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Toxic Chemical Release Inventory Risk Screening Guide

Volume 1 - The Process

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TOXIC CHEMICAL RELEASE INVENTORY RISK SCREENING GUIDE (VERSION 1.0)

VOLUME 1: THE PROCESS

U.S. Environmental Protection Agency
Office of Toxic Substances
Washington, DC 20460

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PREFACE

The Emergency Planning and Community Right-to-Know Act of 1986, or Title III of the Superfund Amendments and Reauthorization Act (SARA) represents a significant step forward in environmental protection. This Act establishes several important "firsts" in collecting and sharing information about the hazardous substances used in our communities. For the first time, communities have access to information about the amounts, location, and potential effects of hazardous chemicals being used or stored in designated quantities, and about accidental releases of hazardous substances in the community. Also for the first time, under Section 313 of the law, all sectors of society - government, industry, academia, and the public - will have access to a common set of data regarding the annual releases of toxic chemicals into the environment. The data will be readily available through a nationally computerized data base called the Toxic Chemical Release Inventory (TRI) and through computer-generated microfiche data sets at county libraries. The TRI is the first national inventory of toxic chemical releases to all environmental media - land, air, and water - from industrial facilities. For all these reasons, EPA believes that the Toxic Chemical Release Inventory will play a major role in helping communities learn about the toxic chemicals in their area and to make informed decisions on how to safely and effectively manage these substances.

The reporting does, however, come with its challenges. The purpose of this guide is to describe some of the challenges raised by the TRI data and to suggest ways of approaching them. The guide suggests steps that can be taken to answer two key issues of concern:

- Setting risk-based priorities for followup investigation of TRI facilities and chemicals within geographic areas of interest.
- Identifying data needs and approaches for collecting information necessary to respond to health and ecological questions from the public.

The guide is directed at those individuals who are involved in interpreting and explaining environmental pollution, exposures, and health risks to the general public, especially at the local or sub-State level. Many users of this guide will already be well-versed in evaluating risk and/or in helping members of the public understand and deal with toxic chemicals, but Title III - particularly, the Section 313 release data - presents new challenges for everyone.

ACKNOWLEDGMENTS

This first edition of the TRI Risk Screening Guide (Version 1.0) is a compilation of the efforts of many individuals dedicated to the objective of providing:

- A useful source of risk information on Title III chemicals.
- A risk screening procedure that
  - is quick and easy to use;
  - is scientifically supportable;
  - is consistent with other EPA risk screening procedures;
  - can be used with readily available input data; and
  - produces an expression of risk compatible with the type and quality of input data.

Foremost, I would like to acknowledge the contributions of Linda Saunders of Eastern Research Group, the principal author of the Guide and my closest working associate, and Lorraine Hester, my secretary through the ups and downs of this project. Jennifer Helmick of Eastern Research Group also contributed editorial support in the development of the Guide.

An EPA "Expression of Risk Workgroup" was convened to provide technical guidance and program office input. Representatives who made significant contributions include Alan Ehrlich, Frank Gostomski, John Gustafson, Renate Kimbrough, Russ Kinerson, Rose Lew, Paul Tobin, John Vandenburg, Dianne Groh, and Suzanne Wuerthele.

In addition, several EPA staff provided special support on specific components of the risk screening procedure. Jim Darr, project manager of Roadmaps, arranged for many of the tables of information on Title III chemicals which appear in Volume II; Gerain Perry provided background information and tables on the reportable quantity process and values; Bob Boethling, David Lynch, and Asa Leifer provided the necessary technical support to develop the environmental fate guidance tables; and Loren Hall, Chris DeRosa, and Jim Cogliano contributed valuable expert opinion. Loren Hall also assisted in the development of the case study and the generation of the toxicological potency and environmental fate tables. Chris DeRosa also provided the EPA reference doses and cancer potency values used to generate part of Appendix A (Volume II).

An external committee comprised of representatives from State and local governments and environmental interest groups was also established to provide expert opinion on the subject matter and its presentation in the guide. Members of this committee are:

George Aburn, Maryland Air Management Administration
Carl Birns, Kansas Department of Health and Environment
J. Wayne Cropp, Tennessee Air Pollution Control Bureau
Richard Dime, New Jersey Department of Environmental Protection
Bob Hodanbosi, Ohio Department of Environmental Protection
Jill Lipoti, New Jersey Department of Environmental Protection
Fred Millar, Environmental Policy Institute
Jack Root, Arizona Department of Environmental Quality
Jim Setzer, Georgia Department of Natural Resources
Deborah Sheiman, Natural Resources Defense Council
Chris Wiant, Colorado TRI-County Health Department

Useful suggestions were also provided by a multitude of individuals, too numerous to list, from all sectors of society, including government, industry, private consultants, and academia, during the national "field test" of the Draft Risk Screening Guide in the fall of 1988.

Lastly, my management in the Office of Toxic Substances, i.e., Chuck Elkins, Office Director, and Joe Merenda, Division Director, deserve credit for the foresight to devote resources to the development of this manual *in advance* of requests for guidance on the use of the TRI data.

I hope you find the TRI Risk Screening Guide useful in your efforts to determine the potential health and environmental significance of the TRI data.

David Klauder, Ph.D.
Director,
Regional Risk Guidance Staff

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EXECUTIVE SUMMARY

The Emergency Planning and Community Right-to-Know Act (Title III) of the Superfund Amendments and Reauthorization Act (SARA) was designed to help communities deal safely and effectively with the many hazardous substances that are used in our society. The toxic chemical release reporting section (Section 313 of the Act) is the focus of this guide. Under Section 313, certain businesses must report annually on their total aggregate releases of toxic chemicals to air, water, and land. (Over 300 chemicals are subject to reporting.) These aggregate data are referred to as the Toxic Chemical Release Inventory (TRI).

In the first years of reporting, there will be some initial difficulties in understanding and using the TRI data. Because the reporting is new, the release data are expected to be limited in type and quality. The data quality is expected to improve, however, in subsequent years through a program of outreach, technical audits, facility inspections, and enforcement.

The risk screening system described in this guide is consistent with EPA's understanding of the type and expected quality of the Section 313 data and readily available supplementary data. The system is intended to serve as a framework for initial analyses of the TRI data. It can be viewed as a tool for setting risk-based priorities for followup investigation of TRI facilities and chemicals within geographic areas of interest. The system relies on general risk assessment principles and results in a qualitative (high, moderate, low) expression of risk. The data requirements are, however, less detailed than those for a formal risk assessment.

Supplementary information will be required to fully characterize the risks from the Section 313 chemical releases, and to put these risks into perspective with those resulting from other sources of chemicals in the community. Therefore, the guide provides sources of information for obtaining these data, including organizations, fact sheets, profiles, training courses, data

bases, models, hotlines, and contacts. The guide also includes information from Roadmaps, a Section 313 chemical information directory.

The risk screening procedure described in this guide will be of limited value in answering health-related questions from citizens (e.g., "Will I get cancer?" or "Is my cancer the result of past exposures to these chemical releases?"). To address these questions, the guide presents strategies for handling inquiries, tracking phone calls, assembling information, disseminating information, and building bridges with other organizations. It also provides guidance in conveying risk-related information to the public. A number of risk communication principles are described in the guide, along with a comprehensive listing of risk communication texts.

The TRI reporting will provide health and environmental officials with an unprecedented amount of data concerning the release of toxic chemicals into the environment; these data will be an important supplement to existing programs. It should be noted that this guide focuses on the TRI chemicals because the release reporting provides a readily available source of aggregate data upon which comparisons can be made and priorities established. If sufficient release and toxicological data are available for other chemicals (including the Extremely Hazardous Substances under Section 302 and the CERCLA hazardous substances under 304), the system could be adapted to assess those chemicals.

The more information communities have about environmental hazards in their communities, the better equipped they will be to ensure individuals' protection from unacceptable risks to their health and safety. The TRI reporting, together with the other information gathered under Title III, is an important step in this direction.

ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AirRISC	Air Risk Information Support Center
ATSDR	Agency for Toxic Substances Disease Registry, Centers for Disease Control
BAT	Best Available Technology
BACT	Best Available Control Technology
BCF	Bioconcentration Factor
BPT	Best Practicable Technology
CAMEO	Computer-assisted Management Emergency Operations
CAS	Chemical Abstract Services
CCC	Criterion Continuous Concentration
CD/ROM	Compact Disk/Read Only Memory
CEPP	Chemical Emergency Preparedness Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CMA	Chemical Manufacturers Association
COMFiche	Computer Output Microfiche
CSSHEA	Chemical Scoring System for Hazard and Exposure Assessment
CTC	Control Technology Center
CMC	Criterion Maximum Concentration
DOE	U.S. Department of Energy
EHS	Extremely Hazardous Substance
EIS/C	Emergency Information System/Chemical
EPA	U.S. Environmental Protection Agency
GEMS	Graphical Exposure Modeling System

GIS	Geographic Information System
HEED	Health and Environmental Effects Document
HEM	Human Exposure Model
HRS	Hazard Ranking System
IRIS	Integrated Risk Information System
ISCLT	Industrial Source Complex Long-Term Model
LAER	Lowest Achievable Emission Rate
LEPC	Local Emergency Planning Committee
MATC	Maximum Acceptable Toxicant Concentrations
MHAPPS	Modified Hazardous Air Pollution Prioritization System
MSDS	Material Safety Data Sheet
NATICH	National Air Toxics Information Clearinghouse
NCC	National Computer Center, U.S. EPA
NCI	National Cancer Institute
NCIC	National Cartographic Information Center
NIOSH	National Institute of Occupational Safety and Health
NLM	National Library of Medicine
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRC	National Response Center
NTIS	National Technical Information Services
ODW	Office of Drinking Water, U.S. EPA
OSHA	Occupational Safety and Health Administration, U.S. Department of Labor
OSWER	Office of Solid Waste and Emergency Response, U.S. EPA
OTS	Office of Toxic Substances, U.S. EPA.

PCGEMS	Graphical Exposure Modeling System - Personal Computer version
PIC	Public Information Center
POTW	Publicly Owned Treatment Works
RAPS	Remedial Action Priority System
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RQ	Reportable Quantity
RTECS	Registry of Toxic Effects of Chemical Substances
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SERC	State Emergency Response Commission
SIC	Standard Industrial Classification
STAR	Stability Array
TOXNET	Toxicology Data Network
TPQ	Threshold Planning Quantity
TRI	Toxic Chemical Release Inventory
TSCA	Toxic Substances Control Act
UF	Uncertainty Factor
USGS	U.S. Geological Survey

GLOSSARY OF TERMS USED IN THE GUIDE

Absorption - The passage of one substance into or through another, often via a membrane such as the skin, lungs, or gastrointestinal tract.

Acute exposure - A one-time or short-term exposure (usually high level).

Additive effect - A toxicologic interaction in which the combined effect of two chemicals is equal to the sum of the effect of each chemical given alone (e.g., 2+3=5).

Adsorption - The attachment of the molecules of a liquid or gaseous substance to the surface of a solid.

Adverse effect - A structural, functional, behavioral, or biochemical change that is deleterious to the health of an organism.

Ambient - Environmental or surrounding conditions. For example, ambient temperatures are temperatures of the surrounding area (e.g., air or water).

Antagonistic effect - An effect that occurs when two chemicals administered together interfere with each other's actions, or one chemical interferes with the action of the other chemical. Thus, the combined effect of the two chemicals is less than the sum of the effect of each chemical given alone (e.g., 2 + 3 = 1).

Aquifer - An underground bed or layer or earth, gravel, or porous rock containing usable amounts of ground water that can supply wells and springs.

Bioaccumulation - The progressive increase in tissue concentrations of chemicals in organisms higher in the food chain (sometimes referred to as biomagnification).

Bioavailability - The degree to which an organism or target tissue has access to a substance after chemical administration or exposure.

Bioconcentration - Increased concentrations of a chemical in an organism compared to the surrounding environment.

Biodegradation - Decomposition of a substance into more elementary substances by the action of microorganisms, such as bacteria and fungi.

Burst - A rapid release of short duration.

By-product - Any material other than the principal product that is generated during the manufacture, processing, use, or disposal of another material.

Cancer potency - The expression of the relationship between the tumorigenic response and the administered dose to target or test organisms.

Carcinogen - An agent capable of producing cancer OR an agent capable of causing malignant or non-malignant tumor formation.

Chemical mixture - Any combination of two or more chemicals, if the combination is not, in whole or in part, the result of a chemical reaction. If the combination was produced by a chemical reaction but could have been produced without a chemical reaction, it is also treated as a mixture under Title III. A mixture also includes any combination which consists of a chemical and associated impurities.

Chronic effect - Adverse responses that become apparent in an organism after prolonged or repeated exposures, or after some time has elapsed from an initial exposure.

Chronic exposure - Exposure (usually low level) during a major portion of a lifetime to an environmental agent. Compare with acute exposure.

CD/ROM (Compact Disc/Read Only Memory) - An optically-read laser disc, capable of storing 50 million characters (as compared to a magnetic floppy disc, which can store only 1.2 million characters). Information can be read from the disc, but not added or deleted.

COMFiche (Computer Output Microfiche) - Microfiche that has been formatted, processed, and output directly by a computer (as compared to photographic reduction from a paper original).

Criterion Continuous Concentration (CCC) - The U.S. EPA national water quality criteria recommendation for the highest in-stream concentration of a toxicant to which organisms can be exposed indefinitely without adverse effect.

Criterion Maximum Concentration (CMC) - The U.S. EPA national water quality criteria recommendation for the highest in-stream concentration of a toxicant or effluent to which organisms can be exposed for a brief period of time without causing mortality.

Degradation - Transformation of chemicals into smaller molecules through chemical, photochemical, or biological processes.

Demography - The study of the characteristics of human populations such as size, growth, density, distribution, and vital statistics.

Developmental toxicity - Adverse effects observed in the developing organism that may result from exposure prior to conception, during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. The major manifestations of developmental toxicity include: 1) death of the developing organism, 2) structural abnormality, 3) altered growth, and 4) functional deficiency.

Dose - The amount of a chemical that enters an organism. It is usually expressed as the amount of the substance per unit of body weight, e.g., mg/kg. The applied dose is the amount of a chemical (per unit of body weight) at the point of contact (skin, lung, gastointestinal tract). The delivered dose is the dose to the site or sites of toxic action (target tissue).

Dose-response curve - A graphical representation of the relationship between the amount of a substance administered and the resulting effects.

Dose-response relationship - The relationship between the dose of a chemical and the extent of adverse health effects.

Environmental fate - What happens to a chemical in the environment from its point of release to point of exposure with organisms/populations of interest. The environmental fate of a chemical is the sum total of all chemical and biological transformation processes acting on the chemical.

Environmental level - A qualitative characterization of amounts and concentrations of a chemical in the environment at the point of contact with populations of interest.

Epidemiology - The study of the causes and distribution patterns of diseases in human and animal populations. Such studies typically compare the health status of exposed groups with comparable unexposed (control) groups.

Exposure - Contact by an organism with a chemical or physical agent. The magnitude of exposure is determined by measuring or estimating the amount of an agent available at the exchange boundaries, i.e., lungs, gut, skin, during some specified time.

Exposure assessment - The determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, and route of exposure. The assessment may include past, current, and anticipated exposures.

Exposure pathway - The route by which an organism comes in contact with a chemical (e.g., ingestion via water or food; inhalation via smoke or vapors; absorption through the skin via consumer products such as solvents).

Extrapolation - The estimation of a value beyond the known range, on the basis of certain variables within that known range, which the estimated value is assumed to follow.

EHSs (Extremely Hazardous Substances) - Chemicals that have the potential for causing death or irreversible toxicity in unprotected populations after relatively short exposure periods at low doses. (They are acutely toxic.) On the basis of toxicity criteria, EPA identified a list of chemicals (Section 302 of Title III of SARA) with acute toxicity.

Facility - All buildings, equipment, structures, and other stationary items which are located on a single site or on adjacent sites and which are owned or operated by the same person (or by any person who controls, is controlled by, or is under common control with, such person).

Ground-Water Classification System Guidelines - EPA has established three classes of ground waters to receive different levels of protection under its Final Ground-Water Classification Guidelines and Ground-Water Protection Strategy (EPA, 1988 and 1984). Class I, or Special Ground Waters, are ground waters highly vulnerable to contamination and that are either irreplaceable sources of drinking water or ecologically vital ground

waters (i.e., ground waters supplying a unique and easily disrupted ecosystem). Class II ground waters are all non-Class I current and potential sources of drinking water or water serving other beneficial purposes (e.g., irrigation, animal husbandry); Class II has been defined to include the majority of the nation's ground waters that may be affected by human activity. Class III ground waters are not a potential source of drinking water (using common current purification technologies), and have limited beneficial uses.

Half-life - The time in which the concentration of a substance will be reduced by half. Half-life is a measure of the chemical's persistence in the environment.

Hydrolysis - Decomposition of a chemical compound by reaction with water, such as the cleavage of an ester into the corresponding acid and alcohol.

Individual risk - The probability that an individual person will experience an adverse effect.

LC_{Lo} (Lethal Concentration Low) - The lowest concentration, in air or water, of a chemical at which some test animals will die following exposure.

LC_{50} (Median Lethal Concentration) - The concentration at which 50% of the test organisms will die when exposed to a substance for a specified period of time. Concentration is usually given in parts per million (ppm), milligrams per cubic meter (mg/m^3), or milligrams per liter (mg/L). The lower the LC_{50}, the more toxic the substance.

LD_{Lo} (Lethal Dose Low) - The lowest dose of chemical at which some test animals will die following exposure.

LD_{50} (Median Lethal Dose) - The amount of a substance (applied dose) at which 50% of the test organisms will die within a specified period of time. Dose is usually given in milligrams per kilogram of body weight. The lower the LD_{50}, the more toxic the substance.

Leaching - The process by which soluble chemicals are dissolved and carried away or moved to a lower layer of soil by a percolating liquid such as water.

Lethal - Causing or capable of causing death.

LOAEL (Lowest-Observed-Adverse-Effect-Level) - The lowest dose in an experimental study at which a statistically or biologically significant adverse effect is seen.

Local Emergency Planning Committee (LEPC) - A committee appointed by the State Emergency Response Commission (SERC) as required by Sections 301 to 303 of Title III of SARA to formulate a comprehensive emergency plan for its district.

Log P (octanol/water partition coefficient) - A number derived from the ratio between solubilities in nonpolar (e.g., fat) and polar (e.g., water) substances. Generally, the higher the partition coefficient and Log P, the greater the likelihood that a substance will accumulate in the organism.

MATC (Maximum Acceptable Toxicant Concentration) - The mean value between the highest no-effect concentration and the lowest concentration causing a statistically significant effect in a chronic toxicity test on an environmental species.

MSDS (Material Safety Data Sheet) - A compilation of information required under the OSHA Communications Standard on the identity of products and hazardous substances found in the workplace, their toxicity, physical properties and hazards, exposure limits, and precautions for handling. Section 311 of SARA requires facilities to submit MSDSs under certain circumstances.

Mutagen - An agent capable of causing a change in the genetic material (DNA) of a cell.

Neurotoxicity - Any adverse effect on the nervous system. This includes pathological changes to the structure or functioning of the brain, spinal cord, or peripheral nerves, including neuromuscular and behavioral effects.

NOAEL (No-Observed-Adverse-Effect-Level) - The highest experimental dose at which there is no statistically significant increase in a toxicologically significant effect.

Non-Point Source - The discharge of chemicals from locations that do not have a stationary location or specific outlet. Examples are automobile emissions and pesticide storm runoff into rivers.

Oxidation - The chemical reaction of oxygen (or other electron acceptors) with other substances, as in burning and rusting.

Photolysis - The degradation of a chemical caused by exposure to light.

Point source - Stationary locations from which chemicals are discharged to the environment, such as smokestacks and effluent pipelines.

ppm (parts per million) - An expression describing a small concentration or amount of substance in a million parts of another material. "A drop in the bucket" is, literally, approximately 1 ppm. (One drop of water in a standard 2.5 gallon bucket is 5 ppm.)

Qualitative - Describing the identity or characteristics of something with little or no indication of amount or degree.

Quantitative - Describing the amounts, concentrations, or degrees of a thing or its characteristics.

Release - Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any toxic chemical.

RfD (Reference dose) - An estimate (with uncertainty spanning perhaps an order of magnitude or greater) of the daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime. The Rfd is expressed in units of mg/kg/day.

Risk - The nature and probability of occurrence of an adverse effect on humans or an environmental species.

Risk analysis - In the context of Section 302 of SARA, risk analysis is the third of a three-step hazards analysis process for emergency planning. It requires an estimation of both the occurrence of an accidental chemical release (unique to this process) as well as the subsequent potential for exposure (with emphasis on human exposure to extremely hazardous substances). It is a flexible, judgmental exercise that results in qualitative risk statements.

Risk assessment - The process of estimating the probability of occurrence of adverse health or ecological effects. Human health risk assessment includes: (1) description of the potential adverse effects; (2) estimation of the extent of effects on humans exposed to a given amount of chemical; (3) judgments on the type and number of persons affected under different conditions of exposure; and (4) characterization of the uncertainties incurred in determining the risk.

Risk management - The decision-making process that uses the results of risk assessment to evaluate and select regulatory and non-regulatory solutions to risk. Risk management includes consideration of technical, legal, political, economic, and social factors.

Risk screening - A type of risk assessment using limited data. The process results in a relative expression of risk (e.g., high, medium, low). Risk screening is useful for establishing risk-based priorities and information needs for followup chemical- or site-specific risk assessment activities. Although the risk screening process relies on general risk assessment principles, the data input requirements are less demanding than those for risk assessment, and the analysis is less rigorous than a formal risk assessment.

Route of exposure - The pathway by which the chemical is introduced into an organism (e.g., inhalation, ingestion, or dermal exposure).

RQ (Reportable Quantity) - The quantity of a hazardous substance that triggers reporting under CERCLA. If a substance is released in a quantity that exceeds its RQ, the release must be reported to the National Response Center (NRC), as well as to the State Emergency Response Commission (SERC) and the Local Emergency Planning Committee (LEPC) for areas likely to be affected by the release.

Safe - Condition of exposure under which there is no risk of practical harm.

