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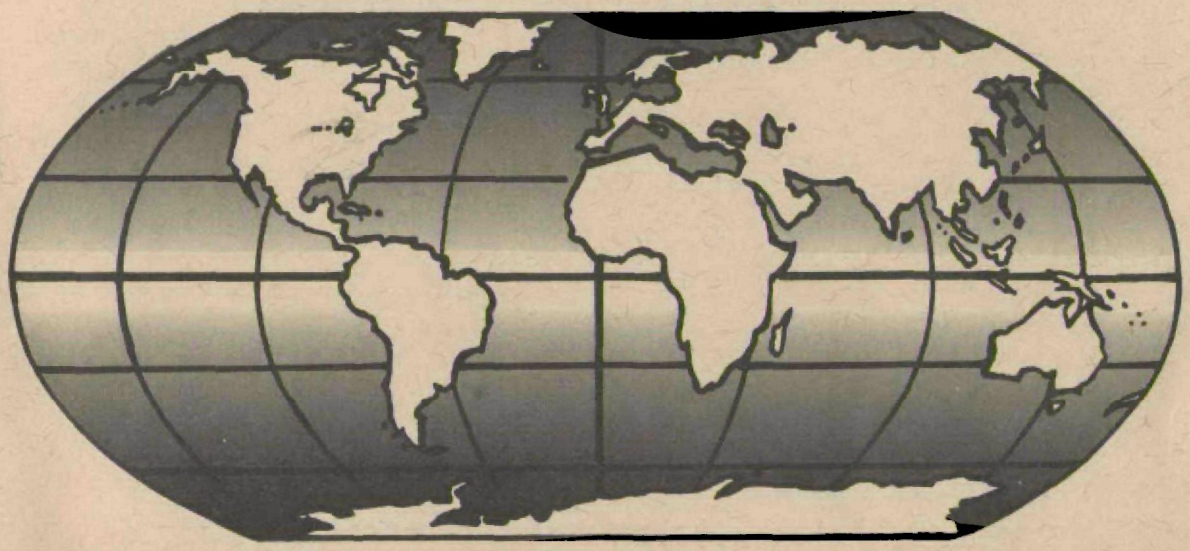

International Conference on Reporting Releases of Toxic Chemicals

November 13–15, 1991 • Vienna, Austria

Sponsored by the

Office of Prevention, Pesticides, and Toxic Substances
U.S. Environmental Protection Agency

in conjunction with the

Organization for Economic Cooperation and Development

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Contents

Introduction v

Toxics Release Inventory: Environmental Information for Government, Industry, and the Community

An Overview of the United States' Toxics Release Reporting Program 3
Mary Ellen Weber

An Introduction to the Data 9
Linda A. Travers

Other Perspectives on Toxics Release Reporting

Canada's Green Plan and the National Pollutant Release Inventory 19
Gordon Pope

A Public Interest Group Perspective 27
Gerald V. Poje

An Industry Perspective on Reporting Releases of Toxic Chemicals 33
Elizabeth A. Fisher

Breakout Sessions

Implementation and Program Issues of the U.S. Toxics Release Inventory (TRI) 41
Mary Ellen Weber, Sam Sasnett, Warren R. Muir, Earl R. Beaver, and Robert Costa

Information Management 45
Linda Travers, Steven D. Newburg-Rinn, Gerald V. Poje, and Robert Wevodau

Computer Tools for TRI Analysis 49
Loren Hall, Robert Palmer, and Gary Hamilton

Data Use and Analysis

Setting Environmental Priorities with the Toxics Release Inventory 55
Mary Ellen Weber

Air Quality and the TRI 57
Denise Devoe

The Toxics Release Inventory — American Journalism's New Arrow in the Quiver 65
Bud Ward

Initiatives Generated by the TRI

Industry Initiatives at the Community Level 71
Earl R. Beaver

Local Initiatives in TRI Reporting: The *SCORECARD* Model 75
Paul L. Hill

Public Initiatives at the National Level 79
Warren Muir

Public Interest Group Initiatives at the Local Level 83
Ted Smith

Closing Plenary

Implications of Toxics Release Reporting for Other Countries 91
Richard P. Wells, Shinichi Arai, Andrew Lees, Hans-Peter Baars, Christopher Ian Pickard, Jack Holland, and Mariá Kazmuková

List of Attendees 97

Introduction

In 1991, the U.S. Environmental Protection Agency and the Organization for Economic Cooperation and Development jointly sponsored the International Conference on Reporting Releases of Toxic Chemicals to demonstrate the uses and applications of the Toxics Release Inventory, the United States' national database of toxic chemical releases to the environment. Held in Vienna, Austria, this conference brought together 104 delegates from western and central European nations, Australia, Canada, Japan, and the United States.

As a result of a major chemical accident at Bhopal, India, in 1984, and the commitment of public interest groups to assure that the public would be provided with information about chemicals in their communities, the U.S. Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA) in November 1986. EPCRA has two main purposes: prepare communities for chemical emergencies that result from accidental releases and provide the public with information on chemicals stored on-site and on chemical releases to the environment.

The conference explored one facet of EPCRA, the requirement that manufacturing facilities provide the government with annual reports on their releases of toxic chemicals to the environment. This section of EPCRA, known as the Toxics Release Inventory (TRI), also requires that data be made available to the public. The pollutants covered under EPCRA have the potential of causing acute or chronic health effects and/or environmental hazards. Data collected for TRI include the types of toxic chemical releases; estimates of the amounts released into the air, water, and ground; estimates of the amounts of waste transported to other sites; and reports on how chemical wastes are treated on-site. Since 1987, the United States has required manufacturing facilities that meet certain criteria to submit annual reports on the specified toxic chemicals that their facilities routinely or accidentally release into the environment.

The Toxics Release Inventory allows the government, industry, and the public to estimate the annual emissions of certain chemicals in a specific geographic region. This information, in turn, gives organizations the ability to substantiate the need for further investigations and/or regulatory action, examine environmental risks at the national and local level, and influence the sources of industrial pollution.

The International Conference on Reporting Releases of Toxic Chemicals was designed to:

- demonstrate the usefulness of a TRI system,
- provide participants with the basic information necessary to build their own emissions database programs, and
- encourage the sharing of toxics release information between governments.

Structure of the Conference

The conference was geared toward environmental policymakers, technical staff (such as toxicologists and chemical engineers), risk assessment managers, information systems staff, and health professionals. A wide range of topics was covered, with a concentration on the analytical potential of the TRI, computer modelling capabilities, and implementation and programmatic uses.

The first plenary session described basic information about TRI and presented the Canadian, public interest, and industry perspective. The second plenary session presented information on the use and analysis of data as well as industry, news media, and public interest group initiatives generated by the TRI.

To facilitate smaller group discussions, three concurrent breakout sessions were held: Implementation and Program Issues of the U.S. Toxics Release Inventory; Information Manage-

ment; and Computer Tools for TRI Analysis. All of the breakout sessions were repeated three times during the conference, allowing the participants to attend each session. The breakout sessions included presentations and a question and answer period. In addition, there were ongoing demonstrations of how TRI data are made available through various sources, including computer programs used in analyzing toxics release data.

The conference concluded with a session on the implications of toxics release reporting for other countries. Representatives from four countries — The Netherlands, the United Kingdom, Australia, and Czechoslovakia — and from two multinational organizations — the Organization for Economic Cooperation and Development and Friends of the Earth — served as panelists to provide a global perspective on TRI-like concepts.

Organization of this Document

The papers contained in this proceedings are given in the order in which they were presented at the conference. These papers are transcripts of the presentations. The issues, comments, and common themes raised during each of the three breakout sessions have been summarized by the moderator or a panel member.

