		1.44876E-10
BENZENE	Off-site Transfer	588	19,611	1.69356E-05	5.57091E-08	4.9024E-10	1.07853E-10	1.07853E-10	4.08762E-11		5.57091E-08
BIPHENYL	Air	0	1,900	1.64079E-06	5.39734E-09	4.74966E-11	1.04493E-11	1.04493E-11	3.96027E-12		5.39734E-09
1,3-BUTADIENE	Air	700	43,315	3.74057E-05	1.23045E-07	1.0828E-09	2.38216E-10	2.38216E-10	9.02837E-11		1.23045E-07
1,3-BUTADIENE	Off-site Transfer	0	120	1.03629E-07	3.40885E-10	2.99979E-12	6.59953E-13	6.59953E-13	2.50122E-13		3.40885E-10
CARBON DISULFIDE	Air	0	7,090	6.12275E-06	2.01406E-08	1.77237E-10	3.89922E-11	3.89922E-11	1.47781E-11		2.01406E-08
CARBON DISULFIDE	Off-site Transfer	0	256	2.21075E-07	7.27221E-10	6.39954E-12	1.4079E-12	1.4079E-12	5.33594E-13		7.27221E-10
CARBON TETRACHLORIDE	Air	0	23,435	2.02379E-05	6.6572E-08	5.85833E-10	1.28883E-10	1.28883E-10	4.88468E-11		6.6572E-08
CARBON TETRACHLORIDE	Water			0							
CARBON TETRACHLORIDE	Off-site Transfer	0	956	8.25578E-07	2.71572E-09	2.38983E-11	5.25763E-12	5.25763E-12	1.99264E-12		2.71572E-09
CARBONYL SULFIDE	Air	71,300	181,300	0.000156566	5.1502E-07	4.53218E-09	9.97079E-10	9.97079E-10	3.77893E-10		5.1502E-07
CHLORINE	Air	0	45,462	3.92598E-05	1.29144E-07	1.13647E-09	2.50023E-10	2.50023E-10	9.47588E-11		1.29144E-07
CHLORINE	Water	0	13,230	1.14251E-05	3.75826E-08	3.30726E-10	7.27598E-11	7.27598E-11	2.7576E-11		3.75826E-08
CHLORODIFLUOROMETHANE	Off-site Transfer	23,000	23,000	1.98622E-05	6.53363E-08	5.74959E-10	1.26491E-10	1.26491E-10	4.79401E-11		6.53363E-08
CHROMIUM COMPOUNDS	Air	14	30	2.59072E-08	8.52212E-11	7.49947E-13	1.64988E-13	1.64988E-13	6.25306E-14		8.52212E-11
CHROMIUM COMPOUNDS	Water	4	4,152	3.58556E-06	1.17946E-08	1.03793E-10	2.28344E-11	2.28344E-11	8.65423E-12		1.17946E-08
CHROMIUM COMPOUNDS	Land	0	5,090	4.3956E-06	1.44592E-08	1.27241E-10	2.7993E-11	2.7993E-11	1.06094E-11		1.44592E-08
CHROMIUM COMPOUNDS	Off-site Transfer	23,674	25,870	2.23407E-05	7.34891E-08	6.46704E-10	1.42275E-10	1.42275E-10	5.39222E-11		7.34891E-08
COBALT COMPOUNDS	Air	0	107	9.24025E-08	3.03956E-10	2.67481E-12	5.88458E-13	5.88458E-13	2.23026E-13		3.03956E-10
COBALT COMPOUNDS	Land	0	2,285	1.97327E-06	6.49102E-09	5.71209E-11	1.25666E-11	1.25666E-11	4.76274E-12		6.49102E-09
COBALT COMPOUNDS	Off-site Transfer	0	150,406	0.000129887	4.27259E-07	3.75988E-09	8.27174E-10	8.27174E-10	3.13499E-10		4.27259E-07
COPPER COMPOUNDS	Air	250	286	2.46982E-07	8.12442E-10	7.14949E-12	1.57289E-12	1.57289E-12	5.96125E-13		8.12442E-10
COPPER COMPOUNDS	Water	81	377	3.25568E-07	1.07095E-09	9.42433E-12	2.07335E-12	2.07335E-12	7.85801E-13		1.07095E-09
COPPER COMPOUNDS	Land	70	9,462	8.17115E-06	2.68788E-08	2.36533E-10	5.20373E-11	5.20373E-11	1.97221E-11		2.68788E-08
COPPER COMPOUNDS	Off-site Transfer	162,122	166,644	0.00014391	4.73387E-07	4.1658E-09	9.16477E-10	9.16477E-10	3.47345E-10		4.73387E-07
CRESOL (MIXED ISOMERS)	Air	0	27,619	2.38511E-05	7.84575E-08	6.90426E-10	1.51894E-10	1.51894E-10	5.75677E-11		7.84575E-08
CRESOL (MIXED ISOMERS)	Water	0	2,709	2.33942E-06	7.69548E-09	6.77202E-11	1.48984E-11	1.48984E-11	5.64651E-12		7.69548E-09
CRESOL (MIXED ISOMERS)	Underground	0	90,000	7.77217E-05	2.55664E-07	2.24984E-09	4.94965E-10	4.94965E-10	1.87592E-10		2.55664E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	78	6.73588E-08	2.21575E-10	1.94986E-12	4.28969E-13	4.28969E-13	1.62579E-13		2.21575E-10
CUMENE	Air	26,570	64,737	5.59053E-05	1.83899E-07	1.61831E-09	3.56028E-10	3.56028E-10	1.34935E-10		1.83899E-07
CUMENE	Water	21	25	2.15894E-08	7.10177E-11	6.24956E-13	1.3749E-13	1.3749E-13	5.21088E-14		7.10177E-11
CUMENE	Off-site Transfer	80	80	6.9086E-08	2.27257E-10	1.99986E-12	4.39969E-13	4.39969E-13	1.66748E-13		2.27257E-10
CYCLOHEXANE	Air	17,000	236,674	0.000204386	6.72321E-07	5.91643E-09	1.30161E-09	1.30161E-09	4.93312E-10		6.72321E-07

Table A4. (Continued)

		Facility 10	Totals								
FACILITY ID -->		39567CHVRNPOBOX									
REFINING CAPACITY (Barrels/day)-->		295000	3689000								
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	0.88% of crude to benzene[5]:	22% of benzene to cumene[6]	100% of cumene to cumene hydroperoxide[7]	37.9% of cumene hydroperoxide to acetone[8]		TRI lbs/lb of crude in:
CYCLOHEXANE	Water	0	29	2.50437E-08	8.23805E-11	7.24948E-13	1.59489E-13	1.59489E-13	6.04462E-14		8.23805E-11
CYCLOHEXANE	Land	1	2,450	2.11576E-06	6.95973E-09	6.12456E-11	1.3474E-11	1.3474E-11	5.10666E-12		6.95973E-09
CYCLOHEXANE	Off-site Transfer	80	2,689	2.32215E-06	7.63866E-09	6.72202E-11	1.47884E-11	1.47884E-11	5.60482E-12		7.63866E-09
1,2-DIBROMOETHANE	Air	0	1,938	1.67361E-06	5.50529E-09	4.84466E-11	1.06582E-11	1.06582E-11	4.03947E-12		5.50529E-09
1,2-DIBROMOETHANE	Water	0	7	6.04502E-09	1.98849E-11	1.74988E-13	3.84973E-14	3.84973E-14	1.45905E-14		1.98849E-11
1,2-DICHLOROETHANE	Air	0	13,300	1.14855E-05	3.77814E-08	3.32476E-10	7.31448E-11	7.31448E-11	2.77219E-11		3.77814E-08
DICHLOROMETHANE	Air			0							
DICHLOROMETHANE	Water			0							
DICHLOROMETHANE	Off-site Transfer			0							
DIETHANOLAMINE	Air	34,000	43,876	3.78902E-05	1.24639E-07	1.09682E-09	2.41301E-10	2.41301E-10	9.1453E-11		1.24639E-07
DIETHANOLAMINE	Off-site Transfer	0	134,000	0.000115719	3.80655E-07	3.34976E-09	7.36948E-10	7.36948E-10	2.79303E-10		3.80655E-07
ETHYLBENZENE	Air	49,600	255,788	0.000220892	7.26619E-07	6.39425E-09	1.40673E-09	1.40673E-09	5.33152E-10		7.26619E-07
ETHYLBENZENE	Water	21	74	6.39045E-08	2.10212E-10	1.84987E-12	4.06971E-13	4.06971E-13	1.54242E-13		2.10212E-10
ETHYLBENZENE	Underground	0	1,700	1.46808E-06	4.8292E-09	4.2497E-11	9.34933E-12	9.34933E-12	3.5434E-12		4.8292E-09
ETHYLBENZENE	Land	12	661	5.70823E-07	1.87771E-09	1.65238E-11	3.63524E-12	3.63524E-12	1.37776E-12		1.87771E-09
ETHYLBENZENE	POTW Transfer	0	38	3.28158E-08	1.07947E-10	9.49932E-13	2.08985E-13	2.08985E-13	7.92054E-14		1.07947E-10
ETHYLBENZENE	Off-site Transfer	3,821	19,598	1.69243E-05	5.56722E-08	4.89915E-10	1.07781E-10	1.07781E-10	4.08491E-11		5.56722E-08
ETHYLENE	Air	65,000	798,010	0.000689141	2.26691E-06	1.99488E-08	4.38874E-09	4.38874E-09	1.66333E-09		2.26691E-06
ETHYLENE	Off-site Transfer	93	93	8.03125E-08	2.64186E-10	2.32483E-12	5.11464E-13	5.11464E-13	1.93845E-13		2.64186E-10
ETHYLENE GLYCOL	Air	17,200	18,138	1.56635E-05	5.15247E-08	4.53418E-10	9.97519E-11	9.97519E-11	3.7806E-11		5.15247E-08
ETHYLENE GLYCOL	Water	19,000	19,323	1.66869E-05	5.4891E-08	4.83041E-10	1.06269E-10	1.06269E-10	4.02759E-11		5.4891E-08
ETHYLENE GLYCOL	Off-site Transfer	0	800	6.9086E-07	2.27257E-09	1.99986E-11	4.39969E-12	4.39969E-12	1.66748E-12		2.27257E-09
FORMALDEHYDE	Air	0	11,562	9.98465E-06	3.28443E-08	2.89029E-10	6.35865E-11	6.35865E-11	2.40993E-11		3.28443E-08
FORMALDEHYDE	Water	0	115	9.93111E-08	3.26681E-10	2.8748E-12	6.32455E-13	6.32455E-13	2.397E-13		3.26681E-10
FORMALDEHYDE	Off-site Transfer	0	259	2.23666E-07	7.35743E-10	6.47454E-12	1.4244E-12	1.4244E-12	5.39847E-13		7.35743E-10
GLYCOL ETHERS	Air	0	1,743	1.50521E-06	4.95135E-09	4.35719E-11	9.58582E-12	9.58582E-12	3.63303E-12		4.95135E-09
HYDROCHLORIC ACID	Air	0	95,573	8.25344E-05	2.71495E-07	2.38916E-09	5.25614E-10	5.25614E-10	1.99208E-10		2.71495E-07
HYDROGEN FLUORIDE	Air	0	3,134	2.70644E-06	8.90278E-09	7.83444E-11	1.72358E-11	1.72358E-11	6.53236E-12		8.90278E-09
4,4'-ISOPROPYLIDENEDIPHENOL	Air			0							
4,4'-ISOPROPYLIDENEDIPHENOL	Water			0							
4,4'-ISOPROPYLIDENEDIPHENOL	Off-site Transfer			0							
LEAD COMPOUNDS	Air	0	79	6.82224E-08	2.24416E-10	1.97486E-12	4.34469E-13	4.34469E-13	1.64664E-13		2.24416E-10
LEAD COMPOUNDS	Water	0	819	7.07268E-07	2.32654E-09	2.04735E-11	4.50418E-12	4.50418E-12	1.70708E-12		2.32654E-09
LEAD COMPOUNDS	Land	0	7,889	6.81274E-06	2.24103E-08	1.97211E-10	4.33864E-11	4.33864E-11	1.64435E-11		2.24103E-08
LEAD COMPOUNDS	Off-site Transfer	1,252	46,408	4.00768E-05	1.31832E-07	1.16012E-09	2.55226E-10	2.55226E-10	9.67306E-11		1.31832E-07
MANGANESE COMPOUNDS	Air	0	16	1.38172E-08	4.54513E-11	3.99972E-13	8.79937E-14	8.79937E-14	3.33496E-14		4.54513E-11
MANGANESE COMPOUNDS	Water	0	1,800	1.55443E-06	5.11327E-09	4.49968E-11	9.8993E-12	9.8993E-12	3.75183E-12		5.11327E-09
MANGANESE COMPOUNDS	Off-site Transfer	0	9,330	8.05715E-06	2.65038E-08	2.33233E-10	5.13114E-11	5.13114E-11	1.9447E-11		2.65038E-08
METHANOL	Air	1,490,000	3,966,434	0.003425313	1.12675E-05	9.91538E-08	2.18138E-08	2.18138E-08	8.26744E-09		1.12675E-05
METHANOL	Water	0	1,207	1.04233E-06	3.42873E-09	3.01729E-11	6.63803E-12	6.63803E-12	2.51581E-12		3.42873E-09
METHANOL	Off-site Transfer	6	6,801	5.87317E-06	1.93196E-08	1.70013E-10	3.74028E-11	3.74028E-11	1.41757E-11		1.93196E-08
2-METHOXYETHANOL	Air	0	63	5.44052E-08	1.78965E-10	1.57489E-12	3.46475E-13	3.46475E-13	1.31314E-13		1.78965E-10
METHYL ETHYL KETONE	Air	0	2,658,956	0.002296208	7.55331E-06	6.64692E-08	1.46232E-08	1.46232E-08	5.5422E-09		7.55331E-06
METHYL ETHYL KETONE	Water	0	5,761	4.97506E-06	1.63653E-08	1.44015E-10	3.16832E-11	3.16832E-11	1.2008E-11		1.63653E-08
METHYL ETHYL KETONE	Underground	0	19,000	1.64079E-05	5.39734E-08	4.74966E-10	1.04493E-10	1.04493E-10	3.96027E-11		5.39734E-08
METHYL ETHYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	1.24991E-13	2.7498E-14	2.7498E-14	1.04218E-14		1.42035E-11
METHYL ETHYL KETONE	Off-site Transfer	0	1,051	9.07617E-07	2.98558E-09	2.62731E-11	5.78009E-12	5.78009E-12	2.19065E-12		2.98558E-09
METHYL ISOBUTYL KETONE	Air	0	229,867	0.000198507	6.52985E-07	5.74627E-09	1.26418E-09	1.26418E-09	4.79124E-10		6.52985E-07
METHYL ISOBUTYL KETONE	Water	0	4	3.4543E-09	1.13628E-11	9.99929E-14	2.19984E-14	2.19984E-14	8.33741E-15		1.13628E-11
METHYL ISOBUTYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	1.24991E-13	2.7498E-14	2.7498E-14	1.04218E-14		1.42035E-11
METHYL ISOBUTYL KETONE	Off-site Transfer	0	415	3.58384E-07	1.17889E-09	1.03743E-11	2.28234E-12	2.28234E-12	8.65006E-13		1.17889E-09

Table A4. (Continued)

FACILITY ID —>		Facility 10 39567CHVRNPOBOX	Totals								
REFINING CAPACITY (Barrels/day)—>		295000	3689000								
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	0.88% of crude to benzene[5]:	22% of benzene to cumene[6]	100% of cumene to cumene hydroperoxide[7]	37.9% of cumene hydroperoxide to acetone[8]		TRI lbs/lb of crude in:
METHYL TERT-BUTYL ETHER	Air	87,570	869,348	0.000750747	2.46956E-06	2.17322E-08	4.78107E-09	4.78107E-09	1.81203E-09		2.46956E-06
METHYL TERT-BUTYL ETHER	Water	0	50,230	4.33774E-05	1.42689E-07	1.25566E-09	2.76245E-10	2.76245E-10	1.04697E-10		1.42689E-07
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0.000138172	4.54513E-07	3.99972E-09	8.79937E-10	8.79937E-10	3.33496E-10		4.54513E-07
MOLYBDENUM TRIOXIDE	Air	181,000	181,267	0.000156538	5.14926E-07	4.53135E-09	9.96898E-10	9.96898E-10	3.77824E-10		5.14926E-07
MOLYBDENUM TRIOXIDE	Water	21	21	1.81351E-08	5.96548E-11	5.24963E-13	1.15492E-13	1.15492E-13	4.37714E-14		5.96548E-11
MOLYBDENUM TRIOXIDE	Land	95	95	8.20396E-08	2.69867E-10	2.37483E-12	5.22463E-13	5.22463E-13	1.98013E-13		2.69867E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer	5,069	593,042	0.000512136	1.68466E-06	1.4825E-08	3.2615E-09	3.2615E-09	1.23611E-09		1.68466E-06
NAPHTHALENE	Air	5,170	101,534	8.76822E-05	2.88428E-07	2.53817E-09	5.58397E-10	5.58397E-10	2.11633E-10		2.88428E-07
NAPHTHALENE	Water	21	143	1.23491E-07	4.06221E-10	3.57475E-12	7.86444E-13	7.86444E-13	2.98062E-13		4.06221E-10
NAPHTHALENE	Land	1	643	5.55279E-07	1.82657E-09	1.60739E-11	3.53625E-12	3.53625E-12	1.34024E-12		1.82657E-09
NAPHTHALENE	Off-site Transfer	0	6,601	5.70046E-06	1.87515E-08	1.65013E-10	3.63029E-11	3.63029E-11	1.37588E-11		1.87515E-08
N-HEXANE	Air	303,000	1,255,114	0.001083885	3.56541E-06	3.13756E-08	6.90264E-09	6.90264E-09	2.6161E-09		3.56541E-06
N-HEXANE	Water	21	143	1.23491E-07	4.06221E-10	3.57475E-12	7.86444E-13	7.86444E-13	2.98062E-13		4.06221E-10
N-HEXANE	Land	2	3,602	3.1106E-06	1.02322E-08	9.00436E-11	1.98096E-11	1.98096E-11	7.50783E-12		1.02322E-08
N-HEXANE	Off-site Transfer	0	6,621	5.71773E-06	1.88083E-08	1.65513E-10	3.64129E-11	3.64129E-11	1.38005E-11		1.88083E-08
NICKEL COMPOUNDS	Air	280	26,773	2.31205E-05	7.60542E-08	6.69277E-10	1.47241E-10	1.47241E-10	5.58043E-11		7.60542E-08
NICKEL COMPOUNDS	Water	560	1,588	1.37136E-06	4.51104E-09	3.96972E-11	8.73338E-12	8.73338E-12	3.30995E-12		4.51104E-09
NICKEL COMPOUNDS	Land	0	21,005	1.81394E-05	5.96691E-08	5.25088E-10	1.15519E-10	1.15519E-10	4.37818E-11		5.96691E-08
NICKEL COMPOUNDS	Off-site Transfer	363,011	922,887	0.000796982	2.62165E-06	2.30705E-08	5.07552E-09	5.07552E-09	1.92362E-09		2.62165E-06
NITRATE COMPOUNDS	Water	220,000	2,632,864	0.002273675	7.4792E-06	6.58169E-08	1.44797E-08	1.44797E-08	5.48781E-09		7.4792E-06
N-METHYL-2-PYRROLIDONE	Air	0	100,109	8.64516E-05	2.8438E-07	2.50255E-09	5.5056E-10	5.5056E-10	2.08662E-10		2.8438E-07
N-METHYL-2-PYRROLIDONE	Land	0	700	6.04502E-07	1.98849E-09	1.74988E-11	3.84973E-12	3.84973E-12	1.45905E-12		1.98849E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	160	1.38172E-07	4.54513E-10	3.99972E-12	8.79937E-13	8.79937E-13	3.33496E-13		4.54513E-10
O-XYLENE	Air	88,500	88,500	7.64264E-05	2.51403E-07	2.21234E-09	4.86715E-10	4.86715E-10	1.84465E-10		2.51403E-07
O-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	5.24963E-13	1.15492E-13	1.15492E-13	4.37714E-14		5.96548E-11
O-XYLENE	Land	86	86	7.42674E-08	2.44301E-10	2.14985E-12	4.72966E-13	4.72966E-13	1.79254E-13		2.44301E-10
O-XYLENE	Off-site Transfer	5,349	5,349	4.61926E-06	1.51949E-08	1.33715E-10	2.94174E-11	2.94174E-11	1.11492E-11		1.51949E-08
P-XYLENE	Air	574,900	574,900	0.000496469	1.63312E-06	1.43715E-08	3.16173E-09	3.16173E-09	1.19829E-09		1.63312E-06
P-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	5.24963E-13	1.15492E-13	1.15492E-13	4.37714E-14		5.96548E-11
P-XYLENE	Land	77	77	6.64953E-08	2.18734E-10	1.92486E-12	4.2347E-13	4.2347E-13	1.60495E-13		2.18734E-10
P-XYLENE	Off-site Transfer	5,369	5,369	4.63653E-06	1.52518E-08	1.34215E-10	2.95274E-11	2.95274E-11	1.11909E-11		1.52518E-08
PHENANTHRENE	Air	0	1,658	1.43181E-06	4.70989E-09	4.14471E-11	9.11835E-12	9.11835E-12	3.45586E-12		4.70989E-09
PHENANTHRENE	Water	0	23	1.98622E-08	6.53363E-11	5.74959E-13	1.26491E-13	1.26491E-13	4.79401E-14		6.53363E-11
PHENANTHRENE	Land	0	4,113	3.55188E-06	1.16838E-08	1.02818E-10	2.26199E-11	2.26199E-11	8.57294E-12		1.16838E-08
PHENANTHRENE	Off-site Transfer	0	209	1.80487E-07	5.93708E-10	5.22463E-12	1.14942E-12	1.14942E-12	4.3563E-13		5.93708E-10
PHENOL	Air	0	112,415	9.70788E-05	3.19338E-07	2.81018E-09	6.18239E-10	6.18239E-10	2.34312E-10		3.19338E-07
PHENOL	Water	0	3,949	3.41026E-06	1.1218E-08	9.8718E-11	2.1718E-11	2.1718E-11	8.23111E-12		1.1218E-08
PHENOL	Underground	0	140,000	0.0001209	3.97699E-07	3.49975E-09	7.69945E-10	7.69945E-10	2.91809E-10		3.97699E-07
PHENOL	Land	0	200	1.72715E-07	5.68141E-10	4.99964E-12	1.09992E-12	1.09992E-12	4.1687E-13		5.68141E-10
PHENOL	POTW Transfer	0	2,266	1.95686E-06	6.43704E-09	5.6646E-11	1.24621E-11	1.24621E-11	4.72314E-12		6.43704E-09
PHENOL	Off-site Transfer	0	45	3.88609E-08	1.27832E-10	1.12492E-12	2.47482E-13	2.47482E-13	9.37958E-14		1.27832E-10
PHOSGENE	Air			0			0	0	0		
PHOSPHORIC ACID	Off-site Transfer	0	74,750	6.45522E-05	2.12343E-07	1.86862E-09	4.11096E-10	4.11096E-10	1.55805E-10		2.12343E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air	0	15,109	1.30478E-05	4.29202E-08	3.77698E-10	8.30936E-11	8.30936E-11	3.14925E-11		4.29202E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	4	3.4543E-09	1.13628E-11	9.99929E-14	2.19984E-14	2.19984E-14	8.33741E-15		1.13628E-11
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	8,705	7.51742E-06	2.47284E-08	2.1761E-10	4.78741E-11	4.78741E-11	1.81443E-11		2.47284E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	441	3.80837E-07	1.25275E-09	1.10242E-11	2.42533E-12	2.42533E-12	9.19199E-13		1.25275E-09
PROPYLENE	Air	100,300	987,512	0.000852791	2.80523E-06	2.4686E-08	5.43093E-09	5.43093E-09	2.05832E-09		2.80523E-06
PROPYLENE	Water	0	95	8.20396E-08	2.69867E-10	2.37483E-12	5.22463E-13	5.22463E-13	1.98013E-13		2.69867E-10
STYRENE	Air	0	759	6.55453E-07	2.1561E-09	1.89737E-11	4.1742E-12	4.1742E-12	1.58202E-12		2.1561E-09
STYRENE	Land	0	5	4.31787E-09	1.42035E-11	1.24991E-13	2.7498E-14	2.7498E-14	1.04218E-14		1.42035E-11