Sensitive Environment - Geographical areas bounded by legal, social, commercial, or biological constraints. These include areas such as wetlands and national parks in need of protection by Federal, State, or even municipal statutes; areas deemed by society as desirable and therefore in need of protection from chemical contamination; areas where

some human food source is grown (e.g., crops, catfish, or rainbow trout) or areas that are used commercially (e.g., lakes or ponds where a fee is charged for boating or fishing); and areas vital for maintenance of a particular population (be it terrestrial or aquatic), including shoreline/wetland areas vital to the breeding or rearing of young, but not necessarily endangered, species. Specialized habitats such as bogs and marshes also may be considered sensitive environments.

Sensitive populations - Groups of people that may be more susceptible than the general population (due to preexisting health conditions [e.g., asthmatics] or age [e.g., infants and the elderly]) to the toxic effects of a chemical release.

Site - The point of release of, or potential exposure to, Section 313 emission.

Source - The location from which a chemical may be released to the environment. These include intended release points (e.g., effluent pipes, smoke stacks) and unintended release points (e.g., leaky valves).

Stability Array (STAR) - Statistical data from meteorological stations around the country that provide meteorological input for modeling.

State Emergency Response Commission (SERC) - Commission appointed by each State governor according to the requirements of Sections 301 to 303 of Title III of SARA. Duties of the commission include designating emergency planning districts, appointing local emergency planning committees (LEPCs), supervising and coordinating the activities of planning committees, reviewing emergency plans, receiving chemical release notifications, and establishing procedures for receiving and processing requests from the public for information.

Storage - Methods of keeping raw materials, finished goods, or products while awaiting use, shipment, or consumption.

Superfund - Federal authority, established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, to respond directly to releases or threatened releases of hazardous substances that may endanger health or welfare. Cleanups are paid for out of a revolving fund, originally provided by general revenue plus a tax on the chemical industry, and reimbursed through subsequent recovery from those found responsible for the damage.

Synergistic effect - Interaction between two or more substances that results in an effect greater than the sum of their individual effects (e.g., 2+3=20).

Teratogen - An agent capable of causing malformations or birth defects in the developing organism following maternal exposure.

Threshold dose - The lowest amount or concentration of a chemical needed to produce a measurable effect.

TPQ (Threshold Planning Quantity) - The amount of an extremely hazardous substance present at a facility above which the facility's owner/operator must give emergency planning notification to the SERC and LEPC.

Title III - A provision of the Superfund Amendments and Reauthorization Act (SARA) that became law in 1986. Also known as the Emergency Planning and Community Right-to-Know Act, Title III establishes requirements for Federal, State, and local governments and industry regarding emergency planning and community right-to-know reporting on hazardous and toxic chemicals.

Toxic Chemical Release Inventory (TRI) - The data base containing annual toxic chemical release reports submitted to EPA by certain manufacturing facilities, specified in Section 313 of Title III. The TRI is available to the public in county libraries through a national computerized data base and through other means.

Toxic Chemical Release Form (Form R) - Information form required to be submitted by facilities that manufacture, process, or otherwise use (in quantities above a specified amount) chemicals listed in Section 313 of Title III of SARA.

Toxicity - The ability of a substance to impair an organism, the central nervous system, or other functional capacity, or enhance its susceptibility to the deleterious effects of other substances.

Toxicological potency evaluation - A determination of whether a chemical causes an adverse effect and, if so, at what dose the effect occurs.

Transport - The physical movement of a chemical in the environment.

Transformation - The chemical or biological conversion of a chemical into other chemical forms, e.g., degradation of an organic hydrocarbon to carbon dioxide and water.

Uncertainty factor - Factors used in operationally deriving the RfD from experimental data. These factors are intended to account for: (1) the variation in sensitivity among the members of the human population; (2) the uncertainty in extrapolating animal data to the case of humans; (3) the uncertainty in extrapolating from data obtained in a study that is of less-than-lifetime exposure; (4) the uncertainty in using LOAEL rather than NOAEL data; and (5) the inability of any single study to adequately address all possible adverse outcomes in man.

Unit risk factor - A statistical upper bound of the probability than an individual will develop cancer from continuous exposure to one unit of a carcinogen over a lifetime (70 years). The unit risk factor is derived from a measure of the cancer potency of a carcinogen.

Volatilization - The process of evaporation or sublimation (change in physical state from the liquid or solid to gaseous).

Wellhead protection areas - As defined by the 1986 Safe Drinking Water Act Amendments, Subsection 1428(e), a wellhead protection area is the surface and subsurface area surrounding a water well or wellfield, supplying a public water system through which contaminants are reasonably likely to move toward and reach the water well or wellfield. The extent of a wellfield protection area within a State, necessary to provide protection from contaminants which may have an adverse human health effect, is to be determined by the State according to its Wellhead Protection Area Program submitted in accordance with the statute.

SECTION I - BACKGROUND

In recent years, the American public has become increasingly aware of and concerned about the risks associated with exposure to toxic industrial chemicals. In 1984, a release of toxic gas from a pesticides plant in Bhopal, India, killed or seriously injured thousands of people. That tragedy, followed by a chemical release in West Virginia, set in motion a number of emergency planning and information gathering activities in the United States. The U.S. Environmental Protection Agency (EPA) established a voluntary program, called the Chemical Emergency Preparedness Program (CEPP) to raise awareness about the potential for chemical accidents and encourage communities to develop emergency plans. At the same time, the Chemical Manufacturers Association (CMA) set up a program encouraging plant managers to participate in local emergency planning and to explain their companies' operations to nearby residents.[1]

The culmination of these and other efforts was the passage of a new law in October 1986. The law, the Emergency Planning and Community Right-to-Know Act[2] enacted as Title III of the Superfund Amendments and Reauthorization Act (SARA, Public Law 99-499), was designed to help communities deal safely and effectively with the many hazardous substances that are used in our society. Also known as Title III, this law establishes requirements for:

- Local, State, and Federal governments and industry regarding emergency planning and emergency release notification.
- Community right-to-know reporting on hazardous and toxic chemicals.

Under Title III, certain businesses must submit reports on the hazardous materials that they manufacture, use, store, process, and release into the environment. Title III requires the establishment of State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs). These entities have substantial responsibilities for implementing Title III at the State and local levels. In addition, other agencies within the State and local government may have responsibilities for managing and interpreting the data made available under the Act.

There are four major provisions of the Act:[3]

- Planning for Chemical Emergencies. Under Sections 301 to 303, Governors appoint SERCs, and SERCs establish and coordinate LEPCs. LEPCs develop and annually review emergency response plans. Businesses are required to participate in emergency planning and to notify SERCs and LEPCs if they have Extremely Hazardous Substances (EHSs) present above threshold planning quantities. Over 300 chemicals are currently listed as EHSs based upon criteria indicating that these substances are acutely lethal in small concentrations.

- Emergency Notification of Chemical Accidents and Releases. Under Section 304, businesses must report accidental releases of both EHSs and over 700 listed hazardous substances defined under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund). Releases of these chemicals above certain amounts must be reported to the National Response Center, the SERC, and the LEPC.

- Reporting of Hazardous Chemical Inventories. Under Sections 311 and 312, businesses must provide information to SERCs, LEPCs, and local fire departments about hazardous chemicals that they produce, use, or store in designated amounts. Businesses must submit Material Safety Data Sheets (MSDSs), which contain information on a chemical's physical properties and health effects. The Occupational Safety and Health Administration (OSHA) requires companies to keep MSDSs on file for all hazardous chemicals used in the workplace. Companies must also submit annual inventories of these same hazardous chemicals, containing information on quantities, hazard categories, and other information.

- Toxic Chemical Release Reporting. Under Section 313, certain businesses must submit annual reports to EPA and the State in which they operate for certain specified toxic chemicals manufactured, imported, processed, or used at the facility. Facilities must account for the total aggregate releases to the environment of each toxic chemical listed under Section 313 for the calendar year. These aggregate data are referred to as the Toxic Chemical Release Inventory (TRI). EPA is mandated to make this information available to the general public in a readily accessible form. The first annual report (for the calendar year 1987) was due to EPA and the designated State agencies on July 1, 1988.

There are two other sections of the Title III: Section 322 (trade secrets) and Sections 325 to 326 (penalties and citizen suits). Since the focus of this manual is Section 313, the guide does not attempt to provide comprehensive descriptions of all sections of Title III. For more information on the Act, see the reference list provided at the back of this section. In addition, this guide should not be used in lieu of Federal Register documents or the Code of Federal Regulations for purposes of compliance. Federal Register citations for the four sections of the Act described above are provided in the reference list.

TOXIC CHEMICAL RELEASE REPORTING (SECTION 313)

Who Must Report[4]

Plants, factories, or other facilities that are classified in the Standard Industrial Classification (SIC) codes **20** through **39**:

SIC	Industry Group
20	Food
21	Tobacco
22	Textiles
23	Apparel
24	Lumber and wood
25	Furniture
26	Paper
27	Printing and publishing
28	Chemicals
29	Petroleum and coal
30	Rubber and plastics
31	Leather
32	Stone, clay, and glass
33	Primary metals
34	Fabricated metals
35	Machinery (excluding electrical)
36	Electrical and electronic equipment
37	Transportation equipment
38	Instruments
39	Miscellaneous manufacturing

AND Employ the equivalent of 10 or more full-time individuals.

AND Manufacture (including import) or process any of the Section 313 or chemical categories in amounts greater than 75,000 pounds in 1987; 50,000 pounds in 1988; or 25,000 pounds in 1989 and subsequent years.

Or

Use any listed chemical or chemical category in any other way (other than manufacture) in amounts greater than 10,000 pounds in 1987 and subsequent years. This includes processing (e.g., using trichloroethylene to degrease tools) or importing of the listed chemical or chemical category .

Chemicals Subject to Reporting[5]

Over 300 toxic chemicals and chemical categories are subject to reporting under Section 313 (a listing of these chemicals is provided in Roadmaps, Appendix H of Volume II). Listed chemicals and/or chemical categories that are components of mixtures also are subject to reporting. The company may use the name of the mixture or the product trade name instead of the chemical's actual name only if the specific identities of the chemicals in the mixture are not known.

Companies can claim a chemical's identity as a trade secret, but they must substantiate such a claim. A $25,000 fine for frivolous trade secret claims has been established under Title III. If a firm claims a chemical is a trade secret, it must provide a generic name for that chemical, and that name must be descriptive of the chemical structure. Companies may withhold only the specific chemical identity of the compound - including chemical name and Chemical Abstract Services (CAS) number.

Releases Subject to Reporting

Section 313 requires reporting of the following chemical releases[6]:

- To the air from fugitive or non-point sources. (Fugitive releases are those that are not released through stacks, vents, or any other confined air stream.)
- To the air from stack or point sources.
- To the water directly discharged to a receiving stream.
- In wastes that are injected underground.
- To land on site (including landfills, surface impoundments, or landspreading).
- To water discharged to a publicly owned treatment works (POTW).
- In wastes transferred offsite for treatment or disposal.

The quantities reported reflect the amounts of chemical released after any onsite treatment and are specific to the chemical or chemical category subject to reporting. Releases of the

chemical to the environment are given in pounds per year. The release quantities represent the total amount of the chemical released from all possible sources for each medium. For example, for water sources, releases estimated separately from process outfalls, pollution control devices, and washing from containers are added and entered under "Discharges to Water." Some sources of chemical wastes are listed in Exhibit 1.

Burst Versus Routine Releases

The releases reported by facilities under Section 313 will include both routine and burst releases:

- "Burst" releases are typically accidental, rapid releases of short duration.
- Routine releases are those occurring during the conduct of normal operation at the facility, and are typically longer in duration than "bursts."

A reported release may have occurred over the course of a year, or on a single day. It may be a combination of burst and routine releases. Because facilities are not required to indicate the frequency, duration, or peak release rate of the release, it will be impossible to know from the TRI reporting form alone whether a release was accidental or routine, short- or long-term, or both. For Section 313 chemicals that are also Section 304 chemicals, releases should be cross-checked to determine if any part of a specific release was accidental.

The guidance presented in this manual is applicable to releases that are longer in term than bursts, and for which there are limited release data. A separate guide, the Technical Guide for Hazard Analysis[7] has been prepared for burst releases of the EHSs listed under Section 302 of Title III. For the most part, burst releases of EHSs should be addressed using the Technical Guide for Hazard Analysis; routine releases should be addressed using this guide.

THE LIMITATIONS OF THE TOXIC CHEMICAL RELEASE INVENTORY

Toxic chemical release reporting can be viewed as a new beginning in environmental awareness for both the government and the public. The reporting represents the first

systematic way of gathering information about the release of specific toxic chemicals in or near communities and of making these data readily available to the public. Because the reporting is new for everyone - localities, States, the Federal government, manufacturers, processors, users, and the public - and because the reporting requirements are phased in over time, there will be some initial difficulties in understanding and using the data. During the first years of reporting, the release data are therefore expected to be limited in type and quality.

Chemical Scope

The chemicals identified for reporting under Section 313 were drawn from lists developed by New Jersey and Maryland in implementation of their State right-to-know laws. The chemicals vary widely in toxicity. Large reported releases of chemicals of relatively low toxicity may be of much lesser environmental concern than smaller releases of highly toxic chemicals. Moreover, the list of chemicals currently covered does not include all toxic chemicals of concern being released into the environment. Chemicals may be added or deleted from the list by petition or on the initiative of EPA.

Facilities Covered

Not all industrial releases of the listed chemicals are covered by the reporting requirements. Those facilities that fall outside the specified range of SIC codes; those with fewer than 10 full-time employees; and those producing, importing, processing, or using the designated chemicals below threshold amounts are not required to participate in release reporting. In addition, fewer facilities are required to report in the first year than in subsequent years, and not everyone who is obligated to report will do so. Some smaller companies may not even be aware they are required to report under this new law. EPA currently is undertaking investigations and enforcement actions to increase the rate of compliance.

There are many sources of toxic chemicals besides industrial processes; these other sources are not covered by the reporting requirements. For example, chemicals can be released through consumer products, agricultural uses, and sources such as automobiles.

Completeness of the Data

Companies are not required to report certain information which could be important in assessing the risk associated with the release. For example, while the location of the facility must be described on the reporting form, the location of point source releases (such as stack heights and the locations of surface water discharges) will be uncertain. Also, the identities of chemicals within mixtures and compound classes reported by the various reporting facilities will not be known. In addition, much of the data provided by industries will be based on engineering estimates (not on actual measurements of release), and the approaches used to develop these estimates often yield errors. If monitoring data are readily available, industries must use that data to calculate releases. However, no additional monitoring or measurements are required.

Another limitation is that the data will be summary data, reported in units of pounds per year; no information on frequency, duration, or peak release is required. This missing information can also be important in determining the effects of the release on human health and the environment.

Reporting Errors

Omissions, errors, and inaccuracies are bound to occur in reporting, especially during the first years, due to unfamiliarity with the reporting requirements and form. For the 1987 calendar year, for example, approximately 60% of the reporting facilities provided latitude and longitude data (these data were optional), but over 15% of the figures provided were erroneously listed as outside the continental United States (for example, in the Gulf of Mexico).[8] There also may be data entry errors, including those made while entering the TRI data into the EPA data base.

Looking Ahead

EPA expects the quality of the data reported to improve in subsequent years as industries become familiar with the reporting requirements. It is also hoped that the data quality will

further improve through a program of outreach, technical audits, facility inspections, and enforcement. In addition, EPA plans to modify the reporting requirements in the future to obtain additional release information. Finally, EPA has a program to check the reports for obvious errors, guide companies in filling out forms correctly, and enforce filing requirements.

AVAILABILITY OF THE TRI

Title III mandates that EPA make the TRI available to the public via "telecommunications and other means." There are several ways the public can access the information:

- TRI Public Data Base - The TRI data file will become part of the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET) and be available on line for public access in the late spring of 1989.
- CD/ROM - The entire TRI data base will be available on Compact Disc/ Read Only Memory (CD/ROM). Copies will be available in each of the Federal Depository Libraries.
- COMFiche - Computer Output Microfiche (COMFiche) will be available either by State or for the entire TRI data base. The Government Printing Office will distribute a copy of the TRI State data to each county in the State. COMFiche for the entire data base will be available in each of the Federal Depository Libraries.
- Magnetic Tape - The entire TRI data base will be available on magnetic tape in ASCII format.
- Special Access - Until the TRI data can be made available to the public, information on TRI submissions is available on an ad hoc basis from the Title III Reporting Center. The center can handle inquiries either by mail, walk-in, or by phone. People wishing to request or view information must first call the center for an appointment at 202-0488-1501.

CD/ROM, COMFiche, and magnetic tape will be available for sale through the National Technical Information Service and the Government Printing Office.

USING THE TRI

The following are examples of ways in which the Toxic Chemical Release Reporting Form (Form R) may be used:

- Determine which substances were released into the environment during the preceding year.
- Determine how much of each substance - in pounds per year - went into air, land, and water in specific geographic ares or nationwide.
- Learn how the wastes were treated onsite and how efficient that treatment was.
- Compare releases by similar facilities in different parts of the country.
- Compare releases among different kinds of facilities.
- Check the data against permits and emission standards to make sure facilities have permission for releases or to flag candidates for further investigation.

Additional information and some form of risk screening will be needed to:

- Find out if there are hot spots (areas with an unusually high number of releases).
- Help set priorities for further investigation and reduction of releases.
- Identify new chemicals for regulatory consideration.
- Help facilities internally identify priorities for release reduction.

This guide addresses two immediate uses of the Toxic Release Inventory: (1) establishing priorities for followup investigation of TRI facilities and chemicals; and (2) identifying data needs and approaches for collecting information necessary to respond to health and ecological questions from the public.

EXHIBIT 1 - SOURCES OF WASTES

When estimating releases of a chemical, industries must consider all sources of wastes. Sources of waste include, but are not limited to:

Fugitive or non-point air sources

- Equipment leaks from pumps, valves and/or flanges
- Building ventilation systems
- Evaporative losses from surface impoundments

Stack and other point air sources

- Vents from reactors and other process vessels
- Storage tank vents
- Stacks or vents from pollution control equipment

Water sources

- Process outfalls
- Washings from vessels, containers, etc.
- Pollution control devices
- Stormwater runoff (if applicable)

Solids, slurries, and non-aqueous sources

- Filter cakes
- Spent catalysts
- Pollution control wastes (such as absorber sludges) and/or wastewater treatment sludges
- Spent catalysts
- Vessel or tank residues
- Spills and sweepings
- Spent solvents
- By-products

Source: U.S. Environmental Protection Agency. 1987. Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form, EPA 560/4-88-002. U.S. EPA, Office of Pesticides and Toxic Substances, Washington, DC.

REFERENCES

Notes

[1]U.S. Environmental Protection Agency. Chemicals in Your Community: A Guide to the Emergency Planning and Community Right-to-Know Act (Washington, DC: U.S. EPA, September 1988) 2.

[2]The Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. §§11001 et. seq.

[3]U.S. Environmental Protection Agency. Chemicals in Your Community. 15.

[4]U.S. Environmental Protection Agency. The Emergency Planning and Community Right-to-Know Law: Section 313 Reporting Requirements (Springfield, Virginia: National Technical Information Service, September 1987), 2-5.

[5]U.S. Environmental Protection Agency. Toxic Chemical Release Inventory Reporting Form R and Instructions. EPA 56014-88-005. (Washington, DC: U.S. EPA, 1988).

[6]U.S. Environmental Protection Agency. Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form. EPA 560/4-88-002. (Washington, DC: U.S. EPA, December 1987) 2-1.

[7]U.S. Environmental Protection Agency, Federal Emergency Management Agency, and U.S. Department of Transportation. Technical Guidance for Hazards Analysis: Emergency Planning for Extremely Hazardous Substances (Washington, DC: U.S. EPA, December 1987).

[8]Klauder, David and Loren Hall. SARA Title III: Qualitative Vs. Quantitative Approaches to Assessing Incomplete Data. Presentation to the International Life Sciences Institute (ILSI) on February 15, 1989. Washington, DC.

Federal Register Citations

Sections 301 to 303 (emergency planning): April 22, 1987; December 17, 1987; February 25, 1988 (40 CFR 300 and 355).

Section 304 (emergency release notification): April 22, 1987; December 19, 1987; February 25, 1988 (40 CFR 300 and 355).

Sections 311-312 (hazardous chemical reporting): October 15, 1987; August 4, 1988 (40 CFR 370).

Section 313 (toxic chemical release reporting): February 16, 1988; June 20, 1988 (40 CFR 372).

Other Sources of Information on Title III

Chemical Manufacturers Association. 1988. Community Guide to Title III. Washington, DC.

Robert Wood Johnson Medical School. 1988. SARA Title III: Emergency Planning and Community Right-to-Know. Infoletter, Vol. 2, No. 4, Piscataway, New Jersey.

U.S. Environmental Protection Agency. 1988. Title III Fact Sheet: Emergency Planning and Community Right-to-Know. Washington, DC.

U.S. Environmental Protection Agency. Questions and Answers About the Emergency Planning and Community Right-to-Know Act and the Toxic Release Inventory for Use by State/Local Officials. Office of Toxic Substances. National Technical Information Service, Springfield, Virginia.

U.S. Environmental Protection Agency. Toxic Chemical Releases and Your Right to Know. Office of Toxic Substances. National Technical Information Service, Springfield, Virginia.

U.S. Environmental Protection Agency. 1987. Protecting Our Environment: Federal Environmental Laws. New York, New York.

U.S. Environmental Protection Agency. 1987. Release of Hazardous Substances: The Federal Response. New York, New York.

U.S. Environmental Protection Agency. 1987. Title III: What It Means to You. Philadelphia, Pennsylvania.

SECTION II - ELEMENTS OF RISK SCREENING

Each year, EPA and the States will receive thousands of Toxic Chemical Release Inventory Reporting Forms. Few organizations will have the resources to treat the reported releases equally. To make decisions about how best to apply their limited resources, organizations responsible for handling TRI data must develop some system, however crude, for screening and prioritizing the information. One screening criterion that most organizations may wish to consider is potential risk to public health or the environment. This section presents one approach to estimating relative risk - risk screening. Risk screening is a process that can be used for gaining initial perspectives on Section 313 chemicals and for setting rough priorities for further analysis, but should not be used for making final or absolute judgments about the risk associated with a particular facility.