Toxics Release Inventory: Environmental Information for Government, Industry, and The Community

An Overview of the United States' Toxics Release Reporting Program

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ABSTRACT

The Toxics Release Inventory (TRI) is the first database ever created in the United States that combines information regarding releases of pollutants to air, water, land, and underground injection on a chemical-by-chemical and facility-by-facility basis. This presentation will describe the origins of the TRI, the concept of public access to environmental information in the United States, and the reporting requirements in terms of which chemicals, companies, and types of information are collected. It will discuss the data that have been reported and the resources needed by government, the public, and industry to design and implement such a program.

I am the director of the Economics and Technology Division in the U.S. Environmental Protection Agency's Office of Pollution Prevention and Toxics. My division is responsible for writing the regulations that design and implement the Toxics Release Inventory, which we often call the TRI.

The second speaker this morning is Linda Travers, who is my partner in Toxics Release Inventory activities. As the director of the Information Management Division, she makes sure that the data are collected, properly entered into a computerized database, managed, and then made available to interested parties.

On behalf of the U.S. Environmental Protection Agency, I would like to thank the Organization for Economic Cooperation and Development (OECD) for encouraging us to have this conference. I would also like to thank in advance the many speakers who will share their knowledge of and history with the Toxics Release Inventory in the United States.

We are privileged to have more than 20 countries represented here today. I recognize that English may be a problem for some of you and am sorry we cannot provide translators. We want to make this an informal exchange of information and ideas, so do not hesitate to interrupt speakers if you do not understand what they are saying.

The United States, as many countries, is facing stiff challenges to its environmental policy. The protection of the environment is no longer a passing fad; it has become a major public policy priority. EPA's administrator, William Reilly, noted recently that the environment is moving from the margins of public policy to the center. It is now relevant in public policy areas where it never was before, such as trade, international economic policy, and foreign aid, and also in critical relations with many other important countries, including Canada, Central Europe, Brazil, and India, most of whom are represented here today.

The environment is newly relevant even to issues of war and peace, as witnessed by our con-

cerns over the Kuwait oil spills and, of course, the oil well fires.

Over a hundred years ago, a great conservationist, Gifford Pinchot, stated that a nation deprived of liberty may win it; a nation that is divided may unite. But a nation whose natural resources are destroyed must inevitably pay the price: the penalties of poverty, degradation, and decay.

There is a vital link between a prosperous economy and healthy environment. Countries have been ravaged by pollution. The air in some of the larger cities is easier to see than it is to breathe. And workers whose labor has contributed to strengthening their countries' economies are falling prey to a host of preventable health problems caused or made worse by tremendous pollution. Even vast agricultural areas have become contaminated wastelands.

Protecting the environment and public health is expensive but not doing so costs much more. We estimate that the United States is spending about 1.7 percent of its gross national product to protect and clean up our environment — about $115 billion. Many countries are doing more: Germany and Canada, for example. The Netherlands has made a policy choice to spend up to 4 percent of its gross national product to protect the environment. We are delighted to have these countries represented here today.

We are learning that it is more economical to prevent pollution than to try to clean it up. Pollution prevention will be one of the major themes in all of the presentations at this conference.

The idea of preventing rather than curing environmental problems has revolutionized environmental policy in the United States. It has altered the way our government approaches the environment, changed the way business views its own interests and responsibilities toward the environment, and stimulated environmental awareness and action by workers, students, and consumers. International cooperation is more important now than ever because each of our countries has limited resources and many demanding public needs.

One of the ways to make productive use of our environmental resources is to extend cooperative relationships in other areas of public policy, such as security, trade, or foreign aid, to the area of environmental policy. Many of us are already actively involved in OECD endeavors to harmonize chemical testing and classification protocols. And one of the goals of this conference is to encourage the availability of toxics release information across national borders because pollution knows no boundaries.

Besides TRI, a number of other established environmental database systems have demonstrated the benefits of cooperation: the Global Environmental Modelling System, Global Resource Information Database, International Registry of Potentially Toxic Chemicals, and the International Referral System. The Earthwatch Program, another ambitious international surveillance system, monitors current conditions and changes in the environment and serves as a global early warning system.

Sharing this information between governments has been very useful. An increased understanding of the environment and the impact of our daily activities helps us find new options for protecting our world. The Toxics Release Inventory program in the United States has proven that sharing environmental information with the public can improve environmental decisionmaking.

Our purpose in this conference is not to suggest that, to be useful, an emissions database must be exactly like the TRI either in content or in size. We do, however, believe that some common elements would be important in designing any toxic release emission database for your countries.

We will show you what we have learned about the need for flexibility and expandability of the kinds of data and the numbers of reports a system can manage. We will discuss the desirability of common chemical definitions and classifications to establish consistent reporting within a country across its economic sectors and also across boundaries. Some countries, as you will hear, are starting out with systems that have much broader coverage than the TRI. Others may choose to start on a smaller scale and grow over time. But in any event, we are interested in learning from you what we have in common and what you perceive to be the special needs of your applications of the TRI.

Background on TRI

In 1986, the TRI was enacted as part of the Emergency Planning and Community Right-to-Know Act (EPCRA) by the United States Congress and

signed into law by President Ronald Reagan. It is the first publicly available database of toxic releases to all media simultaneously, including air, water, land, and underground storage. Its purpose is to provide citizens with more accurate information about their environment so they can make more educated decisions about how to manage it.

TRI has been one of the most powerful environmental policy tools ever wielded by a nation's people. Subsequent sessions will focus on how government, industry, the press, and the public have used TRI information to target resources and influence policy. The TRI has already been discussed at many international meetings, and other nations' interest in it continues to grow, as witnessed by this conference. You will hear about other countries' initiatives in more detail and what different groups are doing to create similar reporting systems.

In the late 1970s and early 1980s, the United States' government and several states passed laws that gave workers the right to know about hazardous chemicals in the workplace. At about the same time, public interest groups focused on providing communities with information about exposure to chemicals beyond a plant's perimeter.

In December 1984, a terrible tragedy occurred at the Union Carbide plant in Bhopal, India. A deadly cloud of methyl isocyanate gas killed over 2,000 people and injured tens of thousands more. Shortly afterward, a chemical release occurred in West Virginia, a state near Washington, D.C. As a result of increasing demands from the American public to know what hazardous chemicals might be released in their neighborhoods, Congress passed the Emergency Planning and Community Right-to-Know Act.

The act has two major purposes. The first is to prepare communities for chemical emergencies that result from accidental (unexpected and unintended) releases; for example, if a railcar overturns or a plant explodes. The second is to give the public information on approximately 300 chemicals and 20 toxic compounds whose use or production could result in both routine and accidental releases to the environment.

EPCRA has four basic parts. The first three relate to the emergency planning component of the community's right to know, as follows:

1. The emergency planning section of the law helps communities prepare for and respond to emergencies involving hazardous substances by establishing local and state emergency planning groups or committees.
2. EPCRA also requires facilities to notify the community and the state if they release substances accidentally, even if local planning groups did not have to respond to the release.
3. Facilities must report the amounts, location, and potential effects of any of 900 hazardous chemicals they might have on their premises. This information is given to fire departments and state and local governments so, if there is an accident, response teams will know how to deal with the chemicals.

The fourth part of EPCRA, section 313, created the TRI. In general, the Toxics Release Inventory requires that manufacturing facilities compile an annual report to the state in which they reside and the federal government estimating the total amount of chemicals routinely or accidentally released to the environment. EPA is required to input these data into a computer database, and once computerized, the data must be made available to the public through computer telecommunications and other means.

The TRI does not cover all sections or segments of our economy nor does it cover all toxic chemicals. You will hear more about the logic and implications of what is and is not covered under TRI in subsequent presentations and particularly in the breakout sessions. The TRI covers only the manufacturing sector of our economy, which includes 20 broad classes of industrial facilities. For example, it includes papermaking as well as chemical manufacturing, metal processing, and petroleum refining.