Table A4. (Continued)

		Facility 10	Totals								
FACILITY ID --->		39567CHVRNPOBOX									
REFINING CAPACITY (Barrels/day)--->		295000	3689000								
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	0.88% of crude to benzene[5]:	22% of benzene to cumene[6]	100% of cumene to cumene hydroperoxide[7]	37.9% of cumene hydroperoxide to acetone[8]		TRI lbs/lb of crude in:
STYRENE	Off-site Transfer	0	36	3.10887E-08	1.02265E-10	8.99936E-13	1.97986E-13	1.97986E-13	7.50367E-14		1.02265E-10
SULFURIC ACID	Air	0	11,246	9.71176E-06	3.19466E-08	2.8113E-10	6.18486E-11	6.18486E-11	2.34406E-11		3.19466E-08
SULFURIC ACID	Off-site Transfer	0	12	1.03629E-08	3.40885E-11	2.99979E-13	6.59953E-14	6.59953E-14	2.50122E-14		3.40885E-11
TERT-BUTYL ALCOHOL	Air	0	300	2.59072E-07	8.52212E-10	7.49947E-12	1.64988E-12	1.64988E-12	6.25306E-13		8.52212E-10
TETRACHLOROETHYLENE	Air	3,522	35,657	3.07925E-05	1.01291E-07	8.91362E-10	1.961E-10	1.961E-10	7.43217E-11		1.01291E-07
TETRACHLOROETHYLENE	Land	0	11	9.49932E-09	3.12478E-11	2.7498E-13	6.04957E-14	6.04957E-14	2.29279E-14		3.12478E-11
TETRACHLOROETHYLENE	Off-site Transfer	0	711	6.14002E-07	2.01974E-09	1.77737E-11	3.91022E-12	3.91022E-12	1.48197E-12		2.01974E-09
TOLUENE	Air	211,000	2,666,136	0.002302408	7.57371E-06	6.66487E-08	1.46627E-08	1.46627E-08	5.55717E-09		7.57371E-06
TOLUENE	Water	21	259	2.23666E-07	7.35743E-10	6.47454E-12	1.4244E-12	1.4244E-12	5.39847E-13		7.35743E-10
TOLUENE	Underground	0	160,000	0.000138172	4.54513E-07	3.99972E-09	8.79937E-10	8.79937E-10	3.33496E-10		4.54513E-07
TOLUENE	Land	19	3,065	2.64686E-06	8.70677E-09	7.66195E-11	1.68563E-11	1.68563E-11	6.38854E-12		8.70677E-09
TOLUENE	POTW Transfer	0	214	1.84805E-07	6.07911E-10	5.34962E-12	1.17692E-12	1.17692E-12	4.46051E-13		6.07911E-10
TOLUENE	Off-site Transfer	726	47,071	4.06493E-05	1.33715E-07	1.17669E-09	2.58872E-10	2.58872E-10	9.81125E-11		1.33715E-07
TRICHLOROETHYLENE	Air	0	65,724	5.67576E-05	1.86703E-07	1.64298E-09	3.61456E-10	3.61456E-10	1.36992E-10		1.86703E-07
TRICHLOROETHYLENE	Off-site Transfer	0	27	2.33165E-08	7.66991E-11	6.74952E-13	1.48489E-13	1.48489E-13	5.62775E-14		7.66991E-11
TRIETHYLAMINE	Air			0			0	0	0		
1,2,4-TRIMETHYLBENZENE	Air	22,100	127,580	0.000110175	3.62417E-07	3.18927E-09	7.0164E-10	7.0164E-10	2.65922E-10		3.62417E-07
1,2,4-TRIMETHYLBENZENE	Water	0	39	3.36794E-08	1.10788E-10	9.74931E-13	2.14485E-13	2.14485E-13	8.12897E-14		1.10788E-10
1,2,4-TRIMETHYLBENZENE	Land	6	1,188	1.02593E-06	3.37476E-09	2.96979E-11	6.53354E-12	6.53354E-12	2.47621E-12		3.37476E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	21	730	6.3041E-07	2.07372E-09	1.82487E-11	4.01471E-12	4.01471E-12	1.52158E-12		2.07372E-09
VANADIUM (FUME OR DUST)	Land	0	11	9.49932E-09	3.12478E-11	2.7498E-13	6.04957E-14	6.04957E-14	2.29279E-14		3.12478E-11
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	6.04502E-06	1.98849E-08	1.74988E-10	3.84973E-11	3.84973E-11	1.45905E-11		1.98849E-08
XYLENE (MIXED ISOMERS)	Air	0	729,067	0.000629604	2.07107E-06	1.82254E-08	4.00958E-09	4.00958E-09	1.51963E-09		2.07107E-06
XYLENE (MIXED ISOMERS)	Water	0	288	2.4871E-07	8.18124E-10	7.19949E-12	1.58389E-12	1.58389E-12	6.00293E-13		8.18124E-10
XYLENE (MIXED ISOMERS)	Underground	0	31,000	2.67708E-05	8.80619E-08	7.74945E-10	1.70488E-10	1.70488E-10	6.46149E-11		8.80619E-08
XYLENE (MIXED ISOMERS)	Land	0	4,624	3.99317E-06	1.31354E-08	1.15592E-10	2.54302E-11	2.54302E-11	9.63804E-12		1.31354E-08
XYLENE (MIXED ISOMERS)	POTW Transfer	0	330	2.8498E-07	9.37433E-10	8.24941E-12	1.81487E-12	1.81487E-12	6.87836E-13		9.37433E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer	0	61,951	5.34993E-05	1.75985E-07	1.54866E-09	3.40706E-10	3.40706E-10	1.29128E-10		1.75985E-07
ZINC COMPOUNDS	Air	2,600	10,608	9.1608E-06	3.01342E-08	2.65181E-10	5.83399E-11	5.83399E-11	2.21108E-11		3.01342E-08
ZINC COMPOUNDS	Water	1,100	14,384	1.24217E-05	4.08607E-08	3.59574E-10	7.91064E-11	7.91064E-11	2.99813E-11		4.08607E-08
ZINC COMPOUNDS	Land	1,400	52,684	4.54966E-05	1.4966E-07	1.31701E-09	2.89741E-10	2.89741E-10	1.09812E-10		1.4966E-07
ZINC COMPOUNDS	POTW Transfer	0	89	7.68582E-08	2.52823E-10	2.22484E-12	4.89465E-13	4.89465E-13	1.85507E-13		2.52823E-10
ZINC COMPOUNDS	Off-site Transfer	148,147	186,534	0.000161086	5.29888E-07	4.66302E-09	1.02586E-09	1.02586E-09	3.88802E-10		5.29888E-07
TOTAL RELEASES & TRANSFERS (LBS)		4,523,599	25,639,240	0.022141405	7.28336E-05	6.40935E-07	1.41006E-07	1.41006E-07	5.34412E-08		7.28336E-05

Table A4. (Continued)

Chemical	Disposition[2]	1.57% of crude to propylene[9]:	4% of propylene to isopropanol[10]:	15% of isopropanol (IPA) to acetone[11]:		total acetone[12] (the 37.9% of cumene hydroperoxide + the 15% of IPA):	20% of acetone to bisphenol A[13] (BPA):		62.1% of cumene hydroperoxide to phenol[14]:	35% of phenol to BPA[15]:
AMMONIA	Air	3.32463E-08	1.32985E-09	1.99478E-10		1.75498E-09	3.50996E-10		2.54873E-09	8.92055E-10
AMMONIA	Water	4.00656E-09	1.60262E-10	2.40394E-11		2.11496E-10	4.22991E-11		3.07151E-10	1.07503E-10
AMMONIA	Underground	5.79144E-08	2.31657E-09	3.47486E-10		3.05714E-09	6.11429E-10		4.43983E-09	1.55394E-09
AMMONIA	POTW Transfer	4.63315E-12	1.85326E-13	2.77989E-14		2.44571E-13	4.89143E-14		3.55187E-13	1.24315E-13
AMMONIA	Off-site Transfer	1.02464E-12	4.09855E-14	6.14783E-15		5.40879E-14	1.08176E-14		7.85509E-14	2.74928E-14
ANTHRACENE	Air	1.09057E-10	4.36229E-12	6.54343E-13		5.75684E-12	1.15137E-12		8.36055E-12	2.92619E-12
ANTHRACENE	Land	7.21702E-12	2.88681E-13	4.33021E-14		3.80967E-13	7.61934E-14		5.53272E-13	1.93645E-13
ANTHRACENE	Off-site Transfer	4.90045E-13	1.96018E-14	2.94027E-15		2.58681E-14	5.17363E-15		3.75678E-14	1.31487E-14
ANTIMONY COMPOUNDS	Air	5.79144E-11	2.31657E-12	3.47486E-13		3.05714E-12	6.11429E-13		4.43983E-12	1.55394E-12
ANTIMONY COMPOUNDS	Land	1.11374E-10	4.45495E-12	6.68243E-13		5.87912E-12	1.17582E-12		8.53814E-12	2.98835E-12
ANTIMONY COMPOUNDS	Off-site Transfer	2.36647E-10	9.46588E-12	1.41988E-12		1.2492E-11	2.49839E-12		1.81418E-11	6.34965E-12
BARIUM COMPOUNDS	Water	8.42877E-11	3.37151E-12	5.05726E-13		4.44932E-12	8.89864E-13		6.46167E-12	2.26158E-12
BARIUM COMPOUNDS	Land	1.02998E-10	4.11994E-12	6.17991E-13		5.43701E-12	1.0874E-12		7.89607E-12	2.76363E-12
BARIUM COMPOUNDS	Off-site Transfer	1.13601E-11	4.54405E-13	6.81607E-14		5.9967E-13	1.19934E-13		8.70891E-13	3.04812E-13
BENZENE	Air	2.71159E-08	1.08464E-09	1.62696E-10		1.43138E-09	2.86276E-10		2.07876E-09	7.27568E-10
BENZENE	Water	4.72225E-12	1.8889E-13	2.83335E-14		2.49275E-13	4.9855E-14		3.62017E-13	1.26706E-13
BENZENE	Underground	7.57342E-09	3.02937E-10	4.54405E-11		3.9978E-10	7.99561E-11		5.80594E-10	2.03208E-10
BENZENE	Land	4.994E-11	1.9976E-12	2.9964E-13		2.6362E-12	5.2724E-13		3.8285E-12	1.33998E-12
BENZENE	POTW Transfer	2.27202E-12	9.0881E-14	1.36321E-14		1.19934E-13	2.39868E-14		1.74178E-13	6.09623E-14
BENZENE	Off-site Transfer	8.7366E-10	3.49464E-11	5.24196E-12		4.61182E-11	9.22364E-12		6.69766E-11	2.34418E-11
BIPHENYL	Air	8.46441E-11	3.38576E-12	5.07864E-13		4.46813E-12	8.93627E-13		6.48899E-12	2.27115E-12
1,3-BUTADIENE	Air	1.92966E-09	7.71865E-11	1.1578E-11		1.01862E-10	2.03723E-11		1.47932E-10	5.17762E-11
1,3-BUTADIENE	Off-site Transfer	5.34594E-12	2.13838E-13	3.20756E-14		2.82198E-13	5.64396E-14		4.09831E-13	1.43441E-13
CARBON DISULFIDE	Air	3.15856E-10	1.26342E-11	1.89514E-12		1.66732E-11	3.33464E-12		2.42142E-11	8.47496E-12
CARBON DISULFIDE	Off-site Transfer	1.14047E-11	4.56187E-13	6.8428E-14		6.02022E-13	1.20404E-13		8.74306E-13	3.06007E-13
CARBON TETRACHLORIDE	Air	1.04402E-09	4.17607E-11	6.26411E-12		5.51109E-11	1.10222E-11		8.00365E-11	2.80128E-11
CARBON TETRACHLORIDE	Water									
CARBON TETRACHLORIDE	Off-site Transfer	4.25893E-11	1.70357E-12	2.55536E-13		2.24818E-12	4.49635E-13		3.26499E-12	1.14275E-12
CARBONYL SULFIDE	Air	8.07682E-09	3.23073E-10	4.84609E-11		4.26354E-10	8.52708E-11		6.19186E-10	2.16715E-10
CHLORINE	Air	2.02531E-09	8.10124E-11	1.21519E-11		1.06911E-10	2.13821E-11		1.55264E-10	5.43425E-11
CHLORINE	Water	5.8939E-10	2.35756E-11	3.53634E-12		3.11123E-11	6.22246E-12		4.51839E-11	1.58143E-11
CHLORODIFLUOROMETHANE	Off-site Transfer	1.02464E-09	4.09855E-11	6.14783E-12		5.40879E-11	1.08176E-11		7.85509E-11	2.74928E-11
CHROMIUM COMPOUNDS	Air	1.33649E-12	5.34594E-14	8.01891E-15		7.05495E-14	1.41099E-14		1.02458E-13	3.58602E-14
CHROMIUM COMPOUNDS	Water	1.8497E-10	7.39878E-12	1.10982E-12		9.76405E-12	1.95281E-12		1.41801E-11	4.96305E-12
CHROMIUM COMPOUNDS	Land	2.26757E-10	9.07028E-12	1.36054E-12		1.19699E-11	2.39398E-12		1.73837E-11	6.08428E-12
CHROMIUM COMPOUNDS	Off-site Transfer	1.1525E-09	4.60998E-11	6.91497E-12		6.08372E-11	1.21674E-11		8.83527E-11	3.09234E-11
COBALT COMPOUNDS	Air	4.7668E-12	1.90672E-13	2.86008E-14		2.51626E-13	5.03253E-14		3.65433E-13	1.27901E-13
COBALT COMPOUNDS	Land	1.01796E-10	4.07182E-12	6.10774E-13		5.37352E-12	1.0747E-12		7.80386E-12	2.73135E-12
COBALT COMPOUNDS	Off-site Transfer	6.70051E-09	2.6802E-10	4.02031E-11		3.53702E-10	7.07404E-11		5.13675E-10	1.79786E-10
COPPER COMPOUNDS	Air	1.27412E-11	5.09646E-13	7.64469E-14		6.72572E-13	1.34514E-13		9.76764E-13	3.41867E-13
COPPER COMPOUNDS	Water	1.67952E-11	6.71806E-13	1.00771E-13		8.86572E-13	1.77314E-13		1.28755E-12	4.50643E-13
COPPER COMPOUNDS	Land	4.21527E-10	1.68611E-11	2.52916E-12		2.22513E-11	4.45026E-12		3.23152E-11	1.13103E-11
COPPER COMPOUNDS	Off-site Transfer	7.42391E-09	2.96956E-10	4.45434E-11		3.91888E-10	7.83776E-11		5.69132E-10	1.99196E-10
CRESOL (MIXED ISOMERS)	Air	1.23041E-09	4.92165E-11	7.38248E-12		6.49502E-11	1.299E-11		9.4326E-11	3.30141E-11
CRESOL (MIXED ISOMERS)	Water	1.20685E-10	4.82738E-12	7.24108E-13		6.37062E-12	1.27412E-12		9.25193E-12	3.23818E-12
CRESOL (MIXED ISOMERS)	Underground	4.00946E-09	1.60378E-10	2.40567E-11		2.11648E-10	4.23297E-11		3.07373E-10	1.07581E-10
CRESOL (MIXED ISOMERS)	Off-site Transfer	3.47486E-12	1.38994E-13	2.08492E-14		1.83429E-13	3.66857E-14		2.6639E-13	9.32365E-14
CUMENE	Air	2.884E-09	1.1536E-10	1.7304E-11		1.52239E-10	3.04477E-11		2.21093E-10	7.73827E-11
CUMENE	Water	1.11374E-12	4.45495E-14	6.68243E-15		5.87912E-14	1.17582E-14		8.53814E-14	2.98835E-14
CUMENE	Off-site Transfer	3.56396E-12	1.42558E-13	2.13838E-14		1.88132E-13	3.76264E-14		2.73221E-13	9.56272E-14
CYCLOHEXANE	Air	1.05437E-08	4.21748E-10	6.32623E-11		5.56574E-10	1.11315E-10		8.08303E-10	2.82906E-10

Table A4. (Continued)

Chemical	Disposition[2]	1.57% of crude to propylene[9]:	4% of propylene to isopropanol[10]:	15% of isopropanol (IPA) to acetone[11]:		total acetone[12] (the 37.9% of cumene hydroperoxide + the 15% of IPA):	20% of acetone to bisphenol A [13] (BPA):		62.1% of cumene hydroperoxide to phenol[14]:	35% of phenol to BPA[15]:
CYCLOHEXANE	Water	1.29194E-12	5.16774E-14	7.75161E-15		6.81978E-14	1.36396E-14		9.90425E-14	3.46649E-14
CYCLOHEXANE	Land	1.09146E-10	4.36585E-12	6.54878E-13		5.76154E-12	1.15231E-12		8.36738E-12	2.92858E-12
CYCLOHEXANE	Off-site Transfer	1.19794E-10	4.79174E-12	7.18762E-13		6.32358E-12	1.26472E-12		9.18363E-12	3.21427E-12
1,2-DIBROMOETHANE	Air	8.63369E-11	3.45348E-12	5.18022E-13		4.5575E-12	9.11499E-13		6.61877E-12	2.31657E-12
1,2-DIBROMOETHANE	Water	3.11847E-13	1.24739E-14	1.87108E-15		1.64615E-14	3.29231E-15		2.39068E-14	8.36738E-15
1,2-DICHLOROETHANE	Air	5.92508E-10	2.37003E-11	3.55505E-12		3.12769E-11	6.25539E-12		4.54229E-11	1.5898E-11
DICHLOROMETHANE	Air									
DICHLOROMETHANE	Water									
DICHLOROMETHANE	Off-site Transfer									
DIETHANOLAMINE	Air	1.95465E-09	7.81862E-11	1.17279E-11		1.03181E-10	2.06362E-11		1.49848E-10	5.24467E-11
DIETHANOLAMINE	Off-site Transfer	5.96963E-09	2.38785E-10	3.58178E-11		3.15121E-10	6.30242E-11		4.57644E-10	1.60176E-10
ETHYLBENZENE	Air	1.13952E-08	4.55809E-10	6.83714E-11		6.01524E-10	1.20305E-10		8.73582E-10	3.05754E-10
ETHYLBENZENE	Water	3.29666E-12	1.31867E-13	1.978E-14		1.74022E-13	3.48044E-14		2.52729E-13	8.84552E-14
ETHYLBENZENE	Underground	7.57342E-11	3.02937E-12	4.54405E-13		3.9978E-12	7.99561E-13		5.80594E-12	2.03208E-12
ETHYLBENZENE	Land	2.94472E-11	1.17789E-12	1.76683E-13		1.55444E-12	3.10888E-13		2.25748E-12	7.9012E-13
ETHYLBENZENE	POTW Transfer	1.69288E-12	6.77152E-14	1.01573E-14		8.93627E-14	1.78725E-14		1.2978E-13	4.54229E-14
ETHYLBENZENE	Off-site Transfer	8.73081E-10	3.49232E-11	5.23849E-12		4.60876E-11	9.21752E-12		6.69322E-11	2.34263E-11
ETHYLENE	Air	3.55509E-08	1.42204E-09	2.13306E-10		1.87664E-09	3.75328E-10		2.72541E-09	9.53893E-10
ETHYLENE	Off-site Transfer	4.1431E-12	1.65724E-13	2.48586E-14		2.18703E-13	4.37407E-14		3.17619E-13	1.11167E-13
ETHYLENE GLYCOL	Air	8.08039E-10	3.23216E-11	4.84823E-12		4.26542E-11	8.53084E-12		6.19459E-11	2.16811E-11
ETHYLENE GLYCOL	Water	8.6083E-10	3.44332E-11	5.16498E-12		4.54409E-11	9.08818E-12		6.5993E-11	2.30976E-11
ETHYLENE GLYCOL	Off-site Transfer	3.56396E-11	1.42558E-12	2.13838E-13		1.88132E-12	3.76264E-13		2.73221E-12	9.56272E-13
FORMALDEHYDE	Air	5.15081E-10	2.06033E-11	3.09049E-12		2.71898E-11	5.43795E-12		3.94872E-11	1.38205E-11
FORMALDEHYDE	Water	5.12319E-12	2.04928E-13	3.07392E-14		2.7044E-13	5.40879E-14		3.92755E-13	1.37464E-13
FORMALDEHYDE	Off-site Transfer	1.15383E-11	4.61533E-13	6.92299E-14		6.09077E-13	1.21815E-13		8.84552E-13	3.09593E-13
GLYCOL ETHERS	Air	7.76498E-11	3.10599E-12	4.65899E-13		4.09892E-12	8.19785E-13		5.95279E-12	2.08348E-12
HYDROCHLORIC ACID	Air	4.25773E-09	1.70309E-10	2.55464E-11		2.24754E-10	4.49508E-11		3.26406E-10	1.14242E-10
HYDROGEN FLUORIDE	Air	1.39618E-10	5.58473E-12	8.37709E-13		7.37007E-12	1.47401E-12		1.07034E-11	3.7462E-12
4,4'-ISOPROPYLIDENEDIPHENOL	Air									
4,4'-ISOPROPYLIDENEDIPHENOL	Water									
4,4'-ISOPROPYLIDENEDIPHENOL	Off-site Transfer									
LEAD COMPOUNDS	Air	3.51941E-12	1.40776E-13	2.11165E-14		1.8578E-13	3.71561E-14		2.69805E-13	9.44319E-14
LEAD COMPOUNDS	Water	3.6486E-11	1.45944E-12	2.18916E-13		1.926E-12	3.852E-13		2.7971E-12	9.78983E-13
LEAD COMPOUNDS	Land	3.51451E-10	1.4058E-11	2.10871E-12		1.85522E-11	3.71043E-12		2.6943E-11	9.43004E-12
LEAD COMPOUNDS	Off-site Transfer	2.06745E-09	8.26981E-11	1.24047E-11		1.09135E-10	2.18271E-11		1.58495E-10	5.54733E-11
MANGANESE COMPOUNDS	Air	7.12792E-13	2.85117E-14	4.27675E-15		3.76264E-14	7.52528E-15		5.46441E-14	1.91254E-14
MANGANESE COMPOUNDS	Water	8.01891E-11	3.20756E-12	4.81135E-13		4.23297E-12	8.46594E-13		6.14746E-12	2.15161E-12
MANGANESE COMPOUNDS	Off-site Transfer	4.15647E-10	1.66259E-11	2.49388E-12		2.19409E-11	4.38818E-12		3.18643E-11	1.11525E-11
METHANOL	Air	1.76703E-07	7.06811E-09	1.06022E-09		9.32766E-09	1.86553E-09		1.35464E-08	4.74124E-09
METHANOL	Water	5.37712E-11	2.15085E-12	3.22627E-13		2.83844E-12	5.67688E-13		4.12222E-12	1.44278E-12
METHANOL	Off-site Transfer	3.02981E-10	1.21192E-11	1.81789E-12		1.59936E-11	3.19871E-12		2.32272E-11	8.12951E-12
2-METHOXYETHANOL	Air	2.80662E-12	1.12265E-13	1.68397E-14		1.48154E-13	2.96308E-14		2.15161E-13	7.53064E-14
METHYL ETHYL KETONE	Air	1.18455E-07	4.73821E-09	7.10731E-10		6.25293E-09	1.25059E-09		9.08102E-09	3.17836E-09
METHYL ETHYL KETONE	Water	2.5665E-10	1.0266E-11	1.5399E-12		1.35478E-11	2.70957E-12		1.96753E-11	6.88635E-12
METHYL ETHYL KETONE	Underground	8.46441E-10	3.38576E-11	5.07864E-12		4.46813E-11	8.93627E-12		6.48899E-11	2.27115E-11
METHYL ETHYL KETONE	Land	2.22748E-13	8.9099E-15	1.33649E-15		1.17582E-14	2.35165E-15		1.70763E-14	5.9767E-15
METHYL ETHYL KETONE	Off-site Transfer	4.68215E-11	1.87286E-12	2.80929E-13		2.47158E-12	4.94317E-13		3.58944E-12	1.2563E-12
METHYL ISOBUTYL KETONE	Air	1.02405E-08	4.09618E-10	6.14428E-11		5.40566E-10	1.08113E-10		7.85055E-10	2.74769E-10
METHYL ISOBUTYL KETONE	Water	1.78198E-13	7.12792E-15	1.06919E-15		9.40659E-15	1.88132E-15		1.3661E-14	4.78136E-15
METHYL ISOBUTYL KETONE	Land	2.22748E-13	8.9099E-15	1.33649E-15		1.17582E-14	2.35165E-15		1.70763E-14	5.9767E-15
METHYL ISOBUTYL KETONE	Off-site Transfer	1.8488E-11	7.39522E-13	1.10928E-13		9.75934E-13	1.95187E-13		1.41733E-12	4.96066E-13