Risk screening, in the context of Section 313 of SARA, is a type of risk assessment used when data or information needs are limited. The process generally results in a relative expression of risk (e.g., high, moderate, low). Risk screening is useful for establishing risk-based priorities as well as information needs for followup risk assessment activities. Although the risk screening process relies on general risk assessment principles, the data requirements are less detailed than those for a formal risk assessment. Risk screening results in less definitive expressions of risk (or "relative risk rankings") than those derived from the risk assessment process.

Risk assessment in the Federal government consists of four major components: hazard identification, dose-response assessment, exposure assessment, and risk characterization.[1] The risk screening procedure described in this guide has three elements: toxicological potency assessment, exposure evaluation, and risk characterization. Each of these elements is described below.

TOXICOLOGICAL POTENCY

In the risk screening procedure described in this manual, the first two steps of risk assessment are combined into a single element, toxicological potency. Toxicological potency involves:

- Hazard identification, or the characterization of the nature of adverse health or ecological effects that may be produced by a chemical (Exhibits 2 and 3 list the adverse health and ecological effects identified under Section 313).
- Dose-response relationships, or the magnitude of these effects at specific exposure levels.

In risk assessment, experimental studies involving test organisms and/or epidemiological studies are reviewed to determine if a chemical can cause health or environmental effects and how these effects are exhibited, and to characterize the dose-response relationship. To make this determination, a number of variables and factors must be considered (see Exhibit 4). For purposes of risk screening on TRI data, the relative toxicological potency of the chemicals is initially all that is needed. Various EPA estimates of toxicological potency are readily available, including:

- Reportable Quantities (RQs). Developed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the RQ for a substance is the level at or above which a release of that substance must be reported to the NRC, the SERC, and the LEPC. There are five levels of RQs: 1, 10, 100, 1,000, and 5,000 pounds. An RQ is assigned to a chemical based on a consideration of the chemical's intrinsic chemical, physical, and toxicological properties. RQs do not provide a definite indication of how hazardous a chemical will be at its reportable level, but they can be used to indicate a chemical's *relative* potential to cause toxicological or ecological effects at a given exposure level.
- Threshold Planning Quantities (TPQs). TPQs have been set for each of the EHSs listed under Section 302 of Title III. TPQs take into account the tendency of the chemicals to become airborne, as well as their toxicity. Like RQs, TPQs are a relative ranking system. There are six levels of TPQs: 1, 10, 100, 500, 1,000, and 10,000. The numbers are generally higher than the RQs for the same chemical, but they can be useful in determining relative toxicity.
- Cancer Potency. Cancer potency is an expression of the relationship between the tumorigenic response to a carcinogen and the administered dose to a target or test

organism. EPA expresses cancer potency using unit risk factors, which translate the estimated cancer potency into a probability of contracting cancer as a result of exposure to a unit dose of a carcinogen over a lifetime (70 years). The unit risk factor is obtained from a mathematical model used to extrapolate from high-dose effects observed in animal studies to potential effects at low doses to which humans may be exposed.

- Reference Doses (RfDs). RfDs are EPA estimates of the daily exposure to the human population, including sensitive populations, that are likely to be without appreciable risk of deleterious effects during a lifetime. RfDs are estimated from either the lowest exposure level at which an adverse effect was observed in animals or humans or on the highest level at which no effect was observed. Appropriate safety factors are applied.

- Aquatic Water Quality Criteria (WQC) Values. Aquatic water quality criteria are EPA estimates of the ambient concentration of a chemical in surface waters (freshwater or marine waters) that will not cause adverse effects to aquatic organisms. WQC exist for both acute and chronic toxicity to aquatic life. These concentrations are based on information concerning the toxicity of the substance and its tendency to bioaccumulate. (EPA also publishes water quality criteria for human health; however, other indices have been selected for use in the risk screening system to address human health concerns.)

Appendix A provides relative toxicological potency rankings for Title III chemicals based on their RQ, TPQ, cancer potency, RfD, and WQC values. The appendix also describes each EPA toxicity index in more detail.

EXPOSURE EVALUATION

No matter how toxic a chemical may be, it cannot cause an effect in a living organism unless it comes into contact with that organism. Exposure is the amount of chemical an individual or population comes in contact with during a given period of time. Release of a chemical into the environment does not necessarily mean that exposure will occur. Exposure depends on many site- and chemical-specific factors. Ideally, exposure is measured at the point of contact between the chemical and the individual or population, either directly (e.g., personal monitoring) or indirectly (e.g., modeling). Opportunities to measure the actual exposure are rare, however. Generally, exposure must be estimated from information on the

levels of a chemical in the environment. (Information on environmental levels may, in turn, be based on modeling estimates.)

For the risk screening methodology described in this guide, two key aspects of exposure - the *plausible exposure pathways* and *potential environmental levels* of the chemicals of concern - are considered qualitatively. An exposure pathway is the route by which an organism comes in contact with a chemical, such as ingestion via water or inhalation via smoke or vapors. The environmental level refers to the qualitative characterization of amounts and concentrations of a chemical in the environment at the point of contact with populations of interest.

There are a variety of possible exposure pathways resulting from releases of a toxic chemical into air, to surface water or publicly owned treatment works (POTWs), or on land:

- Releases to **air** can result in exposures to organisms living near and downwind from facilities releasing toxic chemicals into the atmosphere through smokestacks (or other sources of releases to air). Persistent chemicals may fall or be rained out of air onto land or into surface water, resulting in exposures via these environmental media (see below).

- Plausible exposure pathways resulting from releases to **surface waters** depend on downstream uses of the water, including drinking, cooking, bathing, water contact sports, agricultural livestock watering, and industrial use. Since toxic chemicals can also be taken up by animals and plants, individuals that consume aquatic organisms (such as fish and shellfish from contaminated surface waters) may be exposed in this manner. Releases to **publicly owned treatment works** may result in exposure if chemicals are not removed through treatment processes and are released in POTW effluent to surface water used by downstream communities.

- When toxic chemicals are discharged on **land**, they can penetrate the **soil**. This may become an exposure pathway for individuals who spend time outside. Exposure can occur through inhalation of contaminated dust, incidental ingestion of soil (particularly by children), or ingestion of soil by individuals with pica (an abnormal tendency to eat non-food substances such as dirt). When chemicals migrate downward through the soil, underlying ground water can become contaminated, resulting in an exposure pathway through well water extraction. Chemicals also can be transported over land via surface runoff, resulting in exposures through downgradient uses of land or surface waters. In addition, discharges of volatile chemicals to water and soil can become airborne and expose populations via inhalation. Specially-designed facilities such as permanent landfills and underground injection wells may reduce the potential exposure from land disposal.

Organisms also can be exposed to toxic chemicals through several other pathways, including consumer products such as paints, solvents, glues and deodorizers; pesticides on food; occupational exposures; and indoor air pollutants such as tobacco smoke, fireplaces, unvented stoves, and wood preservatives. While the risk screening system described in this guide addresses only exposure pathways from TRI releases, the user should keep in mind that other sources of toxic chemicals exist. In some locations the TRI releases may contribute insignificantly to chemical exposures relative to other sources.

For the purposes of risk screening on the TRI data, the following factors need to be examined to determine plausible exposure pathways and potential environmental levels:

Plausible Exposure Pathways

Site-Specific Data

- Location of Chemical Releases
- Characterization of Populations of Interest
  - Human or ecological (aquatic or terrestrial)
  - Size
  - Sensitive Populations
- Media Uses
- Geographic Distance to Populations of Interest
- Physical Transport Characteristics of Area

Chemical-Specific Data

- Physical Transport Characteristics of Chemical
- Environmental Transformation Characteristics

Potential Environmental Levels

Site-Specific Data

- Geographic Distance to Populations of Interest
- Physical Transport Characteristics of Area

Chemical-Specific Data

- Quantity of Release
- Physical Transport Characteristics of Chemical
- Environmental Transformation Characteristics
- Rates of Release

Each of these factors is described below.

Site-Specific Exposure Data:

- **Location of Chemical Releases.** An accurate geographical location of each chemical release must be known. From this release point, it is possible to determine how the chemical is likely to move in the environment based on factors discussed below.

- **Characterization of Populations of Interest.** No injury can occur to an organism unless a chemical comes in contact with the organism. It is necessary to identify the organisms (human and other species, both aquatic and terrestrial) that live or periodically enter areas near release points, the size of the population of interest, and the existence of sensitive populations or environments (such as schools and hospitals) that may be more susceptible than average to exposure.

- **Media Uses.** Uses of air, water, and land by humans or animals can affect exposure. Media uses include consumption (such as drinking water and eating fish), recreation (such as swimming and boating) and occupation (such as irrigation and farming). For example, if a given pollutant concentrates in the tissue of fish in Lake Z, the amount of fish consumed by individuals who eat fish from Lake Z is a critical factor affecting exposure.

- **Geographic Distance to Populations of Interest.** The distance from the release site to a population of interest or point of media use (e.g., drinking water intake) is an important consideration. In general, the further the populations of interest are from the point a chemical enters the ambient environment, the less chance that exposure will occur. However, the "effective" distance to organisms of interest depends also on site- and chemical-specific physical transport processes.

- **Physical Transport Characteristics of Area.** Chemicals can be carried or dispersed physically in the environment. The physical characteristics of the release point and the surrounding terrain influence the potential for exposure at any location away from the source. The physical transport characteristics include:

  - Spatial Distance - Chemicals released into air at low heights will, in general, be less widely dispersed than chemicals released from high stacks. (Appendix B illustrates how, under certain conditions, stack height can affect potential concentrations of

chemicals at various distances from the release point.) Chemicals released into surface waters near the banks of rivers or lakes may result in less dispersion and, therefore, higher shoreline concentrations. In general, shallow aquifers are more likely to become contaminated by overlying surface impoundments than deep aquifers under similar containment, soil, and rainfall conditions.

- Meteorological conditions - Precipitation, wind speed and direction, humidity, temperature, and other meteorological variables will affect the transport of chemicals in air, in water, and on land. For example, populations located downwind from the source of the release will generally be exposed to higher concentrations of a chemical than those at equidistant upwind locations. Excessive rainfall can cause surface runoff from land disposal sites, leading to downhill exposures, including surface water contamination.

- Hydrogeological conditions - Chemicals will be transported differently in lakes, slow rivers, swift streams, estuaries, or oceans. For example, tidal movement is the overriding transport mechanism within an estuary, while thermal stratification may control movement within a deep lake. Soil porosity will affect the downward mobility of chemicals. Clay and silt soils will retard leaching whereas sandy or fractured soils will enhance it.

- Topographical conditions - Terrain will also affect the way a chemical is transported. Mountain ranges and tall buildings, for example, may "block" the pathway of a relatively low chemical plume. The ground slope near land disposal sites may affect the potential for transport of a chemical via surface runoff.

Chemical-Specific Exposure Data (at a given site)

- **Quantity of Release.** In general, the greater the quantity of a chemical released, the greater the potential environmental levels of the chemical. (Appendix C presents information that can be used to rank release quantities.) The other factors described below must also be taken into consideration, however. For example, a small quantity of a highly toxic substance released every day of the year might add up to a large quantity, but not be a concern if it degrades rapidly in the environment.

- **Physical Transport Characteristics of Chemical.**

  - Adsorption and Leaching - Environmental transport of a chemical may be enhanced or retarded in air, soil, and water if the chemical is readily sorbed to dust, soil particles, or suspended and bottom sediments. For example, aquatic organisms that are "bottom feeders" would be expected to be exposed to higher levels of adsorbent chemicals. Adsorption is controlled by the characteristics of the chemical and by the type (i.e., organic content) of the soil or sediment. Thus, poorly adsorbed chemicals released to land will leach more rapidly than highly adsorbent chemicals, resulting in greater potential for underlying ground water to become contaminated.

- Volatilization - Some organic chemicals with high vapor pressures and/or low water solubilities have a tendency to volatilize from water or land into the air. Volatilization of chemicals into the air can occur from "holding" ponds, surface water bodies, and spills or leaks on the ground.

- Bioconcentration - Chemicals may persist in the environment when taken up by exposed plants and animals. The chemical accumulates in the organs and tissues of the exposed organisms. If other animals and humans eat these organisms, the chemical will be further concentrated (bioaccumulated).

- **Environmental Transformation Characteristics.** Chemicals will either degrade or persist in the environment, depending upon the environmental transformation properties of the chemical:

  - Photolysis - Some chemicals degrade rapidly when exposed to ultraviolet light. This process may be important to chemicals in the atmosphere, in surface water of sufficient clarity for sunlight to penetrate, and on the surface of the soil.

  - Oxidation - Some chemicals will degrade when exposed to oxygen or other substances (like chlorine and ozone). Oxidation is the process by which electrons are removed from a chemical and then accepted by another substance (an oxidizing element). Oxidation may occur in air, surface water, ground water, and soil.

  - Hydrolysis - Certain chemicals degrade when exposed to water. The water causes the chemical bond to split and the substance decomposes. Hydrolysis may occur in air, surface water, ground water, or soil.

  - Biodegradation - Some chemicals are rapidly degraded by bacteria and other microorganisms. Biodegradation can occur in soil, ground water, surface water, and, to a limited extent, in air.

  - Biological treatment - If a chemical is released to a wastewater treatment facility (or treated on-site) its concentration in the environment will depend on how rapidly it is removed during the treatment process and on its persistence in the environment following treatment. Some chemicals are rapidly removed during wastewater treatment processes; others are resistant to treatment and may be released to surface water in treatment plant effluents.

- **Rates of Release.** As mentioned above, for acutely toxic chemicals, the frequency and duration of the release are important factors. When an acutely toxic chemical is released all at once or over a short period of time, it is more likely to trigger a threshold response than if the same quantity of the chemical is released little by little over a longer period of time. (Appendix B illustrates the expected effect of release rate on potential concentrations of chemicals in the air at various distances from the release point.)

Appendix D provides data on physical transport and environmental transformation properties of the Section 313 chemicals. Appendix E provides information on likely rates of release for these chemicals.

RISK CHARACTERIZATION

Risk characterization, the final component in risk screening, combines the toxicological potency assessment and the exposure evaluation to identify facilities, populations, and chemicals that warrant further investigation. In this step, the risk screener describes risks in relationship to other risks, i.e., in terms of the relative probability of harm. Descriptive terms, (e.g., high, moderate, or trivial) may be used to characterize the risk. Comparisons may also be used. For example, "The release of chemical A from facility X appears to pose a greater concern to local public health than most other releases reported in the area." The risk characterization step also includes a characterization of the nature of the uncertainties in the data used in the risk screening procedure.

Risk screening does not result in estimates of the actual risks from toxic chemical releases. For example, the risk screener will not be able to determine whether a chemical release will increase the incidence rate of cancer in a nearby population, or what the magnitude of such an increase might be. More rigorous risk assessment methodology and additional data are needed to answer questions such as these.

EXHIBIT 2 - HUMAN HEALTH EFFECTS OF CONCERN AS IDENTIFIED UNDER SECTION 313

- Carcinogenicity. The property or quality of being able to cause tumor formation in any tissue.

- Heritable gene and chromosome mutations. Events that occur in germ cells. These include deficiencies, duplications, insertions, inversions, and translocations of chromosomes, as well as gains or losses of whole chromosomes.

- Neurotoxicity. Any adverse effect on the structure or function of the central and/or peripheral nervous system related to exposure to a chemical substance.

- Reproductive and developmental toxic effects. Reproductive toxic effects are adverse effects on the male or female reproductive systems, while developmental toxic effects are any adverse effects on the developing organism, including death, structural abnormalities, altered growth, and functional deficits such as learning disorders. Developmental toxicity also includes teratogenic effects, which are permanent structural abnormalities that may adversely affect development or survival of the developing organism.

- Other chronic effects. Any adverse effects other than cancer that are observed from long-term repeated exposure to a chemical.

- Adverse acute effects. Adverse effects are any deleterious effects suffered by an organism, while acute effects occur rapidly as a result of short-term exposure to a high concentration of a chemical. For TRI listing, both lethal and nonlethal effects (such as eye and respiratory irritation) may be considered significant adverse acute effects. These effects occur outside the facility as a result of continuous or frequently recurring releases.

EXHIBIT 3 - ECOLOGICAL EFFECTS OF CONCERN AS IDENTIFIED UNDER SECTION 313

- Environmental toxicity. EPA has identified several indicators of toxicity. These include aquatic LC_{50}, mammalian or avian LD_{50}, and avian 5-day dietary LC_{50} for acute effects. Chronic maximum acceptable toxicant concentrations (MATCs) can be estimated for aquatic organisms (or cases where some dietary concentration is involved). For avian and mammalian toxicity tests, dosing by gavage is frequently employed, and the NOEL (No-Observed-Effect Level) is used.

- Toxicity and persistence. EPA is especially concerned about chemical persistence in cases where toxicity concerns are based on chronic toxicity data.

- Toxicity and bioaccumulation. Chemicals that bioaccumulate and exhibit some toxicity are also of concern. Bioaccumulation can be considered by evaluating measured bioconcentration factors (BCFs). Chemicals with high BCFs possess a potential for concentrations to build up in the food chain. In the absence of BCF data, the octanol-water partition coefficient (log P) may be used to estimate a BCF figure. Estimated log P data may be used in the absence of log P data.

- Any significant adverse effect on the environment. As defined under the Toxic Substances Control Act (TSCA) 8(e) policy statement, any significant adverse effect means "any ecologically significant change in species interrelationships, such as changes in species behavior, growth, or survival that in turn adversely affect the behavior, growth or survival of other species."

EXHIBIT 4 - FACTORS AFFECTING TOXICITY

- Properties of the individual chemical. Different chemicals vary widely in their ability to produce toxic effects. Differences in chemical structure account for variations in the rate at which a chemical is absorbed, how it is metabolized, and how much of it is excreted. Small differences in chemical structure can produce large differences in toxicity.

- Dose, frequency, and duration of exposure. Exposure to toxic chemicals may be described as acute or chronic, depending on its duration. Acute and chronic exposure to the same dose of a chemical do not necessarily produce the same health effects. A chemical that produces toxic effects when introduced into an organism in large amounts over a short period of time may be non-toxic or even beneficial when introduced in small amounts over a long period of time. A chemical that is acutely non-toxic may be toxic under chronic exposure conditions. These effects are related to the ability of the body to detoxify chemicals. Small doses of toxic chemicals may be tolerated because chemicals can be metabolized or excreted from the system. In larger doses, or over long periods of time, these chemicals may be able to accumulate in parts of the body where they can produce toxic effects.

- Route of exposure. The route of chemical entry into the body - through inhalation exposure, ingestion exposure, or dermal exposure - plays an important role in determining toxicity. Differing routes of exposure produce differing patterns of metabolism, distribution, or excretion. Thus, individual chemicals differ in the route of exposure through which they produce the most toxic effects. Protective barriers such as the outer cell layers of skin and the cilia in the respiratory tract limit the entry of certain chemicals. Other chemicals can penetrate these barriers and enter the bloodstream. Once in the blood, chemicals can be carried to body organs where they can potentially cause injury.

- Other environmental exposures. Another factor affecting toxicity is the combination of different chemicals to which a person is exposed. Two or more chemicals in combination may modify each other's actions or the responses of the exposed individuals. Exposure need not occur at the same time for interactive effects to occur. Interactive effects can be additive, synergistic, or neutral.

- Individual susceptibility. A number of individual characteristics, including age, sex, nutritional and immunologic status, genetic characteristics, and state of health may influence the individual's response to toxic chemicals. Two individuals exposed to the same dose of a toxic chemical may exhibit different reactions (such as allergic reactions).

REFERENCES

Notes

[1]Environmental Protection Agency. 1984. Risk Assessment and Management: Framework for Decision Making. EPA 600/9-85-002. U.S. EPA. PB85-170157

[2]U.S. Environmental Protection Agency. 1986. Toxicology Handbook. Rockville, MD: Government Institutes, Inc.

Other Sources of Information on Toxicology, Exposure Assessment, and Risk Characterization

Rall, David P. 1982. Medicine for the Layman: Environment and Disease. Bethesda, MD: National Institutes of Health.

The Conservation Foundation. 1985. Risk Assessment and Risk Control. Washington, DC: The Conservation Foundation.

Epting, Celia. 1977. Of Mice and Men: Health Risks and Safety Judgments. Washington, DC: League of Women Voters of the United States.

Kamrin, Michael A. 1988. Toxicology: A Primer on Toxicology Principles and Applications. Chelsea, MI: Lewis Publishers.

Marczewski, Alice E. and Michael Kamrin. 1987. Toxicology for the Citizen. Lansing, MI: Michigan State University, Center for Environmental Toxicology.

Ottoboni, M. Alice. 1984. The Dose Makes the Poison: A Plain-Language Guide to Toxicology. Berkeley, CA: Vincente Books.

Sasnett, Sam K. No date. A Toxics Primer. Washington, DC: League of Women Voters of the United States.

Turner, D.B. 1970. Workbook of Atmospheric Dispersion Estimates. Office of Air Programs, U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. 1988. Superfund Exposure Assessment Manual. Prepared for EPA's Office of Emergency and Remedial Response. OSWER Directive 9285.5-1. Washington, DC: U.S. EPA Office of Solid Waste and Emergency Response.

U.S. Environmental Protection Agency. 1987. The Routes of Exposure to Environmental Chemicals. New York, NY.

U.S. Environmental Protection Agency. 1987. The Process of Risk Assessment and Risk Management. New York, NY.

U.S. Environmental Protection Agency. 1986. Superfund Public Health Evaluation Manual. EPA/540/1-86/060. Washington, DC: U.S. EPA Office of Emergency and Remedial Response.

U.S. Environmental Protection Agency. No date. Toxic Chemicals: What They Are, How They Affect You. Chicago, IL.

SECTION III - THE RISK SCREENING SYSTEM

The screening system described in this section provides a qualitative risk-based approach to identifying, from among all the TRI submissions for a particular community or geographic area, those risk scenarios, facilities, chemicals, and populations of interest that should receive the highest priority for followup investigation. It will be of limited value, however, in addressing questions and concerns about actual risk that the public is likely to ask - questions like "Am I safe?" Risk communication, which is discussed in Section IV, Responding to Questions, will be helpful in addressing these concerns.