EPCRA was designed to minimize the reporting burden on small business. Thresholds were set for manufacture, process, use, and import of listed chemicals that trigger the reporting requirement, and the number of employees. Facilities that manufacture, import, or process 11,400 kilograms (25,000 pounds) or more per year, or use approximately 4,550 kilograms (10,000 pounds) per year of the listed chemicals and have more than 10 employees, must file reports with both EPA and the states.

The original list of chemicals and compounds subject to TRI reporting was compiled by Congress from lists assembled by two states, Maryland and New Jersey. These states had estab-

lished somewhat similar reporting systems before Congress passed the act that created the federal TRI.

The chemicals must be known to cause or be reasonably expected to cause significant acute human health effects at concentrations that are likely to exist not inside the plant but beyond the facility's site boundaries, as a result of continuous or frequently recurring releases. Alternatively, the chemical must be known to cause or be likely to cause chronic health effects such as cancer and teratogenic effects, serious or irreversible reproductive effects, neurological disorders, genetic mutations, or other chronic health effects. Finally, if the chemical is known or expected to cause significant adverse effects on the environment, either because of its toxicity or because of a combination of toxicity and persistence in the environment or toxicity and a tendency to bioaccumulate in the environment, it would meet the listing criteria.

Anyone can petition EPA to add or subtract chemicals from the list. So far, about 40 petitions have been filed to add or delete chemicals. The data are reported in a separate annual report for each chemical that includes an estimate of the annual releases and transfers. This report is due six months after the end of the calendar year in which the releases take place.

The TRI covers all the environmental media. Reports must specify total annual releases or transfers of the chemical to air, water, land, underground storage, publicly owned treatment facilities, and other off-site locations. The facilities report one number for the release of each chemical to each destination. However, they do not have to report their highest daily or peak release nor their daily average, and reported amounts are estimated, not measured or monitored. Facilities are required to report even if they have zero releases of the listed chemical provided they have met the manufacture, process, use, or import threshold and have more than 10 employees.

TRI in the Future

A dynamic system, TRI continues to evolve. During the early years of the TRI program, all of our resources were devoted to getting the program established and working well. More recently, we have been expanding the program in response to demands from public interest groups, industry, Congress, and individual citizens to cover additional chemicals and facilities beyond those in the currently covered manufacturing sector of our economy and provide more specific information (such as on peak release reporting) and other ways to measure the amount of releases that go into the environment.

EPA is working hard to juggle competing demands for its resources. One of the ways we are doing this is by developing criteria for chemical list expansion. We are looking at toxicity requirements, production volumes, and a variety of other things. As you are aware, it is neither a quick nor easy task to identify toxicity characteristics of the thousands of chemicals currently used in commerce or trade. We need help in targeting efforts and developing our review process for the thousands of chemicals that will be available as candidates for TRI expansion.

TRI covers only the manufacturing sector of our economy — primarily industries that deal or can be expected to deal with large quantities of specific chemicals. Some of the sectors being considered for expansion now are mining and, possibly, public utilities, public sewage treatment facilities, chemical warehouses, and commercial painters. Other operations that may represent substantial sources of toxic chemical releases are also being studied.

Another activity in which we are progressing, thanks to Congress, is incorporation of pollution prevention information in TRI reporting requirements. The TRI has, up to now, contained estimates only of releases and transfers of reported chemicals. In 1990, Congress passed the Pollution Prevention Act, which expands data collected under TRI. Starting with the 1991 reporting year, facilities must now estimate the total amount of chemicals entering all waste or released directly to the environment before any recycling treatment or disposal. They will also report estimates of amounts of chemicals recycled on-site and sent off-site for recycling. Other important requirements of the Pollution Prevention Act include company reporting of efforts to identify pollution prevention or source reduction activities and actions facilities take to implement them. Another key feature is the requirement for forecasting: companies must report what they intend to do in the future to make things better, not just tell the public what they did in the past.

Peak release reporting is not dead at EPA. It is another area that we are studying carefully under the general rubrick of looking at what sorts of information make the most sense and are the most

useful for policy decisions by the private as well as the public sector.

And finally, we are engaged in expanding outreach. The more TRI is used, the more useful it becomes to EPA, industry, and U.S. citizens. EPA is continuing to promote the use of TRI by developing tools, booklets, and training programs that describe TRI and discuss how it can be used.

Conclusion

In conclusion, I would like to emphasize that TRI has opened up the decisionmaking process. EPA cannot address all the environmental challenges facing our nation. We do not have the resources to do everything at once, and we need to set priorities to target environmental protection efforts on the basis of opportunities for reducing the most serious risks. Many methods can be used to approach the problem. I will close this presentation by discussing one approach that TRI has fostered.

TRI has opened up the decisionmaking process by providing the same information to all interested parties — government, industry, public interest groups, and individual citizens — at the same time. In a democracy, the support of individual citizens is important to the success of any national endeavor. In our effort to reduce environmental risk, such understanding and support is essential because the causes of and solutions to environmental problems are often linked to individual and societal choices.

Using TRI, EPA has expanded the amount of environmental information available to the public. TRI alone does not provide all the answers that people need to protect the environment, but it helps them ask better questions. An engaged public can often help provide information that supports our technical decisions. An informed public operates less from emotion and more from reason. Negotiation rather than confrontation can result from the opening up of records required under TRI.

We have seen that by encouraging and trusting the public to interpret and work with these TRI data, citizens have become more trusting of the actions of government and industry. Rather than saying, as we used to, trust the government to take care of you or the industries to make the right decision, TRI, in effect, says trust but use these data to participate in and verify environmental policy decisions.

The next few days will be an opportunity for us to learn from each other. I look forward to meeting you all during the sessions and the breakouts and to sharing your ideas and concerns.

An Introduction to the Data

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ABSTRACT

The U.S. Environmental Protection Agency has been collecting toxic chemical release information data since 1988 on the TRI database, the first publicly accessible environmental database in the world. TRI is also the first to cut across environmental media, providing information on releases into the air, water, and soil and off-site transfers of toxic chemicals. Release information is available for over 300 different chemicals and 20 chemical categories from 23,000 facilities, for a total of over 225,000 reports from all three reporting years. TRI has been instrumental in generating new pollution prevention initiatives by focusing attention on specific facilities and in developing new environmental laws and regulations (including the recently passed amendments to the U.S. Clean Air Act), water quality standards, and air toxics regulations in various states. Now that three years of data are available, trends in transfers and emissions of chemicals can be analyzed. Such information as the increases and decreases of carcinogens on a state, county, or even facility level can be extracted to provide officials and the public with the most complete emissions trends available.

I want to welcome you to this international conference on the Toxics Release Inventory. I have been involved in working on TRI now for almost four and a half years, and I want to share some of the lessons we have learned. We also look forward to hearing your concerns and issues during the breakout sessions.

My presentation will give a brief overview of the issues that are related to data management. In the later sessions, we will give more details about how we built the database and all of its implications. I want to spend more time giving you illustrations of how these data can be used to challenge your thinking as you listen to the other speakers and think about how to use this information in your country.

One of the main points that makes the TRI very different from any other database in the United States is that the law specifically mandates that data be collected and made publicly accessible, which has set a precedent for information policy in the United States. After enactment of this law, older regulations were amended and other laws are now being considered with similar provisions so the public will have more access to information.

As Mary Ellen Weber pointed out, the TRI is the first multimedia database that contains water, air, land, storage, and offsite information; therefore, it is unique. Many other databases exist in the United States, but this is the only one explicitly mandated to be publicly available.