Table A4. (Continued)

Chemical	Disposition[2]	1.57% of crude to propylene[9]:	4% of propylene to isopropanol[10]:	15% of isopropanol (IPA) to acetone[11]:		total acetone[12] (the 37.9% of cumene hydroperoxide + the 15% of IPA):	20% of acetone to bisphenol A [13] (BPA):		62.1% of cumene hydroperoxide to phenol[14]:	35% of phenol to BPA[15]:
METHYL TERT-BUTYL ETHER	Air	3.8729E-08	1.54916E-09	2.32374E-10		2.0444E-09	4.0888E-10		2.96905E-09	1.03917E-09
METHYL TERT-BUTYL ETHER	Water	2.23772E-09	8.95089E-11	1.34263E-11		1.18123E-10	2.36247E-11		1.71548E-10	6.00419E-11
METHYL TERT-BUTYL ETHER	Underground	7.12792E-09	2.85117E-10	4.27675E-11		3.76264E-10	7.52528E-11		5.46441E-10	1.91254E-10
MOLYBDENUM TRIOXIDE	Air	8.07535E-09	3.23014E-10	4.84521E-11		4.26276E-10	8.52553E-11		6.19073E-10	2.16676E-10
MOLYBDENUM TRIOXIDE	Water	9.3554E-13	3.74216E-14	5.61324E-15		4.93846E-14	9.87692E-15		7.17204E-14	2.51021E-14
MOLYBDENUM TRIOXIDE	Land	4.2322E-12	1.69288E-13	2.53932E-14		2.23407E-13	4.46813E-14		3.24449E-13	1.13557E-13
MOLYBDENUM TRIOXIDE	Off-site Transfer	2.64197E-08	1.05679E-09	1.58518E-10		1.39463E-09	2.78925E-10		2.02539E-09	7.08887E-10
NAPHTHALENE	Air	4.52329E-09	1.80932E-10	2.71397E-11		2.38772E-10	4.77545E-11		3.46765E-10	1.21368E-10
NAPHTHALENE	Water	6.37058E-12	2.54823E-13	3.82235E-14		3.36286E-13	6.72572E-14		4.88382E-13	1.70934E-13
NAPHTHALENE	Land	2.86453E-11	1.14581E-12	1.71872E-13		1.51211E-12	3.02422E-13		2.19601E-12	7.68604E-13
NAPHTHALENE	Off-site Transfer	2.94071E-10	1.17629E-11	1.76443E-12		1.55232E-11	3.10465E-12		2.25441E-11	7.89044E-12
N-HEXANE	Air	5.59147E-08	2.23659E-09	3.35488E-10		2.95159E-09	5.90317E-10		4.28654E-09	1.50029E-09
N-HEXANE	Water	6.37058E-12	2.54823E-13	3.82235E-14		3.36286E-13	6.72572E-14		4.88382E-13	1.70934E-13
N-HEXANE	Land	1.60467E-10	6.41869E-12	9.62804E-13		8.47064E-12	1.69413E-12		1.23018E-11	4.30561E-12
N-HEXANE	Off-site Transfer	2.94962E-10	1.17985E-11	1.76977E-12		1.55703E-11	3.11405E-12		2.26124E-11	7.91435E-12
NICKEL COMPOUNDS	Air	1.19272E-09	4.7709E-11	7.15634E-12		6.29607E-11	1.25921E-11		9.14367E-11	3.20028E-11
NICKEL COMPOUNDS	Water	7.07446E-11	2.82978E-12	4.24468E-13		3.73442E-12	7.46884E-13		5.42343E-12	1.8982E-12
NICKEL COMPOUNDS	Land	9.35762E-10	3.74305E-11	5.61457E-12		4.93964E-11	9.87928E-12		7.17375E-11	2.51081E-11
NICKEL COMPOUNDS	Off-site Transfer	4.11142E-08	1.64457E-09	2.46685E-10		2.17031E-09	4.34061E-10		3.1519E-09	1.10316E-09
NITRATE COMPOUNDS	Water	1.17293E-07	4.69171E-09	7.03757E-10		6.19157E-09	1.23831E-09		8.99191E-09	3.14717E-09
N-METHYL-2-PYRROLIDONE	Air	4.45981E-09	1.78392E-10	2.67588E-11		2.35421E-10	4.70842E-11		3.41898E-10	1.19664E-10
N-METHYL-2-PYRROLIDONE	Land	3.11847E-11	1.24739E-12	1.87108E-13		1.64615E-12	3.29231E-13		2.39068E-12	8.36738E-13
N-METHYL-2-PYRROLIDONE	Off-site Transfer	7.12792E-12	2.85117E-13	4.27675E-14		3.76264E-13	7.52528E-14		5.46441E-13	1.91254E-13
O-XYLENE	Air	3.94263E-09	1.57705E-10	2.36558E-11		2.08121E-10	4.16242E-11		3.0225E-10	1.05788E-10
O-XYLENE	Water	9.3554E-13	3.74216E-14	5.61324E-15		4.93846E-14	9.87692E-15		7.17204E-14	2.51021E-14
O-XYLENE	Land	3.83126E-12	1.5325E-13	2.29875E-14		2.02242E-13	4.04484E-14		2.93712E-13	1.02799E-13
O-XYLENE	Off-site Transfer	2.38295E-10	9.53181E-12	1.42977E-12		1.2579E-11	2.51579E-12		1.82682E-11	6.39387E-12
P-XYLENE	Air	2.56115E-08	1.02446E-09	1.53669E-10		1.35196E-09	2.70393E-10		1.96343E-09	6.87201E-10
P-XYLENE	Water	9.3554E-13	3.74216E-14	5.61324E-15		4.93846E-14	9.87692E-15		7.17204E-14	2.51021E-14
P-XYLENE	Land	3.43031E-12	1.37212E-13	2.05819E-14		1.81077E-13	3.62154E-14		2.62975E-13	9.20412E-14
P-XYLENE	Off-site Transfer	2.39186E-10	9.56745E-12	1.43512E-12		1.2626E-11	2.5252E-12		1.83365E-11	6.41778E-12
PHENANTHRENE	Air	7.38631E-11	2.95452E-12	4.43178E-13		3.89903E-12	7.79807E-13		5.6625E-12	1.98187E-12
PHENANTHRENE	Water	1.02464E-12	4.09855E-14	6.14783E-15		5.40879E-14	1.08176E-14		7.85509E-14	2.74928E-14
PHENANTHRENE	Land	1.83232E-10	7.32928E-12	1.09939E-12		9.67233E-12	1.93447E-12		1.4047E-11	4.91643E-12
PHENANTHRENE	Off-site Transfer	9.31085E-12	3.72434E-13	5.58651E-14		4.91495E-13	9.82989E-14		7.13789E-13	2.49826E-13
PHENOL	Air	5.00803E-09	2.00321E-10	3.00482E-11		2.64361E-10	5.28721E-11		3.83926E-10	1.34374E-10
PHENOL	Water	1.75926E-10	7.03704E-12	1.05556E-12		9.28666E-12	1.85733E-12		1.34869E-11	4.7204E-12
PHENOL	Underground	6.23693E-09	2.49477E-10	3.74216E-11		3.29231E-10	6.58462E-11		4.78136E-10	1.67348E-10
PHENOL	Land	8.9099E-12	3.56396E-13	5.34594E-14		4.7033E-13	9.40659E-14		6.83051E-13	2.39068E-13
PHENOL	POTW Transfer	1.00949E-10	4.03797E-12	6.05695E-13		5.32884E-12	1.06577E-12		7.73897E-12	2.70864E-12
PHENOL	Off-site Transfer	2.00473E-12	8.01891E-14	1.20284E-14		1.05824E-13	2.11648E-14		1.53687E-13	5.37903E-14
PHOSGENE	Air	0	0	0		0	0		0	0
PHOSPHORIC ACID	Off-site Transfer	3.33008E-09	1.33203E-10	1.99805E-11		1.75786E-10	3.51571E-11		2.5529E-10	8.93517E-11
POLYCYCLIC AROMATIC COMPOUNDS	Air	6.73098E-10	2.69239E-11	4.03859E-12		3.55311E-11	7.10621E-12		5.16011E-11	1.80604E-11
POLYCYCLIC AROMATIC COMPOUNDS	Water	1.78198E-13	7.12792E-15	1.06919E-15		9.40659E-15	1.88132E-15		1.3661E-14	4.78136E-15
POLYCYCLIC AROMATIC COMPOUNDS	Land	3.87803E-10	1.55121E-11	2.32682E-12		2.04711E-11	4.09422E-12		2.97298E-11	1.04054E-11
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	1.96463E-11	7.85853E-13	1.17878E-13		1.03708E-12	2.07415E-13		1.50613E-12	5.27145E-13
PROPYLENE	Air	4.39932E-08	1.75973E-09	2.63959E-10		2.32228E-09	4.64456E-10		3.37261E-09	1.18041E-09
PROPYLENE	Water	4.2322E-12	1.69288E-13	2.53932E-14		2.23407E-13	4.46813E-14		3.24449E-13	1.13557E-13
STYRENE	Air	3.38131E-11	1.35252E-12	2.02878E-13		1.7849E-12	3.5698E-13		2.59218E-12	9.07263E-13
STYRENE	Land	2.22748E-13	8.9099E-15	1.33649E-15		1.17582E-14	2.35165E-15		1.70763E-14	5.9767E-15

Table A4. (Continued)

Chemical	Disposition[2]	1.57% of crude to propylene[9]:	4% of propylene to isopropanol[10]:	15% of isopropanol (IPA) to acetone[11]:		total acetone[12] (the 37.9% of cumene hydroperoxide + the 15% of IPA):	20% of acetone to bisphenol A [13] (BPA):		62.1% of cumene hydroperoxide to phenol[14]:	35% of phenol to BPA[15]:
STYRENE	Off-site Transfer	1.60378E-12	6.41513E-14	9.62269E-15		8.46594E-14	1.69319E-14		1.22949E-13	4.30322E-14
SULFURIC ACID	Air	5.01004E-10	2.00401E-11	3.00602E-12		2.64466E-11	5.28933E-12		3.8408E-11	1.34428E-11
SULFURIC ACID	Off-site Transfer	5.34594E-13	2.13838E-14	3.20756E-15		2.82198E-14	5.64396E-15		4.09831E-14	1.43441E-14
TERT-BUTYL ALCOHOL	Air	1.33649E-11	5.34594E-13	8.01891E-14		7.05495E-13	1.41099E-13		1.02458E-12	3.58602E-13
TETRACHLOROETHYLENE	Air	1.5885E-09	6.35401E-11	9.53101E-12		8.38527E-11	1.67705E-11		1.21778E-10	4.26222E-11
TETRACHLOROETHYLENE	Land	4.90045E-13	1.96018E-14	2.94027E-15		2.58681E-14	5.17363E-15		3.75678E-14	1.31487E-14
TETRACHLOROETHYLENE	Off-site Transfer	3.16747E-11	1.26699E-12	1.90048E-13		1.67202E-12	3.34404E-13		2.42825E-12	8.49887E-13
TOLUENE	Air	1.18775E-07	4.751E-09	7.1265E-10		6.26982E-09	1.25396E-09		9.10554E-09	3.18694E-09
TOLUENE	Water	1.15383E-11	4.61533E-13	6.92299E-14		6.09077E-13	1.21815E-13		8.84552E-13	3.09593E-13
TOLUENE	Underground	7.12792E-09	2.85117E-10	4.27675E-11		3.76264E-10	7.52528E-11		5.46441E-10	1.91254E-10
TOLUENE	Land	1.36544E-10	5.46177E-12	8.19265E-13		7.2078E-12	1.44156E-12		1.04678E-11	3.66372E-12
TOLUENE	POTW Transfer	9.53359E-12	3.81344E-13	5.72016E-14		5.03253E-13	1.00651E-13		7.30865E-13	2.55803E-13
TOLUENE	Off-site Transfer	2.09699E-09	8.38796E-11	1.25819E-11		1.10694E-10	2.21389E-11		1.6076E-10	5.62658E-11
TRICHLOROETHYLENE	Air	2.92797E-09	1.17119E-10	1.75678E-11		1.5456E-10	3.0912E-11		2.24464E-10	7.85625E-11
TRICHLOROETHYLENE	Off-site Transfer	1.20284E-12	4.81135E-14	7.21702E-15		6.34945E-14	1.26989E-14		9.22119E-14	3.22742E-14
TRIETHYLAMINE	Air	0	0	0		0	0		0	0
1,2,4-TRIMETHYLBENZENE	Air	5.68363E-09	2.27345E-10	3.41018E-11		3.00023E-10	6.00047E-11		4.35718E-10	1.52501E-10
1,2,4-TRIMETHYLBENZENE	Water	1.73743E-12	6.94972E-14	1.04246E-14		9.17143E-14	1.83429E-14		1.33195E-13	4.66183E-14
1,2,4-TRIMETHYLBENZENE	Land	5.29248E-11	2.11699E-12	3.17549E-13		2.79376E-12	5.58752E-13		4.05733E-12	1.42006E-12
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	3.25211E-11	1.30085E-12	1.95127E-13		1.7167E-12	3.43341E-13		2.49314E-12	8.72598E-13
VANADIUM (FUME OR DUST)	Land	4.90045E-13	1.96018E-14	2.94027E-15		2.58681E-14	5.17363E-15		3.75678E-14	1.31487E-14
VANADIUM (FUME OR DUST)	Off-site Transfer	3.11847E-10	1.24739E-11	1.87108E-12		1.64615E-11	3.29231E-12		2.39068E-11	8.36738E-12
XYLENE (MIXED ISOMERS)	Air	3.24796E-08	1.29918E-09	1.94877E-10		1.71451E-09	3.42902E-10		2.48995E-09	8.71483E-10
XYLENE (MIXED ISOMERS)	Water	1.28303E-11	5.1321E-13	7.69815E-14		6.77275E-13	1.35455E-13		9.83594E-13	3.44258E-13
XYLENE (MIXED ISOMERS)	Underground	1.38103E-09	5.52414E-11	8.28621E-12		7.29011E-11	1.45802E-11		1.05873E-10	3.70555E-11
XYLENE (MIXED ISOMERS)	Land	2.05997E-10	8.23988E-12	1.23598E-12		1.0874E-11	2.1748E-12		1.57921E-11	5.52725E-12
XYLENE (MIXED ISOMERS)	POTW Transfer	1.47013E-11	5.88053E-13	8.8208E-14		7.76044E-13	1.55209E-13		1.12703E-12	3.94462E-13
XYLENE (MIXED ISOMERS)	Off-site Transfer	2.75989E-09	1.10395E-10	1.65593E-11		1.45687E-10	2.91374E-11		2.11579E-10	7.40525E-11
ZINC COMPOUNDS	Air	4.72581E-10	1.89032E-11	2.83549E-12		2.49463E-11	4.98926E-12		3.6229E-11	1.26802E-11
ZINC COMPOUNDS	Water	6.408E-10	2.5632E-11	3.8448E-12		3.38261E-11	6.76522E-12		4.91251E-11	1.71938E-11
ZINC COMPOUNDS	Land	2.34705E-09	9.38818E-11	1.40823E-11		1.23894E-10	2.47789E-11		1.79929E-10	6.29753E-11
ZINC COMPOUNDS	POTW Transfer	3.96491E-12	1.58596E-13	2.37894E-14		2.09297E-13	4.18593E-14		3.03958E-13	1.06385E-13
ZINC COMPOUNDS	Off-site Transfer	8.31E-09	3.324E-10	4.986E-11		4.38662E-10	8.77325E-11		6.37062E-10	2.22972E-10
TOTAL RELEASES & TRANSFERS (LBS)		1.14222E-06	4.56886E-08	6.85329E-09		6.02945E-08	1.20589E-08		8.75646E-08	3.06476E-08

Table A4. (Continued)

						TRI CONTRIBUTION FROM PC CHEMICAL PLANT			TOTAL
							PC		
							FACILITY [20]		
						FACILITY ID --->	36752GPLSTONEPL		
						FACILITY CAPACITY [19] (LBS/YR)--->	280,000,000		
					TRI releases for PC				
Chemical	Disposition[2]		Total BPA[16] (the 20% from acetone + the 35% from phenol):	63% of BPA to PC[17]:	TRI lbs/ lb of PC[18] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing PC:	TRI lbs per lb of PC [21] (attributed to PC chemical plant):	TRI lbs per lb of PC (attributed to oil refineries and PC chemical plant):
AMMONIA	Air		1.24305E-09	7.83122E-10	1.54177E-06			0	1.54177E-06
AMMONIA	Water		1.49802E-10	9.43753E-11	1.85801E-07			0	1.85801E-07
AMMONIA	Underground		2.16537E-09	1.36418E-09	2.68574E-06			0	2.68574E-06
AMMONIA	POTW Transfer		1.7323E-13	1.09135E-13	2.14859E-10			0	2.14859E-10
AMMONIA	Off-site Transfer		3.83104E-14	2.41356E-14	4.75169E-11			0	4.75169E-11
ANTHRACENE	Air		4.07756E-12	2.56886E-12	5.05745E-09			0	5.05745E-09
ANTHRACENE	Land		2.69838E-13	1.69998E-13	3.34684E-10			0	3.34684E-10
ANTHRACENE	Off-site Transfer		1.83224E-14	1.15431E-14	2.27255E-11			0	2.27255E-11
ANTIMONY COMPOUNDS	Air		2.16537E-12	1.36418E-12	2.68574E-09			0	2.68574E-09
ANTIMONY COMPOUNDS	Land		4.16417E-12	2.62343E-12	5.16488E-09			0	5.16488E-09
ANTIMONY COMPOUNDS	Off-site Transfer		8.84804E-12	5.57426E-12	1.09743E-08			0	1.09743E-08
BARIUM COMPOUNDS	Water		3.15145E-12	1.98541E-12	3.90878E-09			0	3.90878E-09
BARIUM COMPOUNDS	Land		3.85103E-12	2.42615E-12	4.77648E-09			0	4.77648E-09
BARIUM COMPOUNDS	Off-site Transfer		4.24746E-13	2.6759E-13	5.26817E-10			0	5.26817E-10
BENZENE	Air		1.01384E-09	6.38721E-10	1.25748E-06			0	1.25748E-06
BENZENE	Water		1.76561E-13	1.11233E-13	2.18991E-10			0	2.18991E-10
BENZENE	Underground		2.83164E-10	1.78393E-10	3.51212E-07			0	3.51212E-07
BENZENE	Land		1.86722E-12	1.17635E-12	2.31593E-09			0	2.31593E-09
BENZENE	POTW Transfer		8.49492E-14	5.3518E-14	1.05363E-10			0	1.05363E-10
BENZENE	Off-site Transfer		3.26654E-11	2.05792E-11	4.05154E-08			0	4.05154E-08
BIPHENYL	Air		3.16477E-12	1.99381E-12	3.92531E-09			0	3.92531E-09
1,3-BUTADIENE	Air		7.21485E-11	4.54535E-11	8.94867E-08			0	8.94867E-08
1,3-BUTADIENE	Off-site Transfer		1.9988E-13	1.25925E-13	2.47914E-10			0	2.47914E-10
CARBON DISULFIDE	Air		1.18096E-11	7.44005E-12	1.46476E-08		705	2.9223E-06	2.93695E-06
CARBON DISULFIDE	Off-site Transfer		4.26411E-13	2.68639E-13	5.28883E-10			0	5.28883E-10
CARBON TETRACHLORIDE	Air		3.9035E-11	2.4592E-11	4.84156E-08		1	4.14511E-09	5.25607E-08
CARBON TETRACHLORIDE	Water				0		1	4.14511E-09	4.14511E-09
CARBON TETRACHLORIDE	Off-site Transfer		1.59238E-12	1.0032E-12	1.97505E-09		30,000	0.000124353	0.000124355
CARBONYL SULFIDE	Air		3.01986E-10	1.90251E-10	3.74557E-07		435	1.80312E-06	2.17768E-06
CHLORINE	Air		7.57247E-11	4.77065E-11	9.39223E-08		29	1.20208E-07	2.14131E-07
CHLORINE	Water		2.20368E-11	1.38832E-11	2.73325E-08		1	4.14511E-09	3.14776E-08
CHLORODIFLUOROMETHANE	Off-site Transfer		3.83104E-11	2.41356E-11	4.75169E-08			0	4.75169E-08
CHROMIUM COMPOUNDS	Air		4.99701E-14	3.14812E-14	6.19785E-11			0	6.19785E-11
CHROMIUM COMPOUNDS	Water		6.91586E-12	4.35699E-12	8.57783E-09			0	8.57783E-09
CHROMIUM COMPOUNDS	Land		8.47826E-12	5.3413E-12	1.05157E-08			0	1.05157E-08
CHROMIUM COMPOUNDS	Off-site Transfer		4.30909E-11	2.71473E-11	5.34462E-08			0	5.34462E-08
COBALT COMPOUNDS	Air		1.78227E-13	1.12283E-13	2.21057E-10			0	2.21057E-10
COBALT COMPOUNDS	Land		3.80606E-12	2.39781E-12	4.7207E-09			0	4.7207E-09
COBALT COMPOUNDS	Off-site Transfer		2.50527E-10	1.57832E-10	3.10731E-07			0	3.10731E-07
COPPER COMPOUNDS	Air		4.76382E-13	3.0012E-13	5.90862E-10			0	5.90862E-10
COPPER COMPOUNDS	Water		6.27957E-13	3.95613E-13	7.78864E-10			0	7.78864E-10
COPPER COMPOUNDS	Land		1.57606E-11	9.92916E-12	1.9548E-08			0	1.9548E-08
COPPER COMPOUNDS	Off-site Transfer		2.77574E-10	1.74872E-10	3.44278E-07			0	3.44278E-07
CRESOL (MIXED ISOMERS)	Air		4.60041E-11	2.89826E-11	5.70595E-08			0	5.70595E-08
CRESOL (MIXED ISOMERS)	Water		4.5123E-12	2.84275E-12	5.59666E-09			0	5.59666E-09
CRESOL (MIXED ISOMERS)	Underground		1.4991E-10	9.44435E-11	1.85936E-07			0	1.85936E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer		1.29922E-13	8.1851E-14	1.61144E-10			0	1.61144E-10
CUMENE	Air		1.0783E-10	6.79332E-11	1.33743E-07			0	1.33743E-07
CUMENE	Water		4.16417E-14	2.62343E-14	5.16488E-11			0	5.16488E-11
CUMENE	Off-site Transfer		1.33254E-13	8.39498E-14	1.65276E-10			0	1.65276E-10
CYCLOHEXANE	Air		3.94221E-10	2.48359E-10	4.88957E-07			0	4.88957E-07