The screening procedure provides a logical process for considering the many variables associated with a determination of potential risks at a facility or site. It describes how to screen potential risks among multiple facilities, each releasing several chemicals into different environmental media (air, water, and land). The same approach may be used to estimate relative risks among chemicals at a specific facility.

The screening system was developed for use with Section 313 chemicals because the TRI reporting provides a readily available source of aggregate data that is useful for making comparisons and establishing priorities. If sufficient release and toxicological data are available for other chemicals (including the Extremely Hazardous Substances under Section 302 and the CERCLA hazardous substances under 304 of Title III), the system could be adapted to assess those chemicals as well.

The risk screening system is a simplified version of EPA's Hazard Ranking System, which has been adapted to address the TRI release scenarios. The Hazard Ranking System is the principal mechanism for placing sites on the Superfund National Priority List (NPL) for followup investigation.[1] (Appendix G describes the Hazard Ranking System in more detail.) The system is consistent with EPA's understanding of the type and expected quality of the Section 313 data and readily available supplementary data, and balances scientific rigor with simplicity and ease of use.

USING THE RISK SCREENING SYSTEM

Before Beginning

The steps of the risk screening procedure are designed to be flexible enough to serve the interest and needs of a diversity of users in all parts of the country. Only limited guidance is provided for quantitative definition of qualitative terms used in the procedure, such as "high," "large," or "far from." The numerical values used to define these terms will vary depending on site location, area of the country, program emphasis, and other factors. For consistency within their own programs, agencies may want to establish quantitative ranges or limits for these terms that will best meet program objectives and serve community interests.

Since it is difficult to assess risks when few data exist, as in the case of the TRI reporting, it may be useful to consult with expert scientists and toxicologists when applying the system. Sources of information useful for risk screening are listed in Section V, Resources. The more reliable the information that agencies access in performing the screen, the greater the confidence they can have in the results.

In addition, before applying this risk screening system, organizations may wish to determine whether the release is permitted and meets the permit requirements. Releases from permitted facilities in compliance with their permits may be less likely to pose a concern than an unpermitted release or one in violation of a permit. However, the process of comparing TRI releases with existing standards may not be straightforward (see Case Study, Appendix F).

Before performing a screen, agencies will want to make several copies of the sample worksheets provided at the end of this section, since worksheets must be filled out for each environmental medium into which there is a TRI chemical release.

How It Works

The risk screening procedure follows the basic risk assessment steps. The user considers site- and chemical-specific data to characterize the relative toxicological potency of chemicals

and to evaluate exposure (including plausible exposure pathways and potential environmental levels). For each facility, the user fills out three workseets - Facility Worksheet on Site-Specific Data, Facility Worksheet on Chemical-Specific Data, and Relative Risk Worksheet. A worksheet is filled out for releases into each environmental medium (Air, Surface Water or Publicly Owned Treatment Works [POTW], and Land) of concern. In the final step of the procedure the user sets risk-based priorities for followup investigation of facilities, chemicals, and populations of interest.

TOXICOLOGICAL POTENCY

To characterize relative toxicological potency, the user chooses from among the EPA toxicological indices on Title III chemicals provided in Appendix A (reportable quantities, threshold planning quantities, cancer potency, reference doses, and water quality criteria). Chemicals of high or moderate concern, along with information on the quantity of release and chemical-specific exposure factors, are recorded on the *Facility Worksheet on Chemical-Specific Data.*

The risk screening procedure allows the user to consider risks to aquatic life as well as humans and other terrestrial species. The selection of EPA indices for evaluating relative toxicological potency will depend, in part, on which species are of concern. The user records a description of the species of interest on the *Facility Worksheet on Site-Specific Data*, and evaluates potential exposure routes and exposure factors for each.

EXPOSURE EVALUATION

As part of exposure evaluation, the user considers populations, exposure routes, and exposure factors within Inner and Outer Zones. The risk screening procedure provides suggested Inner Zones for each medium (e.g., 1 mile radius from the release site for Air). Populations within the Inner Zone are considered to be in a plausible exposure pathway if they are in contact with the medium into which chemicals are released. The Outer Zones are areas beyond the Inner Zones that contain populations of interest that are likely to be exposed. The user qualitatively characterizes the Outer Zones by evaluating the site- and chemical-specific

data recorded on the Facility Worksheets. Information about populations, exposure routes, and exposure factors within the Inner and Outer Zones are recorded on the *Facility Worksheet on Site-Specific Data.*

RELATIVE RISK CHARACTERIZATION

In the final step of the risk screening procedure, data from the completed Facility Worksheets for each medium are used to assess plausible exposure pathways, potential environmental levels, and toxicological potency. Risk scenarios of "High," "Moderate," and "Low" priority are identified on the *Relative Risk Worksheet.* Where possible, cross-media priorities are established. The information recorded on the *Relative Risk Worksheet* and information about data gaps recorded on the Facility Worksheets can be used to direct followup investigation activities.

Case Study

Appendix F applies the screening procedure to a theoretical situation. The case study illustrates the kinds of data needed to perform risk screening, where to get these data, and how to use the data to answer questions. The case study takes the user through each step of the risk screening process and indicates the conclusions that may be drawn as a result of the screen.

After Screening - Then What?

Ultimately, the decision-makers who have jurisdiction over the environment in a specific geographic area must decide on the next steps. The risk screening procedure identifies high-priority routes of potential exposure, facilities, and chemicals, as well as data gaps for followup information collection activities necessary to perform a more comprehensive risk assessment. The risk assessment models provided in Appendix G can also be used as a guide to the kind of information agencies may want to collect to perform a quantitative risk assessment.

In any case, additional information will be required to fully characterize the risks from the TRI routine chemical releases and to put these risks into perspective with those resulting from other sources of chemicals in the community - such as indoor air pollutants, roadway vehicles, and consumer products. The risk screening procedure could be used to assess relative risks of other sources of toxic chemicals, where the sources and amounts of release are known. Even these analyses, however, would not allow one to make value judgments about which risks are acceptable and unacceptable. The determination of acceptable risk, or what is "safe enough," will require involvement of all interested parties within the potential exposure zones from TRI chemical releases.

When assessing the type and extent of followup activities of a facility or geographic area, agencies may also wish to consider non-risk factors, e.g., local, State, and Federal laws, public concern, control technologies, economics, and politics. The level of public concern about an area, facility, or individual release may be an important indicator of a situation requiring some followup, both from a public health/environmental and a political standpoint. If a facility is already using best practicable technology (BPT) or best available technology (BAT), it may not be able to reduce the level of releases any further without tradeoffs. Budgetary restraints and political factors will also be important considerations. Before allocating significant resources to followup risk assessment activities, agencies should consider consulting an expert toxicologist or risk assessor for advice on the validity of their risk screening conclusions, and the feasibility and costs of their followup plan.

THE QUALITATIVE RISK SCREENING PROCEDURE

RELEASES TO AIR

I. **Facility Worksheet on Site-Specific Data**
(SITE-SPECIFIC EXPOSURE DATA)

1. *Location of Chemical Releases, or Area of Indirect Entry into Air.* Record the most exact description of the release site or area of indirect entry into air from other media (if noted under Releases to Surface Water or POTW or Releases to Land).[a] Complete a separate Facility Worksheet on Site-Specific Data for each different entry location. Group locations where releases are close together (e.g., releases within perhaps 1/2 mile) unless there are reasons not to do so (e.g., residences or recreational areas in between release locations).

   IF INSUFFICIENT DATA are available to describe Location of Release or Area of Indirect Entry into Air, risk screening of Releases to Air is not possible.

2. *Radius of Inner Zone.*[b] A radius of I mile is suggested unless there is a reason to select an alternative radius. Draw Inner Zone on a local map of area.

3. *Population of Interest.* Record description of populations of interest within the Inner and a preliminary Outer Zone.[c] Characterize species (human and/or ecological-terrestrial or aquatic), population sizes, and any potentially sensitive subpopulations in these zones.

   IF NONE, go to Exposure Factors (both Site- and Chemical-Specific), to determine the potential for indirect entry into other media.

4. *Potential Exposure Routes.* Identify uses of air that may result in exposures, and record "breathing" under Media Uses. Record the direction (e.g., S, SE, NW) and distance (for Outer Zone only) from the location of chemical release/entry to each

population of interest. For Outer Zone populations which occupy large areas, record a distance range from the closest to the farthest individuals within the population.

5. *Exposure Factors (Site-Specific)*

a. *Wind Direction.* Record "+(WD)" for populations of interest in predominantly downwind direction from the locations of chemical release/entry. Record "-(WD)" for those in predominantly upwind directions.

b. *Release Height.* For Outer Zone populations of interest, record "+(RH)" for populations downwind from the release site when release heights are high.[d]

c. *Other Factors.* Consider other site-specific factors that might significantly affect exposures to populations of interest. For example, wind patterns may be seasonal or altered by topographical barriers. In addition, excessive rainfall could reduce air concentrations of chemicals and result in indirect (and/or surface water) exposure routes. (If so, record this on the Release to Air worksheet and consider completing Releases to Land or Releases to Surface Water for this indirect entry.)

IF INSUFFICIENT DATA are available to address potentially important Site-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet.

II. Facility Worksheet on Chemical-Specific Data

A. *TOXICOLOGICAL POTENCY*

Determine the most appropriate expression of toxicological potency for the chemical, depending on the species of concern (see Appendix A). If there are several indices that are applicable (e.g., for ranking toxicological potency for humans) choose the index that results in the lowest ranking (the greatest toxicological potency). If the

chemical falls under Group I or Group 2, list the chemical under the appropriate heading.

IF INSUFFICIENT DATA are available to determine Toxicological Potency of any of the chemicals released into Air, make a note under Data Gaps on the Facility Worksheet.

B. *CHEMICAL-SPECIFIC EXPOSURE DATA*

1. *Quantity of Release.* Group quantities of release into ranges of High, Medium, and Low. No single ranking scale is applicable in all situations. Appendix C describes several approaches that can be used to rank quantities of release. For example, a particular release can be compared to the national average (median) quantity of a chemical released to a particular environmental medium. The release can also be compared to local releases of other chemicals in the same industry or to releases of the same chemical from other industries. Comparisons across environmental media can also be made.

   Record relative quantities of release for each Group I and 2 chemical. Also note under "Release Quantity" what approach was used to rank releases (e.g., compare to national median for this chemical released to air.)

2. *Exposure Factors (Chemical-Specific).*

   a. *Environmental Transformation.* Record "+(ET)" or "-(ET)" for chemicals that are highly persistent or rapidly degraded in air, respectively (see Appendix D). Fallout or rainout of persistent chemicals may result in indirect entry to surface water or land. Note, however, that chemicals can degrade to other toxic chemicals (or intermediates that lead to the formation of other toxic chemicals). The oxidation or photolysis of volatile organic compounds may lead to local ozone and smog problems.

b. *Release Rate.* Record "+(RR)" for chemicals for which acute toxicity to humans or terrestrial organisms is the end effect of highest concern (see Appendix A) and release rates are intermittent or sporadic (see Appendix E and, if available, reports of accidental releases submitted under SARA, Section 304). Acute toxicity to populations of interest in the Inner Zone may be of concern.

c. *Other Factors.* If there are additional chemical-specific factors that could be important in describing plausible exposure pathways and/or environmental levels for any of the identified populations of interest, note them under Exposure Factors (Chemical-Specific), on the Facility Worksheet.

IF INSUFFICIENT DATA are available to address any of the above Chemical-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet.

III. Relative Risk Rank - See page 45.

RELEASES TO SURFACE WATER OR POTW

I. Facility Worksheet on Site-Specific Data

(SITE-SPECIFIC EXPOSURE DATA)

1. *Location of Chemical Release, or Area of Indirect Entry into Surface Water.* Record the most exact description of the site of release to surface water, i.e., site of direct entry from the facility, site of indirect entry from a publicly owned treatment works (POTW), or area of indirect entry into surface water from other media (if noted under Releases to Air or Releases to Land).[a] Complete a separate Facility Worksheet on Site-Specific Data for each different entry location. Group locations where releases are close together (e.g., releases within perhaps 1/2 mile) unless there are reasons not to do so (e.g., drinking water intakes or recreational areas in between release locations).

   IF INSUFFICIENT DATA are available to describe location of Release or Area of Indirect Entry into Surface Water, risk screening of Releases to Surface Water is not possible.

2. *Radius (arc) of Inner Zone.*[b] A radius of 4 miles downstream for rivers and streams, or arc for lakes, estuaries, and oceans is suggested unless there is a reason to select an alternative area. Draw the Inner Zone on a local map of area.

3. *Populations of Interest.* Record a description of populations of interest within the Inner and a preliminary Outer Zone.[c] Characterize species (human and/or ecological-terrestrial or aquatic), population sizes, and any potentially sensitive subpopulations in these zones.

   IF NONE, go to Exposure Factors (both Site- and Chemical-Specific), to determine the potential for indirect entry into other media.

4. *Potential Exposure Routes.* For each population of interest, consider and record the uses of surface water receiving chemical releases (or, if appropriate, receiving POTW effluent) that result in water contact with populations of interest (e.g., drinking, recreation, irrigation, harvesting aquatic organisms for food) within Inner and Outer Zones. For Outer Zone populations, record the direction and downstream (if river or stream) distance from the location of chemical release/entry. For Outer Zone populations that occupy large areas, record a distance range from the closest to the farthest individuals within the population.

5. *Exposure Factors (Site-Specific)*

   a. *Dilution.* Record a "+(DI)" if discharges are to small lakes or streams and a "-DI)" if discharges are to large bodies of water.[e]

   b. *Treatment.* Record a "-(TR)" if water is treated before it is used by the population of interest (e.g., water passes through a POTW or a drinking water treatment plant). See also "Treatability" under Exposure Factors (Chemical-Specific).

   c. *Other Factors.* Other site-specific factors that might significantly affect exposures to populations of interest include spatial relationships between locations of release and water use or intake (e.g., upstream water discharges and downstream water intakes on the same side of the river).

   IF INSUFFICIENT DATA are available to address potentially important Site-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet.

II. Facility Worksheet on Chemical-Specific Data

A. *TOXICOLOGICAL POTENCY*

Determine the most appropriate expression of toxicological potency for the chemical (see Appendix A). If the chemical falls under Group I or Group 2, list the chemical under the appropriate heading.

IF INSUFFICIENT DATA are available to determine Toxicological Potency of any of the chemicals released into Surface Water or POTW, make a note under Data Gaps on Facility Worksheet.

B. *CHEMICAL-SPECIFIC EXPOSURE DATA*

1. *Quantity of Release.* Group quantities of release into ranges of High, Medium, and Low. No single ranking scale is applicable in all situations. Appendix C describes several approaches that can be used to rank quantities of release. For example, a particular release can be compared to the national average (median) quantity of a chemical released to a particular environmental medium. The release can also be compared to local releases of other chemicals in the same industry or to releases of the same chemical from other industries. Comparisons across environmental media can also be made.

   Record relative quantities of release for each Group I and 2 chemical. Also note under "Release Quantity" what approach was used to rank releases (e.g., compare to national median for this chemical released to surface water or to POTW.)

2. *Exposure Factors (Chemical-Specific).*

a. *Adsorption.* Record "+(AD)" for adsorbent chemicals (see Appendix D) if aquatic "bottom-feeding" organisms are of interest or consumed as food by populations of interest. The effects on potential exposures will be greatest in the Inner Zone.

b. *Bioconcentration.* Record "+(BC)" for chemicals that may readily bioconcentrate (see Appendix D) if aquatic populations in the Inner or Outer Zone are of interest or are consumed as food by populations of interest.

c. *Volatilization.* Record a "-(VO)" for chemicals that may rapidly volatilize from water (see Appendix D) and consider as an indirect entry into air. COMPLETE RELEASES TO AIR.

d. *Environmental Transformation.* Record a "+(ET)" or a "-(ET)" for chemicals that are highly persistent or rapidly degraded in water, respectively (see Appendix D). Note, however, that chemicals can degrade to other toxic chemicals (or intermediates that lead to the formation of other toxic chemicals).

e. *Release Rate.* Record "+(RR)" for chemicals for which acute toxicity to aquatic organisms is the end effect of highest concern (see Appendix A) and release rates are intermittent or sporadic (see Appendix E and, if available, reports of accidental releases submitted under SARA, Section 304). Acute toxicity to aquatic organisms of interest in the Inner Zone may be of concern.

f. *Treatability for Releases to POTW or Equivalent On-Site Treatment.* Record "-(TB)" for chemicals listed in Appendix D that are readily removed during biological treatment processes either by adsorption or degradation. Record a "+(TB)" for those chemicals that are resistant to treatment and are more likely to reach receiving waters in POTW effluents.

g. *Other Factors.* If there are additional chemical-specific factors that could be important in describing plausible exposure pathways and/or environmental levels for any of the identified populations of interest, note them under Exposure Factors (Chemical-Specific) on the Facility Worksheet.

IF INSUFFICIENT DATA are available to address any of the above Chemical-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet.

III. **Relative Risk Rank** - see page 45.

RELEASES TO LAND

I. Facility Worksheet on Site-Specific Data

(SITE-SPECIFIC EXPOSURE DATA)

1. *Location of Chemical Releases, or Areas of Indirect Entry onto Land.* Record the most exact description of the release site or area of indirect entry onto land from other media (if noted under Releases to Air or Releases to Land).[a] Complete a separate Facility Worksheet on Site-Specific Data for each different entry location. Group locations where releases are close together (e.g., perhaps within 1/2 mile) unless there are reasons not to do so (e.g., residences, recreational areas, or wells in between release locations).

   IF INSUFFICIENT DATA are available to describe location of Release or Area of Indirect Entry onto Land, risk screening of Releases to Land is not possible.

2. *Radius of Inner Zone.*[b] A radius of 12 feet and 1 mile from location of release to aquifer and nearest well, respectively, and 1/2 mile downgradient runoff radius are suggested, unless there is reason to select an alternative area. Draw Inner Zones on a local map of the area.

3. *Populations of Interest.* Record a description of populations of interest within the Inner and Outer Zone[c] (human and/or ecological-terrestrial and aquatic), population sizes, and any potentially sensitive subpopulations in these zones.

   IF NONE, go to Exposure Factors (both Site- and Chemical-Specific), to determine the potential for indirect entry into other media.

4. *Potential Exposure Routes.* For each population of interest in the Inner and Outer Zones, consider and record the uses of land (e.g., farming, gardening). If ground water is taken from wells, consider uses of this water (e.g., drinking, irrigation). Evaluate the potential for direct access to the release site by neighborhood children

and determine the likelihood that surface runoff from the site might contaminate neighboring land or surface waters. For Outer Zone population, record the direction and distance from the location of chemical release/entry. For Outer Zone populations that occupy large areas, record a distance range from the closest to the farthest individuals within the population.

5. *Exposure Factors (Site-Specific)*

   a. *Containment.* Record a "+(CO)" for populations of interest if no approved and effective containment measures are in place at the release site, (e.g., properly lined and covered landfills or holding ponds).

   b. *Treatment.* Record a "-(TR)" if ground water is treated before use by populations of interest (e.g., ground water passes through a drinking water treatment plant).

   c. *Soil and Rainfall.* Record a "+(SO/RF)" for populations of interest extracting ground water in the vicinity of the release site if the soil is sandy or fractured and rainfall in the area is abundant. Also record a "+(SO/RF)" for organisms/ populations of interest that are using land or surface water downhill from the disposal site within a zone of potential runoff if the soil shows signs of erosion. Consider as an indirect entry to surface water and COMPLETE RELEASES TO SURFACE WATER.

   d. *Soil and Wind.* Record a "+(SO/WE)" for populations of interest that live or use land or surface water close to the disposal site if conditions in the area are generally dry and subject to wind erosion. Consider as an indirect entry to air and COMPLETE RELEASES TO AIR.

   e. *Other Factors.* Consider other site-specific exposure factors that might significantly affect exposures to populations of interest. For example, the evapo/transpiration rate of the area may exaggerate volatization of chemicals into

air. Or, the presence of surface springs could serve as a more direct conduit to ground water.

IF INSUFFICIENT DATA are available to address potentially important Site-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet.

II. Facility Worksheet on Chemical-Specific Data

A. *TOXICOLOGICAL POTENCY*

Determine the most appropriate expression of toxicological potency for the chemical (See Appendix A). If the chemical falls under Group 1 or Group 2, list the chemical under the appropriate heading.

IF INSUFFICIENT DATA are available to determine Toxicological Potency of any chemicals released to Land, make a note under Data Gaps on the Facility Worksheet.

B. *CHEMICAL-SPECIFIC EXPOSURE DATA*

1. *Quantity of Release.* Group quantities of release into ranges of High, Medium, and Low. No single ranking scale is applicable in all situations. Appendix C describes several approaches that can be used to rank quantities of release. For example, a particular release can be compared to the national average (median) quantity of a chemical released to a particular environmental medium. The release can also be compared to local releases of other chemicals in the same industry or to releases of the same chemical from other industries. Comparisons across environmental media can also be made.

   Record relative quantities of release for each Group 1 and 2 chemical. Also note under "Release Quantity" what approach was used to rank releases (e.g., compare to national median for this chemical released to land.)

2. *Exposure Factors (Chemical-Specific).*

a. *Leaching.* Record a "+(LE)" for chemicals that have the potential to leach readily into underlying ground water (see Appendix D).

b. *Volatilization.* Record a "-(VO)" if the chemical has the potential to rapidly volatilize from land (see Appendix D) and consider as an indirect entry into air. COMPLETE RELEASES TO AIR.

c. *Environmental Transformation.* Record a "+(ET)" or a "-(ET)" for chemicals that are highly persistent or rapidly degraded in soil, respectively (see Appendix D). Note, however, that chemicals can be degraded to other toxic chemicals (or intermediates that lead to the formation of other toxic chemicals).

d. *Release Rate.* Record "+(RR)" for chemicals for which acute toxicity to organisms of interest is the end effect of highest concern (see Appendix A) and release rates are intermittent or sporadic (see Appendix E and, if available, reports of accidental releases submitted under SARA, Section 304). Acute toxicity to populations of interest in the Inner Zone may be of concern.

e. *Other Factors.* If there are additional chemical-specific factors that could be important in describing plausible exposure pathways and/or environmental levels for any of the identified populations of interest, note them under Exposure Factors (Chemical-Specific) on the Facility Worksheet.