Scope of the TRI

The scope of the program, as has been reported, is annual. So far, we have received nearly 85,000 reports per year. Three years of the data are now publicly available in a computer on-line system and in many other products, such as compact disks, diskettes, and papers. A significant amount of data is processed each year. Each form has about 60 data elements with a fairly large amount

of information. We are now processing the fourth year data, which will be publicly available in the spring of 1992.

Currently, we receive data on 300 chemicals and 20 chemical categories from approximately 23,000 facilities each year. One interesting statistic is that eight industries represent about 75 percent of those reports: paper, chemical, plastics, primary metals, fabricated metals, electronics, petroleum, and transportation.

These data are used by a variety of people in a variety of ways, including

- Studies on environmental distribution,
- Multiyear analyses,
- Geographic distribution analyses,
- Individual chemical analyses, and
- Studies on the distribution of carcinogens.

Many companies are deciding to make dramatic voluntary reductions in their toxic releases. Citizens are beginning to study the releases of chemicals in their communities. Good neighbor contracts are being established between industry and citizens. These data are used at the national level and the state and local level to enact voluntary programs and write new legislation within states. This activity has created a strong demand for other types of analyses and information tools. Some demonstrations during this conference will show how this information can be used with other sources, such as population data, and in what we call geographic information systems.

Other types of analyses are being conducted as well. Geographic distribution lets you look at chemicals at different sites, states, and locations that intersect with the population to give you a better understanding of all the analyses that can be performed.

The following figures start at an aggregated level of information that shows distribution of multimedia releases across the United States. These data are often used at the national level to target strategies for enforcement.

Trends

Now that we have three years of data, we can start looking at trends. In Figure 1, you can see the 1987 level, which is the bar to the left, the 1988 level (the center bar), and the 1989 level, which is the bar on the right. This information helps people to focus questions and resources. Which facilities reported in 1989 that did not report in 1987? Is industrial production increasing or decreasing in an area? We are now beginning to perform trend analyses with these TRI data.

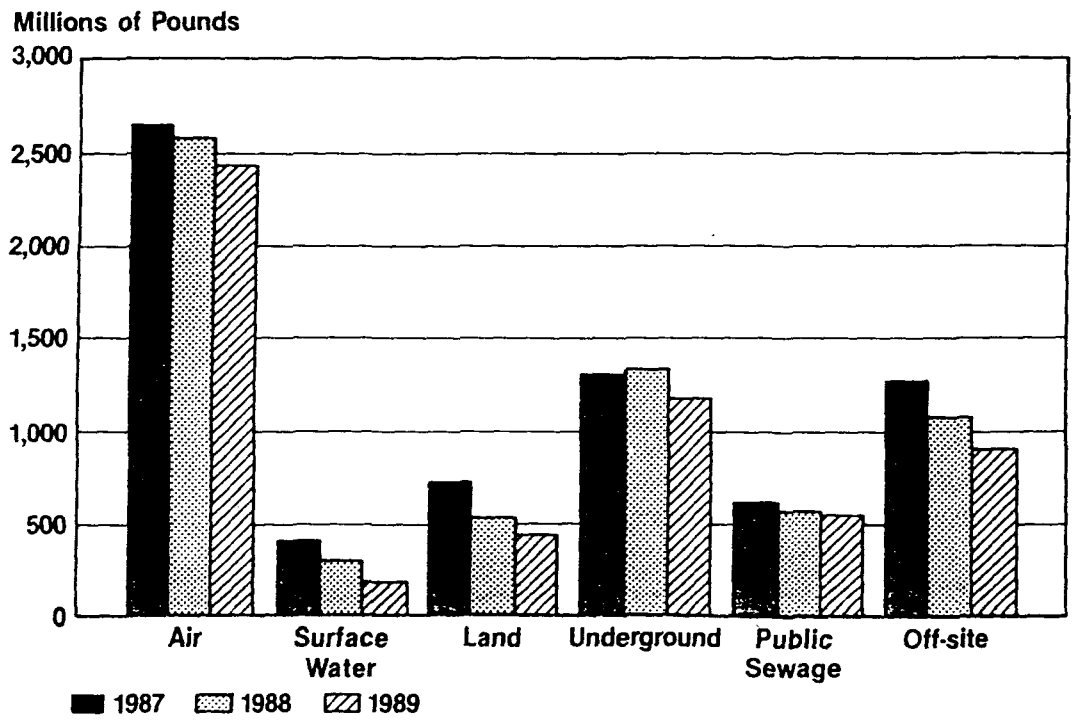


Figure 1.—Changes in releases and transfers of chemicals: 1987-89.

Figure 2 shows the differences between the total releases from 1988 to 1989. If you think about this in terms of our states, you can see that a significant number, about a third, had decreases in toxic release inventories or transfers of greater than one million pounds. Two states, Texas and Louisiana, had decreases in their releases but were still ranked first and second in overall releases.

You can take the analysis down to another level and look at data on the county level in the United States. Figure 3 shows the top 100 counties with the largest releases and transfers in 1989. Again, the data help both the state and national level policymakers to set priorities and focus resources to make determinations about how they want to work with industry to control emissions.

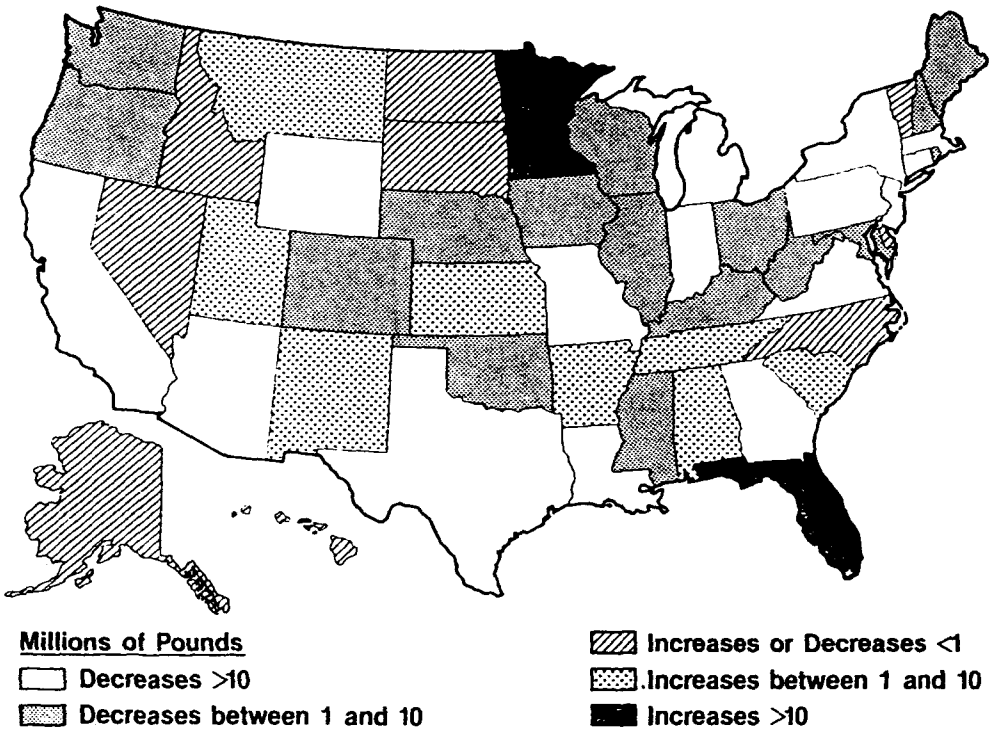


Figure 2.—Changes in TRI total by state: 1988-89.