Table A4. (Continued)

						TRI CONTRIBUTION FROM PC CHEMICAL PLANT			TOTAL
							PC		
							FACILITY [20]		
						FACILITY ID --->	36752GPLSTONEPL		
						FACILITY CAPACITY [19] (LBS/YR)--->	280,000,000		
					TRI releases for PC				
Chemical	Disposition[2]		Total BPA[16] (the 20% from acetone + the 35% from phenol):	63% of BPA to PC[17]:	TRI lbs/ lb of PC[18] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing PC:	TRI lbs per lb of PC [21] (attributed to PC chemical plant):	TRI lbs per lb of PC (attributed to oil refineries and PC chemical plant):
CYCLOHEXANE	Water		4.83044E-14	3.04318E-14	5.99126E-11			0	5.99126E-11
CYCLOHEXANE	Land		4.08089E-12	2.57096E-12	5.06158E-09			0	5.06158E-09
CYCLOHEXANE	Off-site Transfer		4.47899E-12	2.82176E-12	5.55534E-09			0	5.55534E-09
1,2-DIBROMOETHANE	Air		3.22807E-12	2.03368E-12	4.00381E-09			0	4.00381E-09
1,2-DIBROMOETHANE	Water		1.16597E-14	7.3456E-15	1.44617E-11			0	1.44617E-11
1,2-DICHLOROETHANE	Air		2.21534E-11	1.39566E-11	2.74771E-08			0	2.74771E-08
DICHLOROMETHANE	Air				0		791,000	0.003278784	0.003278784
DICHLOROMETHANE	Water				0		1	4.14511E-09	4.14511E-09
DICHLOROMETHANE	Off-site Transfer				0		37,000	0.000153369	0.000153369
DIETHANOLAMINE	Air		7.30829E-11	4.60422E-11	9.06457E-08			0	9.06457E-08
DIETHANOLAMINE	Off-site Transfer		2.232E-10	1.40616E-10	2.76837E-07			0	2.76837E-07
ETHYLBENZENE	Air		4.26058E-10	2.68417E-10	5.28445E-07			0	5.28445E-07
ETHYLBENZENE	Water		1.2326E-13	7.76535E-14	1.5288E-10			0	1.5288E-10
ETHYLBENZENE	Underground		2.83164E-12	1.78393E-12	3.51212E-09			0	3.51212E-09
ETHYLBENZENE	Land		1.10101E-12	6.93635E-13	1.36559E-09			0	1.36559E-09
ETHYLBENZENE	POTW Transfer		6.32954E-14	3.98761E-14	7.85061E-11			0	7.85061E-11
ETHYLBENZENE	Off-site Transfer		3.26438E-11	2.05656E-11	4.04885E-08			0	4.04885E-08
ETHYLENE	Air		1.32922E-09	8.37409E-10	1.64865E-06			0	1.64865E-06
ETHYLENE	Off-site Transfer		1.54907E-13	9.75916E-14	1.92133E-10			0	1.92133E-10
ETHYLENE GLYCOL	Air		3.02119E-11	1.90335E-11	3.74722E-08		1	4.14511E-09	4.16173E-08
ETHYLENE GLYCOL	Water		3.21857E-11	2.0277E-11	3.99204E-08			0	3.99204E-08
ETHYLENE GLYCOL	Off-site Transfer		1.33254E-12	8.39498E-13	1.65276E-09			0	1.65276E-09
FORMALDEHYDE	Air		1.92585E-11	1.21328E-11	2.38865E-08			0	2.38865E-08
FORMALDEHYDE	Water		1.91552E-13	1.20678E-13	2.37584E-10			0	2.37584E-10
FORMALDEHYDE	Off-site Transfer		4.31408E-13	2.71787E-13	5.35081E-10			0	5.35081E-10
GLYCOL ETHERS	Air		2.90326E-12	1.82906E-12	3.60095E-09			0	3.60095E-09
HYDROCHLORIC ACID	Air		1.59193E-10	1.00292E-10	1.97449E-07			0	1.97449E-07
HYDROGEN FLUORIDE	Air		5.22021E-12	3.28873E-12	6.47469E-09			0	6.47469E-09
4,4'-ISOPROPYLIDENEDIPHENOL	Air				0		10	4.14511E-08	4.14511E-08
4,4'-ISOPROPYLIDENEDIPHENOL	Water				0		2,400	9.94827E-06	9.94827E-06
4,4'-ISOPROPYLIDENEDIPHENOL	Off-site Transfer				0		1,200	4.97413E-06	4.97413E-06
LEAD COMPOUNDS	Air		1.31588E-13	8.29004E-14	1.6321E-10			0	1.6321E-10
LEAD COMPOUNDS	Water		1.36418E-12	8.59436E-13	1.69201E-09			0	1.69201E-09
LEAD COMPOUNDS	Land		1.31405E-11	8.2785E-12	1.62983E-08			0	1.62983E-08
LEAD COMPOUNDS	Off-site Transfer		7.73004E-11	4.86993E-11	9.58767E-08			0	9.58767E-08
MANGANESE COMPOUNDS	Air		2.66507E-14	1.679E-14	3.30552E-11			0	3.30552E-11
MANGANESE COMPOUNDS	Water		2.99821E-12	1.88887E-12	3.71871E-09			0	3.71871E-09
MANGANESE COMPOUNDS	Off-site Transfer		1.55407E-11	9.79064E-12	1.92753E-08			0	1.92753E-08
METHANOL	Air		6.60677E-09	4.16226E-09	8.19446E-06			0	8.19446E-06
METHANOL	Water		2.01046E-12	1.26659E-12	2.4936E-09			0	2.4936E-09
METHANOL	Off-site Transfer		1.13282E-11	7.13678E-12	1.40505E-08			0	1.40505E-08
2-METHOXYETHANOL	Air		1.04937E-13	6.61104E-14	1.30155E-10			0	1.30155E-10
METHYL ETHYL KETONE	Air		4.42894E-09	2.79023E-09	5.49327E-06			0	5.49327E-06
METHYL ETHYL KETONE	Water		9.59592E-12	6.04543E-12	1.19019E-08			0	1.19019E-08
METHYL ETHYL KETONE	Underground		3.16477E-11	1.99381E-11	3.92531E-08			0	3.92531E-08
METHYL ETHYL KETONE	Land		8.32835E-15	5.24686E-15	1.03298E-11			0	1.03298E-11
METHYL ETHYL KETONE	Off-site Transfer		1.75062E-12	1.10289E-12	2.17131E-09			0	2.17131E-09
METHYL ISOBUTYL KETONE	Air		3.82883E-10	2.41216E-10	4.74894E-07		4,000	1.65804E-05	1.70553E-05
METHYL ISOBUTYL KETONE	Water		6.66268E-15	4.19749E-15	8.2638E-12			0	8.2638E-12
METHYL ISOBUTYL KETONE	Land		8.32835E-15	5.24686E-15	1.03298E-11			0	1.03298E-11
METHYL ISOBUTYL KETONE	Off-site Transfer		6.91253E-13	4.35489E-13	8.5737E-10			0	8.5737E-10

Table A4. (Continued)

						TRI CONTRIBUTION FROM PC CHEMICAL PLANT			TOTAL
							PC		
							FACILITY [20]		
						FACILITY ID --->	36752GPLSTONEPL		
						FACILITY CAPACITY [19] (LBS/YR)--->	280,000,000		
					TRI releases for PC				
Chemical	Disposition[2]		Total BPA[16] (the 20% from acetone + the 35% from phenol):	63% of BPA to PC[17]:	TRI lbs/ lb of PC[18] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing PC:	TRI lbs per lb of PC [21] (attributed to PC chemical plant):	TRI lbs per lb of PC (attributed to oil refineries and PC chemical plant):
METHYL TERT-BUTYL ETHER	Air		1.44805E-09	9.12269E-10	1.79603E-06			0	1.79603E-06
METHYL TERT-BUTYL ETHER	Water		8.36666E-11	5.271E-11	1.03773E-07			0	1.03773E-07
METHYL TERT-BUTYL ETHER	Underground		2.66507E-10	1.679E-10	3.30552E-07			0	3.30552E-07
MOLYBDENUM TRIOXIDE	Air		3.01931E-10	1.90217E-10	3.74489E-07			0	3.74489E-07
MOLYBDENUM TRIOXIDE	Water		3.49791E-14	2.20368E-14	4.3385E-11			0	4.3385E-11
MOLYBDENUM TRIOXIDE	Land		1.58239E-13	9.96903E-14	1.96265E-10			0	1.96265E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer		9.87812E-10	6.22322E-10	1.2252E-06			0	1.2252E-06
NAPHTHALENE	Air		1.69122E-10	1.06547E-10	2.09764E-07			0	2.09764E-07
NAPHTHALENE	Water		2.38191E-13	1.5006E-13	2.95431E-10			0	2.95431E-10
NAPHTHALENE	Land		1.07103E-12	6.74746E-13	1.32841E-09			0	1.32841E-09
NAPHTHALENE	Off-site Transfer		1.09951E-11	6.9269E-12	1.36373E-08			0	1.36373E-08
N-HEXANE	Air		2.09061E-09	1.31708E-09	2.593E-06			0	2.593E-06
N-HEXANE	Water		2.38191E-13	1.5006E-13	2.95431E-10			0	2.95431E-10
N-HEXANE	Land		5.99974E-12	3.77984E-12	7.44156E-09			0	7.44156E-09
N-HEXANE	Off-site Transfer		1.10284E-11	6.94789E-12	1.36787E-08			0	1.36787E-08
NICKEL COMPOUNDS	Air		4.4595E-11	2.80948E-11	5.53117E-08			0	5.53117E-08
NICKEL COMPOUNDS	Water		2.64508E-12	1.6664E-12	3.28073E-09			0	3.28073E-09
NICKEL COMPOUNDS	Land		3.49874E-11	2.20421E-11	4.33953E-08			0	4.33953E-08
NICKEL COMPOUNDS	Off-site Transfer		1.53722E-09	9.68452E-10	1.90664E-06			0	1.90664E-06
NITRATE COMPOUNDS	Water		4.38548E-09	2.76285E-09	5.43937E-06			0	5.43937E-06
N-METHYL-2-PYRROLIDONE	Air		1.66749E-10	1.05052E-10	2.0682E-07			0	2.0682E-07
N-METHYL-2-PYRROLIDONE	Land		1.16597E-12	7.3456E-13	1.44617E-09			0	1.44617E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer		2.66507E-13	1.679E-13	3.30552E-10			0	3.30552E-10
O-XYLENE	Air		1.47412E-10	9.28694E-11	1.82837E-07			0	1.82837E-07
O-XYLENE	Water		3.49791E-14	2.20368E-14	4.3385E-11			0	4.3385E-11
O-XYLENE	Land		1.43248E-13	9.0246E-14	1.77672E-10			0	1.77672E-10
O-XYLENE	Off-site Transfer		8.90967E-12	5.61309E-12	1.10508E-08			0	1.10508E-08
P-XYLENE	Air		9.57594E-10	6.03284E-10	1.18772E-06			0	1.18772E-06
P-XYLENE	Water		3.49791E-14	2.20368E-14	4.3385E-11			0	4.3385E-11
P-XYLENE	Land		1.28257E-13	8.08016E-14	1.59078E-10			0	1.59078E-10
P-XYLENE	Off-site Transfer		8.94298E-12	5.63408E-12	1.10921E-08			0	1.10921E-08
PHENANTHRENE	Air		2.76168E-12	1.73986E-12	3.42535E-09			0	3.42535E-09
PHENANTHRENE	Water		3.83104E-14	2.41356E-14	4.75169E-11			0	4.75169E-11
PHENANTHRENE	Land		6.8509E-12	4.31607E-12	8.49726E-09			0	8.49726E-09
PHENANTHRENE	Off-site Transfer		3.48125E-13	2.19319E-13	4.31784E-10			0	4.31784E-10
PHENOL	Air		1.87246E-10	1.17965E-10	2.32244E-07		3,605	1.49431E-05	1.51754E-05
PHENOL	Water		6.57773E-12	4.14397E-12	8.15844E-09			0	8.15844E-09
PHENOL	Underground		2.33194E-10	1.46912E-10	2.89233E-07			0	2.89233E-07
PHENOL	Land		3.33134E-13	2.09874E-13	4.1319E-10			0	4.1319E-10
PHENOL	POTW Transfer		3.77441E-12	2.37788E-12	4.68144E-09			0	4.68144E-09
PHENOL	Off-site Transfer		7.49551E-14	4.72217E-14	9.29678E-11		1,300	5.38865E-06	5.38874E-06
PHOSGENE	Air		0	0	0		6	2.48707E-08	2.48707E-08
PHOSPHORIC ACID	Off-site Transfer		1.24509E-10	7.84406E-11	1.5443E-07			0	1.5443E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air		2.51666E-11	1.5855E-11	3.12145E-08			0	3.12145E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water		6.66268E-15	4.19749E-15	8.2638E-12			0	8.2638E-12
POLYCYCLIC AROMATIC COMPOUNDS	Land		1.44997E-11	9.13478E-12	1.79841E-08			0	1.79841E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer		7.3456E-13	4.62773E-13	9.11084E-10			0	9.11084E-10
PROPYLENE	Air		1.64487E-09	1.03627E-09	2.04015E-06			0	2.04015E-06
PROPYLENE	Water		1.58239E-13	9.96903E-14	1.96265E-10			0	1.96265E-10
STYRENE	Air		1.26424E-12	7.96473E-13	1.56806E-09			0	1.56806E-09
STYRENE	Land		8.32835E-15	5.24686E-15	1.03298E-11			0	1.03298E-11

Table A4. (Continued)

						TRI CONTRIBUTION FROM PC CHEMICAL PLANT			TOTAL
							PC FACILITY [20]		
						FACILITY ID —>	36752GPLSTONEPL		
						FACILITY CAPACITY [19] (LBS/YR)—>	280,000,000		
					TRI releases for PC				
Chemical	Disposition[2]		Total BPA[16] (the 20% from acetone + the 35% from phenol):	63% of BPA to PC[17]:	TRI lbs/ lb of PC[18] (attributed to oil refineries):		Annual TRI releases (lbs/yr) from facility producing PC:	TRI lbs per lb of PC [21] (attributed to PC chemical plant):	TRI lbs per lb of PC (attributed to oil refineries and PC chemical plant):
STYRENE	Off-site Transfer		5.99641E-14	3.77774E-14	7.43742E-11			0	7.43742E-11
SULFURIC ACID	Air		1.87321E-11	1.18012E-11	2.32337E-08			0	2.32337E-08
SULFURIC ACID	Off-site Transfer		1.9988E-14	1.25925E-14	2.47914E-11			0	2.47914E-11
TERT-BUTYL ALCOHOL	Air		4.99701E-13	3.14812E-13	6.19785E-10			0	6.19785E-10
TETRACHLOROETHYLENE	Air		5.93928E-11	3.74175E-11	7.36656E-08			0	7.36656E-08
TETRACHLOROETHYLENE	Land		1.83224E-14	1.15431E-14	2.27255E-11			0	2.27255E-11
TETRACHLOROETHYLENE	Off-site Transfer		1.18429E-12	7.46103E-13	1.46889E-09			0	1.46889E-09
TOLUENE	Air		4.4409E-09	2.79777E-09	5.50811E-06			0	5.50811E-06
TOLUENE	Water		4.31408E-13	2.71787E-13	5.35081E-10			0	5.35081E-10
TOLUENE	Underground		2.66507E-10	1.679E-10	3.30552E-07			0	3.30552E-07
TOLUENE	Land		5.10528E-12	3.21632E-12	6.33214E-09			0	6.33214E-09
TOLUENE	POTW Transfer		3.56453E-13	2.24566E-13	4.42114E-10			0	4.42114E-10
TOLUENE	Off-site Transfer		7.84047E-11	4.9395E-11	9.72464E-08			0	9.72464E-08
TRICHLOROETHYLENE	Air		1.09474E-10	6.89689E-11	1.35783E-07			0	1.35783E-07
TRICHLOROETHYLENE	Off-site Transfer		4.49731E-14	2.8333E-14	5.57807E-11			0	5.57807E-11
TRIETHYLAMINE	Air		0	0	0		18,400	7.62701E-05	7.62701E-05
1,2,4-TRIMETHYLBENZENE	Air		2.12506E-10	1.33879E-10	2.63574E-07			0	2.63574E-07
1,2,4-TRIMETHYLBENZENE	Water		6.49611E-14	4.09255E-14	8.05721E-11			0	8.05721E-11
1,2,4-TRIMETHYLBENZENE	Land		1.97882E-12	1.24665E-12	2.45435E-09			0	2.45435E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer		1.21594E-12	7.66042E-13	1.50814E-09			0	1.50814E-09
VANADIUM (FUME OR DUST)	Land		1.83224E-14	1.15431E-14	2.27255E-11			0	2.27255E-11
VANADIUM (FUME OR DUST)	Off-site Transfer		1.16597E-11	7.3456E-12	1.44617E-08			0	1.44617E-08
XYLENE (MIXED ISOMERS)	Air		1.21438E-09	7.65062E-10	1.50622E-06			0	1.50622E-06
XYLENE (MIXED ISOMERS)	Water		4.79713E-13	3.02219E-13	5.94994E-10			0	5.94994E-10
XYLENE (MIXED ISOMERS)	Underground		5.16358E-11	3.25305E-11	6.40445E-08			0	6.40445E-08
XYLENE (MIXED ISOMERS)	Land		7.70206E-12	4.8523E-12	9.55296E-09			0	9.55296E-09
XYLENE (MIXED ISOMERS)	POTW Transfer		5.49671E-13	3.46293E-13	6.81764E-10			0	6.81764E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer		1.0319E-10	6.50096E-11	1.27988E-07			0	1.27988E-07
ZINC COMPOUNDS	Air		1.76694E-11	1.11317E-11	2.19156E-08			0	2.19156E-08
ZINC COMPOUNDS	Water		2.3959E-11	1.50942E-11	2.97166E-08			0	2.97166E-08
ZINC COMPOUNDS	Land		8.77541E-11	5.52851E-11	1.08843E-07			0	1.08843E-07
ZINC COMPOUNDS	POTW Transfer		1.48245E-13	9.33941E-14	1.8387E-10			0	1.8387E-10
ZINC COMPOUNDS	Off-site Transfer		3.10704E-10	1.95744E-10	3.8537E-07			0	3.8537E-07
TOTAL RELEASES & TRANSFERS (LBS)			4.27065E-08	2.69051E-08	5.29694E-05		890095	0.003689544	0.003742513

Table A4. (Continued)

FOOTNOTES

[1] Info on the top ten facilities by capacity for the petroleum refining industry comes from the website for the Sector Facility Indexing Project: Petroleum Refining Data Access, <http://es.epa.gov/oeca/sfi/petdata.htm>, obtained October 1999. The TRI release data for each facility comes from the Right-to-Know Network environmental database for facility TRIs, <http://www.rtknet.org/triinputfacility.html>, obtained October 1999.

[2] Under the "Disposition" column, the category "air" includes fugitive and stack emissions.

[3] TRI lbs/barrel of crude in was computed by: (?? lbs/yr of the TRI chemical totaled for the ten refineries) divided by (365 days/yr) divided by (3,689,000 bbl of crude in/day - total of the plant capacities for the ten refineries) divided by (0.8600).

The 0.8600 (or 86%) value is the refining capacity factor which represents % of capacity at which the refinery is actually operating. It was calculated by taking each annual total U.S. refinery throughput divided by each yearly U.S. refining total capacity for the years 1987 -1993, and averaging the values. These values were obtained from the International Petroleum Encyclopedia, 1995 edition. These were the only years that U.S. refinery throughput and capacity values were both available, and were thus used to estimate the actual rate at which the ten refineries were actually operating. Note that the throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days." It was assumed that these terms each refer to a 365 day year. See further Table 1 in the bottom right corner of this worksheet (starting at cell AN240) for the calculation of the facility capacity factor.

[4] Conversion of "bbls of crude" to "lbs of crude", using the density of crude: bbls of crude in X 42 US gal/bbl X 3.785ee3 cm3/gal X 0.8673 g crude in/cm3 X 1 lb/ 453.6 g; or, a factor of 304.0 lbs of crude in/bbl of crude in. On this basis, the ten refineries processed 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

Table A4. (Continued)

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries. this resulted in an average API (American Petroleum Institute) gravity of 31.7 degrees, or specific gravity of 0.8692. The data came from Tables P-13 and P-14 on pages 851-2 of Chemical and Process Technology Encyclopedia, Douglas M. Considine, editor-in-chief, McGraw-Hill Book Company, New York. 1974. The data from the tables was copyrighted to the Universal Oil Products Company, 1973. (API , in degrees = [141.5/specific gravity @ 60/60] - 131.5).

[5] Calculating the 0 88% value 13.9 billion lbs/yr benzene divided by 1 575 trillion lbs crude/yr. The benzene value comes from CMR, 1.9 billion gallons benzene demand for 1996, and using the density of benzene (0.8765 kg/l or 7.314 lb/gal, obtained from the 61st edition of the CRC handbook of Chemistry and Physics) to convert to lbs.

[6] From the Chemical Profile of Benzene found in the Chemical Marketing Reporter (CMR), 1996.
<http://chemexpo com/news/newsframe.cfm?framebody=/news/profile.cfm>

[7] From the Chemical Profile of Cumene found in the Chemical Marketing Reporter (CMR), 1996

[8] According to Rudd (1981, p. 245) and according to CMR (on cumene, 1996), there is 1 lb of phenol for every 0.61 lbs of of acetone produced from the oxidation of cumene to cumene hydroperoxide, which is then cleaved catalytically to acetone (37.9%) and phenol (62.1%). Therefore, 0.61/1.61 x 100 = 37.9% acetone produced.