IF INSUFFICIENT DATA are available to address any of the above Chemical-Specific Exposure Factors, make a note under Data Gaps on the Facility Worksheet (Part IV).

III. <u>Relative Risk Rank</u> - See below.

IV. Relative Risk Worksheet

The objective of this step is to set risk-based priorities for followup investigation of facilities, chemicals, and populations of interest. The Relative Risk Worksheet is used to record the results of the relative risk assessment performed in this step for releases to each medium.

A. *INNER ZONE*

By definition, populations of interest within the Inner Zone are in one or more plausible exposure pathways, depending on the media uses of these populations. For Inner Zone populations, evaluate both site- and chemical-specific data recorded on the Facility Worksheets that affect potential environmental levels (described in Section II of the Guide) and the toxicological potency of the chemicals released into the medium under study.

The highest potential risks will be to those populations of interest (considering size and sensitivity) within the most plausible exposure pathways that may be exposed to high potential environmental levels of chemicals with high toxicological potency. Record the requested data on these high potential risk scenarios under "High," listing the chemicals determined to have among the highest potential exposure levels and high toxicological potency under both columns (see Case Study, Appendix F).

Consider listing release sites and plausible exposure pathways involving chemicals determined to exhibit either high potential exposure levels or high toxicological potency under "Moderate." Large and/or sensitive populations meeting these criteria might be considered for inclusion in the "High" relative risk category.

The same release site and/or plausible exposure pathway may be listed under more than one relative risk category, depending on the potential environmental levels and toxicological potency of chemicals released from the site.

B. *OUTER ZONE*

Plausible exposure pathways for populations of interest in the Outer Zone must be determined using the Facility Worksheet data and the risk screener's expert judgment. Consider both direct and indirect potential exposure pathways. Consider the media uses and distances from the sites of release to each population of interest. Also consider both site-specific and chemical-specific exposure factors that may enhance exposures or decrease the "relative effective distances" between populations and locations of release.

For those pathways determined to be of potential concern, consider the site- and chemical-specific exposure data affecting potential environmental levels and toxicological potency as described above under the Inner Zone. Compare these data with those for the Inner Zone release sites and plausible exposure pathways already assigned "High" and "Moderate" priority. In a similar fashion, record the requested data on potential risk scenarios in the Outer Zone, under the appropriate relative risk category, "High" or "Moderate."

C. *CROSS-MEDIA*

In general, the risk screening results for one medium cannot be compared to those for another medium. For example, it is not possible to compare the relative risk ranks for releases to surface water with those for releases to land. However, by looking across all of the Relative Risk Worksheets, users may be able to identify the highest priority potential risk scenarios for followup investigation among all media releases.

D. *DATA GAPS*

Consider the data gaps for the risk scenarios selected for followup investigation, as well as those listed as lower priority. These data gaps should be described, along with other uncertainties and limitations in the risk screening procedure presented in this section, when the results are communicated to others. The data gaps should also provide screeners with guidance on the information that will be needed to perform a more comprehensive risk assessment on the high priority sites and chemicals. Consult Appendix G for information on available risk assessment models that match your needs and resources.

NOTES

a The most exact geographic descriptions of a site in decreasing order are latitude/longitude coordinates, facility street address, zip code.

b Suggested Inner Zones for the three media into which chemical releases are considered by the risk screening procedure are:

Medium	Radius from Release Site
Air	1 mile
Surface Water	
■ Flowing (e.g., river without tidal influence)	4 miles (downstream)
■ Static (e.g., lake)	4 miles (arc)
Land	
■ Depth to aquifer	12 feet
■ Distance to well	1 mile
■ Downgradient runoff	1/2 mile

Except for the depth to aquifer, the Inner Zone distances were determined by dividing the proposed Hazard Ranking System target distance limits (53 FR 51962-52081) by four. (For aquifer depth, the most shallow limit for clay/silt soil still receiving the highest weighted value for aquifer depth was adopted.) The HRS target distance limits are based on technical analyses using existing data at NPL sites and environmental fate models to calculate distances within which risks to highly toxic, mobile, and persistent chemicals would be considered acceptable, barring unusual circumstances. Each site is then scored based on an evaluation of site- and chemical-specific risk factors within the target distance limits (see Appendix G for a more complete description of the HRS). The HRS target distance limits are not zones of plausible exposure, as are Inner Zones, but zones within which plausible exposure pathways are evaluated. A divisor of four was chosen because, in most cases, the results of the technical analyses showed that migration either occurred or was highly likely to occur within the first quarter of the target distance limits.

c The Outer Zone begins at the distance limits of the Inner Zone and extends as far as site- and chemical-specific exposure data indicate chemicals may reasonably be expected to be transported in environmental media which come into contact with populations of interest. There could be as many Outer Zones as there are chemicals with distinctly different sets of physical transport and/or environmental transformation characteristics. Appendix D contains guidance on these characteristics for TRI chemicals. Initially, for purposes of identifying populations of interest within the Outer Zone, the HRS target distance limits could be used:

Medium	HRS Target Distance Limits (Radius from Release Site)
Air	4 miles
Surface Water	
■ Flowing (e.g., river without tidal influence)	15 miles (downstream)
■ Static (e.g., lake)	15 miles (arc)
Land	
■ Depth to Aquifer	800 feet (sandy/fractured soil)
■ Distance to Well	4 miles
■ Downgradient runoff	2 miles

Consideration of site- and chemical-specific exposure factors through the risk screening procedure should allow users to better define the general limits of the Outer Zone. Enough site-specific exposure data relevant to the likely directional transport of chemicals in each medium should be available to skew the boundaries of the Outer Zone in specific directions.

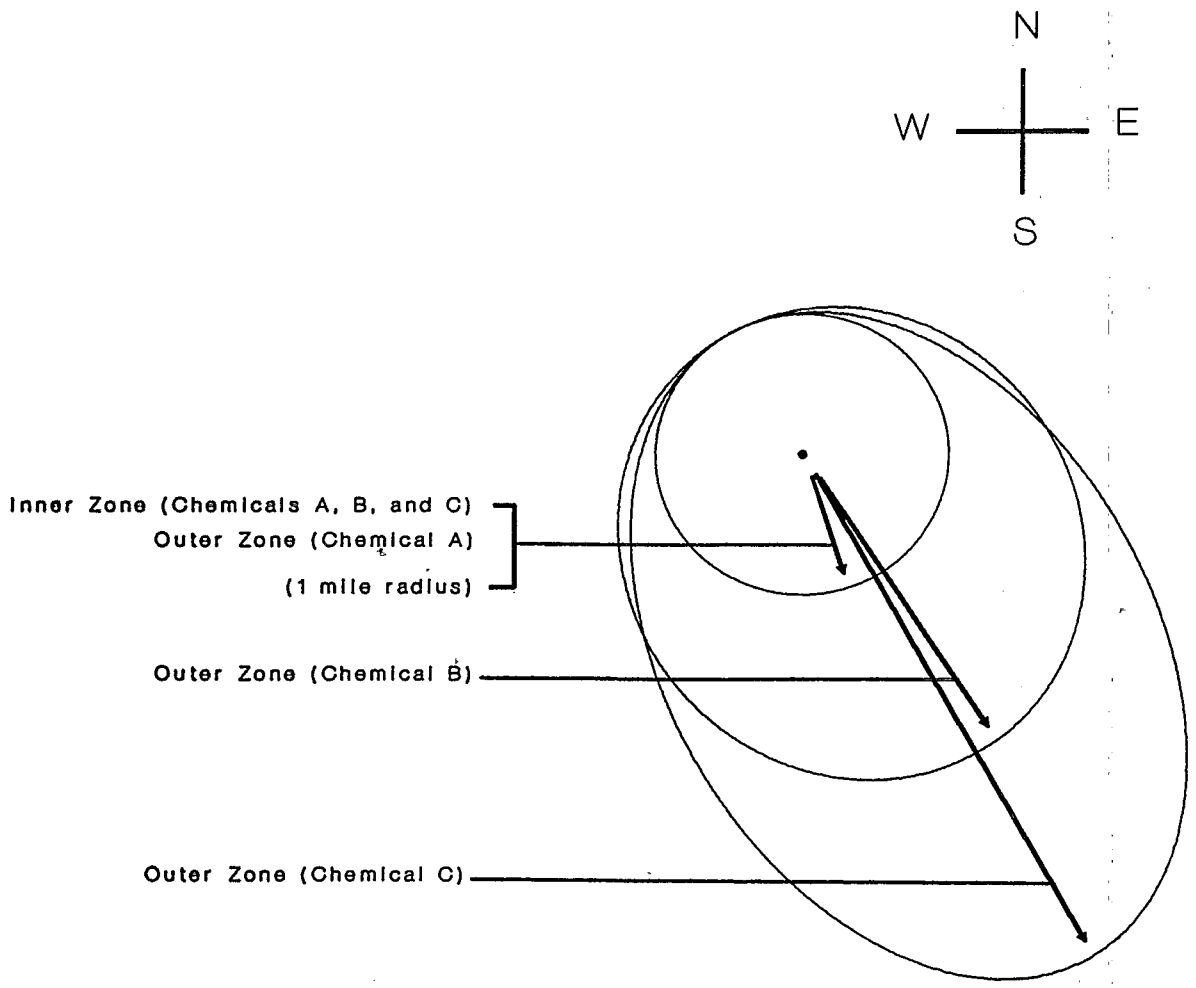
Air example: Prevailing wind patterns should be reflected in the characterization of the Outer Zone. The Outer Zone might appropriately be characterized as the mirror image of the wind rose for the area (see Case Study, Appendix F), e.g., more conical or pear-shaped; the base being in the direction of the wind flow and the apex continuous with the radius of the Inner Zone.

In a given geographic area, the size of the "pear" will depend upon chemical-specific data. The Outer Zone for some highly mobile and persistent chemicals may extend beyond the 4-mile HRS target distance limit. Likewise, users may determine that the transport of other less mobile and rapidly degraded chemicals beyond the Inner Zone is unlikely. Under such circumstances, the Outer Zone could be defined as being equivalent to the Inner Zone. (See Figure 1).

d "Low release heights" are those that occur at levels from ground to 5 or 10 meters. Fugitive releases would most often be low. Indirect entry of chemicals into air from other media (i.e., surface water or land) would also most often be low. "High release heights" might be those that occur at levels in excess of 40 or 50 meters (See also Appendix B).

e "Small" streams might be considered to be those with mean flow rates less than 350 million liters per day, the 25th percentile of all stream segments receiving discharges from facilities in SIC 20-39. These same streams, at some time during the year, consist entirely of plant effluent. "Large" rivers might be considered to be those with mean flow rates in excess of 7,220 million liters per day, the 75th percentile of all stream segments receiving discharges from facilities in SIC 20-39. In addition, an expression of dilution could include a ratio of the amount of discharge of TRI chemicals (total pounds per year of all TRI chemicals released to a surface water) to the volume of stream or river flow. In general, the higher the ratio, the higher the potential concentrations of chemicals in the receiving waters.

Figure 1: Inner and Outer Zones: An Air Example



Prevailing Wind Direction: NW (toward SE)

Chemical A: Low mobility and rapidly degraded

Chemical B: Moderate mobility and persistence

Chemical C: High mobility and/or persistence

I. FACILITY WORKSHEET
Site-Specific Data

For Releases to: _____ From Site: (1)_____
(Medium -- Air, Surface Water or POTW, Land) (Name and Location of Release Site)

(3) POPULATIONS OF INTEREST			(4) POTENTIAL EXPOSURE ROUTE	(5) EXPOSURE FACTORS	
Species Name	Size	Sensitive Subpopulations	Medium Uses	(from Site of Release) Direction	Distance (miles)
INNER ZONE OF EXPOSURE EVALUATION					
(2) Radius of Inner Zone_____ (e.g. Air: 1 mi)					
1.					--
2.					--
3.					--
4.					--
OUTER ZONE OF EXPOSURE EVALUATION					
5.					
6.					
7.					
8.					

DATA GAPS

II. FACILITY WORKSHEET
Chemical-Specific Data

For Releases to: _____ From Site: (1)_____
(Medium -- Air, Surface Water or POTW, Land) (Name and Location of Release Site)

A. TOXICOLOGICAL POTENCY	B. EXPOSURE DATA	C. DATA GAPS
Chemical Name	(1) Release Quantity (2) Exposure Factors[1]	

GROUP 1 (HIGH CONCERN)

A.

B.

C.

D.

E.

GROUP 2 (MODERATE CONCERN)

F.

G.

H.

I.

[1]Exposure Factor Symbols

AD = Adsorption	DI = Dilution	RH = Release Height	TR = Treatment	Others:
AQ = Aquifer Depth	ET = Environ Transformation	RR = Release Rate	VO = Volatilitization	
BC = Bioconcentration	LE = Leaching	SO = Soil	WD = Wind Direction	
CO = Contaminant	RF = Rainfall	TB = Treatability	WE = Wind Erosion	

III. RELATIVE RISK WORKSHEET

For Releases to: _____

(Medium -- Air, Surface Water or POTW, Land)

PLAUSIBLE EXPOSURE PATHWAY			POTENTIAL ENVIR LEVELS	TOX POTENCY
Release Site Location	Population of Interest	Medium Uses	Chemical Names	Chemical names

HIGH PRIORITY FACILITIES/POPULATIONS/CHEMICALS

1.

2.

3.

4.

5.

6.

MODERATE PRIORITY FACILITIES/POPULATIONS/CHEMICALS

7.

8.

9.

10.

11.

12.

REFERENCES

[1]U.S. Environmental Protection Agency. December 23, 1988. Hazard Ranking System (HRS) for Uncontrolled Hazardous Substance Releases; Appendix A of the National Oil and Hazardous Substances Contingency Plan; Proposed Rule. Federal Register, Volume 53. pp. 51962-52081, and HRS Revisions Technical Support Document.

Other Sources of Information (Regional Risk Assessments)

U.S. Environmental Protection Agency. 1989. Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southeast Chicago. Chicago, IL: Region V, Air and Radiation Division.

U.S. Environmental Protection Agency. 1987. Kanawha Valley Toxics Screening Study (Final Report). Washington, DC: Region III, Environmental Services Division (Philadelphia) and the Office of Policy Analysis.

U.S. Environmental Protection Agency. 1987. Baltimore Integrated Environmental Management Project (Phase I Report). Washington, DC: Regulatory Integration Division, Office of Policy Analysis, Office of Policy Planning and Evaluation.

U.S. Environmental Protection Agency. 1987. The Total Exposure Assessment Methodology (TEAM) Study (Project Summary). EPA/600/SG-871-002. Office of Acid Deposition, Environmental Monitoring, and Quality Assurance.

U.S. Environmental Protection Agency. 1986. Santa Clara Valley: Integrated Environmental Management Project (Revised Stage One Report). Washington, DC: Office of Policy Analysis, Office of Policy, Planning, and Evaluation.

U.S. Environmental Protection Agency. 1986. Final Report of the Philadelphia Integrated Management Project. Washington, DC: Regulatory Integration Division, Office of Policy Analysis.

SECTION IV - RESPONDING TO QUESTIONS

No one can predict how a community will respond to the avalanche of information that will be made available under the toxic chemical release reporting. Some communities will use information to develop effective solutions to environmental problems; other communities may be apathetic and ignore the data. Still other communities may misinterpret the information and become overly concerned about some chemicals. In any case, responding to the variety of questions and concerns about the chemical releases will not be an easy task. Communicating information on life and health issues is never simple, for these subjects evoke strong emotions.

The steering committee of Federal, State, and local government representatives that helped develop this document identified several questions the public is likely to ask about the Toxic Chemical Release Inventory. These questions fall into two main categories: risk assessment and risk management (see Exhibit 5). Responding to risk-related questions will require estimates of actual risk. These questions cannot be answered by risk screening, which estimates "relative risk." Such questions can only be answered by a more rigorous risk assessment. Responding to these questions will therefore require more information than what is provided on the TRI reporting forms. Along with the emissions data, information on chemical toxicity and level of exposure is needed. For some questions, information on applicable standards and permits also is needed. Many sources for these types of data are provided in Section V, Resources.

It is the risk communicator's responsibility to inform people about what is known and to place risks into a meaningful perspective. This section provides guidance on how to talk about and convey risk-related information to the public. It does not attempt to cover all aspects of risk communication; the bibliography at the end of this section lists a number of useful resources on this topic.

SETTING UP A COMMUNICATIONS SYSTEM

The TRI provision (Section 313) of SARA Title III was enacted to provide toxic chemical release information to the public. It is, therefore, essential to have in place a workable system for communicating with concerned citizens. There are several steps you can take and resources you can assemble to ensure your agency's communications system is as efficient as possible. Steps for answering questions, assembling information, and disseminating materials are outlined in the "Action Checklist" in Exhibit 6. The checklist also suggests ways to build bridges with other organizations. It's a good idea to consult with others to determine who is best able to answer questions about risk and to issue communications jointly with other trustworthy sources, such as credible university scientists or physicians.[1] Remember that the checklist presents *general* strategies for establishing or refining a response system, but that different risk communication goals, audiences, and media require different risk communication strategies.

HOW COMMUNITIES VIEW RISK

Different individuals will have different reactions to the Toxic Chemical Release Inventory reporting. Individuals in some communities may think it a good idea. Others will be skeptical that industry will comply with the reporting requirements or that the government will enforce it. Still others may be unaware of TRI or of Title III altogether. Those who work within agencies need to understand not only how the public views the TRI reporting, but also how people perceive risks in general. By understanding public perception of risks, it is far easier to anticipate community response. Research with focus groups reveals the following widely held assumptions about chemical releases into the environment:[2]

- All releases are illegal or accidental; none are routine and allowable.
- No releases are safe.
- Releases equal exposure and exposure equals health risks.
- It's difficult and frustrating to attempt to seek information about chemical releases.
- Neither industry nor the government are likely to take action to effectively address environmental hazards.

People's perceptions of risk may seem at times to defy logic, but these perceptions are based on strongly held beliefs. To the experts, risk means facts and figures (such as expected annual mortality), but to the public risk means much more than that. People often respond more to factors other than the hazard itself (see Exhibit 7).

It is important to pay as much attention to these factors as to scientific variables. Take the time to find out what people are thinking, using techniques such as interviews, focus groups, and surveys. Recognize people's emotions and the "hidden agendas," symbolic meanings, and economic or political considerations that often enter in to risk communication. If you neglect the concerns of the community and concentrate only on the scientific information, you run the risk of outraging citizens and creating battlegrounds over risks that are perceived by the agency - but not by citizens - as minimal.[3]

RULES OF RISK COMMUNICATION

While there is no simple formula for successful risk communication, the principles described below can help agencies effectively communicate with the public about environmental risk. Remember that communicating about environmental problems cannot replace effective risk management - "good" communication about risks will not make environmental problems disappear.

- Aim your communications at the target audience. The questions that are likely to be asked of you will come from citizens, workers, local and national environmental groups, realtors, lawyers, and others. Each of these individuals will have different needs and concerns. The more you know about your audience, the better you can formulate your communications. To get to know your audience, you might ask questions like "What do you already know?" "What would you like to know?" "Whom do you consider a credible source of information?" "How do you feel about technology?" "How do you feel about the environment?" A person's education and attitude toward technology, for instance, are determining factors in what they care to hear about. Knowing your audience will also help you avoid talking up or down to people.[4]

- Accept and involve the public as a legitimate partner. Demonstrate your respect for the public by involving the community early - before important decisions are made - and by involving all parties that have an interest or stake in the issue under consideration.[5]

- Be honest, frank, and open. Trust and credibility are key in communicating risk information. If you do not know an answer or are uncertain, say so. There are many uncertainties associated with the TRI data. Discuss the uncertainties, strengths, and weaknesses of the data, and disclose risk information as soon as possible. Identify worst-case estimates as such, and cite ranges of risk estimates when appropriate.[6]

- Speak clearly and with compassion. Use simple, nontechnical language. Be sensitive to local norms, such as speech and dress. Use examples, anecdotes, and images that make technical risk information personal. Avoid abstract, unfeeling language about deaths, injuries and illnesses. Remember that most people will focus on risks to themselves and their families. Acknowledge and respond to emotions that people express - anxiety, fear, anger, outrage, helplessness. Acknowledge and respond to the distinctions that the public views as important in evaluating risks. Use risk comparisons to help put risks in perspective, but avoid comparisons that ignore distinctions that people consider important. Always try to include a discussion of actions that are under way or can be taken, and tell people what you can and cannot do.[7]

- Put numbers in the proper context. The TRI reports show the total amounts in pounds per year of the chemical releases subject to reporting. Because these numbers can be alarming, it is important for people to understand the numerical significance of the information reported and to put this information into the proper context. People need to understand that such information does not in itself indicate the level of associated risk. For example, a citizen may read in a report that the average concentration of a Chemical X in the atmosphere at Plant Z is 0.5 ppm. It would be important to stress to any citizen that might call expressing concern about this number that the specific toxicity of Chemical X must be known to assign any meaning to this concentration. Some highly toxic chemicals produce noticeable health effects at concentrations of less than 0.5 ppm (usually over long periods of exposure) while others may be present in much larger concentrations and pose no health threat.[8]

THE IMPORTANCE OF CITIZEN PARTICIPATION

The goal of risk communication should be to produce an informed, involved, solution-oriented public; it should not be to diffuse public concerns or replace action. Citizen involvement will lead to a better understanding of risks, and community input can improve risk management decisions made by government agencies.

Risk communicators can help direct citizens to the appropriate avenues of participation. For example, a local company can be useful for providing citizens with information on the frequency and duration of releases, treatment technologies, and waste minimization efforts.

To encourage citizen participation, some of the following avenues might be recommended to concerned individuals:

- Identify other concerned citizens. Local Emergency Planning Committees (LEPCs) will be a good starting place for networking with other citizens. Citizen groups can compare chemicals used, release quantities, and control technologies at the local facility with those at similar facilities. If a company is doing a good job recycling and minimizing waste, citizen groups can encourage that company to get its story into the media so other facilities can benefit from its experience.