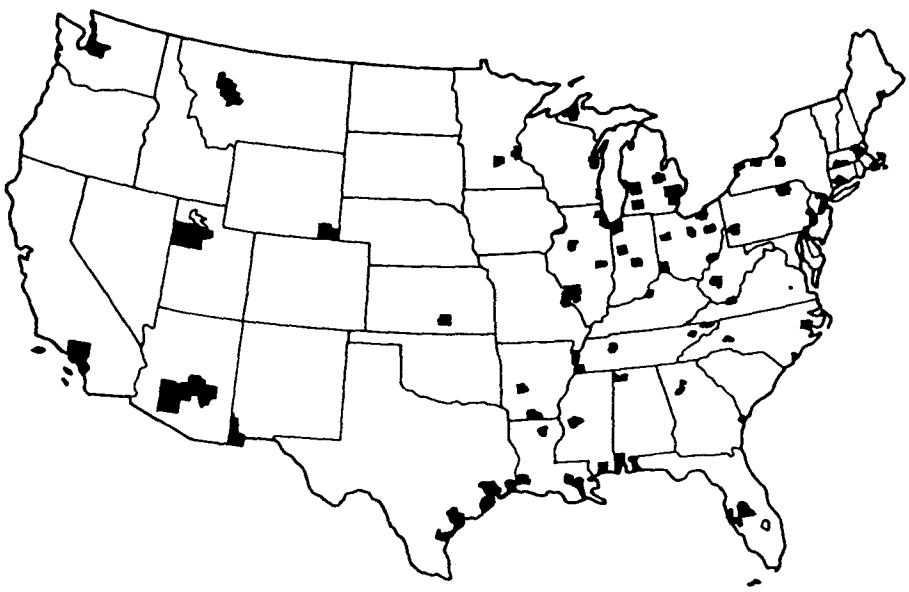


Figure 3.—Top 100 counties for TRI total releases and transfers: 1989.

You can also examine the counties that have the most change from 1988 to 1989. Figure 4 indicates the 50 counties with largest increases and the 50 with the greatest decreases. You can begin to make comparisons and decisions about how to focus resources.

Figure 5 is the list of the top 10 chemicals that were released and transferred in 1989. The black bar is the releases and the gray bar is the transfers. I'm sure you are familiar with many of these chemicals.

Taking one of those chemicals, you can then begin to examine individual trends. In Figure 6, take a look at 1,1,1-trichloroethane (or, as we call it, methylene chloroform), which is used as a solvent in cleaning instruments for metal degreasing and textile processing and as a pesticide in such things as aerosols, stain repellents, and inks. This map shows you where the chemical is being released and transferred, by state. The black color represents the three states where the 1,1,1-trichloroethane is the number one chemical released: Colorado, Vermont, and Connecticut.

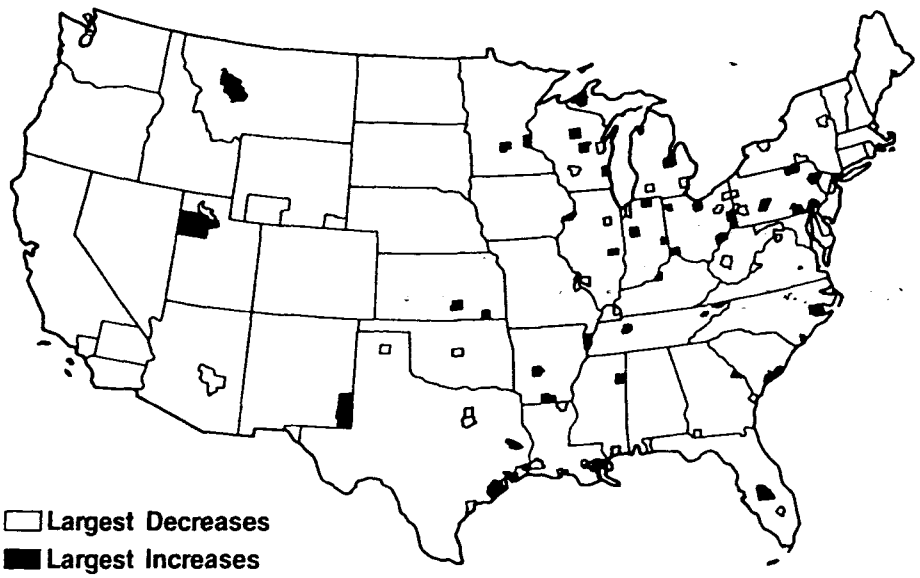


Figure 4.—Fifty counties with the largest increases and decreases from 1988 to 1989.

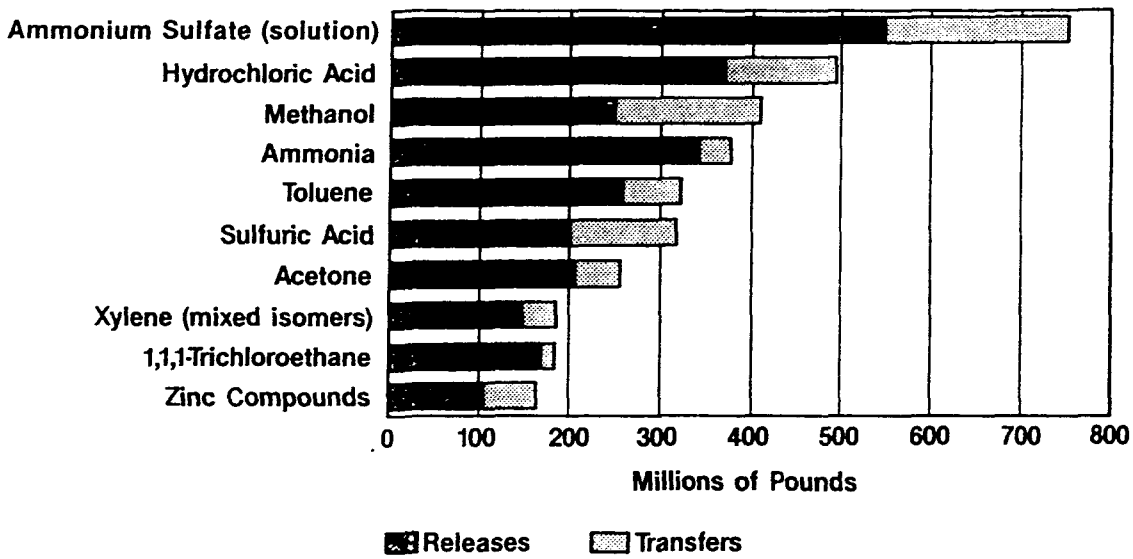
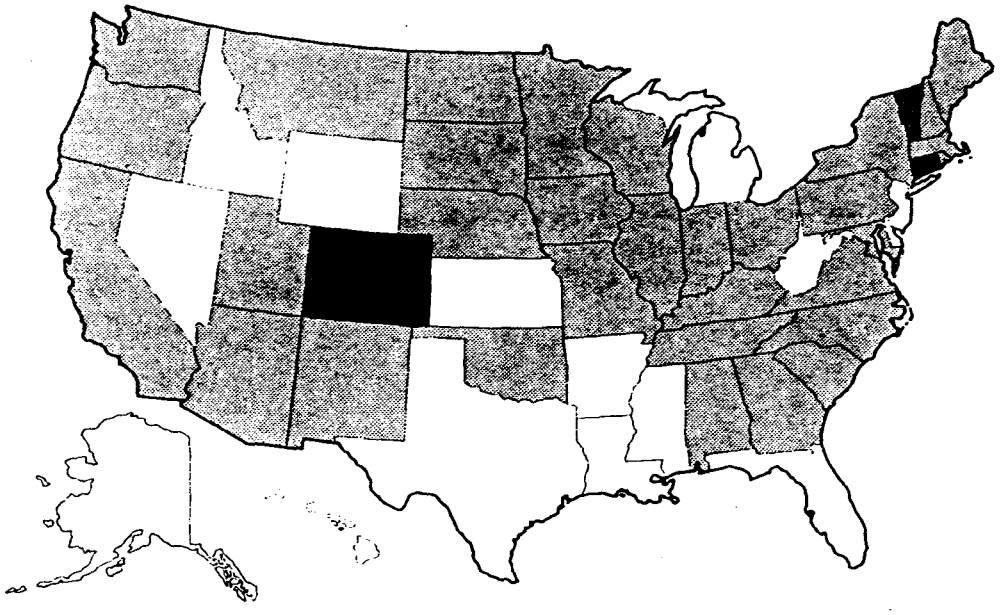


Figure 5.—Top 10 chemicals with the largest release and transfer: 1989.