[9] 24.7ee9 lbs propylene (the 1995 demand from CMR, 1995) divided by 1.575ee12 lbs crude in = 0.0157

[10] From the Chemical Profile of Propylene found in the Chemical Marketing Reporter (CMR), 1995.

[11] From the Chemical Profile of Isopropanol found in the Chemical Marketing Reporter (CMR), 1998.

Table A4. (Continued)

[12] According to CMR's(1999) report on Acetone, over 90% of US acetone is produced as a coproduct with phenol through cumene peroxidation. However, dehydrogenation of isopropanol (IPA) and production of acetone as a byproduct of Propylene Oxide (PPO) were mentioned as other methods of commercial production.

CMR reported that at least 65 million lbs/yr of acetone were produced as a PPO byproduct. This represents only 2.4% of total acetone demand and thus was not included in this spreadsheet.

15% of IPA, or 210 million lbs, were used to make Acetone, which accounts for ~7.8% of acetone demand. This was deemed of enough signifigance to include in these calculations.

[13] From the Chemical Profile of Acetone found in the Chemical Marketing Reporter (CMR), 1998.

[14] According to Rudd (1981, p. 245) and according to CMR (on cumene, 1996), there is 1 lb of phenol for every 0.61 lbs of of acetone produced from the oxidation of cumene to cumene hydroperoxide, which is then cleaved catalytically to acetone (37.9%) and phenol (62 1%) Therefore, 1.0/1.61 x 100 = 62.1% phenol produced.

[15] From the Chemical Profile of Phenol found in the Chemical Marketing Reporter (CMR), 1996.

[16] According to 1999 CMR on BPA, all US producers make BPA through an acid-catalyzed condensation reaction of phenol with acetone.

[17] From the Chemical Profile of BPA found in the Chemical Marketing Reporter (CMR), 1999.

[18] Calculation for TRI lbs/lb PC· "lbs of TRI chemical lbs/lb of crude in" multiplied by "1 575 trillion lbs/yr crude" divided by "0.8 billion lbs PC (from CMR, 1996 - this value is the demand for 1996)"; or in other words, a factor of about "1,970 lbs of crude/lb of product".

Table A4. (Continued)

[19] Facility Capacity obtained from CMR report on PC, 1996.

[20] The TRI release data for this facility comes from the Right-to-Know Network environmental database for facility TRIs. <http://www.rtknet.org/triinputfacility.html>

[21] TRI lbs/lb of PC was computed by: (?? lbs/yr of the TRI chemical attributed to the PC chemical plant) divided by (280,000,000 lbs/yr - facility capacity) divided by (0.8616 - the facility capacity factor). The 0 8616 (or ~ 86%) value is the facility capacity factor which represents % of capacity at which the facility is actually operating. It was calculated by taking each yearly U.S. demand value (considered to approximate the throughput) divided by each yearly U.S. capacity for 141 different chemicals, and averaging the values These values were obtained from ChemExpo, accessed November 1999, available from <http://www chemexpo.com>, and make up all the chemicals listed in the "chemical profile archives." See further Table 2 in the bottom right corner of this worksheet (starting at cell AS251) for the calculation of the facility capacity factor.

Table A5. Ethylene Glycol Database Generated by the Public Data Method (page order: down, then over)

IN THE PRODUCTION OF ETHYLENE GLYCOL, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70806XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
ACETALDEHYDE	Air									
ACETALDEHYDE	Underground									
ACETALDEHYDE	POTW Transfer									
ACETALDEHYDE	Off-site Transfer									
ACROLEIN	Air									
ACRYLIC ACID	Air									
ACRYLIC ACID	Off-site Transfer									
AMMONIA	Air	60,962	160	71,376	436	49,128	505	440,000	3,500	10,000
AMMONIA	Water	24,767	25,000	2,822	2,400	13,134	2,162	0	7,350	3,600
AMMONIA	Underground	0	1,300,000	0	0	0	0	0	0	0
AMMONIA	POTW Transfer	0	0	0	0	0	104	0	0	0
AMMONIA	Off-site Transfer	0	0	0	23	0	0	0	0	0
ANTHRACENE	Air	0	0	1,029	0	895	0	0	524	0
ANTHRACENE	Land	0	0	0	0	162	0	0	0	0
ANTHRACENE	Off-site Transfer	0	0	0	0	11	0	0	0	0
ANTIMONY COMPOUNDS	Air	0	0	0	200	0	0	0	0	1,100
ANTIMONY COMPOUNDS	Land	0	0	0	0	0	0	0	0	2,500
ANTIMONY COMPOUNDS	Off-site Transfer	0	0	0	5,312	0	0	0	0	0
BARIUM COMPOUNDS	Water	0	0	0	0	1,892	0	0	0	0
BARIUM COMPOUNDS	Land	0	160	0	0	2,152	0	0	0	0
BARIUM COMPOUNDS	Off-site Transfer	0	70	0	0	185	0	0	0	0
BENZENE	Air	58,853	145,000	33,614	11,400	34,184	51,619	60,000	90,000	56,000
BENZENE	Water	15	1	43	13	11	0	0	2	0
BENZENE	Underground	0	170,000		0	0	0	0	0	0
BENZENE	Land	0	950	101	46	22	0	0	0	0
BENZENE	POTW Transfer	0	0	0	0	0	51	0	0	0
BENZENE	Off-site Transfer	4,533	4,189	357	4,666	2,390	2,010	44	1	833
BIPHENYL	Air	0	0	0	0	0	0	0	1,900	0
1,3-BUTADIENE	Air	10,848	280	338	50	3,098	1,771	18,400	1,730	6,100
1,3-BUTADIENE	Off-site Transfer	0	0	0	0	0	0	0	0	120
BUTYL ACRYLATE	Air									
BUTYL ACRYLATE	Off-site Transfer									
CARBON DISULFIDE	Air	0	0	0	0	0	0	0	7,090	0
CARBON DISULFIDE	Off-site Transfer	0	0	0	0	0	0	0	256	0
CARBON TETRACHLORIDE	Air	16,653	250	0	0	0	0	340	6,192	0
CARBON TETRACHLORIDE	Off-site Transfer	0	956	0	0	0	0	0	0	0
CARBONYL SULFIDE	Air	0	0	0	0	0	0	0	110,000	0
CHLORINE	Air	0	2,500	0	0	702	255	5	24,000	18,000
CHLORINE	Water	0	0	0	0	198	32	0	13,000	0
CHLORODIFLUOROMETHANE	Air									
CHLORODIFLUOROMETHANE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CHLOROETHANE	Air									
CHROMIUM COMPOUNDS	Air	0	0	0	0	0	0	16	0	0
CHROMIUM COMPOUNDS	Water	0	52	0	0	4,096	0	0	0	0
CHROMIUM COMPOUNDS	Land	0	36	0	0	5,054	0	0	0	0

Table A5. (Continued)

IN THE PRODUCTION OF ETHYLENE GLYCOL, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
CHROMIUM COMPOUNDS	Off-site Transfer	0	102	0	0	260	0	1,834	0	0
COBALT COMPOUNDS	Air	1	0	0	0	106	0	0	0	0
COBALT COMPOUNDS	Land	0	2	0	0	2,283	0	0	0	0
COBALT COMPOUNDS	Off-site Transfer	72,840	8,950	403	0	63,687	0	4,526	0	0
COPPER COMPOUNDS	Air	0	0	0	0	0	0	36	0	0
COPPER COMPOUNDS	Water	0	0	0	0	296	0	0	0	0
COPPER COMPOUNDS	Land	0	0	0	0	9,392	0	0	0	0
COPPER COMPOUNDS	Off-site Transfer	0	1,600	0	0	2,915	0	7	0	0
CRESOL (MIXED ISOMERS)	Air	0	0	619	0	0	0	0	27,000	0
CRESOL (MIXED ISOMERS)	Water	0	0	9	0	0	0	0	2,700	0
CRESOL (MIXED ISOMERS)	Underground	0	90,000	0	0	0	0	0	0	0
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	0	63	0	0	0	0	15	0
CUMENE	Air	1,018	0	2,265	0	3,059	23,675	0	8,148	2
CUMENE	Water	0	0	4	0	0	0	0	0	0
CUMENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
CYCLOHEXANE	Air	36,837	27,300	13,632	15,830	19,595	6,580	8,900	54,000	37,000
CYCLOHEXANE	Water	0	1	4	24	0	0	0	0	0
CYCLOHEXANE	Land	0	2,400	0	49	0	0	0	0	0
CYCLOHEXANE	Off-site Transfer	0	0		2,600	0	0	0	9	0
1,2-DIBROMOETHANE	Air	0	0	1,938	0	0	0	0	0	0
1,2-DIBROMOETHANE	Water	0	0	7	0	0	0	0	0	0
1,2-DICHLOROETHANE	Air	0	0	0	0	0	0	0	13,300	0
DIETHANOLAMINE	Air	0	0	0	0	0	276	9,600	0	0
DIETHANOLAMINE	Off-site Transfer	0	0	0	0	0	134,000	0	0	0
DIETHYL SULFATE	Off-site Transfer									
ETHYL ACRYLATE	Air									
ETHYL ACRYLATE	Off-site Transfer									
ETHYLBENZENE	Air	36,179	11,500	23,385	3,900	6,990	33,734	20,500	57,000	13,000
ETHYLBENZENE	Water	1	0	43	1	8	0	0	0	0
ETHYLBENZENE	Underground	0	1,700	0	0	0	0	0	0	0
ETHYLBENZENE	Land	0	490	0	42	117	0	0	0	0
ETHYLBENZENE	POTW Transfer	0	0	0	0	0	38	0	0	0
ETHYLBENZENE	Off-site Transfer	3,192	403	412	5,102	1,550	4,462	610	46	0
ETHYLENE	Air	277,061	110,000	1,254	2,500	83,530	27,177	31,400	37,088	163,000
ETHYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
ETHYLENE GLYCOL	Air	0	250	600	80	3	5	0	0	0
ETHYLENE GLYCOL	Underground									
ETHYLENE GLYCOL	POTW Transfer									
ETHYLENE GLYCOL	Water	0	0	319	0	4	0	0	0	0
ETHYLENE GLYCOL	Off-site Transfer	0	0		800	0	0	0	0	0
ETHYLENE OXIDE	Air									
ETHYLENE OXIDE	Underground									
ETHYLENE OXIDE	POTW Transfer									
ETHYLENE OXIDE	Off-site Transfer									
FORMALDEHYDE	Air	0	0	11,562	0	0	0	0	0	0

Table A5. (Continued)

IN THE PRODUCTION OF ETHYLENE GLYCOL, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996								Assumption: Refineries operate all		
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
FORMALDEHYDE	Underground									
FORMALDEHYDE	Water	0	0	115	0	0	0	0	0	0
FORMALDEHYDE	Off-site Transfer	0	0	259	0	0	0	0	0	0
GLYCOL ETHERS	Air	0	0	1,743	0	0	0	0	0	0
HYDROCHLORIC ACID	Air	0	37,000	19,901	16,000	22,653	0	19	0	0
HYDROGEN FLUORIDE	Air	0	2,800	0	0	0	255	0	0	79
HYDROQUINONE	Air									
HYDROQUINONE	Off-site Transfer									
LEAD COMPOUNDS	Air	0	0	25	54	0	0	0	0	0
LEAD COMPOUNDS	Water	0	0	732	40	47	0	0	0	0
LEAD COMPOUNDS	Land	0	0			7,889	0	0	0	0
LEAD COMPOUNDS	Off-site Transfer	0	0	652	41,725	426	0	2,280	73	0
MANGANESE COMPOUNDS	Air	0	0	0	16	0	0	0	0	0
MANGANESE COMPOUNDS	Water	0	0	0	1,800	0	0	0	0	0
MANGANESE COMPOUNDS	Off-site Transfer	0	0	0	9,330	0	0	0	0	0
METHANOL	Air	4,375	2,200,250	11,975	23,000	124,331	590	8,743	99,600	3,570
METHANOL	Water	0	0	7	0	0	0	0	1,200	0
METHANOL	Underground									
METHANOL	POTW Transfer									
METHANOL	Off-site Transfer	0	0	195	0	0	0	0	0	6,600
2-METHOXYETHANOL	Air	0	0	0	0	63	0	0	0	0
METHYL ETHYL KETONE	Air	0	0	201,068	358,000	133,888	0	1,556,000	410,000	0
METHYL ETHYL KETONE	Water	0	0	61	0	0	0	0	5,700	0
METHYL ETHYL KETONE	Underground	0	19,000	0	0	0	0	0	0	0
METHYL ETHYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ETHYL KETONE	Off-site Transfer	0	0	0	0	1,051	0	0	0	0
METHYL IODIDE	Air									
METHYL IODIDE	Underground									
METHYL IODIDE	Off-site Transfer									
METHYL ISOBUTYL KETONE	Air	0	0	96,974	0	132,893	0	0	0	0
METHYL ISOBUTYL KETONE	Water	0	0	4	0	0	0	0	0	0
METHYL ISOBUTYL KETONE	Land	0	0	0	0	5	0	0	0	0
METHYL ISOBUTYL KETONE	Off-site Transfer	0	0	0	0	415	0	0	0	0
METHYL TERT-BUTYL ETHER	Air	134,733	40,600	254,552	64,000	89,388	48,005	107,000	28,000	15,500
METHYL TERT-BUTYL ETHER	Water	0	42,000	30	8,200	0	0	0	0	0
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Air	0	0	0	0	267	0	0	0	0
MOLYBDENUM TRIOXIDE	Water	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Land	0	0	0	0	0	0	0	0	0
MOLYBDENUM TRIOXIDE	Off-site Transfer	338,652	43,690	11,646	0	20,139	0	21,120	152,726	0
NAPHTHALENE	Air	9,324	47,014	6,427	660	779	11,790	4,380	15,990	0
NAPHTHALENE	Water	0	1	83	21	0	0	0	17	0
NAPHTHALENE	Land	17	490	0	41	94	0	0	0	0
NAPHTHALENE	Off-site Transfer	3,239	0	1,197	248	1,038	123	6	750	0
N-BUTYL ALCOHOL	Air									

Table A5. (Continued)

IN THE PRODUCTION OF ETHYLENE GLYCOL, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM										
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996							Assumption: Refineries operate all			
(Data obtained from the RTK Network on 10/25/99)									365	days of the year
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	775223XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
N-BUTYL ALCOHOL	Off-site Transfer									
N-HEXANE	Air	180,829	93,000	47,248	51,500	116,432	18,105	133,000	96,000	216,000
N-HEXANE	Water	72	2	0	48	0	0	0	0	0
N-HEXANE	Land	0	3,500	0	100	0	0	0	0	0
N-HEXANE	Off-site Transfer	0	0	0	6,621	0	0	0	0	0
NICKEL COMPOUNDS	Air	98	0	374	0	216	21,405	1,200	200	3,000
NICKEL COMPOUNDS	Water	0	0	0	0	518	0	0	0	510
NICKEL COMPOUNDS	Land	6,412	110	0	0	6,914	69	0	0	7,500
NICKEL COMPOUNDS	Off-site Transfer	35,530	167,800	2,769	0	83,892	1,309	2	11,574	257,000
NITRATE COMPOUNDS	Water	5,275	84,000	2,005,479	70,000	174,310	0	0	73,800	0
N-METHYL-2-PYRROLIDONE	Air	0	0	73,240	11,000	15,869	0	0	0	0
N-METHYL-2-PYRROLIDONE	Land	0	0	0	700	0	0	0	0	0
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	0	0	0	160	0	0	0	0
O-XYLENE	Air	0	0	0	0	0	0	0	0	0
O-XYLENE	Water	0	0	0	0	0	0	0	0	0
O-XYLENE	Land	0	0	0	0	0	0	0	0	0
O-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
P-XYLENE	Air	0	0	0	0	0	0	0	0	0
P-XYLENE	Water	0	0	0	0	0	0	0	0	0
P-XYLENE	Land	0	0	0	0	0	0	0	0	0
P-XYLENE	Off-site Transfer	0	0	0	0	0	0	0	0	0
PHENANTHRENE	Air	0	530	0	870	258	0	0	0	0
PHENANTHRENE	Water	0	1	0	22	0	0	0	0	0
PHENANTHRENE	Land	0	3,700	0	37	376	0	0	0	0
PHENANTHRENE	Off-site Transfer	0	1	0	150	58	0	0	0	0
PHENOL	Air	54,876	0	3,344	0	3,363	728	5,100	45,004	0
PHENOL	Water	1,504	950	115	0	267	193	0	920	0
PHENOL	Underground	0	140,000	0	0	0	0	0	0	0
PHENOL	Land	44	3	0	0	153	0	0	0	0
PHENOL	POTW Transfer	0	0	0	0	0	2,266	0	0	0
PHENOL	Off-site Transfer	0	0	16	0	28	1	0	0	0
PHOSPHORIC ACID	Off-site Transfer	0	0	0	0	0	74,750	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Air	809	2,920	0	1,710	339	7,517	24	1,790	0
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	3	0	1	0	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	7,600	0	110	995	0	0	0	0
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	0	0	430	11	0	0	0	0
PROPYLENE	Air	223,245	43,000	4,849	45,000	109,396	27,722	85,000	220,000	129,000
PROPYLENE	Water	0	0	95	0	0	0	0	0	0
STYRENE	Air	0	0	520	0	239	0	0	0	0
STYRENE	Land	0	0	0	0	5	0	0	0	0
STYRENE	Off-site Transfer	0	0	0	0	36	0	0	0	0
SULFURIC ACID	Air	1,154	3,400	0	0	0	692	0	6,000	0
SULFURIC ACID	Off-site Transfer	0	0	0	0	0	0	0	12	0
TERT-BUTYL ALCOHOL	Air	0	0	0	0	0	0	0	300	0
TETRACHLOROETHYLENE	Air	29,612	250	568	0	5	0	1,700	0	0

Table A5. (Continued)

IN THE PRODUCTION OF ETHYLENE GLYCOL, THIS IS THE TRI CONTRIBUTION FROM REFINING OF PETROLEUM								Assumption: Refineries operate all	365 days of the year	
Releases of TRI Chemicals to the Environment by Top Ten Petroleum Refineries[1] (by Capacity) - 1996										
(Data obtained from the RTK Network on 10/25/99)										
		Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Facility 7	Facility 8	Facility 9
FACILITY ID --->		00851HSSLVLIMET	77590MCLCM24015	70805XXNBT4050S	46394MCLC 2815I	77522XXNBY2800D	19145TLNTC3144P	77701BMNTREASTE	70602CTGPTHIGHW	77480PHLLPSH35A
REFINING CAPACITY (Barrels/day)--->		495000	433000	424000	410000	396000	315000	315000	305000	301000
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.	LBS/YR.
TETRACHLOROETHYLENE	Land	0	0	0	11	0	0	0	0	0
TETRACHLOROETHYLENE	Off-site Transfer	0	580	0	95	36	0	0	0	0
TOLUENE	Air	158,398	80,000	94,542	252,000	213,327	61,869	1,033,000	562,000	0
TOLUENE	Water	62	2	39	55	63	0	0	17	0
TOLUENE	Underground	0	160,000	0	0	0	0	0	0	0
TOLUENE	Land	1	2,800	0	180	65	0	0	0	0
TOLUENE	POTW Transfer	0	0	0	0	0	214	0	0	0
TOLUENE	Off-site Transfer	6,958	756	1,407	18,809	12,876	3,342	2,137	60	0
1,1,1-TRICHLOROETHANE	Air									
1,1,1-TRICHLOROETHANE	Off-site Transfer									
TRICHLOROETHYLENE	Air	0	11,000	0	0	54,724	0	0	0	0
TRICHLOROETHYLENE	Off-site Transfer	0	0	0	0	27	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Air	10,474	22,300	11,222	4,844	274	13,726	20,300	22,340	0
1,2,4-TRIMETHYLBENZENE	Water	0	1	0	38	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Land	0	1,100	0	82	0	0	0	0	0
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	0	21	0	688	0	0	0	0	0
VANADIUM (FUME OR DUST)	Land	0	11	0	0	0	0	0	0	0
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	0	0	0	0	0	0	0
VINYL ACETATE	Air									
VINYL ACETATE	Underground									
VINYL ACETATE	POTW Transfer									
VINYL ACETATE	Off-site Transfer									
XYLENE (MIXED ISOMERS)	Air	161,546	82,000	64,534	21,500	37,389	51,098	87,000	224,000	0
XYLENE (MIXED ISOMERS)	Water	24	3	0	57	202	0	0	2	0
XYLENE (MIXED ISOMERS)	Underground	0	31,000	0	0	0	0	0	0	0
XYLENE (MIXED ISOMERS)	Land	52	3,900	0	300	372	0	0	0	0
XYLENE (MIXED ISOMERS)	POTW Transfer	0	0	0	0	0	330	0	0	0
XYLENE (MIXED ISOMERS)	Off-site Transfer	14,267	1,238	4,819	9,556	14,769	13,608	3,096	598	0
ZINC COMPOUNDS	Air	0	0	954	6,801	0	63	190	0	0
ZINC COMPOUNDS	Water	0	1,500	7,686	1,700	1,219	1,179	0	0	0
ZINC COMPOUNDS	Land	0	57	0	0	51,227	0	0	0	0
ZINC COMPOUNDS	POTW Transfer	0	0	0	0	0	89	0	0	0
ZINC COMPOUNDS	Off-site Transfer	0	0	1,603	8,660	1,019	27,069	36	0	0
TOTAL RELEASES & TRANSFERS (LBS)		1,985,342	5,453,186	3,099,268	1,092,284	1,747,909	676,563	3,667,551	2,443,524	950,014

Table A5. (Continued)