- Contact the company. Most companies are concerned about their public image and may be more than happy to establish a meaningful liaison with a concerned citizen or citizens' group. Call or write the public contact designated on the TRI reporting form (Form R). Citizens may want to request a tour of the plant and ask to be put on any community mailing list that the company maintains. Citizens can also ask the company representative what that facility has done or is doing to minimize the releases of toxic chemicals into the environment.

- Write a followup letter. Citizens can write to:

  - The designated Region or Section 313 State contact.

  - Local government officials such as local health officials, the Mayor, town council members, selectmen or planning boards, and LEPCs.

  - The U.S. Environmental Protection Agency (Federal, Regional, and State offices).

  - The reporting company.

  - Local and national environmental groups.

  - Elected officials such as Senators and Congress members.

- Contact appropriate hotlines for more information. Section V, Resources describes a number of informational hotlines sponsored by EPA and other organizations. The Emergency Planning and Community Right-to-Know Information Hotline will be particularly useful for citizens who would like more information on Title III and related issues.

- Contact the family physician to discuss medical concerns.

FOLLOWUP

Depending on your organization's resources and priorities, you may wish to flag certain queries for followup. These queries can be identified in several ways:

- Information provided by a caller may suggest that a situation deserves further followup.
- Periodic and systematic review of the call logs will help identify releases, facilities, or communities for which there have been unusually high levels of concern.
- The risk screening described in Section II will help identify releases and facilities that should receive a higher priority for followup from a public health and environmental standpoint.

Title III is based on the belief that the more information citizens have about environmental hazards in their communities, the better equipped they will be to ensure their own protection from unacceptable risks to their health and safety. When sufficiently motivated, citizens are quite capable of understanding and acting on complex risk information. While many of the suggestions for improving risk communication in this section may seem to be common sense, experience has shown they are consistently violated in practice. Understanding why they are often not followed may help improve interaction with citizens and risk communication practices.

EXHIBIT 5 - QUESTIONS THAT MAY BE ASKED

Risk Assessment Questions

1. Am I exposed?
2. To how much of Chemical X am I exposed?
3. Will I/my child get sick (e.g., die, get cancer)?
4. Is my present sickness (or that of my child or my community) the result of past exposures to toxic chemicals?
5. How can I be sure if Chemical X caused this effect(s)?
6. What if I am exposed to more than one chemical?
7. Is the decline of the fish population in Lake X a result of these releases?
8. Can I eat the fish from this lake?
9. Can I swim in this lake?

Risk Management Questions

1. Why are releases of this chemical allowed at all?
2. What is being done to control releases?
3. Is the chemical regulated?
   (a) If so, are the releases in compliance with existing standards or permits?
   (b) If not, why not?
4. How can I get more information about these releases?
5. What can I do to get the release of a particular chemical reduced?

EXHIBIT 6 - ACTION CHECKLIST

ANSWERING QUESTIONS

1. **How will you handle the calls as they come in? Will you:**

   - Designate one or more people to answer the questions?
   - Prepare a guide instructing secretaries and others who generally answer the phones on how and where to forward Section 313 related calls?
   - Establish an intra-State/Regional or local network to handle questions you will be getting?
   - Supply written responses to inquiries? If so, what will you provide?
   - Suggest callers follow up inquiries with a letter detailing their concerns?

2. **If you intend to designate people to answer questions, do you know who within the Region, State, or locality are the contact points for answering specific questions related to:**

   - Health and/or environmental effects?
   - Exposure assessment?
   - Risk assessment?
   - Air, solid waste, ambient water, and drinking water questions?
   - Standards and regulations?

3. **How will you document calls as they come in? Will you:**

   - Ask responders to record essential information in a caller log, including:
     - Caller's name (check your organization's policy regarding your ability to keep callers' requests and queries confidential).

EXHIBIT 6 (continued)

ANSWERING QUESTIONS (continued)

- Address.
- Telephone number.
- Date and time of call.
- Facility(s) of concern.
- Chemical(s) of concern.
- Caller's specific concerns.
- Reasons for concern.
- Source of the caller's information.
- Other information about caller's problem.
- Nature of verbal response provided.
- Documents sent.
- Further followup/response.

- Create a system that enables you to track how many call were received per facility?

- Periodically review these files to ascertain the level and nature of public concern?

4. If a serious problem is apparent:

- Do you know what action your agency can or will take?

- Can you communicate this to the public?

ASSEMBLING INFORMATION

1. Have you assembled the appropriate materials that may be needed to answer the questions?

- Are copies of the Toxic Chemical Release Inventory Reporting Form readily accessible?

- Do you have access to report data from Sections 302, 304, 311, and 312 of Title III?

- Will you have access to the TRI data base or the information on the data base?

EXHIBIT 6 (continued)

ASSEMBLING INFORMATION (continued)

- Can you access the EPA Roadmaps data base that has been developed? (Volume II contains a hard-copy version of Roadmaps.)
- Do you have information related to the health and/or environmental effects of the TRI chemicals? (See Section V and Roadmaps.)

- Do you have a listing of certified toxicologists, physicians, and poison control centers in the area who are willing to assist in responding to citizens' health questions? (Section V provides a listing of poison control centers.)
- Do you know the status of Federal regulations on the Title III chemicals?
- Do you know how your State regulates the Title III chemicals?
- Do you have access to data from State media programs (e.g., air toxics or water releases)? (Contacts for State media programs are provided in Roadmaps.)
- Have you collected maps containing site-specific information, such as facility locations, and meteorological, topological, hydrological, and demographic information (including sensitive population locations) in your geographic area that are important to exposure evaluations?
- Have you contacted local groups or associations, e.g., libraries, weather services, LEPCs, in your geographic area of responsibility to determine their willingness to provide site-specific information?
- If you answered no to any of the above questions, do you know where to get the information? (Section V and the reference lists at the end of each section describe a number of useful resources.)

2. **Will you read local newspaper articles to prepare draft responses to anticipated questions about facilities and chemical releases in your area?**

EXHIBIT 6 (continued)

ASSEMBLING INFORMATION (continued)

3. **Do you want to prepare summary data of the Toxic Chemical Release Inventory Reporting Forms?** If so, will you do it by:
   _State _county
   _zip code _industry?

DISSEMINATING INFORMATION

1. **Do you have plans to publicize your phone number?**

2. **Do you have summary information that you can give to the public concerning:**

   - The community right-to-know law? (Fact sheets and brochures are available from the State and EPA Regional Section 313 contacts listed in Appendix A and from your LEPC; other sources of information are listed in the reference lists for Section I.)

   - Health and environmental effects? (This manual lists many sources of health information, along with information on how to obtain those sources.)

   - Access to the TRI data?

3. **Do other programs in your State or locality know (have) what you have in terms of materials you have assembled?**

4. **Will you be developing communication channels for sharing call information with other agencies? If so, how will you share this information?**

EXHIBIT 6 (continued)

DISSEMINATING INFORMATION (continued)

5. **Do you have a form you can send to those who request more information?** (See sample form below.)

REQUEST FOR MORE INFORMATION

Please send me more information on the following facility or chemical. (I have attached sheets for other facilities/chemicals that interest me.)

Facility/chemical name: _____

Name: _____

Address: _____

City: _____

County: _____

Telephone No.: _____

I am interested in the potential uses of the hazardous substance data collected under the Emergency Planning and Community Right-To-Know law. Specifically, the reason that I am requesting information is:

- ☐ I am a firefighter and this information will help me take appropriate precautions when dealing with an emergency situation.
- ☐ I want to discuss possible hazardous material exposure with my physician.
- ☐ I am concerned about the releases of toxic chemicals into the environment.
- ☐ Other _____
  _____
- ☐ I want to use my RIGHT-TO-KNOW!

  _____

Source: New Jersey Department of Environmental Protection, Bureau of Hazardous Substances. Community Right-to-Know Fact Sheets.

EXHIBIT 7 - FACTORS IMPORTANT IN RISK PERCEPTION AND EVALUATION

Factor	Conditions Associated with Increased Public Concern	Conditions Associated with Decreased Public Concern
Catastrophic potential	Facilities and injuries grouped in time and space	Facilities and injuries scattered and random
Familiarity	Unfamiliar	Familiar
Understanding	Mechanisms or process not understood	Mechanisms or process understood
Uncertainty	Risk scientifically unknown or uncertain	Risk known to science
Controllability (personal)	Uncontrollable	Controllable
Voluntariness of exposure	Involuntary	Voluntary
Effects on children	Children specifically at risk	Children not specifically at risk
Effects manifestation	Delayed effects	Immediate effects
Effects on future generations	Risk to future generations	No risk to future generations
Victim identity	Identifiable victims	Statistical victims
Dread	Effects dreaded	Effects not dreaded
Trust in institutions	Lack of trust in responsible institutions	Trust in responsible institutions
Media attention	Much media attention	Little media attention

EXHIBIT 7 (continued)

Factor	Conditions Associated with Increased Public Concern	Conditions Associated with Decreased Public Concern
Accident history	Major and sometimes minor accidents	No major or minor accidents
Equity	Inequitable distribution of risks and benefits	Equitable distribution of risks and benefits
Benefits	Unclear benefits	Clear benefits
Reversibility	Effects irreversible	Effects reversible
Origin	Caused by human actions or failures	Caused by acts of nature or God

Source: Covello, V.T., P.M. Sandman, and P. Slovic, "Risk Communication, Risk Statistics, and Risk Comparisons: A Manual for Plant Managers," Chemical Manufacturers Association, Washington, DC, 1988, p. 54.

REFERENCES

Notes

[1]U.S. Environmental Protection Agency. Seven Cardinal Rules of Risk Communication. (Washington, DC: U.S. EPA, 1988).

[2]U.S. Environmental Protection Agency and Georgetown University Medical Center. Public Needs Assessment. (Washington, DC: U.S. EPA, 1988).

[3]Hance, Billie Joe; Carol Chess; Peter M. Sandman; and the Environmental Communication Research Program, Rutgers University. Improving Dialogue with Communities: A Risk Communication Manual for Government. (Trenton, New Jersey: New Jersey Department of Environmental Protection, 1988).

[4]Arkin, Elaine Bratic, David B. McCallum, and Maria Pavlova (Project Officer). Talking about Toxic Substances: A Communications Handbook. (Washington, DC: U.S. EPA and Georgetown University, 1988). Fisher, Ann, Gary H. McClelland, and William D. Schulze. Strategies for Explaining Very Small Risks in a Community Context. (Pittsburgh, Pennsylvania: Air Pollution Control Association, 1988).

[5]U.S. EPA. Seven Cardinal Rules.

[6]U.S. EPA. Seven Cardinal Rules.

[7]U.S. EPA. Seven Cardinal Rules.

[8]U.S. Environmental Protection Agency and Federal Emergency Management Agency. Risk Communication Resource Package (draft). (Washington, DC: U.S. EPA and FEMA, 1988).

Other Sources of Information on Risk Communication and Risk Perception

Bowonder, B. 1985. "Low Probability Event: A Case Study in Risk Assessment." Paper presented at the workshop "Risk analysis in developing countries." Hyderabad, India.

Burger, E. 1984. Health Risks: The Challenge of Informing the Public. Washington, DC: The Media Institute.

Chemical Manufacturers Association (with assistance from Rowan and Blewitt, Inc.). 1988. Title III Community Awareness Workbook. Washington, DC: MA.

Covello, V.T. 1983. "The Perception of Technological Risks: A Literature Review." Technological Forecasting and Social Change. 23, 285-297.

Covello, V.T. 1984. "Uses of Social and Behavioral Research on Risk." Environment International.

Covello, V., D. von Winterfeldt, and P. Slovic. 1986. Risk Communication: Background Report for the National Conference on Risk Communication. Washington, DC: Conservation Foundation.

Conrad, J. (Ed.) 1980. Society, Technology, and Risk Assessment. New York, N Y : Academic Press.

Creighton, J.L. 1980. Public Involvement Manual: Involving the Public in Water and Power Resource Discussions. Washington, DC: U.S. Government Printing Office.

Delli Priscoli, J., J. Creighton, C.M. Dunning, eds. 1983. "Public Involvement Techniques: A Reader of Ten Years' Experience of the Institute for Water Resources." IWR Research Report 82-R1. U.S. Army Corps of Engineers, Institute for Water Resources.

Earle, T.C. and G. Cvetkovich. 1983. "Risk Judgement and the Communication of Hazard Information: Toward a New Look in the Study of Risk Perception." BH ARC (400/83/017), Seattle, WA: Battelle Human Affairs Research Centers.

Fischoff, B. 1981. Acceptable Risk. New York, NY: Cambridge University Press.

Fischoff, B., P. Slovic, S. Lichtenstein, S. Read, and B. Combs. 1978. "How Safe Is Safe Enough? A Psychometric Study of Attitudes Towards Technological Risks and Benefits." Policy Sciences. 8, 127-52.

Fischoff, B., P. Slovic, and S. Lichtenstein. 1979. "Weighing the Risks." Environment. 21, 17-10, 32-38.

Fischoff, B., S. Watson, and C. Hope. 1984. "Defining Risk." Policy Sciences. 17, 123-139.

Kasperson, R. and J. Kasperson. 1983. "Determining the Acceptability of Risk: Ethical and Policy Issues." In J. Rogers and D. Bates, eds., Risk: A Symposium. Ottawa, Canada: The Royal Society of Canada.

Lowrence, W.W. 1976. Of Acceptable Risk: Science and the Determination of Safety. Los Altos, CA: W. Kaufman.

Mazur, A. 1980. "Media Coverage and Public Opinion on Scientific Controversies." Journal of Communications Research. 31, 106-115.

Media Institute. 1985. Chemical Risks: Fears, Facts, and the Media. Washington, DC: Media Institute.

Mitchell, R.C. 1980. Public Opinion on Environmental Issues: Results of a National Public Opinion Survey. Washington, DC: Council on Environmental Quality.

Otway, H.J. 1980. "Risk Perception: A Psychological Perspective." In M. Dierkes, S. Edwards, and R. Coppock, eds., Technological Risk: Its Perspective and Handling in Europe. Boston, MA: Oelgeschlager, Gunn and Hain.

Otway, H.J. and D. von Winterfeldt. 1982. "Beyond Acceptable Risk: On the Social Acceptability of Technologies." Policy Sciences. 8, 127-152.

Peltu, M. 1985. "Risk Communication: The Role of the Media." In H. Otway, ed., Risk and Regulation. London, England: Buttersworths.

Ruckelshaus, W. 1984. "Risk in a Free Society." Risk Analysis. Vol. 4, No. 3, September, 157-163.

Saarinen, T., ed. 1982. Perspectives on Increasing Hazard Awareness. Boulder, CO: Institute of Behavioral Science.

Sandman, Peter M. Explaining Environmental Risk. U.S. Environmental Protection Agency, Office of Toxic Substances. Springfield, VA: National Technical Information Service.

Slovic, P., B. Fischhoff, and S. Lichtenstein. 1982. "Facts and Fears: Understanding Perceived Risk." In R. Schwing and W. A. Albers, eds., Social Risk Assessment: How Safe Is Safe Enough? New York, NY: Plenum, 1980. Revision in D. Kahneman, P. Slovic, and A. Tversky, eds., Judgement Under Uncertainty: Heuristics and Biases. New York, NY: Cambridge University Press 464-489.

Slovic, P., B. Fischhoff, and S. Lichtenstein. 1981. "Perceived Risk: Psychological Factors and Social Implications." In F. Warner and D. H. Slater, eds., The Assessment and Perception of Risk. London, England: The Royal Society.

Vertinsky, I. and P. Vertinsky. 1982. "Communicating Environmental Health Assessment and Other Risk Information: Analysis of Strategies." In Kunreuther, H., ed., Risk: A Seminar Series. IIASA-CP-82-S2, Laxenburg, Austria: International Institute for Applied Systems Analysis 421-482.

Vlek, C., and D.J. Stallen. 1981. "Judging Risks and Benefits in the Small and in the Large." Organizational Behavior and Human Performance. 28, 235-271.

U.S. Environmental Protection Agency. 1984. Risk Assessment and Risk Management: Framework for Decision Making. Washington, DC: U.S. EPA, December.

Weinstein, N.D. 1984. "Why It Won't Happen to Me: Perceptions of Risk Factors and Susceptibility." Health Psychology. 3, 431-457.

SECTION V - RESOURCES

By itself the Toxic Chemical Release Inventory means very little in terms of human health and environmental effects. As explained earlier, information on toxicological potency and exposure are also needed to perform risk screening and to answer questions from the public. While your organization will need to determine the extent to which you collect these kinds of data, this section describes a number of resources that will be useful. Additional resources are provided in Appendices A - J in Volume II.

Some of the resources described below were drawn from Public Education on Toxic Substances: An Annotated Bibliography (September 1988). The bibliography was developed under a cooperative agreement between EPA's Office of Toxic Substances and Georgetown University Medical Center. The EPA's Air Risk Information Support Center's Sources of Health Risk and Exposure Assessment Information Directory (Draft) and the Federal Emergency Management Agency's Risk Communication Resource Package (Draft) were also used to develop this section.

ORGANIZATIONS

- Local Companies. Many of these firms are themselves preparing to interpret the data and respond to the public's questions. They may already have had extensive interactions with the local community on the TRI. Companies will have data on the chemicals, including possible health impacts, and may know the route of human exposure to the chemical emissions. Exhibit 8 lists questions that would be useful to ask local companies.

- EPA Regional Offices. Regional Offices have experts on risk assessment, risk communication, and risk management practices. They also have information resources (such as fact sheets) on a range of related topics and on Title III. A listing of EPA Regional contacts is provided in Exhibit 9.

- State Section 313 Contacts. Each State has designated contacts that can provide information related to the Toxic Chemical Release Inventory. See Exhibit 10 for a listing of these contacts.

- State and Federal Media Programs. These programs can provide information on regulation and compliance. They may also have monitoring data, physical transport, and environmental transformation data on specific chemicals. State agencies may also

be able to tell you if a chemical has a State air or water standard, and if a particular release is permitted. In this way, toxic chemicals released into the environment without permit restrictions or standards can be identified. State programs also may be aware of a permitted company's compliance record. Roadmaps (Appendix H of Volume II) contains a listing of State media contacts.

- State Departments of Health. Toxicologists and environmental health and safety specialists from State Departments of Health can provide information about the biological effects of hazardous chemical exposure and the environmental impact of hazardous chemical use in the community or area.

- State Emergency Response Commissions (SERCs). Each State is required to establish a SERC that will serve as the link between local and Federal emergency response teams. In many States, the SERC is made up of representatives from public agencies and departments. In other States, it may be a part of existing State organizations, such as environmental or health agencies. In almost all cases, its representatives can help to identify people who can respond to questions raised by the TRI data. SERCs designate local emergency planning districts within the state, and appoint a Local Emergency Planning Committee (LEPC) to serve each of the districts. The SERC also coordinates and supervises the LEPCs' actions by coordinating Title III information received from facilities and EPA and assisting in understanding and communicating the chemical risks. Exhibit 10 contains a listing of contacts for SERCs.

- Local Emergency Planning Committees (LEPCs). These are local committees appointed by the SERCs and include representatives from many organizations: elected officials, police and fire departments, health, environment and transportation agencies, broadcast and print media, community groups, and reporting facility representatives. LEPCs are the link between local communities and State-level emergency response committees. They develop emergency plans for their community that include emergency shelter, communication, and schedules for testing the plan. Although LEPCs are not designated to received TRI data, they may have information about many Title III chemicals; local facilities; and meteorological, topological, hydrological, and demographic information (including sensitive population locations) in your geographic area. Call your EPA Region, SERC, or State Section 313 contact for more information.

- Universities. Some universities have a school of public health, the faculty of which should be familiar with risk assessment procedures. Universities also may employ physical chemists, who can describe the properties and uses of hazardous chemicals, and biochemists, who can describe the adverse health effects associated with exposure to hazardous chemicals. Finally, some universities have environmental studies and meteorological departments that can provide information useful to exposure evaluations.

- Society of Toxicology. This organization can assist in identifying both nationally recognized experts and toxicologists in your area. Call your EPA Region or State Section 313 contact for more information.

- State/Local Poison Control Centers. Toxicologists at poison control centers can discuss the acute and chronic health effects resulting from exposure to hazardous

chemicals, identify the chemical hazards that are most prevalent in the community, and describe preventive actions and remedial measures that should be taken to minimize health problems. Exhibit 11 provides a listing of State and local Poison Control Centers.

- American Chemical Society (ACS). This organization has nearly 200 local sections across the United States. Its members are chemists and chemical engineers who can help interpret technical data. ACS members can also identify scientists in your community. ACS is located at 1155 16th Street, N.W., Washington, DC 20036. 202-872-4600.

  Chemical Manufacturers Association (CMA). This organization can identify individuals and companies with expertise on toxic chemicals and related topics. CMA is located at 2501 M Street, N.W., Washington, DC 20037. 202-887-1100.

  Agency for Toxic Substances and Disease Registry (ATSDR). Personnel from this agency, which is a component of the Centers for Disease Control, can discuss toxic substance use and associated adverse effects and relay specific case histories. Call your EPA Region or State Section 313 contact for more information.

- U.S. Geological Survey (USGS) and National Cartographic Information Center (NCIC). These organizations have land use maps that can be useful in exposure evaluations. Aerial photographs, which are archived at USGS, also can be used to indicate the chronology of changes in an area's land use and identify indicators of contamination (such as changes in soil conditions and vegetation), as well as patterns of dispersion, and a general idea of site environs. Call your EPA Regional contact for more information.

- Census Bureau. For humans, census data may be accessed to determine the size, distribution, and demographic characteristics of a geographically defined population.

- Libraries. City, county, and university libraries may have technical documents that can provide information on the physical transport and environmental transformation processes that chemicals are likely to undergo in various media. County libraries will also have microfiche copies of State TRI data.

- Airport, weather services, television and radio stations, and the NOAA all will have meteorological data that can be useful in exposure evaluations.

- The Red Cross, town halls, physicians, health departments, hospitals, and schools will be able to help pinpoint sensitive human populations.

TRAINING

U.S. EPA Risk Assessment and Exposure Assessment Training Courses. These courses teach basic principles of risk and exposure assessment. Call your Regional EPA contact for more information. Some State agencies may offer similar courses. Check with your State Section 313 contact or State environmental or health department.

FACT SHEETS AND PROFILES

Information on toxicological potency is available for many Section 313 chemicals in various fact sheets and profiles. Some of these publications are written for the public and may be useful to distribute to callers.