#1 chemical with largest total release/transfer per state

a top 10 chemical for total release/transfer per state

Figure 6.—Releases and transfers of 1,1,1-trichloroethane.

Figure 7 illustrates how you can look at the geographic distribution of carcinogens at a state level. In 1989, about 123 carcinogens out of the 300 chemicals were on the list. Seven percent (411.5 million pounds) of TRI total releases and transfers were comprised of carcinogens. Another interesting statistic is that 25 of those carcinogens account for about 98 percent of the total carcinogen emissions.

Since the data are reported by chemical and facility, you can then focus on which facilities are releasing the largest amount. Individual facilities can be targeted as candidates for cleanup action or enforcement. The top 50 facilities accounted for over a 100 million pounds or 26 percent of the carcinogen totals. Much of the emissions are in the Texas–Louisiana area.

The TRI database allows you to continue focusing your microscope further and further down, analyzing multiple layers of data.

We cover 20 sectors of the manufacturing industries in the United States. Figure 8 shows the carcinogen releases by those sectors. When you cross the carcinogen data with the industry information, you can see that the chemical industry ranks first with most carcinogens released — a total of about 135 million pounds or about 33 percent of the total. The primary metals and plastic industries rank second.

You can also examine population distributions surrounding three different TRI facilities in a state (Fig. 9). The first facility is in a heavily populated urban area, the second in a rural area, and the third in a suburban neighborhood. By using population figures, the risks versus the population size of the surrounding areas can be analyzed. A chemical release from traffic in high density urban areas with heavy population can have a different effect on health than a release produced in a sparsely populated area. You then can take other data and integrate them with the TRI.

Conclusion

In conclusion, I would say that the uses of TRI are endless. These data can be examined on a national scale, by state, region, city, county, or by individual facility. Individual chemicals or classes of chemicals, such as carcinogens, can be examined and analyzed for one, two, three, soon to be four years, to look at the overall trends to determine the overall increases or decreases.

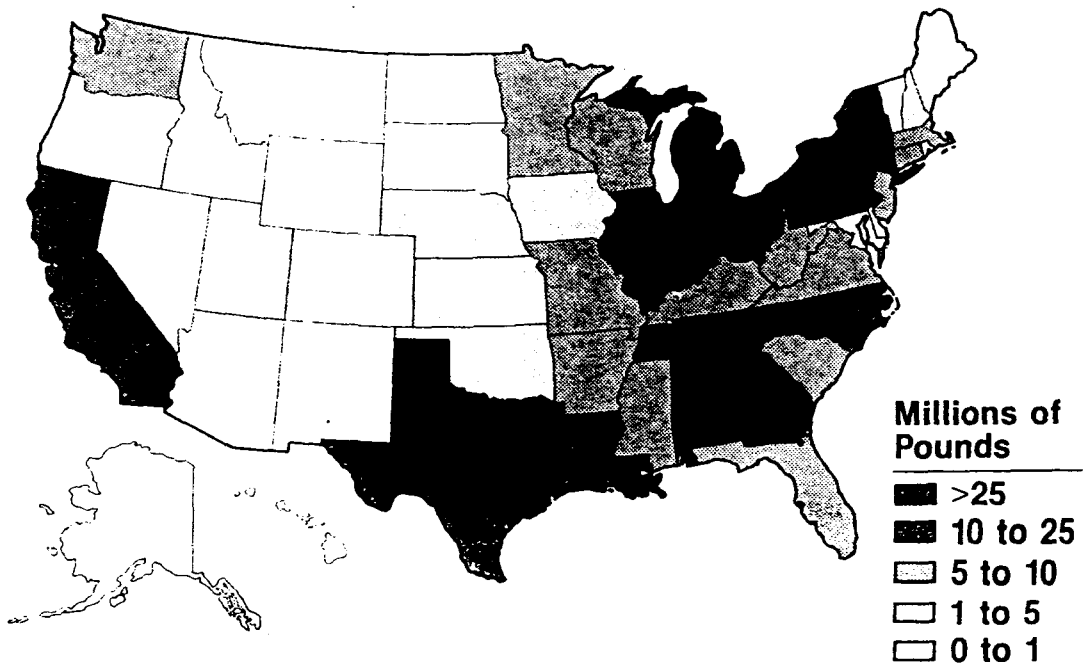


Figure 7.—Total releases and transfers of carcinogens.

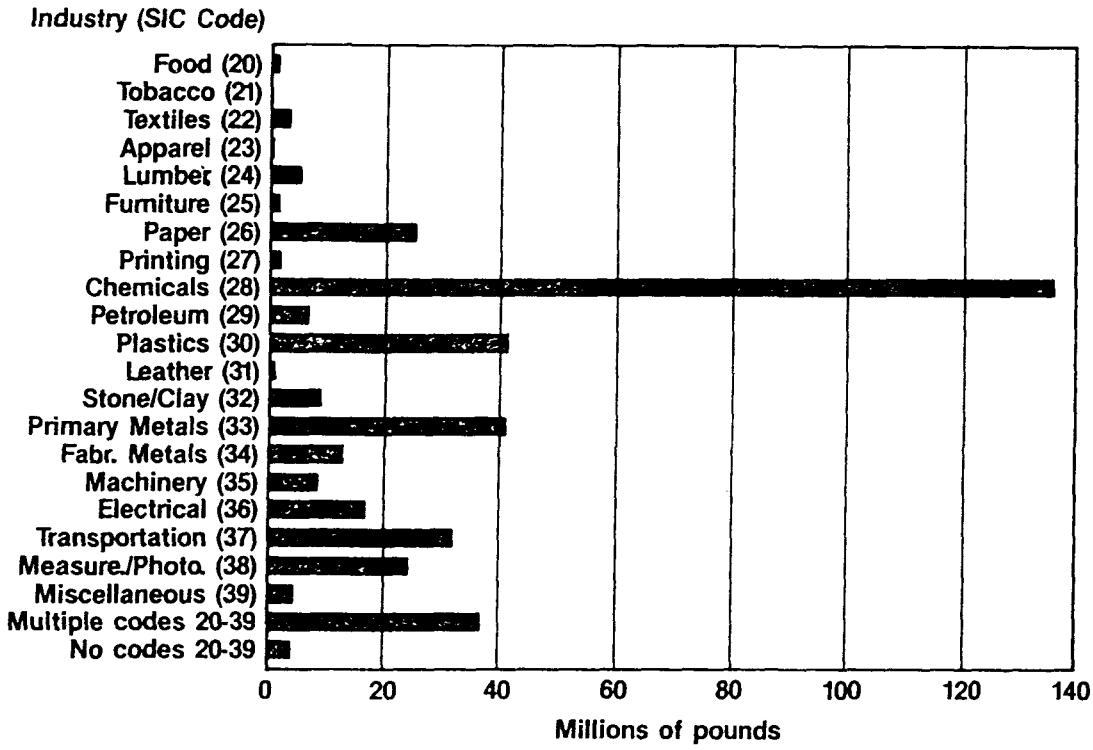


Figure 8.—Carcinogenic releases and transfers by industry: 1989.