		Facility 10	Totals						
FACILITY ID --->		39567CHVRNPOBOX							
REFINING CAPACITY (Barrels/day)--->		295000	3689000						
									TRI Releases for ethylene glycol
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	13% of ethylene to ethylene oxide[6]:	64% of ethylene oxide to ethylene glycol[7]:	TRI lbs/ lb of ethylene glycol[8] (attributed to oil refineries):
ACETALDEHYDE	Air								
ACETALDEHYDE	Underground								
ACETALDEHYDE	POTW Transfer								
ACETALDEHYDE	Off-site Transfer								
ACROLEIN	Air								
ACRYLIC ACID	Air								
ACRYLIC ACID	Off-site Transfer								
AMMONIA	Air	110,210	746,277	0.000644466	2.11995E-06	6.51465E-08	8.46905E-09	5.42019E-09	1.29345E-06
AMMONIA	Water	8,700	89,935	7.76656E-05	2.55479E-07	7.85091E-09	1.02062E-09	6.53196E-10	1.55876E-07
AMMONIA	Underground	0	1,300,000	0.001122647	3.69292E-06	1.13484E-07	1.47529E-08	9.44187E-09	2.25317E-06
AMMONIA	POTW Transfer	0	104	8.98118E-08	2.95434E-10	9.07872E-12	1.18023E-12	7.55349E-13	1.80254E-10
AMMONIA	Off-site Transfer	0	23	1.98622E-08	6.53363E-11	2.00779E-12	2.61013E-13	1.67048E-13	3.98638E-11
ANTHRACENE	Air	0	2,448	2.11403E-06	6.95405E-09	2.13699E-10	2.77809E-11	1.77798E-11	4.2429E-09
ANTHRACENE	Land	0	162	1.39899E-07	4.60195E-10	1.41419E-11	1.83844E-12	1.1766E-12	2.8078E-10
ANTHRACENE	Off-site Transfer	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.24832E-13	7.98927E-14	1.90653E-11
ANTIMONY COMPOUNDS	Air	0	1,300	1.12265E-06	3.69292E-09	1.13484E-10	1.47529E-11	9.44187E-12	2.25317E-09
ANTIMONY COMPOUNDS	Land	0	2,500	2.15894E-06	7.10177E-09	2.18238E-10	2.8371E-11	1.81574E-11	4.33303E-09
ANTIMONY COMPOUNDS	Off-site Transfer	0	5,312	4.58731E-06	1.50898E-08	4.63713E-10	6.02827E-11	3.85809E-11	9.20681E-09
BARIUM COMPOUNDS	Water	0	1,892	1.63388E-06	5.37462E-09	1.65163E-10	2.14712E-11	1.37415E-11	3.27923E-09
BARIUM COMPOUNDS	Land	0	2,312	1.99659E-06	6.56771E-09	2.01827E-10	2.62375E-11	1.6792E-11	4.00718E-09
BARIUM COMPOUNDS	Off-site Transfer	0	255	2.20212E-07	7.2438E-10	2.22603E-11	2.89384E-12	1.85206E-12	4.41969E-10
BENZENE	Air	68,000	608,670	0.000525632	1.72905E-06	5.31341E-08	6.90743E-09	4.42076E-09	1.05495E-06
BENZENE	Water	21	106	9.15389E-08	3.01115E-10	9.25331E-12	1.20293E-12	7.69875E-13	1.8372E-10
BENZENE	Underground	0	170,000	0.000146808	4.8292E-07	1.48402E-08	1.92923E-09	1.23471E-09	2.94646E-07
BENZENE	Land	2	1,121	9.68068E-07	3.18443E-09	9.78581E-11	1.27216E-11	8.1418E-12	1.94293E-09
BENZENE	POTW Transfer	0	51	4.40423E-08	1.44876E-10	4.45206E-12	5.78768E-13	3.70412E-13	8.83937E-11
BENZENE	Off-site Transfer	588	19,611	1.69356E-05	5.57091E-08	1.71195E-09	2.22553E-10	1.42434E-10	3.399E-08
BIPHENYL	Air	0	1,900	1.64079E-06	5.39734E-09	1.65861E-10	2.1562E-11	1.37997E-11	3.2931E-09
1,3-BUTADIENE	Air	700	43,315	3.74057E-05	1.23045E-07	3.7812E-09	4.91556E-10	3.14596E-10	7.5074E-08
1,3-BUTADIENE	Off-site Transfer	0	120	1.03629E-07	3.40885E-10	1.04754E-11	1.36181E-12	8.71557E-13	2.07985E-10
BUTYL ACRYLATE	Air			0		0	0	0	0
BUTYL ACRYLATE	Off-site Transfer			0		0	0	0	0
CARBON DISULFIDE	Air	0	7,090	6.12275E-06	2.01406E-08	6.18924E-10	8.04601E-11	5.14945E-11	1.22885E-08
CARBON DISULFIDE	Off-site Transfer	0	256	2.21075E-07	7.27221E-10	2.23476E-11	2.90519E-12	1.85932E-12	4.43702E-10
CARBON TETRACHLORIDE	Air	0	23,435	2.02379E-05	6.6572E-08	2.04577E-09	2.6595E-10	1.70208E-10	4.06178E-08
CARBON TETRACHLORIDE	Off-site Transfer	0	956	8.25578E-07	2.71572E-09	8.34544E-11	1.08491E-11	6.9434E-12	1.65695E-09
CARBONYL SULFIDE	Air	71,300	181,300	0.000156566	5.1502E-07	1.58267E-08	2.05746E-09	1.31678E-09	3.14231E-07
CHLORINE	Air	0	45,462	3.92598E-05	1.29144E-07	3.96862E-09	5.15921E-10	3.30189E-10	7.87952E-08
CHLORINE	Water	0	13,230	1.14251E-05	3.75826E-08	1.15492E-09	1.50139E-10	9.60892E-11	2.29304E-08
CHLORODIFLUOROMETHANE	Air			0		0	0	0	0
CHLORODIFLUOROMETHANE	Off-site Transfer	23,000	23,000	1.98622E-05	6.53363E-08	2.00779E-09	2.61013E-10	1.67048E-10	3.98638E-08
CHLOROETHANE	Air			0		0	0	0	0
CHROMIUM COMPOUNDS	Air	14	30	2.59072E-08	8.52212E-11	2.61886E-12	3.40452E-13	2.17889E-13	5.19963E-11
CHROMIUM COMPOUNDS	Water	4	4,152	3.58556E-06	1.17946E-08	3.6245E-10	4.71186E-11	3.01559E-11	7.19629E-09
CHROMIUM COMPOUNDS	Land	0	5,090	4.3956E-06	1.44592E-08	4.44333E-10	5.77634E-11	3.69685E-11	8.82204E-09

Table A5. (Continued)

		Facility 10	Totals						
FACILITY ID --->		39567CHVRNPOBOX							
REFINING CAPACITY (Barrels/day)--->		295000	3689000						
									TRI Releases for ethylene glycol
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	13% of ethylene to ethylene oxide[6]:	64% of ethylene oxide to ethylene glycol[7]:	TRI lbs/ lb of ethylene glycol[8] (attributed to oil refineries):
CHROMIUM COMPOUNDS	Off-site Transfer	23,674	25,870	2.23407E-05	7.34891E-08	2.25833E-09	2.93583E-10	1.87893E-10	4.48381E-08
COBALT COMPOUNDS	Air	0	107	9.24025E-08	3.03956E-10	9.34061E-12	1.21428E-12	7.77138E-13	1.85453E-10
COBALT COMPOUNDS	Land	0	2,285	1.97327E-06	6.49102E-09	1.9947E-10	2.59311E-11	1.65959E-11	3.96038E-09
COBALT COMPOUNDS	Off-site Transfer	0	150,406	0.000129887	4.27259E-07	1.31297E-08	1.70687E-09	1.0924E-09	2.60685E-07
COPPER COMPOUNDS	Air	250	286	2.46982E-07	8.12442E-10	2.49665E-11	3.24564E-12	2.07721E-12	4.95698E-10
COPPER COMPOUNDS	Water	81	377	3.25568E-07	1.07095E-09	3.29104E-11	4.27835E-12	2.73814E-12	6.5342E-10
COPPER COMPOUNDS	Land	70	9,462	8.17115E-06	2.68788E-08	8.25989E-10	1.07379E-10	6.87223E-11	1.63996E-08
COPPER COMPOUNDS	Off-site Transfer	162,122	166,644	0.00014391	4.73387E-07	1.45473E-08	1.89114E-09	1.21033E-09	2.88829E-07
CRESOL (MIXED ISOMERS)	Air	0	27,619	2.38511E-05	7.84575E-08	2.41101E-09	3.13431E-10	2.00596E-10	4.78695E-08
CRESOL (MIXED ISOMERS)	Water	0	2,709	2.33942E-06	7.69548E-09	2.36483E-10	3.07428E-11	1.96754E-11	4.69527E-09
CRESOL (MIXED ISOMERS)	Underground	0	90,000	7.77217E-05	2.55664E-07	7.85658E-09	1.02136E-09	6.53668E-10	1.55989E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer	0	78	6.73588E-08	2.21575E-10	6.80904E-12	8.85175E-13	5.66512E-13	1.3519E-10
CUMENE	Air	26,570	64,737	5.59053E-05	1.83899E-07	5.65124E-09	7.34661E-10	4.70183E-10	1.12203E-07
CUMENE	Water	21	25	2.15894E-08	7.10177E-11	2.18238E-12	2.8371E-13	1.81574E-13	4.33303E-11
CUMENE	Off-site Transfer	80	80	6.9086E-08	2.27257E-10	6.98363E-12	9.07872E-13	5.81038E-13	1.38657E-10
CYCLOHEXANE	Air	17,000	236,674	0.000204386	6.72321E-07	2.06605E-08	2.68587E-09	1.71896E-09	4.10206E-07
CYCLOHEXANE	Water	0	29	2.50437E-08	8.23805E-11	2.53157E-12	3.29104E-13	2.10626E-13	5.02631E-11
CYCLOHEXANE	Land	1	2,450	2.11576E-06	6.95973E-09	2.13874E-10	2.78036E-11	1.77943E-11	4.24636E-09
CYCLOHEXANE	Off-site Transfer	80	2,689	2.32215E-06	7.63866E-09	2.34737E-10	3.05158E-11	1.95301E-11	4.6606E-09
1,2-DIBROMOETHANE	Air	0	1,938	1.67361E-06	5.50529E-09	1.69178E-10	2.19932E-11	1.40756E-11	3.35896E-09
1,2-DIBROMOETHANE	Water	0	7	6.04502E-09	1.98849E-11	6.11068E-13	7.94388E-14	5.08408E-14	1.21325E-11
1,2-DICHLOROETHANE	Air	0	13,300	1.14855E-05	3.77814E-08	1.16103E-09	1.50934E-10	9.65976E-11	2.30517E-08
DIETHANOLAMINE	Air	34,000	43,876	3.78902E-05	1.24639E-07	3.83017E-09	4.97922E-10	3.1867E-10	7.60463E-08
DIETHANOLAMINE	Off-site Transfer	0	134,000	0.000115719	3.80655E-07	1.16976E-08	1.52069E-09	9.73239E-10	2.3225E-07
DIETHYL SULFATE	Off-site Transfer			0		0	0	0	0
ETHYL ACRYLATE	Air			0		0	0	0	0
ETHYL ACRYLATE	Off-site Transfer			0		0	0	0	0
ETHYLBENZENE	Air	49,600	255,788	0.000220892	7.26619E-07	2.23291E-08	2.90278E-09	1.85778E-09	4.43334E-07
ETHYLBENZENE	Water	21	74	6.39045E-08	2.10212E-10	6.45986E-12	8.39782E-13	5.3746E-13	1.28258E-10
ETHYLBENZENE	Underground	0	1,700	1.46808E-06	4.8292E-09	1.48402E-10	1.92923E-11	1.23471E-11	2.94646E-09
ETHYLBENZENE	Land	12	661	5.70823E-07	1.87771E-09	5.77022E-11	7.50129E-12	4.80083E-12	1.14565E-09
ETHYLBENZENE	POTW Transfer	0	38	3.28158E-08	1.07947E-10	3.31722E-12	4.31239E-13	2.75993E-13	6.5862E-11
ETHYLBENZENE	Off-site Transfer	3,821	19,598	1.69243E-05	5.56722E-08	1.71081E-09	2.22406E-10	1.4234E-10	3.39675E-08
ETHYLENE	Air	65,000	798,010	0.000689141	2.26691E-06	6.96626E-08	9.05614E-09	5.79593E-09	1.38312E-06
ETHYLENE	Off-site Transfer	93	93	8.03125E-08	2.64186E-10	8.11847E-12	1.0554E-12	6.75457E-13	1.61189E-10
ETHYLENE GLYCOL	Air	17,200	18,138	1.56635E-05	5.15247E-08	1.58336E-09	2.05837E-10	1.31736E-10	3.1437E-08
ETHYLENE GLYCOL	Underground			0		0	0	0	0
ETHYLENE GLYCOL	POTW Transfer			0		0	0	0	0
ETHYLENE GLYCOL	Water	19,000	19,323	1.66869E-05	5.4891E-08	1.68681E-09	2.19285E-10	1.40342E-10	3.34908E-08
ETHYLENE GLYCOL	Off-site Transfer	0	800	6.9086E-07	2.27257E-09	6.98363E-11	9.07872E-12	5.81038E-12	1.38657E-09
ETHYLENE OXIDE	Air			0		0	0	0	0
ETHYLENE OXIDE	Underground			0		0	0	0	0
ETHYLENE OXIDE	POTW Transfer			0		0	0	0	0
ETHYLENE OXIDE	Off-site Transfer			0		0	0	0	0
FORMALDEHYDE	Air	0	11,562	9.98465E-06	3.28443E-08	1.00931E-09	1.3121E-10	8.39745E-11	2.00394E-08
FORMALDEHYDE	Underground			0		0	0	0	0

Table A5. (Continued)

		Facility 10	Totals						
FACILITY ID --->		39567CHVRNPOBOX							
REFINING CAPACITY (Barrels/day)--->		295000	3689000						
									TRI Releases for ethylene glycol
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	13% of ethylene to ethylene oxide[6]:	64% of ethylene oxide to ethylene glycol[7]:	TRI lbs/ lb of ethylene glycol[8] (attributed to oil refineries):
FORMALDEHYDE	Water	0	115	9.93111E-08	3.26681E-10	1.0039E-11	1.30507E-12	8.35242E-13	1.99319E-10
FORMALDEHYDE	Off-site Transfer	0	259	2.23666E-07	7.35743E-10	2.26095E-11	2.93924E-12	1.88111E-12	4.48901E-10
GLYCOL ETHERS	Air	0	1,743	1.50521E-06	4.95135E-09	1.52156E-10	1.97803E-11	1.26594E-11	3.02099E-09
HYDROCHLORIC ACID	Air	0	95,573	8.25344E-05	2.71495E-07	8.34308E-09	1.0846E-09	6.94144E-10	1.65648E-07
HYDROGEN FLUORIDE	Air	0	3,134	2.70644E-06	8.90278E-09	2.73584E-10	3.55659E-11	2.27622E-11	5.43188E-09
HYDROQUINONE	Air			0		0	0	0	0
HYDROQUINONE	Off-site Transfer			0		0	0	0	0
LEAD COMPOUNDS	Air	0	79	6.82224E-08	2.24416E-10	6.89633E-12	8.96524E-13	5.73775E-13	1.36924E-10
LEAD COMPOUNDS	Water	0	819	7.07268E-07	2.32654E-09	7.14949E-11	9.29434E-12	5.94838E-12	1.4195E-09
LEAD COMPOUNDS	Land	0	7,889	6.81274E-06	2.24103E-08	6.88673E-10	8.95275E-11	5.72976E-11	1.36733E-08
LEAD COMPOUNDS	Off-site Transfer	1,252	46,408	4.00768E-05	1.31832E-07	4.0512E-09	5.26657E-10	3.3706E-10	8.04348E-08
MANGANESE COMPOUNDS	Air	0	16	1.38172E-08	4.54513E-11	1.39673E-12	1.81574E-13	1.16208E-13	2.77314E-11
MANGANESE COMPOUNDS	Water	0	1,800	1.55443E-06	5.11327E-09	1.57132E-10	2.04271E-11	1.30734E-11	3.11978E-09
MANGANESE COMPOUNDS	Off-site Transfer	0	9,330	8.05715E-06	2.65038E-08	8.14466E-10	1.05881E-10	6.77636E-11	1.61708E-08
METHANOL	Air	1,490,000	3,966,434	0.003425313	1.12675E-05	3.46251E-07	4.50127E-08	2.88081E-08	6.87466E-06
METHANOL	Water	0	1,207	1.04233E-06	3.42873E-09	1.05366E-10	1.36975E-11	8.76641E-12	2.09198E-09
METHANOL	Underground			0		0	0	0	0
METHANOL	POTW Transfer			0		0	0	0	0
METHANOL	Off-site Transfer	6	6,801	5.87317E-06	1.93196E-08	5.93696E-10	7.71805E-11	4.93955E-11	1.17876E-08
2-METHOXYETHANOL	Air	0	63	5.44052E-08	1.78965E-10	5.49961E-12	7.14949E-13	4.57567E-13	1.09192E-10
METHYL ETHYL KETONE	Air	0	2,658,956	0.002296208	7.55331E-06	2.32115E-07	3.01749E-08	1.93119E-08	4.60853E-06
METHYL ETHYL KETONE	Water	0	5,761	4.97506E-06	1.63653E-08	5.02909E-10	6.53781E-11	4.1842E-11	9.98502E-09
METHYL ETHYL KETONE	Underground	0	19,000	1.64079E-05	5.39734E-08	1.65861E-09	2.1562E-10	1.37997E-10	3.2931E-08
METHYL ETHYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	5.6742E-14	3.63149E-14	8.66605E-12
METHYL ETHYL KETONE	Off-site Transfer	0	1,051	9.07617E-07	2.98558E-09	9.17474E-11	1.19272E-11	7.63339E-12	1.8216E-09
METHYL IODIDE	Air			0		0	0	0	0
METHYL IODIDE	Underground			0		0	0	0	0
METHYL IODIDE	Off-site Transfer			0		0	0	0	0
METHYL ISOBUTYL KETONE	Air	0	229,867	0.000198507	6.52985E-07	2.00663E-08	2.60862E-09	1.66952E-09	3.98408E-07
METHYL ISOBUTYL KETONE	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	4.53936E-14	2.90519E-14	6.93284E-12
METHYL ISOBUTYL KETONE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	5.6742E-14	3.63149E-14	8.66605E-12
METHYL ISOBUTYL KETONE	Off-site Transfer	0	415	3.58384E-07	1.17889E-09	3.62276E-11	4.70959E-12	3.01413E-12	7.19282E-10
METHYL TERT-BUTYL ETHER	Air	87,570	869,348	0.000750747	2.46956E-06	7.58901E-08	9.86571E-09	6.31405E-09	1.50676E-06
METHYL TERT-BUTYL ETHER	Water	0	50,230	4.33774E-05	1.42689E-07	4.38485E-09	5.7003E-10	3.64819E-10	8.70591E-08
METHYL TERT-BUTYL ETHER	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	1.81574E-09	1.16208E-09	2.77314E-07
MOLYBDENUM TRIOXIDE	Air	181,000	181,267	0.000156538	5.14926E-07	1.58238E-08	2.05709E-09	1.31654E-09	3.14174E-07
MOLYBDENUM TRIOXIDE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.38316E-13	1.52522E-13	3.63974E-11
MOLYBDENUM TRIOXIDE	Land	95	95	8.20396E-08	2.69867E-10	8.29306E-12	1.0781E-12	6.89983E-13	1.64655E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer	5,069	593,042	0.000512136	1.68466E-06	5.17698E-08	6.73008E-09	4.30725E-09	1.02787E-06
NAPHTHALENE	Air	5,170	101,534	8.76822E-05	2.88428E-07	8.86345E-09	1.15225E-09	7.37439E-10	1.7598E-07
NAPHTHALENE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	1.62282E-12	1.03861E-12	2.47849E-10
NAPHTHALENE	Land	1	643	5.55279E-07	1.82657E-09	5.61309E-11	7.29702E-12	4.67009E-12	1.11445E-09
NAPHTHALENE	Off-site Transfer	0	6,601	5.70046E-06	1.87515E-08	5.76237E-10	7.49108E-11	4.79429E-11	1.14409E-08
N-BUTYL ALCOHOL	Air			0		0	0	0	0
N-BUTYL ALCOHOL	Off-site Transfer			0		0	0	0	0
N-HEXANE	Air	303,000	1,255,114	0.001083885	3.56541E-06	1.09566E-07	1.42435E-08	9.11586E-09	2.17538E-06

Table A5. (Continued)

		Facility 10	Totals						
FACILITY ID --->		39567CHVRNPOBOX							
REFINING CAPACITY (Barrels/day)--->		295000	3689000						
									TRI Releases for ethylene glycol
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	13% of ethylene to ethylene oxide[6]:	64% of ethylene oxide to ethylene glycol[7]:	TRI lbs/ lb of ethylene glycol[8] (attributed to oil refineries):
N-HEXANE	Water	21	143	1.23491E-07	4.06221E-10	1.24832E-11	1.62282E-12	1.03861E-12	2.47849E-10
N-HEXANE	Land	2	3,602	3.1106E-06	1.02322E-08	3.14438E-10	4.08769E-11	2.61612E-11	6.24302E-09
N-HEXANE	Off-site Transfer	0	6,621	5.71773E-06	1.88083E-08	5.77983E-10	7.51378E-11	4.80882E-11	1.14756E-08
NICKEL COMPOUNDS	Air	280	26,773	2.31205E-05	7.60542E-08	2.33716E-09	3.03831E-10	1.94452E-10	4.64032E-08
NICKEL COMPOUNDS	Water	560	1,588	1.37136E-06	4.51104E-09	1.38625E-10	1.80213E-11	1.15336E-11	2.75234E-09
NICKEL COMPOUNDS	Land	0	21,005	1.81394E-05	5.96691E-08	1.83364E-09	2.38373E-10	1.52559E-10	3.64061E-08
NICKEL COMPOUNDS	Off-site Transfer	363,011	922,887	0.000796982	2.62165E-06	8.05638E-08	1.04733E-08	6.70291E-09	1.59956E-06
NITRATE COMPOUNDS	Water	220,000	2,632,864	0.002273675	7.4792E-06	2.29837E-07	2.98788E-08	1.91224E-08	4.56331E-06
N-METHYL-2-PYRROLIDONE	Air	0	100,109	8.64516E-05	2.8438E-07	8.73905E-09	1.13608E-09	7.27089E-10	1.7351E-07
N-METHYL-2-PYRROLIDONE	Land	0	700	6.04502E-07	1.98849E-09	6.11068E-11	7.94388E-12	5.08408E-12	1.21325E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer	0	160	1.38172E-07	4.54513E-10	1.39673E-11	1.81574E-12	1.16208E-12	2.77314E-10
O-XYLENE	Air	88,500	88,500	7.64264E-05	2.51403E-07	7.72564E-09	1.00433E-09	6.42773E-10	1.53389E-07
O-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.38316E-13	1.52522E-13	3.63974E-11
O-XYLENE	Land	86	86	7.42674E-08	2.44301E-10	7.5074E-12	9.75962E-13	6.24616E-13	1.49056E-10
O-XYLENE	Off-site Transfer	5,349	5,349	4.61926E-06	1.51949E-08	4.66943E-10	6.07026E-11	3.88497E-11	9.27094E-09
P-XYLENE	Air	574,900	574,900	0.000496469	1.63312E-06	5.01861E-08	6.52419E-09	4.17548E-09	9.96422E-07
P-XYLENE	Water	21	21	1.81351E-08	5.96548E-11	1.8332E-12	2.38316E-13	1.52522E-13	3.63974E-11
P-XYLENE	Land	77	77	6.64953E-08	2.18734E-10	6.72174E-12	8.73827E-13	5.59249E-13	1.33457E-10
P-XYLENE	Off-site Transfer	5,369	5,369	4.63653E-06	1.52518E-08	4.68689E-10	6.09296E-11	3.89949E-11	9.3056E-09
PHENANTHRENE	Air	0	1,658	1.43181E-06	4.70989E-09	1.44736E-10	1.88156E-11	1.2042E-11	2.87366E-09
PHENANTHRENE	Water	0	23	1.98622E-08	6.53363E-11	2.00779E-12	2.61013E-13	1.67048E-13	3.98638E-11
PHENANTHRENE	Land	0	4,113	3.55188E-06	1.16838E-08	3.59046E-10	4.6676E-11	2.98726E-11	7.12869E-09
PHENANTHRENE	Off-site Transfer	0	209	1.80487E-07	5.93708E-10	1.82447E-11	2.37182E-12	1.51796E-12	3.62241E-10
PHENOL	Air	0	112,415	9.70788E-05	3.19338E-07	9.81331E-09	1.27573E-09	8.16467E-10	1.94839E-07
PHENOL	Water	0	3,949	3.41026E-06	1.1218E-08	3.44729E-10	4.48148E-11	2.86815E-11	6.84445E-09
PHENOL	Underground	0	140,000	0.0001209	3.97699E-07	1.22214E-08	1.58878E-09	1.01682E-09	2.42649E-07
PHENOL	Land	0	200	1.72715E-07	5.68141E-10	1.74591E-11	2.26968E-12	1.4526E-12	3.46642E-10
PHENOL	POTW Transfer	0	2,266	1.95686E-06	6.43704E-09	1.97811E-10	2.57155E-11	1.64579E-11	3.92745E-09
PHENOL	Off-site Transfer	0	45	3.88609E-08	1.27832E-10	3.92829E-12	5.10678E-13	3.26834E-13	7.79945E-11
PHOSPHORIC ACID	Off-site Transfer	0	74,750	6.45522E-05	2.12343E-07	6.52533E-09	8.48293E-10	5.42907E-10	1.29557E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air	0	15,109	1.30478E-05	4.29202E-08	1.31895E-09	1.71463E-10	1.09736E-10	2.61871E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water	0	4	3.4543E-09	1.13628E-11	3.49182E-13	4.53936E-14	2.90519E-14	6.93284E-12
POLYCYCLIC AROMATIC COMPOUNDS	Land	0	8,705	7.51742E-06	2.47284E-08	7.59906E-10	9.87878E-11	6.32242E-11	1.50876E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer	0	441	3.80837E-07	1.25275E-09	3.84973E-11	5.00464E-12	3.20297E-12	7.64346E-10
PROPYLENE	Air	100,300	987,512	0.000852791	2.80523E-06	8.62052E-08	1.12067E-08	7.17228E-09	1.71157E-06
PROPYLENE	Water	0	95	8.20396E-08	2.69867E-10	8.29306E-12	1.0781E-12	6.89983E-13	1.64655E-10
STYRENE	Air	0	759	6.55453E-07	2.1561E-09	6.62572E-11	8.61343E-12	5.5126E-12	1.31551E-09
STYRENE	Land	0	5	4.31787E-09	1.42035E-11	4.36477E-13	5.6742E-14	3.63149E-14	8.66605E-12
STYRENE	Off-site Transfer	0	36	3.10887E-08	1.02265E-10	3.14263E-12	4.08542E-13	2.61467E-13	6.23956E-11
SULFURIC ACID	Air	0	11,246	9.71176E-06	3.19466E-08	9.81724E-10	1.27624E-10	8.16794E-11	1.94917E-08
SULFURIC ACID	Off-site Transfer	0	12	1.03629E-08	3.40885E-11	1.04754E-12	1.36181E-13	8.71557E-14	2.07985E-11
TERT-BUTYL ALCOHOL	Air	0	300	2.59072E-07	8.52212E-10	2.61886E-11	3.40452E-12	2.17889E-12	5.19963E-10
TETRACHLOROETHYLENE	Air	3,522	35,657	3.07925E-05	1.01291E-07	3.11269E-09	4.0465E-10	2.58976E-10	6.18011E-08
TETRACHLOROETHYLENE	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.24832E-13	7.98927E-14	1.90653E-11
TETRACHLOROETHYLENE	Off-site Transfer	0	711	6.14002E-07	2.01974E-09	6.2067E-11	8.06871E-12	5.16398E-12	1.23231E-09
TOLUENE	Air	211,000	2,666,136	0.002302408	7.57371E-06	2.32741E-07	3.02564E-08	1.93641E-08	4.62097E-06