- Hazardous Substance Fact Sheets. These fact sheets are based on ones developed for the workplace by the New Jersey Department of Health. Each chemical-specific fact sheet contains a hazard summary; a brief description of the chemical; workplace exposure limits; acute and chronic health effects; medical testing; and definitions of terms. It is important to note, however, that these fact sheets contain occupational data based on a healthy male worker population. Therefore, the information presented (such as workplace exposure limits) do not reflect environmental exposures and may not be protective of the general human population (which includes women, children, and sensitive populations). These fact sheets are available from LEPCs and EPA Regional Section 313 contacts. Appendix I of Volume II contains a sample hazardous substance fact sheet.

- CEPP/SARA Title III Section 302 Profiles. Section 302 profiles are the chemical reference documents used in the Chemical Emergency Preparedness Program (CEPP). They include summaries of information on each of 366 chemicals on EPA's list of Extremely Hazardous Substances in a format similar to the Occupational Health and Safety Administration's (OSHA's) Material Safety Data Sheets (MSDSs). The following chemical-specific information is included: general information about the chemical; regulatory information; health hazard and fire and explosion hazard data; information on the chemical's uses and precautions for safe handling; protective equipment and emergency first-aid treatment. Appendix J of Volume II contains a sample Profile. Section 302 profiles on specific Extremely Hazardous Substances are available from State 313 contacts, SERCs, or EPA libraries.

- Material Safety Data Sheets (MSDSs). For some chemicals, information on chemical toxicity is available on the MSDSs that companies have filed with the LEPC, SERC, and local fire departments.

- Toxicological Profiles. Under SARA, Section 110, ATSDR and EPA are required to develop toxicological profiles on a specified number of hazardous substances commonly found at facilities on the Superfund National Priorities List (NPL) and which

pose the most significant potential threat to human health. Some of these profiles have been completed on Title III chemicals and are available through ATSDR. Source: Ms. Georgia Jones, Director, Office of External Affairs, Agency for Toxic Substances and Disease Registry, Chamblee 28 South, 1600 Clifton Road, Atlanta, Georgia 30330.

- Chemical Advisories. This series of fact sheets by EPA warns manufacturers, employees, and homeowners of the hazards of these substances: 2-nitropropane; used motor oil (in English and Spanish); nitrosamines; p-tert-Butyl benzoic acid; 4-4'-methylene bis(2)-chloroaniline; and toluenediamines. Source: U.S. Environmental Protection Agency, Office of Toxic Substances (TS-799), 401 M Street SW, Washington, DC 20460; 202-554-1404.

DATA BASES

- Roadmaps. This is a Section 313 chemical information directory. Roadmaps can point you to a number of data bases and documents containing information on health and ecological effects, as well as physical transport and environmental transformation of Section 313 chemicals. It also contains information on Federal and State regulatory levels for these chemicals, as well as State contacts for various media (air, water, etc.) programs. Some information from Roadmaps is provided in Appendix H of Volume II. An on-line version is also available.

- IRIS. IRIS is an on-line data base that contains the latest information about Agency conclusions on toxicological potencies, health assessments, and regulatory decisions on approximately 400 chemicals (about 85 Section 313 chemicals). It has been designed specifically for Federal, State, and local environmental health agencies. A more detailed description of IRIS is provided in Roadmaps.

- Environmental Transport and Fate Data Bases. Descriptions of useful environmental transport and fate data bases are provided in Roadmaps. Among these are Envirofate and the Hazardous Substances Data Bank.

- National Air Toxics Information Clearinghouse (NATICH) Data Base.
  919-541-0850
  FTS 629-0850
  Monday through Friday, 7:30 a.m. to 5:00 p.m.
  The National Air Toxics Information Clearinghouse assists Federal, State, and local agencies in exchanging information about air toxics and the development of air toxics programs. The core of the Clearinghouse is the NATICH data base, which contains all the information collected from agencies, including regulatory program descriptions and contacts; permitting data; acceptable ambient concentrations; ambient air monitoring information; source test data; emissions inventory data; research methods development information; and bibliographic and ongoing project citations. (See Roadmaps for a more detailed description of NATICH.)

- Exposure Analysis and Systems. These systems provide access to data and models used in estimating chemical fate, exposed populations, and aggregate exposure. EPA

has developed several exposure analysis systems, including the Graphical Exposure Modeling System (PC-GEMS); the Computer-Assisted Management Emergency Operations (CAMEO); and the Emergency Information System/Chemical (EIS/C). These systems run on PCs and provide access to data management and analysis tools. PC-GEMS includes data on selected environmental characteristics (primarily meteorology and streams) and population; models for predicting concentrations in air, water, soil, and ground water; and mapping and graphics capabilities. CAMEO, which currently runs on a MacIntosh, was designed for first responders to chemical spills and emergency planners. A number of local governments have used CAMEO to load and manage information on chemicals in their cities' facilities, and display this information together with locally-entered data on populations, schools, and hospitals. CAMEO contains two spill-scenario models, and can display extents of estimated plumes. EIS/C, also primarily an emergency planning system, records chemical, facility, transportation, vulnerable population, and other information. Check with the State contacts listed in Exhibit 10 about the availability of these systems.

- Geographic Information Systems (GIS). GIS are computer mapping and analysis systems that can store and combine multiple "layers" of information (e.g., meteorologic, geologic, hydrologic, demographic, land use data). Most GIS run on mainframe systems, and are used for land use planning, although others which are oriented toward environmental analysis have been recently implemented in EPA regions and several states. Check with your Regional or State Section 313 contact for more information (Exhibits 9 and 10).

- Risk * Assistant.
  703-683-6695
  Risk * Assistant provides analytical tools, data bases, and information handling for risk assessors at hazardous waste sites. The system's component programs, which require only estimates of the types and concentrations of hazardous chemicals present at the waste site, can perform a variety of tasks: analysis of exposure and risk, taking into account transport and fate, pathways of exposure, and current in-formation on the hazard assessment of the chemicals; production of standardized risk reports; storage of risk assessment methodologies and data; and cross referencing through four databases that compile information from IRIS, regulatory standards and guidance, chemical properties, and chemical synonyms and CAS numbers. The system is currently only a prototype, and is still in the development stage.

HOTLINES

A number of hotlines sponsored by EPA and other organizations can provide information (both verbal and written) on a wide range of topics related to toxic chemicals and health, exposure, and risk assessments. The Emergency Planning and Community Right-to-Know Information Hotline (described below) will be particularly useful.

Emergency Planning and Community Right-to-Know (Title III) Information Hotline

OS-120
U.S. EPA
401 M Street, S.W.
Washington, D. C. 20460
1-800-535-0202
202-479-2449 (Washington D.C. area and Alaska)
Monday through Friday, 8:30 a.m. to 7:30 p.m., EST

The EPCRA Information Hotline is operated under the guidance of the Office of Solid Waste and Emergency Response and the Office of Toxic Substances. The Hotline can answer questions from manufacturers, government agencies, and the general public regarding Title III. Hotline specialists can answer questions and requests concerning all aspects of Title III, as well as general issues regarding preventing and preparing for chemical accidents.

Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hotline
401 M Street, S.W.
Washington, D.C. 20460
1-800-424-9346 or 202-382-3000
FTS 382-3000
Monday through Friday, 8:30 a.m. to 7:30 p.m., EST

The RCRA/CERCLA Hotline has been in operation since 1980. It is operated under the guidance of EPA's Office of Solid Waste and Emergency Response. The primary function of the RCRA/CERCLA Hotline is to assist the public and regulated community in understanding EPA regulations and policy under the RCRA/CERCLA and Underground Storage Tank programs. Hotline specialists answer regulatory and technical questions, and can respond to requests for documents on virtually all aspects of the RCRA, CERCLA, and UST programs. Federal, State, and local governments; regulated communities; people involved in managing and cleaning up hazardous waste; and the general public may contact the RCRA/CERCLA Hotline for information.

Air RISC Hotline
919-541-0888
FTS 629-0888
Monday through Thursday, 7:30 a.m. to 5:00 p.m., EST
Friday, 7:30 a.m. to 4:00 p.m., EST

The Air Risk Information Support Center (Air RISC) provides, in a timely fashion, technical assistance and information related to health, exposure, and risk assessments for toxic air pollutants. The Air RISC is operated by EPA's Office of Air Quality Planning and Standards, Office of Health and Environmental Assessment, and Center for Environmental Research Information. The Air RISC Hotline puts agencies and offices in direct contact with a variety of experts. The Hotline is designed to provide an initial, quick response based on available data and expertise. The Air RISC also provides a feedback mechanism for State and local air agencies to identify to EPA the technical support needs of their agencies in the areas of

health, exposure, and risk assessment. Policy guidance and risk management advice, however, are outside the scope of the Air RISC.

Control Technology Center (CTC)
919-541-0800
FTS 629-0800
Monday through Friday, 8:00 a.m. to 4:30 p.m. EST

The Control Technology Center (CTC) supports State and local agencies and EPA Regional Offices in implementing air pollution programs for both toxic and criteria air pollutants by providing engineering guidance and support on air pollution control technology. The CTC Hotline provides initial, rapid responses to questions and problems based on available information and expertise.

Toxic Substances Control Act (TSCA) Assistance Information Service
Office of Toxic Substances (TS-799)
U.S. EPA
401 M Street, S.W.
Washington, D.C. 20460
202-554-1404
FTS 554-1404
Monday through Friday, 8:30 a.m. to 5:00 p.m., EST

The Toxic Substances Control Act (TSCA) Assistance Information Service is administered by the Office of Toxic Substances. It provides information on TSCA regulations to the chemical industry, labor and trade organizations, environmental groups, and the general public. The TSCA Assistance Information Service can direct inquiries to the appropriate EPA personnel and handle requests for certain publications related to management of toxic substances.

Best Available Control Technology (BACT)/Lowest Achievable Emission Rate (LAER) Clearinghouse
Emission Standards Division
Office of Air Quality Planning and Standards (MD-13)
U.S. EPA
Research Triangle Park, NC 27711
919-541-5432
FTS 629-5432
Monday through Friday, 8:00 a.m. to 4:30 p.m., EST

The Best Available Control Technology (BACT)/Lowest Achievable Emission Rate (LAER) Clearinghouse assists Federal, State, and local agencies in exchanging information about BACT and LAER determinations as established under the Clean Air Act. This Clearinghouse was established in 1979 and is a cooperative effort between EPA and the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Organizations.

Public Information Center (PIC)
U.S. EPA (PM-211B)
401 M Street, S.W.
Washington, D.C. 20460
202-382-2080
FTS 382-2080
Monday through Friday, 8:00 a.m. to 5:30 p.m., EST

The Public Information Center (PIC) answers inquiries from the public about EPA programs and activities. PIC also offers a variety of nontechnical information materials. This well-established public service is operated by the Office of Information Resource Management.

Risk Communication Hotline

Office of Policy, Planning, and Evaluation
U.S. EPA
401 M Street, S.W.
Washington, D.C. 20460
202-382-5606
FTS 382-5606
Monday through Friday, 8:30 a.m. to 4:30 p.m., EST

The Risk Communication Hotline serves EPA Regions and program offices. It is an up-to-date resource for information on risk communication, research, skill building, implementation, and evaluation. The primary purpose of this hotline is to provide support to EPA Regional Offices and Headquarters; however, the Hotline staff will provide assistance to State and local agencies as time and resources permit. State and local agencies should first contact their Regional Offices with risk communication questions and concerns. The Risk Communication Hotline was established in 1987 and is operated under the Office of Policy, Planning, and Evaluation.

Safe Drinking Water Hotline
401 M Street, S.W.
Washington, D.C. 20024
1-800-426-4791
Monday through Friday, 8:30 a.m. to 4:30 p.m., EST

The Safe Drinking Water Hotline, established in 1987, answers questions regarding the Safe Drinking Water Act of 1974 (SDWA), the SDWA Amendments of 1986, and EPA drinking water programs (including public water supply). The Hotline is targeted at a broad audience ranging from regulatory agencies to the general public. In addition to responding to questions on regulations, the Hotline can provide a list of Office of Drinking Water publications (available through the National Technical Information Service for a fee) and copies of related Federal Register notices, as well as add interested persons to the National Pesticides Survey mailing list to receive monthly updates on that program.

Cancer Information Service
1-800-4-CANCER
Monday through Friday, 6:00 a.m. to 10:00 p.m.
Saturday, 10:00 a.m. to 6:00 p.m.

This Hotline is a service of the National Cancer Institute (NCI). All phone calls are automatically routed to the nearest Regional NCI office. A national office in Maryland answers calls after normal business hours (9:00 a.m. to 4:30 p.m. local time) and on Saturdays. This Hotline can answer general questions about the relationship of indoor air pollution and cancer; however, more specific questions about air toxics are referred to other agencies. Callers can also receive information about treatment, diagnosis, and prevention of cancer from this Hotline, as well as literature and listings of local resources (including home health care, hospitals, and support groups).

EXHIBIT 8 - QUESTIONS TO ASK A COMPANY'S TECHNICAL CONTACT

1. Does the total quantity of the release reported include any accidental releases? If so:
   - When did they happen?
   - How much of Chemical X was released?
   - How likely is it for such a release to happen again?
   - What area was affected?
   - Is there any unusual topography in the area?
   - Was the release reported consistent with Section 304 requests?
   - Were followup reports filed? If so, what do these reports say about hazards and exposure?
2. What is the frequency of any routine releases?
3. What is the duration of any routine releases?
4. When and what is the peak release?
5. For air, what are the stack heights from which specific chemicals are released?
6. For water, what are the exact locations of direct discharges?
7. How long have there been releases of Chemical X?
8. Do reported releases reflect past release levels?
9. Is the release pattern of Chemical X expected to change in the future?
10. If the TRI data indicate a mixture or chemical compound, what substances might be expected to be present in the mixture or compound, and in what quantities?
11. Is the company employing best practicable technology (BPT) or best available technology (BAT)? What are they?
12. Has the company done any monitoring? If so, is this information available? What sampling and analytical methods were used?
13. Has the company attempted to model potential exposures from release or monitoring data? If so, what models and assumptions were used?
14. Is any toxicological information available on Chemical X?
15. Is any information available on potential transport and transformation of Chemical X?
16. Has the company filed a report under Sections 311-312 (Reporting of hazardous chemical inventories)?

EXHIBIT 9 - EPA REGIONAL SECTION 313 CONTACTS

EPA Region 1 (CT, MA, ME, NH, RI, VT)

Dwight Peavey
Pesticides and Toxics Branch
U.S. EPA (APT2311)
JFK Federal Building
Boston, MA 02203
(617) 565-3230

EPA Region 2 (NJ, NY, VI, PR)

Nora Lopez
Pesticides and Toxics Branch
U.S. EPA Region 2 (MS240)
Woodbridge Avenue, Building 209
Edison, NJ 08837
(201) 906-6890

EPA Region 3 (DE, MD, PA, VA, WV, DC)

Kurt Elsner
Toxics and Pesticides Branch
U.S. EPA Region 3 (3HW42)
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-1260

EPA Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)

Jill Perry
Pesticides and Toxic Substances Branch
U.S. EPA Region 4
345 Courtland Street
Atlanta, GA 30365
(404) 347-5053

EPA Region 5 (IL, IN, MI, MN, OH, WI)

Dennis Wesolowski
Pesticides and Toxic Substances Branch
U.S. EPA Region 5 (5SPT-7)
230 So. Dearborn Street
Chicago, IL 60605
(312) 353-5907

EPA Region 6 (AR, LA, MN, OK, TX)

Gerald Carney
Pesticides and Toxic Substances Branch
U.S. EPA Region 6 (6TPT)
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 655-7244

EPA Region 7 (IA, KS, MO, NE)

Ed West
Congressional and Intergovernmental Liaison
U.S. EPA Region 7 (CIGL)
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2806

EPA Region 8 (CO, MT, ND, SD, UT, WY)

Diane Groh
Toxic Substances Branch
U.S. EPA Region 8 (8AT-TS)
999 18th Street
Denver, CO 80202-2405
(303) 293-1730

EPA Region 9 (AZ, CA, HI, NV, AS, GU, MP)

Kathleen Gorforth
Pesticides and Toxics Branch
U.S. EPA Region 9 (A-4-3)
211 Main Street
San Franciso, CA 94105
(415) 974-7280

EPA Region 10 (AK, ID, OR, WA

Phil Wong
Pesticides and Toxic Substances Branch
U.S. EPA Region 10 (AT083)
1200 Sixth Avenue
Seattle, WA 98101
(206) 443-4016

EXHIBIT 10

STATE EMERGENCY RESPONSE COMMISSIONS, REGIONAL SECTION 313 CONTACTS, AND STATE DESIGNATED AGENCIES

This list is the U.S. Environmental Protection Agency's listing of State Emergency Response Commissions and State-designated agencies for the Emergency Planning and Community Right-to-Know Act. EPA has verified each contact individually. All addresses listed under State Commissions receive the Section 302 emergency planning notification and the Section 304 emergency release notification unless otherwise specified. The State-designated agencies receive the submissions for the sections listed in their headings. If one address is listed with no heading, the State commission receives all submissions for every section of the Act. If an additional address is listed under the heading Mailing Address, this address is to be used for mailings to the State commissions rather than the P.O. boxes used for the form submissions.

Alabama

State Commission:
J. Danny Cooper, Co-Chair
Alabama Emergency Response Commission
Director, Alabama Emergency Management Agency
520 South Court Street
Montgomery, AL 36130
(205) 834-1375
Contact: Dave White

Section 311/312 Submissions:
Leigh Pegues, Co-Chair
Alabama Emergency Response Commission
Director, Alabama Department of Environmental Management
1751 Congressman W.G. Dickinson Drive
Montgomery, AL 36109
(205) 271-7700
Contacts: L.G. Linn (205) 271-7700
E. John Williford (205) 271-7931

Section 313 Submissions:
E. John Williford, Chief of Operations
Alabama Emergency Respopnse Commission
Alabama Department of Environmental Management
1751 Congressman W.G. Dickinson Drive
Montgomery, AL 36109
(205) 271-7700
Contacts: L.G. Linn (205) 271-7700
E. John Williford (205) 271-7931

Alaska

Linda VanHaughten, Chair
Alaska State Emergency Response Commission
P.O. Box 0
Juneau, AK 99811
(907) 465-2600

Mailing Address:
Linda VanHaughten
Alaska State Emergency Response Commission
3220 Hospital Drive
Juneau, AK 99811

American Samoa

State Commission:
Maiava O. Hunkin
Program Coordinator for the Territorial Emergency Management Coordination Office
American Samoan Government
Pago Pago, American Samoa 96799
International #(684) 633-2331

Section 311/312 and 313 Submissions:
Pati Faiai, Director
American Samoa EPA
Office of the Governor
Pago Pago, American Samoa 96799
International #(684) 633-2682

Arizona

Carl F. Funk, Executive Director
Arizona Emergency Response Commission
Division of Emergency Services
5636 East McDowell Road
Phoenix, AZ 85008
(602) 231-6326

EXHIBIT 10 (continued)

Arkansas

State Commission:
Randall Mathis, Acting Director
Arkansas Hazardous Materials Emergency Response Commission
P.O. Box 9583
8001 National Drive
Little Rock, AR 72219
(501) 562-7444
Contact: Mike Bates (501) 455-6888

Section 311/312 and 313 Submissions:
Becky Bryant
Depository of Documents
Arkansas Department of Labor
10421 West Markham
Little Rock, AR 72205
Contact: John Ward (501) 562-7444

Mailing Address:
Arkansas Department of Pollution Control and Ecology
P.O. Box 9583
8001 National Drive
Little Rock, AR 72219
Attn: John Ward

California

State Commission:
William Medigovich, Chair
California Emergency Planning and Response Commission
Director, Office of Emergency Services
2800 Meadowview Road
Sacramento, CA 95832
(916) 427-4287

Section 302, 304, and 311/312 Submissions:
California Emergency Planning and Response Commission
Office of Emergency Services
Hazardous Materials Division
2800 Meadowview Road
Sacramento, CA 95832
(916) 427-4287
Contact: Gary Burton
Michelle LaBella
Dave Zocchetti

Section 313 Submissions:
Chuck Shulock
Office of Environmental Affairs
P.O. Box 2815
Sacramento, CA 95812
Attn: Section 313 Reports
(916) 324-8124
(916) 322-7236 Completed Form R Information

Colorado

State Commission:
David C. Shelton, Chair
Colorado Emergency Planning Commission
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220
(303) 273-1624
Emergency release notification:
(303) 377-6326
After hours & weekends (emergencies only):
(303) 370-9395

Section 311/312 & 313 Submissions:
Colorado Emergency Planning Commission
4210 E. 11th Avenue
Denver, CO 80220
Contact: Richard Bardsley
(303) 273-1789
Pam Harley (303) 331-4858

Connecticut

Sue Vaughn, Title III Coordinator
State Emergency Response Commission
Department of Environmental Protection
State Office Building
Room 161
165 Capitol Avenue
Hartford, CT 06106
(203) 566-4856

EXHIBIT 10 (continued)

Delaware

State Commission:
Patrick W. Murray, Chair
Delaware Commission on Hazardous Materials
Department of Public Safety
Administration Center
Dover, DE 19901
Contact: George Frick (302) 736-3169

Section 302 Submissions:
Dominick Petrilli, Acting Director
Division of Emergency Planning and Operations
P.O. Box 527
Delaware City, DE 19706
(302) 834-4531

Section 304 Submissions:
Phillip Retallick, Director
Division of Air and Waste Management
Department of Natural Resources and Environmental Control
Richardson and Robbins Building
89 Kings Highway
P.O. Box 1401
Dover, DE 19901
(302) 736-4764

Section 311/312 Submissions:
Dr. Lawrence Krone, Chief
Bureau of Health and Social Services
802 Silver Lake Boulevard
Dover, DE 19901
(302) 736-4731

Section 313 Submissions:
Robert French, Chief Program Administrator
Air Resource Section
Department of Natural Resources and Environmental Control
P.O. Box 1401
Dover, DE 19901
(302) 736-4791

District of Columbia

State Commission and Section 311/312 Submissions:
Joseph P. Yeldell, Director
State Emergency Response Commission for Title III in the District of Columbia
Office of Emergency Preparedness
2000 14th Street, NW
Frank Reeves Center for Municipal Affairs
Washington, DC 20009
(202) 727-6161