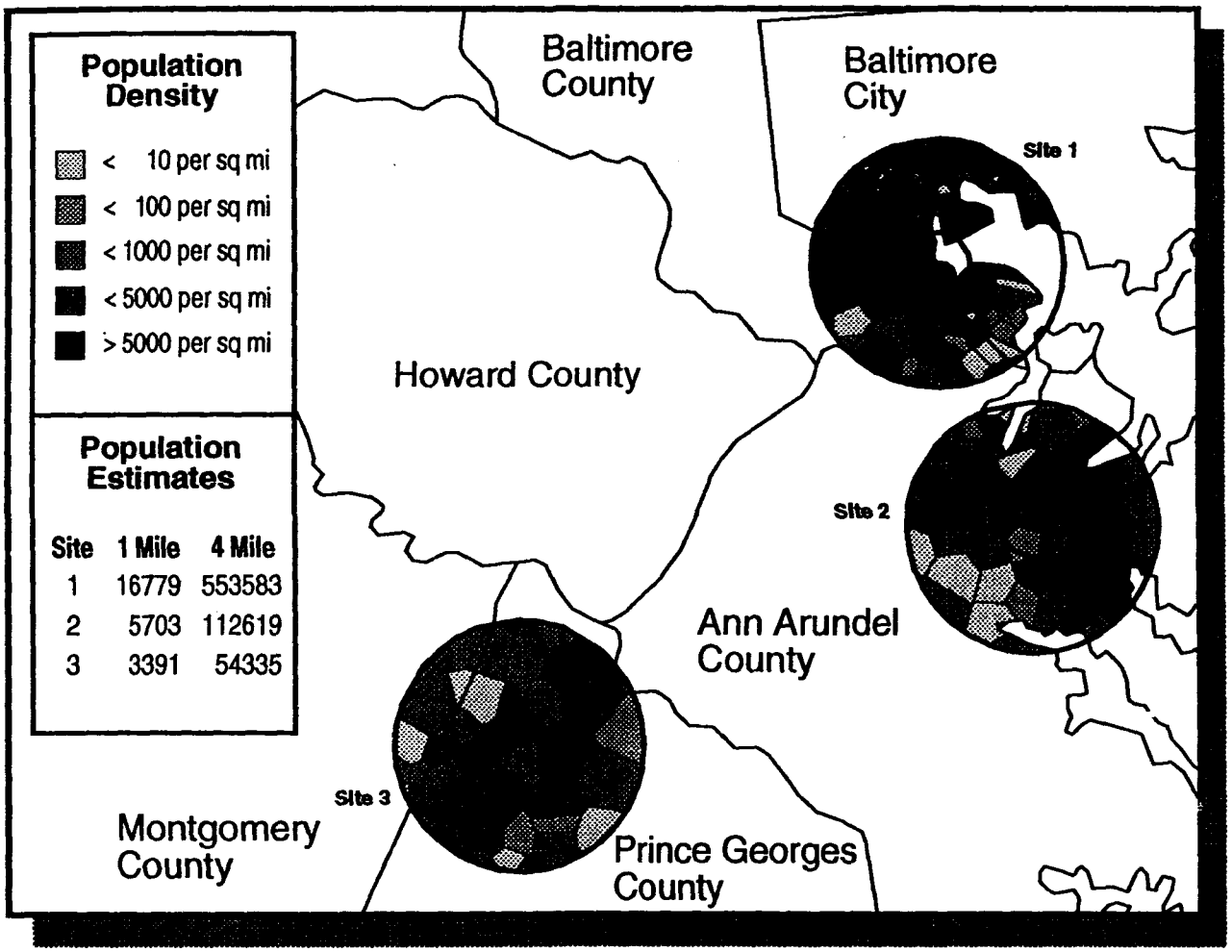


Figure 9.—Population estimates around selected TRI sites: one- and four-mile radii.

Other Perspectives on Toxics Release Reporting

Canada's Green Plan and the National Pollutant Release Inventory

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ABSTRACT

In August of 1990, Canada adopted the Green Plan, which is a governmentwide initiative aimed at solving our environmental challenges effectively. This plan commits $3 billion in new funds over six years — in addition to the $1.3 billion the government of Canada already spends annually on the environment. One section in the Green Plan states that the government will develop a national database for hazardous pollutants being released from industrial and transportation sources. Reporting requirements for industry will be established by 1992, with the first reports scheduled for public release no later than 1994. Environment Canada has decided to use the U.S. Environmental Protection Agency's Toxics Release Inventory as a model, making the necessary changes to adapt it to a Canadian context. The design of this National Pollutant Release Inventory and the reporting criteria will be determined by consulting with the provinces, territories, and other stakeholders.

We have a picture on the wall at Environment Canada that shows a young girl holding the world globe, and although it has few words, it says a great deal. It represents the two most important things in our lives: our children and our environment. There is no question at all that, if we continue contaminating our planet at the same rate as the past couple of decades, we will not only destroy the quality of life, but most likely life itself. Pollution prevention has to be a top priority, and it must transcend all political barriers, cultural differences, and economic constraints.

Every day we wait in taking preventative measures, we are getting two days further away from the cure. Metaphorically speaking, we're on a runaway train speeding downhill toward certain environmental destruction. Not only are we polluting our air, land, and water with very dangerous, persistent chemicals, but also by clear-cutting our forests, destroying the protective ozone layer, causing global warning, and using the ocean as garbage dumps, we are destroying the earth's natural ability to cleanse itself. We must deter the industrial nations from their irresponsible polluting activities, and we must help the developing nations jump into the 21st century by supplying aid in the form of state-of-the-art, pollution-eliminating technologies. Instead of tearing around wildly, spending the taxpayers' money on random bits of pollution control to appease the most prominent and noisiest environmentalists, we must first provide some benchmarks from which to establish meaningful controls and measure the effectiveness of our work. A release database similar to the United States' Toxics Release Inventory (TRI) can provide these benchmarks.

Canadian Environmental Protection Act

Canada recognized that the issue of pollution prevention was of prime importance and, on June

28, 1988, the Canadian Environmental Protection Act (CEPA) was assented to by the Canadian government. This act gives the government power to protect human health and the environment from the risks associated with the use of chemicals and from exposure to toxic substances. Under CEPA, Environment Canada is responsible for assessing substances for their impact on the environment and for recommending appropriate restrictions or limits on their use to prevent harm. Health and Welfare Canada is responsible for assessing substances for their potential impact on human health and for recommending appropriate controls on their use. When the assessments indicate a significant risk, the two departments recommend controls or prohibitions on the use of the substance. The government can order immediate action if necessary, and controls may govern any and all aspects of the life cycle of a toxic substance.

The regulations developed under CEPA are designed to control toxic substances in the following broad categories:

- **Existing chemicals** are defined by the Domestic Substances List or DSL.
- **Priority substances** (PSL) are those existing chemicals that must be assessed before February 11, 1994.
- **Toxic substances** (or those deemed toxic through assessment) are those existing chemicals already scheduled in CEPA for regulatory action.
- **New substances** are those that do not yet appear on our Domestic Substances List.

Domestic Substances List

The Domestic Substance List names all the chemicals used in Canada as of January 15, 1990. Industries that develop new chemicals in Canada or who import new or different chemicals have to apply to the federal government to have them added to the DSL and provide enough data for their assessment by Environment Canada and Health and Welfare Canada. This process is designed to control chemicals used in the Canadian environment and to prevent highly toxic or persistent chemicals from entering the country.

Companies were obliged to report all chemicals used if they wanted them to appear on the Domestic Substance List. Now, if a company eliminates one of its chemicals (and happens to be the only company reporting that chemical), then the substance will be removed from the Domestic Substance List and anyone wanting reinstatement of that chemical on the Domestic Substance List must go through the same procedure described for new chemicals. For this reason, there was a real incentive for the companies to make sure they were identified as users of specific chemicals.