Table A5. (Continued)

		Facility 10	Totals						
FACILITY ID --->		39567CHVRNPOBOX							
REFINING CAPACITY (Barrels/day)--->		295000	3689000						
									TRI Releases for ethylene glycol
Chemical	Disposition[2]	LBS/YR.	LBS/YR.	TRI lbs/barrel of crude in [3]	TRI lbs/lb of crude in[4]:	3.07% of crude to ethylene[5]:	13% of ethylene to ethylene oxide[6]:	64% of ethylene oxide to ethylene glycol[7]:	TRI lbs/ lb of ethylene glycol[8] (attributed to oil refineries):
TOLUENE	Water	21	259	2.23666E-07	7.35743E-10	2.26095E-11	2.93924E-12	1.88111E-12	4.48901E-10
TOLUENE	Underground	0	160,000	0.000138172	4.54513E-07	1.39673E-08	1.81574E-09	1.16208E-09	2.77314E-07
TOLUENE	Land	19	3,065	2.64686E-06	8.70677E-09	2.6756E-10	3.47828E-11	2.2261E-11	5.31229E-09
TOLUENE	POTW Transfer	0	214	1.84805E-07	6.07911E-10	1.86812E-11	2.42856E-12	1.55428E-12	3.70907E-10
TOLUENE	Off-site Transfer	726	47,071	4.06493E-05	1.33715E-07	4.10908E-09	5.3418E-10	3.41876E-10	8.15839E-08
1,1,1-TRICHLOROETHANE	Air			0		0	0	0	0
1,1,1-TRICHLOROETHANE	Off-site Transfer			0		0	0	0	0
TRICHLOROETHYLENE	Air	0	65,724	5.67576E-05	1.86703E-07	5.7374E-09	7.45862E-10	4.77352E-10	1.13913E-07
TRICHLOROETHYLENE	Off-site Transfer	0	27	2.33165E-08	7.66991E-11	2.35698E-12	3.06407E-13	1.961E-13	4.67967E-11
1,2,4-TRIMETHYLBENZENE	Air	22,100	127,580	0.000110175	3.62417E-07	1.11371E-08	1.44783E-09	9.2661E-10	2.21123E-07
1,2,4-TRIMETHYLBENZENE	Water	0	39	3.36794E-08	1.10788E-10	3.40452E-12	4.42588E-13	2.83256E-13	6.75952E-11
1,2,4-TRIMETHYLBENZENE	Land	6	1,188	1.02593E-06	3.37476E-09	1.03707E-10	1.34819E-11	8.62841E-12	2.05905E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer	21	730	6.3041E-07	2.07372E-09	6.37256E-11	8.28433E-12	5.30197E-12	1.26524E-09
VANADIUM (FUME OR DUST)	Land	0	11	9.49932E-09	3.12478E-11	9.60249E-13	1.24832E-13	7.98927E-14	1.90653E-11
VANADIUM (FUME OR DUST)	Off-site Transfer	0	7,000	6.04502E-06	1.98849E-08	6.11068E-10	7.94388E-11	5.08408E-11	1.21325E-08
VINYL ACETATE	Air					0	0	0	0
VINYL ACETATE	Underground					0	0	0	0
VINYL ACETATE	POTW Transfer					0	0	0	0
VINYL ACETATE	Off-site Transfer					0	0	0	0
XYLENE (MIXED ISOMERS)	Air	0	729,067	0.000541459	1.78112E-06	5.4734E-08	7.11542E-09	4.55387E-09	1.08672E-06
XYLENE (MIXED ISOMERS)	Water	0	288	2.1389E-07	7.03586E-10	2.16213E-11	2.81077E-12	1.79889E-12	4.29281E-10
XYLENE (MIXED ISOMERS)	Underground	0	31,000	2.30229E-05	7.57332E-08	2.32729E-09	3.02548E-10	1.93631E-10	4.62074E-08
XYLENE (MIXED ISOMERS)	Land	0	4,624	3.43413E-06	1.12965E-08	3.47142E-10	4.51285E-11	2.88822E-11	6.89235E-09
XYLENE (MIXED ISOMERS)	POTW Transfer	0	330	2.45083E-07	8.06193E-10	2.47744E-11	3.22068E-12	2.06123E-12	4.91885E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer	0	61,951	4.60094E-05	1.51347E-07	4.65091E-09	6.04618E-10	3.86956E-10	9.23417E-08
ZINC COMPOUNDS	Air	2,600	10,608	7.87829E-06	2.59154E-08	7.96385E-10	1.0353E-10	6.62593E-11	1.58119E-08
ZINC COMPOUNDS	Water	1,100	14,384	1.06826E-05	3.51402E-08	1.07986E-09	1.40382E-10	8.98447E-11	2.14402E-08
ZINC COMPOUNDS	Land	1,400	52,684	3.91271E-05	1.28707E-07	3.9552E-09	5.14176E-10	3.29073E-10	7.85287E-08
ZINC COMPOUNDS	POTW Transfer	0	89	6.6098E-08	2.17428E-10	6.68159E-12	8.68606E-13	5.55908E-13	1.3266E-10
ZINC COMPOUNDS	Off-site Transfer	148,147	186,534	0.000138534	4.55704E-07	1.40039E-08	1.8205E-09	1.16512E-09	2.7804E-07
TOTAL RELEASES & TRANSFERS (LBS)		4,523,599	25,639,240	0.022009435	7.23995E-05	2.22485E-06	2.8923E-07	1.85107E-07	4.41733E-05

Table A5. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			ETHYLENE GLYCOL FACILITY [10]		
		FACILITY ID --->	77507HCHST9502B		
		FACILITY CAPACITY [9] (LBS/YR)--->	615,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing ethylene glycol:	TRI lbs per lb of ethylene glycol [11] (attributed to ethylene glycol chemical plant):	TRI lbs per lb of ethylene glycol (attributed to oil refineries and ethylene glycol chemical plant):
ACETALDEHYDE	Air		11,260	2.12499E-05	2.12499E-05
ACETALDEHYDE	Underground		62,000	0.000117007	0.000117007
ACETALDEHYDE	POTW Transfer		6,200	1.17007E-05	1.17007E-05
ACETALDEHYDE	Off-site Transfer		300	5.66162E-07	5.66162E-07
ACROLEIN	Air		400	7.54882E-07	7.54882E-07
ACRYLIC ACID	Air		62,600	0.000118139	0.000118139
ACRYLIC ACID	Off-site Transfer		2,351,800	0.00443833	0.00443833
AMMONIA	Air			0	1.29345E-06
AMMONIA	Water			0	1.55876E-07
AMMONIA	Underground			0	2.25317E-06
AMMONIA	POTW Transfer			0	1.80254E-10
AMMONIA	Off-site Transfer			0	3.98638E-11
ANTHRACENE	Air			0	4.2429E-09
ANTHRACENE	Land			0	2.8078E-10
ANTHRACENE	Off-site Transfer			0	1.90653E-11
ANTIMONY COMPOUNDS	Air			0	2.25317E-09
ANTIMONY COMPOUNDS	Land			0	4.33303E-09
ANTIMONY COMPOUNDS	Off-site Transfer			0	9.20681E-09
BARIUM COMPOUNDS	Water			0	3.27923E-09
BARIUM COMPOUNDS	Land			0	4.00718E-09
BARIUM COMPOUNDS	Off-site Transfer			0	4.41969E-10
BENZENE	Air			0	1.05495E-06
BENZENE	Water			0	1.8372E-10
BENZENE	Underground			0	2.94646E-07
BENZENE	Land			0	1.94293E-09
BENZENE	POTW Transfer			0	8.83937E-11
BENZENE	Off-site Transfer			0	3.399E-08
BIPHENYL	Air			0	3.2931E-09
1,3-BUTADIENE	Air			0	7.5074E-08
1,3-BUTADIENE	Off-site Transfer			0	2.07985E-10
BUTYL ACRYLATE	Air		10,050	1.89664E-05	1.89664E-05
BUTYL ACRYLATE	Off-site Transfer		24,480	4.61988E-05	4.61988E-05
CARBON DISULFIDE	Air			0	1.22885E-08
CARBON DISULFIDE	Off-site Transfer			0	4.43702E-10
CARBON TETRACHLORIDE	Air			0	4.06178E-08
CARBON TETRACHLORIDE	Off-site Transfer			0	1.65695E-09
CARBONYL SULFIDE	Air			0	3.14231E-07
CHLORINE	Air			0	7.87952E-08
CHLORINE	Water			0	2.29304E-08
CHLORODIFLUOROMETHANE	Air		37,900	7.15251E-05	7.15251E-05
CHLORODIFLUOROMETHANE	Off-site Transfer			0	3.98638E-08
CHLOROETHANE	Air		2,100	3.96313E-06	3.96313E-06
CHROMIUM COMPOUNDS	Air			0	5.19963E-11
CHROMIUM COMPOUNDS	Water			0	7.19629E-09
CHROMIUM COMPOUNDS	Land			0	8.82204E-09

Table A5. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			ETHYLENE GLYCOL FACILITY [10]		
		FACILITY ID --->	77507HCHST9502B		
		FACILITY CAPACITY [9] (LBS/YR)--->	615,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing ethylene glycol:	TRI lbs per lb of ethylene glycol [11] (attributed to ethylene glycol chemical plant):	TRI lbs per lb of ethylene glycol (attributed to oil refineries and ethylene glycol chemical plant):
CHROMIUM COMPOUNDS	Off-site Transfer			0	4.48381E-08
COBALT COMPOUNDS	Air			0	1.85453E-10
COBALT COMPOUNDS	Land			0	3.96038E-09
COBALT COMPOUNDS	Off-site Transfer			0	2.60685E-07
COPPER COMPOUNDS	Air			0	4.95698E-10
COPPER COMPOUNDS	Water			0	6.5342E-10
COPPER COMPOUNDS	Land			0	1.63996E-08
COPPER COMPOUNDS	Off-site Transfer			0	2.88829E-07
CRESOL (MIXED ISOMERS)	Air			0	4.78695E-08
CRESOL (MIXED ISOMERS)	Water			0	4.69527E-09
CRESOL (MIXED ISOMERS)	Underground			0	1.55989E-07
CRESOL (MIXED ISOMERS)	Off-site Transfer			0	1.3519E-10
CUMENE	Air			0	1.12203E-07
CUMENE	Water			0	4.33303E-11
CUMENE	Off-site Transfer			0	1.38657E-10
CYCLOHEXANE	Air			0	4.10206E-07
CYCLOHEXANE	Water			0	5.02631E-11
CYCLOHEXANE	Land			0	4.24636E-09
CYCLOHEXANE	Off-site Transfer			0	4.6606E-09
1,2-DIBROMOETHANE	Air			0	3.35896E-09
1,2-DIBROMOETHANE	Water			0	1.21325E-11
1,2-DICHLOROETHANE	Air			0	2.30517E-08
DIETHANOLAMINE	Air			0	7.60463E-08
DIETHANOLAMINE	Off-site Transfer			0	2.3225E-07
DIETHYL SULFATE	Off-site Transfer		3,293,147	0.006214845	0.006214845
ETHYL ACRYLATE	Air		6,000	1.13232E-05	1.13232E-05
ETHYL ACRYLATE	Off-site Transfer		687,264	0.001297008	0.001297008
ETHYLBENZENE	Air		1,900	3.58569E-06	4.02902E-06
ETHYLBENZENE	Water			0	1.28258E-10
ETHYLBENZENE	Underground			0	2.94646E-09
ETHYLBENZENE	Land			0	1.14565E-09
ETHYLBENZENE	POTW Transfer			0	6.5862E-11
ETHYLBENZENE	Off-site Transfer			0	3.39675E-08
ETHYLENE	Air		113,300	0.00021382	0.000215204
ETHYLENE	Off-site Transfer			0	1.61189E-10
ETHYLENE GLYCOL	Air		223,700	0.000422168	0.000422199
ETHYLENE GLYCOL	Underground		6,883,600	0.012990768	0.012990768
ETHYLENE GLYCOL	POTW Transfer		396,700	0.00748654	0.000748654
ETHYLENE GLYCOL	Water			0	3.34908E-08
ETHYLENE GLYCOL	Off-site Transfer		6,171	1.16459E-05	1.16473E-05
ETHYLENE OXIDE	Air		19,500	3.68005E-05	3.68005E-05
ETHYLENE OXIDE	Underground		22,200	4.1896E-05	4.1896E-05
ETHYLENE OXIDE	POTW Transfer		1,200	2.26465E-06	2.26465E-06
ETHYLENE OXIDE	Off-site Transfer		1,047	1.9759E-06	1.9759E-06
FORMALDEHYDE	Air		578	1.0908E-06	1.11084E-06
FORMALDEHYDE	Underground		33,800	6.37875E-05	6.37875E-05

Table A5. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			ETHYLENE GLYCOL FACILITY [10]		
		FACILITY ID --->	77507HCHST9502B		
		FACILITY CAPACITY [9] (LBS/YR)--->	615,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing ethylene glycol:	TRI lbs per lb of ethylene glycol [11] (attributed to ethylene glycol chemical plant):	TRI lbs per lb of ethylene glycol (attributed to oil refineries and ethylene glycol chemical plant):
FORMALDEHYDE	Water			0	1.99319E-10
FORMALDEHYDE	Off-site Transfer		654	1.23423E-06	1.23468E-06
GLYCOL ETHERS	Air			0	3.02099E-09
HYDROCHLORIC ACID	Air			0	1.65648E-07
HYDROGEN FLUORIDE	Air			0	5.43188E-09
HYDROQUINONE	Air		8	1.50976E-08	1.50976E-08
HYDROQUINONE	Off-site Transfer		9,480	1.78907E-05	1.78907E-05
LEAD COMPOUNDS	Air			0	1.36924E-10
LEAD COMPOUNDS	Water			0	1.4195E-09
LEAD COMPOUNDS	Land			0	1.36733E-08
LEAD COMPOUNDS	Off-site Transfer			0	8.04348E-08
MANGANESE COMPOUNDS	Air			0	2.77314E-11
MANGANESE COMPOUNDS	Water			0	3.11978E-09
MANGANESE COMPOUNDS	Off-site Transfer			0	1.61708E-08
METHANOL	Air		278,400	0.000525398	0.000532273
METHANOL	Water			0	2.09198E-09
METHANOL	Underground		536,500	0.001012486	0.001012486
METHANOL	POTW Transfer		36,700	6.92604E-05	6.92604E-05
METHANOL	Off-site Transfer		350	6.60522E-07	6.72309E-07
2-METHOXYETHANOL	Air			0	1.09192E-10
METHYL ETHYL KETONE	Air		1,100	2.07593E-06	6.68446E-06
METHYL ETHYL KETONE	Water			0	9.98502E-09
METHYL ETHYL KETONE	Underground			0	3.2931E-08
METHYL ETHYL KETONE	Land			0	8.66605E-12
METHYL ETHYL KETONE	Off-site Transfer		5	9.43603E-09	1.12576E-08
METHYL IODIDE	Air		3,309	6.24476E-06	6.24476E-06
METHYL IODIDE	Underground		23,500	4.43493E-05	4.43493E-05
METHYL IODIDE	Off-site Transfer		3,327	6.27873E-06	6.27873E-06
METHYL ISOBUTYL KETONE	Air			0	3.98408E-07
METHYL ISOBUTYL KETONE	Water			0	6.93284E-12
METHYL ISOBUTYL KETONE	Land			0	8.66605E-12
METHYL ISOBUTYL KETONE	Off-site Transfer			0	7.19282E-10
METHYL TERT-BUTYL ETHER	Air			0	1.50676E-06
METHYL TERT-BUTYL ETHER	Water			0	8.70591E-08
METHYL TERT-BUTYL ETHER	Underground			0	2.77314E-07
MOLYBDENUM TRIOXIDE	Air			0	3.14174E-07
MOLYBDENUM TRIOXIDE	Water			0	3.63974E-11
MOLYBDENUM TRIOXIDE	Land			0	1.64655E-10
MOLYBDENUM TRIOXIDE	Off-site Transfer			0	1.02787E-06
NAPHTHALENE	Air			0	1.7598E-07
NAPHTHALENE	Water			0	2.47849E-10
NAPHTHALENE	Land			0	1.11445E-09
NAPHTHALENE	Off-site Transfer			0	1.14409E-08
N-BUTYL ALCOHOL	Air		2,000	3.77441E-06	3.77441E-06
N-BUTYL ALCOHOL	Off-site Transfer		654	1.23423E-06	1.23423E-06
N-HEXANE	Air			0	2.17538E-06

Table A5. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			ETHYLENE GLYCOL FACILITY [10]		
		FACILITY ID --->	77507HCHST9502B		
		FACILITY CAPACITY [9] (LBS/YR)--->	615,000,000		
Chemical	Disposition [2]		Annual TRI releases (lbs/yr) from facility producing ethylene glycol:	TRI lbs per lb of ethylene glycol [11] (attributed to ethylene glycol chemical plant):	TRI lbs per lb of ethylene glycol (attributed to oil refineries and ethylene glycol chemical plant):
N-HEXANE	Water			0	2.47849E-10
N-HEXANE	Land			0	6.24302E-09
N-HEXANE	Off-site Transfer			0	1.14756E-08
NICKEL COMPOUNDS	Air			0	4.64032E-08
NICKEL COMPOUNDS	Water			0	2.75234E-09
NICKEL COMPOUNDS	Land			0	3.64061E-08
NICKEL COMPOUNDS	Off-site Transfer			0	1.59956E-06
NITRATE COMPOUNDS	Water			0	4.56331E-06
N-METHYL-2-PYRROLIDONE	Air			0	1.7351E-07
N-METHYL-2-PYRROLIDONE	Land			0	1.21325E-09
N-METHYL-2-PYRROLIDONE	Off-site Transfer			0	2.77314E-10
O-XYLENE	Air			0	1.53389E-07
O-XYLENE	Water			0	3.63974E-11
O-XYLENE	Land			0	1.49056E-10
O-XYLENE	Off-site Transfer			0	9.27094E-09
P-XYLENE	Air			0	9.96422E-07
P-XYLENE	Water			0	3.63974E-11
P-XYLENE	Land			0	1.33457E-10
P-XYLENE	Off-site Transfer			0	9.3056E-09
PHENANTHRENE	Air			0	2.87366E-09
PHENANTHRENE	Water			0	3.98638E-11
PHENANTHRENE	Land			0	7.12869E-09
PHENANTHRENE	Off-site Transfer			0	3.62241E-10
PHENOL	Air			0	1.94839E-07
PHENOL	Water			0	6.84445E-09
PHENOL	Underground			0	2.42649E-07
PHENOL	Land			0	3.46642E-10
PHENOL	POTW Transfer			0	3.92745E-09
PHENOL	Off-site Transfer			0	7.79945E-11
PHOSPHORIC ACID	Off-site Transfer			0	1.29557E-07
POLYCYCLIC AROMATIC COMPOUNDS	Air			0	2.61871E-08
POLYCYCLIC AROMATIC COMPOUNDS	Water			0	6.93284E-12
POLYCYCLIC AROMATIC COMPOUNDS	Land			0	1.50876E-08
POLYCYCLIC AROMATIC COMPOUNDS	Off-site Transfer			0	7.64346E-10
PROPYLENE	Air		10,200	1.92495E-05	2.09611E-05
PROPYLENE	Water			0	1.64655E-10
STYRENE	Air			0	1.31551E-09
STYRENE	Land			0	8.66605E-12
STYRENE	Off-site Transfer			0	6.23956E-11
SULFURIC ACID	Air			0	1.94917E-08
SULFURIC ACID	Off-site Transfer			0	2.07985E-11
TERT-BUTYL ALCOHOL	Air			0	5.19963E-10
TETRACHLOROETHYLENE	Air			0	6.18011E-08
TETRACHLOROETHYLENE	Land			0	1.90653E-11
TETRACHLOROETHYLENE	Off-site Transfer			0	1.23231E-09
TOLUENE	Air		95	1.79285E-07	4.80026E-06

Table A5. (Continued)

		TRI CONTRIBUTION FROM PS CHEMICAL PLANT			TOTAL
			ETHYLENE GLYCOL FACILITY [10]		
		FACILITY ID --->	77507HCHST9502B		
		FACILITY CAPACITY [9] (LBS/YR)--->	615,000,000		
Chemical	Disposition[2]		Annual TRI releases (lbs/yr) from facility producing ethylene glycol:	TRI lbs per lb of ethylene glycol [11] (attributed to ethylene glycol chemical plant):	TRI lbs per lb of ethylene glycol (attributed to oil refineries and ethylene glycol chemical plant):
TOLUENE	Water			0	4.48901E-10
TOLUENE	Underground			0	2.77314E-07
TOLUENE	Land			0	5.31229E-09
TOLUENE	POTW Transfer			0	3.70907E-10
TOLUENE	Off-site Transfer		1,790	3.3781E-06	3.45968E-06
1,1,1-TRICHLOROETHANE	Air		360	6.79394E-07	6.79394E-07
1,1,1-TRICHLOROETHANE	Off-site Transfer		9,888	1.86607E-05	1.86607E-05
TRICHLOROETHYLENE	Air			0	1.13913E-07
TRICHLOROETHYLENE	Off-site Transfer			0	4.67967E-11
1,2,4-TRIMETHYLBENZENE	Air			0	2.21123E-07
1,2,4-TRIMETHYLBENZENE	Water			0	6.75952E-11
1,2,4-TRIMETHYLBENZENE	Land			0	2.05905E-09
1,2,4-TRIMETHYLBENZENE	Off-site Transfer			0	1.26524E-09
VANADIUM (FUME OR DUST)	Land			0	1.90653E-11
VANADIUM (FUME OR DUST)	Off-site Transfer			0	1.21325E-08
VINYL ACETATE	Air		19,100	3.60456E-05	3.60456E-05
VINYL ACETATE	Underground		109,600	0.000206838	0.000206838
VINYL ACETATE	POTW Transfer		780	1.47202E-06	1.47202E-06
VINYL ACETATE	Off-site Transfer		4,660	8.79438E-06	8.79438E-06
XYLENE (MIXED ISOMERS)	Air		8,200	1.54751E-05	1.65618E-05
XYLENE (MIXED ISOMERS)	Water			0	4.29281E-10
XYLENE (MIXED ISOMERS)	Underground			0	4.62074E-08
XYLENE (MIXED ISOMERS)	Land			0	6.89235E-09
XYLENE (MIXED ISOMERS)	POTW Transfer			0	4.91885E-10
XYLENE (MIXED ISOMERS)	Off-site Transfer		23	4.34057E-08	1.35747E-07
ZINC COMPOUNDS	Air			0	1.58119E-08
ZINC COMPOUNDS	Water			0	2.14402E-08
ZINC COMPOUNDS	Land			0	7.85287E-08
ZINC COMPOUNDS	POTW Transfer			0	1.3266E-10
ZINC COMPOUNDS	Off-site Transfer			0	2.7804E-07
TOTAL RELEASES & TRANSFERS (LBS)			15,319,880	0.028911762	0.028955935

Table A5. (Continued)

FOOTNOTES

[1] Info on the top ten facilities by capacity for the petroleum refining industry comes from the website for the Sector Facility Indexing Project: Petroleum Refining Data Access, <http://es.epa.gov/oeca/sfi/petdata.htm>, obtained October 1999. The TRI release data for each facility comes from the Right-to-Know Network environmental database for facility TRIs. <http://www rtknet.org/triinputfacility.html>, obtained October 1999.