Contact: Pamela Thurber
Environmental Planning Specialist

Florida

Thomas G. Pelham, Chair
Florida Emergency Response Commission
Secretary, Florida Department of Community Affairs
2740 Centerview Drive
Tallahassee, FL 32399-2149
(904) 488-1472
In FL: 800-635-7179
Contact: Greg Dawkins

Georgia

J. Leonard Ledbetter, Chair
Georgia Emergency Response Commission
Commissioner, Georgia Department of Natural Resources
205 Butler Street, SE
Floyd Towers East, 11th Floor
Atlanta, GA 30334
(404) 656-4713

Section 302, 304, 311/312, and 313 Submissions:
Jimmy Kirkland
Georgia Emergency Response Commission
205 Butler Street, SE
Floyd Tower East
Atlanta, GA 30334
(404) 656-6905
Emergency release number:
(800) 241-4113

Guam

State Commission and Section 311/312 Submissions:
Dr. George Boughton, Chair
Guam State Emergency Response Commission
Civil Defense
Guan Emergency Services Office
Government of Guam
P.O. Box 2877
Aguana, Guam 96910
(671) 734-3410

EXHIBIT 10 (continued)

Section 313 Submissions:
Roland Solidio
Guam EPA
P.O. Box 2999
Aguana, Guam 96910
(671) 646-8863

Hawaii

State Commission and Section 311/312 Submissions:
Bruce S. Anderson, Ph.D., Vice Chair
Hawaii Emergency Response Commission
Hawaii Department of Health
P.O. Box 3378
Honolulu, HI 96801
(808) 548-2076
(808) 548-5832
Contact: Samir Araman (808) 548-5832
Mark Ingoglia (808) 548-2076

Section 313 Submissions:
John C. Levin, M.D., Chair
Hawaii State Emergency Response Commission
Hawaii State Department of Health
P.O. Box 3378
Honolulu, HI 96801-9904
(808) 548-6505

Idaho

State Commission:
Idaho Emergency Response Commission
Department of Health and Welfare
State House
Boise, ID 83720
(208) 334-5888

Section 311/312 & 313 Submissions:
Jenny Records
Idaho Emergency Response Commission
State House
Boise, ID 83720
(208) 334-5888

Illinois

State Commission and Section 311/312 Submissions:
Oran Robinson
Illinois Emergency Response Commission
Illinois Emergency Services and Disaster Agency
Attn: Hazmat Section
110 East Adams Street
Springfield, IL 62706
(217) 782-4694

Section 313 Submissions:
Joe Goodner
Emergency Planning Unit
Illinois EPA
P.O. Box 19276
2200 Churchill Road
Springfield, IL 62794-9276
(217) 782-3637

Indiana

Skip Powers, Director
Indiana Emergency Response Commission
5500 West Bradbury Avenue
Indianapolis, IN 46241
(317) 243-5176

Iowa

State Commission and Section 302 Submissions:
Ellen Gordon, Co-Chair
Iowa Emergency Response Commission
Iowa Disaster Services
Hoover Building, Level A
Room 29
Des Moines, IA 50319
(515) 281-3231

Section 304 Submissions:
Air Quality and Solid Waste Protection Bureau
Department of Natural Resources
Wallace Building, 5th Floor
Des Moines, IA 50319
(515) 281-8694
Contact: Pete Hamlin

Section 311/312 Submissions:
Iowa Emergency Response Commission
Iowa Division of Labor
1000 East Grand Avenue
Des Moines, IA 50319
(515) 281-6175
Contact: Don Peddy

Section 313 Submissions:
Department of Natural Resources
Records Department
900 East Grand Avenue
Des Moines, IA 50319
(515) 281-6175
Contact: Don Peddy

EXHIBIT 10 (continued)

Kansas

State Commission:
Karl Birns, Staff Director
Kansas Emergency Response Commission
Building 740, Forbes Field
Topeka, KS 66620
(913) 296-1690

Section 302 and 304 Submissions:
Karl Birns
Kansas Department of Health and Environment
Right-to-Know Program
Building 740, Forbes Field
Topeka, KS 66620
(913) 296-1690
Emergency release number only (24 hours):
(913) 296-3176

Section 311/312 and 313 Submissions:
Right-to-Know Program
Kansas Department of Health and Environment
Building 740, Forbes Field
Topeka, KS 66620-7430
(913) 296-1690
Contact: Karl Birns

Kentucky

State Commission and Section 311/312 Submissions:
Colonel James H. "Mike" Molloy, Chair
Kentucky Emergency Response Commission
Kentucky Disaster and Emergency Services
Boone National Guard Center
Frankfort, KY 40601-6168
(502) 564-8660
(502) 564-8682
Contact: Mike Molloy or Craig Martin

Section 313 Submissions:
Valerie Hudson
Kentucky Department of Environmental Protection
18 Reilly Road
Frankfort, KY 40601
(502) 564-2150

Mailing Address:
Lucille Orlando
SARA Title III
Kentucky Department of Environmental Protection
Kentucky Disaster and Emergency Services
Boone National Guard Center
Frankfort, KY 60601-6161

Louisiana

State Commission and Section 311/312 Submissions:
Sgt. Ronnie Mayeaux
Louisiana Emergency Response Commission
Office of State Police
P.O. Box 66614
Baton Route, LA 70896
(504) 925-6113

Section 313 Submissions:
R. Bruce Hammatt
Emergency Response Coordinator
Department of Environmental Quality
P.O. Box 44066
Baton Rouge, LA 70804-4066
(504) 342-8932

Maine

David D. Brown, Chair
State Emergency Response Commission
Station Number 72
Augusta, ME 04333
(207) 289-4080
In Maine: (800) 452-8735
Contact: Tammy Gould

Maryland

State Commission:
June L. Swem
Governor's Emergency Management Agency
c/o Maryland Emergency Management Agency
2 Sudbrook Lane, East
Pikesville, MD 21208
(301) 486-4422

Section 302, 304, 311/312, and 313 Submissions:
Marsha Ways
State Emergency Response Commission
Maryland Department of the Environment
Toxics Information Center
2500 Broening Highway
Baltimore, MD 21224
(301) 631-3800

EXHIBIT 10 (continued)

Massachusetts

Arnold Sarpenter
c/o Title III Emergency Response Commission
Department of Environmental Quality Engineering
One Winter Street, 9th Floor
Boston, MA 02108
(617) 292-5810
For LEPC information: Jack Callahan
(508) 820-2060

Michigan

Title III Coordinator
Michigan Department of Natural Resources
Environmental Response Division
Title III Notification
P.O. Box 30028
Lansing, MI 48909
(517) 373-8481

Minnesota

Lee Tischler, Director
Minnesota Emergency Response Commission
Department of Public Safety
Room B-5
State Capitol
St. Paul, MN 55155
(612) 296-0488

Mississippi

J.E. Maher, Chair
Mississippi Emergency Response Commission
Mississippi Emergency Management Agency
P.O. Box 4501, Fondren Station
Jackson, MS 39296-4501
(601) 960-9973
Contact: Bill Austin

Missouri

Dean Martin, Coordinator
Missouri Emergency Response Commission
Missouri Department of Natural Resources
P.O. Box 3133
Jefferson City, MO 65102
(314) 751-7929

Mailing Address:
Dean Martin
Missouri Emergency Response Commission
Missouri Department of Natural Resources
2010 Missouri Boulevard
Jefferson City, MO 65109

Montana

Tom Ellerhoff, Co-Chair
Montana Emergency Response Commission
Environmental Sciences Division
Department of Health & Environmental Sciences
Cogswell Building A-107
Helena, MT 59620
(406) 444-3948

Nebraska

Clark Smith, Coordinator
Nebraska Emergency Response Commission
Nebraska Department of Environmental Control
P.O. Box 98922
State House Station
Lincoln, NE 68509-8922
(402) 471-4217

Nevada

State Commission and Section 311/312 Submissions:
Joe Quinn
Nevada Division of Emergency Management
2525 South Carson Street
Carson City, NV 89710
(702) 885-4240
Emergency release number (after hours and weekends):
(702) 885-5300

Section 313 Submission:
Bob King
Division of Emergency Management
2525 South Carson Street
Carson City, NV 98710
(702) 885-4240

New Hampshire

Richard Strome, Director
State Emergency Management Agency
Title III Program
State Office Park South
107 Pleasant Street
Concord, NH 03301
(603) 271-2231
Contact: Leland Kimball

EXHIBIT 10 (continued)

New Jersey

State Commission:
Tony McMahon, Director
New Jersey Emergency Response Commission
SARA Title III Project
Department of Environmental Protection
Division of Environmental Quality
CN-405
Trenton, NJ 08625
(609) 292-6714

Section 302, 304, and 311/312 Submissions:
New Jersey Emergency Response Commission
SARA Title III Project
Department of Environmental Protection
Division of Environmental Quality
Bureau of Hazardous Waste Information
CN-405
Trenton, NJ 06825
(609) 292-6714

Section 313 Submissions:
New Jersey Emergency Response Commission
SARA Title III Section 313
Department of Environmental Protection
Division of Environmental Quality
Bureau of Hazardous Waste Information
CN-405
401 East State Street
Trenton, NJ 08625
(609) 292-6714

New Mexico

Samuel Larcombe
New Mexico Emergency Response Commission
New Mexico Department of Public Safety
P.O. Box 1628
Santa Fe, NM 87504-1628
(505) 827-9222

New York

State Commission:
Anthony Germain, Deputy Director
State Emergency Management Office
Building 22
State Campus
Albany, NY 12226
(518) 547-9994

Section 302, 304, 311/312, and 313 Submissions:
New York Emergency Response Commission
New York State Department of Environmental Conservation
Bureau of Spill Response
50 Wolf Road/Room 326
Albany, NY 12233-3510
(518) 457-4107
Contact: William Miner

North Carolina

State Commission:
Joseph Myers, Chair
North Carolina Emergency Response Commission
116 West Jones Street
Raleigh, NC 27603-1335
(919) 733-3867

Section 302, 304, 311/312, and 313 Submissions:
North Carolina Emergency Response Commission
North Carolina Division of Emergency Management
116 West Jones Street
Raleigh, NC 27603-1335
(919) 733-3867
In North Carolina: (800) 451-01403
General information only
Contacts: Vance Kee (919) 733-3844
Emily Kilpatrick (919) 733-3865
Darian Maylory (919) 733-3890

North Dakota

State Commission:
Ronald Affeldt, Chair
North Dakota Emergency Response Commission
Division of Emergency Management
P.O. Box 5511
Bismark, ND 58502-5511
(701) 224-2111

EXHIBIT 10 (continued)

Section 302, 311/312, and 313 Submissions:
SARA Title III Coordinator
North Dakota State Department of Health and Consolidated Laboratories
1200 Missouri Avenue
P.O. Box 5520
Bismarck, ND 58502-5520
(701) 224-2374
Contact: Charles Rydell

Commonwealth of Northern Mariana Islands

State Commission and Section 311/312 Submissions:
Felix A. Sasamoto, Civil Defense Coordinator
Office of the Governor
Capitol Hill
Commonwealth of Northern Mariana Islands
Saipan, CNMI 96950
International # (670) 322-9529

Section 313 Submissions:
Russel Meecham, III
Division of Environmental Quality
P.O. Box 1304
Saipan, CNMI 96950
(670) 234-6984

Ohio

State Commission and Section 311/312 Submissions:
Ken Schultz, Coordinator
Ohio Emergency Response Commission
Ohio EPA
Office of Emergency Response
P.O. Box 1049
Columbus, OH 43266-0149
(614) 644-2260

Section 313 Submissions:
Cindy Sferra-DeWulf
Division of Air Pollution Control
1800 Watermark Drive
Columbus, OH 43215
(614) 644-2270

Oklahoma

Jack Muse, Coordinator
Emergency Response Commission
Office of Civil Defense
P.O. Box 53365
Oklahoma City, OK 73152
(405) 521-2481
Contact: Aileen Ginther

Oregon

Ralph M. Rodia
Oregon Emergency Response Commission
C/O State Fire Marshall
3000 Market Street Plaza
Suite 534
Salem, OR 97310
(503) 378-2885

Pennsylvania

State Commission:
Sanders Courtner
PA Emergency Response Commission
SARA Title III Officer
PEMA Response and Recovery
P.O. Box 3321
Harrisburg, PA 17105
(717) 783-8150
(717) 783-8193
Emergency Release Number
(24 hrs): (717) 783-8150

Section 311/312 Submissions:
PA Emergency Response Commission
C/O Bureau of Right-to-Know
Room 1503
Labor and Industry Building
7th & Forrester Streets
Harrisburg, PA 17120
(717) 783-2071

Section 313 Submissions:
James Tinney
C/O Bureau of Right-to-Know
Room 1503
Labor and Industry Building
7th & Forrester Streets
Harrisburg, PA 17120
(717) 783-8150

EXHIBIT 10 (continued)

Puerto Rico

State Commission and Section 311/312 Submissions:
Mr. Santos Rohena, Chair
PR Emergency Response Commission
Environmental Quality Board
P.O. Box 11488
Sernades Juncos Station
Santurce, PR 00910
(809) 722-1175
(809) 722-2173

Section 313 Submissions:
SERC Commissioner
Title III-SARA Section 313
PR Environmental Quality Board
P.O. Box 11488
Santurce, PR 00910
(809) 722-0077

Rhode Island

State Commission:
Joseph A. DeMarco, Exec. Director
Rhode Island Emergency Response Commission
Rhode Island Emergency Management Agency
State House Room 27
Providence, RI 02903
(401) 277-3039
Emergency release number:
(401) 274-7745

Section 311/312 Submissions:
Lynn Colby
Rhode Island Department of Labor
Division of Occupational Safety
220 Elmwood Avenue
Providence, RI 02907
(401) 457-1847

Section 313 Submissions:
Department of Environmental Management
Division of Air and Hazardous Materials
291 Promenade St.
Providence, RI 02908
Attn: Toxic Release Inventory
(401) 277-2808
Contact: Martha Mulcahy

South Carolina

State Commission and Section 302 Submissions:
Stan M. McKinney, Chair
South Carolina Emergency Response Commission
Division of Public Safety Programs
Office of the Governor
1205 Pendleton Street
Columbia, SC 29201
(803) 734-0425

Section 304, 311/312 Submissions:
Purdy McLeod
South Carolina Emergency Response Commission
Division of Public Safety Programs
Office of the Governor
1205 Pendleton Street
Columbia, SC 29201
(803) 734-0425

Section 313 Submissions:
Ron Kinney
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
(803) 734-5200

South Dakota

State Commission and Section 311/312 Submissions:
Clark Haberman, Director
SD Emergency Response Commission
Department of Water and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181
(605) 773-3151

Section 313 Submissions:
Lee Ann Smith, Director
South Dakota Emergency Response Commission
Department of Water and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181
(605) 773-3153

EXHIBIT 10 (continued)

Tennessee

Lacy Suiter, Chair
Tennessee Emergency Response Commission
Director, Tennessee Emergency Management Agency
3041 Sidco Drive
Nashville, TN 37204
(615) 252-3300
Outside of Tennessee: (800) 258-3300
In Tennessee: (800) 262-3300
Contact: Lacy Suiter
Tom Durham

Texas

State Commission:
Mike Scott, Coordinator
Texas Emergency Response Commission
Division of Emergency Management
P.O. Box 4087
Austin, TX 78773-0001
(512) 465-2138

Section 302, 311/312 Submissions:
Dr. William Elliot
Texas Department of Health
Division of Occupational Safety and Health
1100 West 49th Street
Austin, TX 78756
(512) 458-7410

Section 313 Submissions:
David Barker, Supervisor
Emergency Response Unit
Texas Water Commission
P.O. Box 13087
Capitol Station
Austin, TX 78711-3087
(512) 463-8527
Contact: Priscilla Seymour

Utah

State Commission:
Lorayne Tempest-Frank, Director
Comprehensive Emergency Management
P.O. Box 58136
Salt Lake City, UT 84108-0136
(801) 533-5271

Section 311/312 and 313 Submissions:
Neil Taylor
Utah Hazardous Chemical Emergency Response Commission
Utah Division of Environmental Health
P.O. Box 16690
Salt Lake City, UT 84116-0690
(801) 538-6121

Vermont

State Commission:
Jeanne VanVlandren, Chairman
Vermont Emergency Response Commission
Department of Labor and Industry
120 State Street
Montpelier, VT 05602
(802) 828-2286
Contact: Robert McLeod
(802) 828-2765

Section 311/312 & 313 Submissions:
Dr. Jan Carney, Deputy Commissioner
Department of Health
60 Main Street
P.O. Box 70
Burlington, VT 05402
(802) 863-7281

Virgin Islands

Allan D. Smith, Commissioner
Department of Planning and Natural Resources
U.S. Virgin Islands Emergency Response Commission
Title III
Suite 231, Nisky Center
Charlotte Amalie
St. Thomas, VI 00802
(809) 774-3320 Extension 169 or 170
Contact: Gregory Rhymer

Virginia

Wayne Halbleib, Director
Virginia Emergency Response Council
Department of Waste Management
James Monroe Building
18th Floor
101 North 14th Street
Richmond, VA 23219
(804) 225-2513

EXHIBIT 10 (continued)

Washington

Chuck Clarke
Washington Emergency Response Commission
Department of Community Development
Mail Stop GH-51
9th and Columbia Blvd.
Olympia, WA 98504
(206) 753-5625
Contact: In Washington: (800) 633-7585
Bill Bennett (206) 459-9191

West Virginia

State Commission and Section 311/312 Submissions:
Carl L. Bradford, Director
West Virginia Emergency Response Commission
West Virginia Office of Emergency Services
State Office Building, EB-30
Charleston, WV 25305
(304) 348-5380
Emergency release number: (304) 348-5380
Contact: Bill Jopling

Wisconsin

State Commission
Richard I. Braund, Director
Wisconsin Emergency Response Commission
Division of Emergency Government
4802 Sheboygan Avenue
P.O. Box 7865
Madison, WI 53707
(608) 266-3232

Section 313 Submissions:
Russ Dumst
Department of Natural Resources
P.O. Box 7921
Madison, WI 53707
(608) 266-9255

Wyoming

Ed Usui, Executive Secretary
Wyoming Emergency Response Commission
Wyoming Emergency Management Agency
Comprehensive Emergency Management
P.O. Box 1709
Cheyenne, WY 82003
(307) 777-7566
Contact: Brooke Hefner

Mailing Address:
Ed Usui
Wyoming Emergency Response Commission
Wyoming Emergency Management Agency
Comprehensive Emergency Management
5500 Bishop Boulevard
Cheyenne, WY 82009

EXHIBIT 11 - STATE/LOCAL POISON CONTROL CENTERS

Alabama Poison Center
205-345-0600
800-462-0800 (AL only)

Arizona Poison Control System
602-626-7899
602-626-6016 (Tucson)
602-253-3334 (Phoenix)
800-362-0101 (AZ only)

Blodgett Regional Poison Center
616-774-7854
800-442-4571 (616 area code only)
800-632-2727 (MI only)

Cardinal Glennon Children's Hospital Regional Poison Center
314-772-8300
314-772-5200
800-392-9111 (MO only)

Central Ohio Poison Center
614-461-2012
614-228-1323
800-682-7625 (OH only)

Duke Univ. Poison Control Center
919-684-8111
919-684-4438
800-672-1697 (NC only)

Georgia Poison Control Center
404-589-4400
800-282-5846 (GA only)
404-525-3323 (TTY)

Hennepin Regional Poison Center (Minnesota)
612-347-3144
612-347-3141
612-347-6219 (TTY)

Kentucky Regional Poison Center of Kosair Children's Hospital
502-562-7253
502-589-8222
800-722-5725 (KY only) (TDD)

Long Island Regional Poison Control Center
516-542-3707
516-542-2323

Los Angeles County Medical Association Regional Poison Control Center
213-664-1212
213-484-5151

Louisiana Regional Poison Control Center
318-674-6364
318-425-1524
800-535-0525 (LA only)

Maryland Poison Center
301-528-7604
301-528-7701

Massachusetts Poison Control System
617-735-6607
617-232-2120
800-682-9211 (MA only)

Michigan Poison Control Center
313-745-5329
313-745-5711
800-462-6642 (313 area code only)
800-572-1655 (remainder of MI)

Mid-Plains Poison Center
402-390-5434
402-390-5400
800-642-9999 (NE only)
800-228-9515 (surrounding states)

EXHIBIT 11 (continued)

Intermountain Regional Poison Control Center
801-581-7504
801-581-2151
800-662-0062 (UT only)

Minnesota Regional Poison Center
612-221-2113
800-222-1222 (MN only)

National Capital Poison Center
202-625-6073
202-625-3333

New Jersey Poison Information and Education System
201-926-7443
201-923-0764
800-962-1253 (NJ only)

New Mexico Poison and Drug Information Center
505-277-4261
505-843-2551
800-432-6866 (NM only)

New York City Poison Control Center
212-340-4497
212-340-4494

North Central Texas Poison Center
214-920-2586
916-453-3692
214-920-2400
800-441-0040 (TX only)

Oregon Poison Control and Drug Information Center
503-225-7799
503-225-8968 (Portland, OR)
800-452-7165 (OR only)

Pittsburgh Poison Center
412-647-5600
412-681-6669

Rhode Island Poison Center
401-277-5906
401-277-5727
612-221-3096

Rocky Mountain Poison Center
303-893-7774
303-629-1123
800-332-3073 (CO only)
800-525-5042 (MT only)
800-442-2702 (WY only)

San Diego Regional Poison Center
619-294-3666
619-294-6000

San Francisco Bay Area Regional Poison Control Center
415-821-8324
415-476-6600

Southwest Ohio Regional Poison Control System
513-872-5111
800-872-5111

Tampa Bay Regional Poison Control Center
813-251-6911
813-253-4444
800-282-3171

Texas State Poison Center
409-761-3332
409-765-1420
713-654-1701 (Houston)
516-478-4490 (Austin)
800-392-8548 (TX only)

EXHIBIT 11 (continued)

UCMC Regional Poison Control Center
916-453-3414

West Virginia Poison Center
304-347-1212
304-348-4211
800-642-3625

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