[2] Under the "Disposition" column, the category "air" includes fugitive and stack emissions.

[3] TRI lbs/barrel of crude in was computed by: (?? lbs/yr of the TRI chemical totaled for the ten refineries) divided by (365 days/yr) divided by (3,689,000 bbl of crude in/day - total of the plant capacities for the ten refineries) divided by (0.8600)

The 0 8600 (or 86%) value is the refining capacity factor which represents % of capacity at which the refinery is actually operating. It was calculated by taking each annual total U.S. refinery throughput divided by each yearly U.S. refining total capacity for the years 1987 -1993, and averaging the values. These values were obtained from the International Petroleum Encyclopedia, 1995 edition. These were the only years that U.S. refinery throughput and capacity values were both available, and were thus used to estimate the actual rate at which the ten refineries were actually operating. Note that the throughput values were reported in the literature as "calendar days", and the capacity values were reported as just "days." It was assumed that these terms each refer to a 365 day year. See further Table 1 in the bottom right corner of this worksheet (starting at cell Y252) for the calculation of the facility capacity factor.

[4] Conversion of "bbls of crude" to "lbs of crude", using the density of crude: bbls of crude in X 42 US gal/bbl X 3.785ee3 cm3/gal X 0.8673 g crude in/cm3 X 1 lb/ 453.6 g; or, a factor of 304.0 lbs of crude in/bbl of crude in. On this basis, the ten refineries processed 352 billion lbs/yr of crude for the year 1996, at 86% capacity.

Table A5. (Continued)

The density of the crude was the average of nine crude oils from the United States and seven crude oils from other countries. this resulted in an average API (American Petroleum Institute) gravity of 31.7 degrees, or specific gravity of 0.8692. The data came from Tables P-13 and P-14 on pages 851-2 of Chemical and Process Technology Encyclopedia, Douglas M. Considine, editor-in-chief, McGraw-Hill Book Company, New York: 1974. The data from the tables was copyrighted to the Universal Oil Products Company, 1973. (API , in degrees = [141.5/specific gravity @ 60/60] - 131.5).

[5]Calculating the 3.07% value: 48.4 billion lbs/yr ethylene divided by 1.575 trillion lbs crude/yr. The ethylene value comes from CMR (1997), ethylene demand for 1996.

[6] From the Chemical Profile of Ethylene found in the Chemical Marketing Reporter (CMR), 1997.
<http://chemexpo.com/news/newsframe.cfm?framebody=/news/profile.cfm>

[7] From the Chemical Profile of Ethylene Oxide found in the Chemical Marketing Reporter (CMR), 1996.
<http://chemexpo.com/news/newsframe.cfm?framebody=/news/profile.cfm>

[8] Conversion factor: "TRI lbs/lb crude" multiplied by "1.575 trillion lbs crude/yr" divided by "6 6 billion lbs/yr Ethylene Glycol (from CMR, 1996 - this value is the demand for 1996)" = "238.6 lbs crude/lb Ethylene Glycol".

[9] Facility Capacity obtained from CMR report on Ethylene Glycol, 1996. Note that according to The *Chemical Guide to the United States* this facility produced five chemicals in 1996: 1. Acetic acid, 2030 million lbs/yr (1998) 2. Ethyleene glycol, 615 million lbs/yr (1996) 3. ethylene oxide, 590 million lbs/yr (1996) 4 vinyl acetate (esters), 585 million lbs/yr (1998) 5. acrylic acid, 425 million lbs/yr (1996)

[10] The TRI release data for this facility comes from the Right-to-Know Network environmental database for facility TRIs. <http://www.rtknet.org/triinputfacility.html>

Table A5. (Continued)

[11] TRI lbs/lb of EG was computed by: (?? lbs/yr of the TRI chemical attributed to the EG chemical plant) divided by (615,000,000 lbs/yr - facility capacity) divided by (0.8616 - the facility capacity factor). The 0.8616 (or ~ 86%) value is the facility capacity factor which represents % of capacity at which the facility is actually operating. It was calculated by taking each yearly U.S. demand value (considered to approximate the throughput) divided by each yearly U.S capacity for 141 different chemicals, and averaging the values. These values were obtained from ChemExpo, accessed November 1999, available from <http·//www chemexpo.com>, and make up all the chemicals listed in the "chemical profile archives." See further Table 2 in the bottom right corner of this worksheet (starting at cell AD263) for the calculation of the facility capacity factor.

APPENDIX B: ADDITIONAL TABLES & FIGURES

Table B1. CMR Chemicals and Facility Capacity Factor

No	[a]Name	[a]Date	[a]Demand (millions of lbs)	[a]Capacity (millions of lbs)	Capacity factor
1	1,4-butanediol	1997	615	760	0 8092
2	a-methylstyrene	1995	120	123	0.9756
3	ma-methylstyrene	1998	155	159	0 9748
4	abs resins	1997	1600	1920	0.8333
5	acetaminophen (in metric tons)	1997	29000	39000	0 7436
6	acetic acid	1998	4100	5544	0 7395
7	acetic anhydride	1998	2100	2785	0.7540
8	acetylene	1996	350	431	0 8121
9	acrylamide	1996	125	190	0 6579
10	acrylic acid	1996	1470	1785	0.8235
11	acrylonitrile	1997	3440	3560	0 9663
12	activated carbon	1998	375	465	0 8065
13	adipic acid	1998	2000	2260	0 8850
14	alpha olefins	1998	3000	3121	0 9612
15	ammonium phosphates	1995	8	9215	0.0009
16	aniline	1996	1400	1430	0.9790
17	ascorbic acid	1998	40	41	0 9756
18	benzene	1996	1900	2748	0 6914
19	benzoic acid	1996	235	235	1 0000
20	bht	1996	20	27	0.7407
21	bisphenol-a	1998	1800	1895	0 9499
22	borates (in short tons)	1997	695000	900000	0.7722
23	bromine	1997	435	635	0 6850
24	butadiene	1997	4700	4260	1.1033
25	butyl rubber (in metric tons)	1997	220000	312000	0 7051
26	calcium chloride (in short tons)	1999	900,000	2265000	0 3974
27	calcium hypochlorite (in short tons)	1997	100000	116500	0 8584
28	caprolactam	1998	1600	1680	0 9524
29	carbon black	1997	3440	300	11 4667
30	carbon disulfide	1997	220	350	0 6286
31	caustic potash (in thousands of short tons)	1998	425	549	0.7741
32	chromic acid (in short tons)	1997	72000	78000	0.9231
33	chlorine (in thousands of short tons)	1997	13700	14080	0 9730
34	chloroacetic acid	1997	92	95	0 9684
35	chloroform	1997	520	720	0 7222
36	chloroparaffins	1996	92	222	0 4144
37	citric acid	1998	450	445	1 0112
38	cmc	1997	77	57.5	1 3391
39	cresylics	1996	116	240	0 4833
40	cumene	1996	5500	6260	0 8786

([a]Source: adapted from *ChemExpo* web site, accessed November 1999. Under headings "Chemical Profiles," "ChemExpo Profile Archives;" <http://www.chemexpo com>)

Table B1 (Continued)

No	[a]Name	[a]Date	[a]Demand (millions of lbs)	[a]Capacity (millions of lbs)	Capacity factor
41	cyclohexane	1998	435	553	0 7866
42	cyclohexylamine	1998	21	50	0 4200
43	dicyclopentadiene	1996	340	445	0 7640
44	diethylene glycol	1998	775	879	0 8817
45	dimer acid	1998	105	170	0 6176
46	dipropylene	1998	108	131	0.8244
47	ep rubber (in metric tons)	1997	288000	381000	0 7559
48	ethane	1997	265	1885	0 1406
49	ethanolamines	1998	845	1160	0 7284
50	ethylbenzene	1995	12500	12705	0 9839
51	ethyl acetate	1997	335	300	1 1167
52	ethylene	1997	49600	52526	0 9443
53	ethylenamines	1997	310	390	0 7949
54	ehtylene dichloride	1997	23600	30530	0.7730
55	ethylene glycol	1996	6600	7780	0 8483
56	ethylene oxide	1995	7600	7715	0 9851
57	2-ethylhexanol	1996	775	865	0 8960
58	ferric chloride (in tons)	1997	255000	578000	0 4412
59	formaldehyde	1998	9600	11304	0 8493
60	glycerine	1998	460	522 5	0 8804
61	hydrochloric acid (in millions of tons)	1995	3 42	6 935	0.4932
62	hydrofluoric acid (in metric tons)	1997	247000	371000	0 6658
63	hydrogen cyanide	1998	1440	1827	0 7882
64	hydrogen peroxide	1998	1260	1656	0.7609
65	isopropanol	1998	1400	1820	0.7692
66	linear alkylbenzene	1998	850	1130	0 7522
67	ma-methylstyrene	1998	155	159	0 9748
68	maleic anhydride	1998	560	580	0 9655
69	melamine	1996	260	245	1.0612
70	methanol	1998	108	21400	0 0050
71	methylamines	1997	318	535	0.5944
72	methyl chloride	1997	670	790	0 8481
73	methyl ethyl ketone	1996	545	595	0.9160
74	methyl isobutyl ketone	1996	175	220	0 7955
75	methyl methacrylate	1996	1180	1515	0.7789
76	methylene chloride	1997	325	430	0 7558
77	methylene diisocyanate	1996	1140	1215	0 9383
78	monochlorbenzene	1996	185	370	0 5000
79	napthalene	1996	240	350	0 6857
80	naphthenic acid	1996	20	28	0.7143
81	n-butanol	1996	1400	1760	0 7955
82	n-butyl acetate	1996	310	345	0 8986
83	nitrobenzene	1996	1600	1750	0 9143
84	nitrile rubber (in metric tons)	1997	122000	137000	0 8905
85	nonylphenol	1997	225	338	0 6657

Table B1 (Continued)

No	[a]Name	[a]Date	[a]Demand (millions of lbs)	[a]Capacity (millions of lbs)	Capacity factor
86	n-paraffins	1998	705	910	0 7747
87	orthoxylene	1995	965	1155	0.8355
88	o-dichlorobenzene	1996	35	81	0 4321
89	p-dichlorobenzene	1996	75	130	0 5769
90	paraxylene	1998	7925	10080	0 7862
91	perchloroethylene	1997	290	355	0 8169
92	pentaerythritol	1997	140	158	0 8861
93	PET (in million metric tons)	1996	1 32	2.22	0 5946
94	phenol	1996	4100	4165	0 9844
95	phosgene	1996	2600	3011	0 8635
96	phosphorus (in short tons)	1997	350000	342000	1 0234
97	phosphorus oxychloride (in short tons)	1997	35000	41000	0 8537
98	phosphorus pentasulfide (in short tons)	1997	60000	105000	0 5714
99	phosphorus trichloride (in short tons)	1997	200000	359000	0 5571
100	phthalic anhydride	1998	1050	1250	0.8400
101	polybutadiene (in metric tons)	1997	532000	740000	0.7189
102	polybutenes	1996	750	910	0 8242
103	polycarbonate	1996	800	1035	0 7729
104	polychloroprene (in thousands of metric tons)	1996	70000	163000	0.4294
105	polyethylene-HD	1998	12700	10005	1 2694
106	polyethylene-LD	1997	7660	8025	0 9545
107	polypropylene	1997	12100	12873	0.9400
108	polystyrene	1997	6200	7380	0 8401
109	polyvinyl alcohol	1998	315	325	0.9692
110	polyvinyl chloride	1997	14200	14861	0.9555
111	potash (in millions of short tons)	1997	14 3	15.4	0.9286
112	propionic acid	1997	250	319	0.7837
113	propylene	1995	24700	30225	0.8172
114	propylene glycol	1998	1050	1312	0.8003
115	propylene oxide	1998	3200	4650	0.6882
116	PTA/DMT	1998	9500	10043	0.9459
117	soda ash (in thosands of short tons)	1997	11800	13350	0 8839
118	sodium bicarbonate (in short tons)	1997	540000	703000	0 7681
119	sodium bichromate (in short tons)	1997	150000	172000	0.8721
120	sodium chlorate (in short tons)	1996	1750000	1950000	0 8974
121	sodium hydrosulfide (in short tons)	1997	112000	136500	0.8205
122	sodium hydrosulfite (in short tons)	1997	92000	108600	0.8471
123	sodium silicates (in millions of short tons)	1998	1 27	1 423	0.8925

Table B1. (Continued)

No	[a]Name	[a]Date	[a]Demand (millions of lbs)	[a]Capacity (millions of lbs)	Capacity factor
124	sodium sulfate (in thousands of short tons)	1998	645	1926	0 3349
125	sodium sulfite (in thousands of short tons)	1998	102	258	0 3953
126	sorbitol	1998	515	595	0 8655
127	SB rubber (in metric tons)	1997	900000	1045000	0 8612
128	STPP (in thousands of short tons)	1998	262	555	0 4721
129	styrene	1998	11700	12320	0.9497
130	sulfur dioxide (in thousands of short tons)	1997	390	509	0 7662
131	sulfuric acid (in thousands of short tons)	1997	6000	6400	0.9375
132	tall oil (in thousands of short tons)	1997	970	1022	0 9491
133	titanium dioxide (in metric tons)	1997	1175	1622	0 7244
134	TKPP (in thousands of short tons)	1998	31 5	52	0 6058
135	toluene didsocyanate	1996	900	930	0 9677
136	trichloroethylene	1997	190	320	0 5938
137	triethylene glycol	1998	137	237	0 5781
138	urea (in thousands of short tons)	1997	5430	7852	0 6915
139	vinyl acetate	1998	3000	3727	0.8049
140	vinyl chloride	1997	14500	16630	0 8719
141	zinc sulfate (in thousands of short tons)	1997	56 5	93	0 6075
				Average Facility Capacity Factor:	0.8616

Note: Methanol capacity was reported in millions of gallons/yr Converted to 21,400 million lbs/year using specific gravity of 0.792g/cm^3. This value is two orders of magnitude higher than the demand. It is assumed that there is an error in the CMR report. Assuming the correct capacity is nearly equal to the demand, the capacity factor average would change only one tenth of a percent, from from 86% to 87%

May 5, 1997

POLYSTYRENE

PRODUCER	CAPACITY*
American Polymers, Oxford, Mass.	70
American Polystyrene, Torrance, Calif.	30
BASF, Holyoke, Mass.	80
BASF, Joliet, Ill.	480
BASF, Santa Ana, Calif.	70
BASF, South Brunswick, N.J	175
Chevron, Marietta, Ohio	520
Dart Polymers, Owensboro, Ky	70
Deltech, Troy, Ohio	150
Dow, Allyn's Point, Conn.	160
Dow, Hanging Rock, Ohio	135
Dow, Joliet, Ill.	280
Dow, Midland, Mich.	275
Dow, Pevely, Mo.	160
Dow, Sarnia, Ontario	260
Dow, Torrance, Calif.	235
Fina, Carville, La.	1,050
GE-Huntsman, Selkirk, N.Y.	100
Huntsman, Belpre, Ohio	490
Huntsman, Chesapeake, Va.	450
Huntsman, Joliet, Ill.	255
Huntsman, Peru, Ill.	305
Huntsman, Willow Springs, Ill.	75
Kama, Hazleton, Pa.	75
Nova, Addyston, Ohio	80
Nova, Beaver Valley, Pa.	375
Nova, Decatur, Ala.	380
Nova, Montreal, Quebec	130
Nova, Painesville, Ohio	70
Nova, Springfield, Mass.	275
Scott Polymers, Fort Worth, Tex.	120
Total	7,380

*Millions of pounds of polystyrene resins supplied as crystal, impact and expandable beads. Most capacity for solid crystal and impact resins is flexible. American Polymers is in the midst of an expansion, expected to be complete by the end of the year, that will add about 30 million pounds of impact

Figure B1. CMR Chemical Profile of Polystyrene

(Source: *ChemExpo* web site, accessed November 1999f. Under headings "Chemical Profiles," "ChemExpo Profile Archives," "Polystyrene, May 5, 1997;" available at <http://www.chemexpo.com>)

polystyrene capacity. BASF has scheduled a 240-million-pound high-impact polystyrene line at Joliet to come on line in the third quarter of 1998 A 315-million-pound general-purpose polystyrene unit is due on line at BASF's Altamira site in Mexico at mid-year. Chevron plans to add 250 million pounds of capacity at Marietta Dow Chemical, which has global PS capacity of some 3 7 billion pounds at 19 plants, plans to add 2 billion pounds of additional capacity by the year 2006. The additions will be made through expansion and debottlenecking of existing units and investment in new world-scale plants, each of which the company says will have capacity of at least 260 million pounds per year. Fina has brought on a 25 -million-pound expansion and made incremental additions at Carville to raise capacity from 730 million pounds in 1994. Huntsman acquired Amoco Chemical's polystyrene business including plants at Willow Springs and Joliet, Ill., in December 1996 and is debottlenecking the Joliet plant to add 200 million pounds by fourth quarter 1997. The company has closed its 45-million-pound EPS plant at Rome, Ga , and shifted the production to Peru, Ill Nova acquired Arco Chemical's expandable polystyrene and engineering resins businesses, including plants at Beaver Valley, Pa., and Painesville, Ohio, in October 1996 Tenneco Packaging (formerly Packaging Corporation of America) mothballed its 65-million-pound plant at City of Industry, Calif., in March 1997. Total North American polystyrene capacity is approximately 8 billion pounds, with Canada and Mexico each accounting for about 400 million pounds annually. Profile last published 4/25/94, this revision, 5/5/97.

DEMAND
1996· 6.1 billion pounds; 1997· 6 2 billion pounds; 2001: 7 2 billion pounds. (Includes exports of about 580 million pounds in 1996, but not imports of 230 million pounds)

GROWTH
Historical (1987-1996): 2.5 percent per year; future· 3 percent per year through 2001.

Figure B1 (Continued)

PRICE
Historical (1981-1996). High, 60c. per pound, bulk cryst., hopper cars frt. alld.; low, 40c. per pound, same basis
Current: bulk, cryst., hopper cars, frt. alld., 41.5c. per pound, impact, same basis, 45c. per pound; expandable beads, pkging grade, 1,000-lb. lots, same basis, 74c per pound.

USES
Packaging and one-time use, 40 percent, resellers and compounding, 15 percent; expandable polystyrene beads, 13 percent; consumer and institutional products, 13 percent, electronics, 12 percent; furniture, building and construction, 5 percent; other, 2 percent.

STRENGTH
Polystyrene use in consumer and institutional products, including toys, housewares and medical and personal care items, continues to grow in excess of the overall market. Medical use, though increasing from a small base, is projected to average 6 percent growth annually over the next few years.

WEAKNESS
Producers' attempts at margin improvement over the past year have been largely thwarted by stiff consumer resistance and fierce competition Most recently, an attempted 3-cent increase in February was followed by a 3-cent TVA in March because market conditions didn't support the increase

OUTLOOK
Polystyrene sales and captive use was up nearly 6 percent last year, according to Society of the Plastics Industry While the PS market won't match that performance in 1997, forecasts for major packaging and consumer segments remain bullish overall and a 3 to 4 percent increase is not unreasonable. Longer term, expansion and consolidation efforts of the past two years are expected to benefit the US industry. Four top producers now account for approximately 70 percent of capacity.

Figure B1 (Continued)

VITA

Lawrence C. Lasher, Jr., better known as Chip, was born in Oak Ridge, Tennessee, on December 24, 1959. He graduated from Oak Ridge High School in 1978. In the Fall of 1978 he entered the University of Tennessee, Knoxville, where he also participated in the Co-operative program in conjunction with Milliken Textiles in Pendleton, South Carolina. In May 1984, he received the Bachelor of Science degree in Chemical Engineering.

Pursuing religious convictions, Chip entered Mid-America Baptist Theological Seminary, Memphis, Tennessee, in 1985. He officially received the degree of Master of Divinity in 1989. He was licensed in the gospel ministry in August 1990 and received his Certificate of Ordination from Calvary Baptist Church, Knoxville, in November 1990.

In 1997 he entered the Masters program in Chemical Engineering at the University of Tennessee, working as a Graduate Research Assistant at the University of Tennessee's Center for Clean Products and Clean Technologies. The Master of Science degree was awarded in August 2000.