Priority Substances List

The Priority Substances List (PSL) (Table 1) identifies which of the approximately 21,700 substances on the Domestic Substance List most urgently require assessment for their effect on human health and the environment to determine if they should be placed on the List of Toxic Substances. A substance was selected for this list if it met at least one of the following three criteria:

1. The substance causes or has the potential to cause adverse effects on human health or the environment.
2. The substance accumulates or could accumulate to significant concentrations in air, water, soil, sediment, or tissue.
3. The substance is or may be released into the environment in significant quantities or concentrations.

List of Toxic Substances

Canada has a rather lengthy process for dealing with potentially toxic substances (Fig. 1). The substance must first be identified and assessed before a report on the technical methods of control will be made public. If a regulation is the preferred option for controlling the substance, the regulation is drafted. The initial draft is made public, often through meetings that bring together groups, organizations, or persons with an interest in these issues. The process allows public review and involvement at every stage, ensures careful examination of the options, and documents the social and economic effects of compliance. Table 2 gives the List of Toxic Substances and applicable regulations (Schedule I, sections 13, 33 to 37).

Under the Canadian Environmental Protection Act, polluters can be fined up to $1 million a day or more if they profited from their activities. Corporate officials can also be punished if they authorize or participate in activities that violate

Table 1.—The Priority Substances List.

GROUP 1

Arsenic and its compounds
Benzene
Effluents from pulp mills using bleaching
Hexachlorobenzene
Methyl tertiary-butyl ether
Polychlorinated dibenzodioxins
Polychlorinated dibenzofurans
Polycyclic aromatic hydrocarbons
Waste crankcase oils

GROUP 2

Cadmium and its compounds
Chlorinated wastewater effluents
Chlorobenzene
Chromium and its compounds
Creosote-impregnated waste materials
Dibutyl phthalate
1, 2-Dichlorobenzene
1, 4-Dichlorobenzene
1, 2-Dichloroethane
Dichloromethane
Di-n-octyl phthalate
bis (2-Ethylhexyl) phthalate
Inorganic fluorides
Nickel and its compounds
Pentachlorobenzene
Styrene
Tetrachlorobenzenes
1, 1, 2, 2-Tetrachloroethane
Tetrachloroethylene
Toluene
Trichlorobenzenes
1, 1, 1-Trichloroethane
Trichloroethylene
Xylenes

GROUP 3

Aniline
Benzidine
Chlorinated paraffin waxes
bis (2-Chloroethyl) ether
bis (Chloromethyl) ether
Chloromethyl methyl ether
3, 3-Dichlorobenzidine
3, 5-Dimethylaniline
Methyl methacrylate
Mineral fibers
Organotin compounds (non-pesticidal uses)

About one third of the priority substances are families of chemicals or effluents, each comprising up to several hundred substances. Dioxins, furans, pulp mill effluents, arsenic, benzene, hexachlorobenzene, polycyclic aromatic hydrocarbons (PAHs), methyl tertiary-butyl ether, and waste crankcase oils are the nine substances slated for earliest assessment.

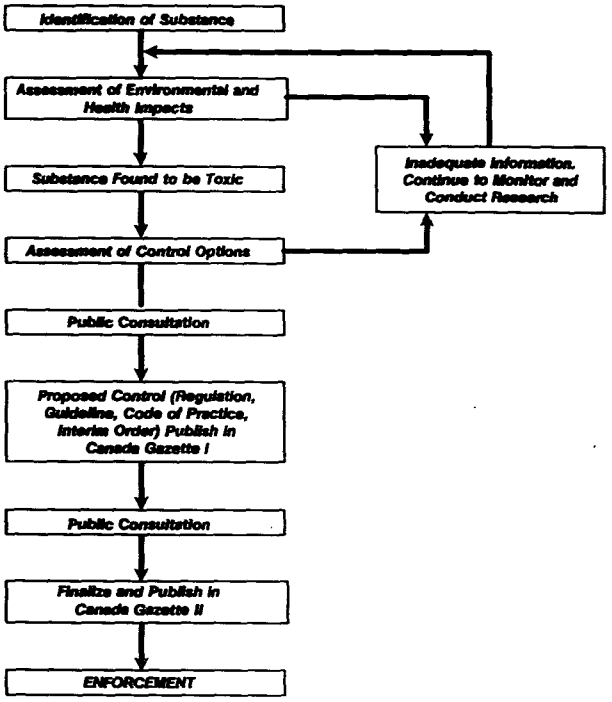

Figure 1.—Procedure for assessing substances for regulatory control.

this act. Anyone who is or may be affected by offenses under CEPA or its regulations can seek an injunction. Any two Canadians can petition the minister of the environment to investigate any offense.

The Green Plan

In December 1990, the Canadian federal government launched its environmental action plan — the Green Plan. The most important environmental action plan ever produced in Canada, it is the source for more than 100 important and well-funded initiatives over the next six years and a comprehensive plan that deals with the environment as interrelated and whole. In addition to the $1.3 billion Canada already spends annually on the environment, the Green Plan commits an additional $3 billion in new funds over six years (Table 3).

The Green Plan provides definite targets and schedules that will drive environmental initiatives within federal jurisdictions for years to come and will form the basis on which Canadians can judge our overall performance. This plan has implications to go beyond Canada's borders. The tools we develop and programs we implement will make a contribution to global environmental health in this critical decade of the 1990s.

Table 2.—List of Toxic Substances—Schedule I (sections 13, 33 to 37).

COLUMN I NAME OR DESCRIPTION OF SUBSTANCE	COLUMN II TYPE OF REGULATION APPLICABLE
Chlorobiphenyls that have the molecular $C_{12}H_{10-n}Cl_n$ in which "n" is greater than 2	(a) Prohibited commercial, manufacturing, or processing uses (b) Maximum concentrations in products (c) Maximum quantities and concentrations that may be released into the environment
Dodecachloropentacyclo $[5.3.0.0^{2,6}.0^{3,9}.0^{4,8}]$ decane	Prohibited commercial, manufacturing, or processing uses
Polybrominated biphenyls that have the molecular formula $C_{12}H_{10-n}Br_n$ in which "n" is greater than 2	Prohibited commercial, manufacturing, or processing uses
Chlorofluorocarbon: totally halogenated chlorofluorocarbons that have the molecular formula $C_nCl_xF_{(2n + -x)}$	Prohibited commercial, manufacturing, or processing uses
Polychlorinated terphenyls that have a molecular formula $C_{18}H_{14-n}Cl_n$ in which "n" is greater than 2	Prohibited commercial, manufacturing, or processing uses
Asbestos	Limited atmospheric releases from asbestos mines and mills
Lead	Limited atmospheric releases from secondary lead smelters
Mercury	Limited atmospheric releases from chlor-alkali mercury plants
Vinyl chloride	Limited atmospheric releases from vinyl chloride and polyvinyl chloride plants

Table 3.—Green Plan resources (over six years).

I	Life's Three Essentials: Clean Air, Water, and Land	$850 million
II.	Sustaining Our Renewable Resources	$350 million
III.	Our Special Spaces and Species	$175 million
IV.	Canada's Unique Stewardship: The Arctic	$100 million
V.	Global Environmental Security	$575 million
VI.	Environmentally Responsible Decisionmaking	$500 million
VII.	Starting in Our Own House	$275 million
VIII.	Emergency Preparedness	$175 million
	TOTAL	**$3 billion**

Two major themes are woven throughout the Green Plan: sustainable development and the benefit of partnerships. Sustainable development is described, in general, as activity in which the environment is fully incorporated into the economic decisionmaking process as a forethought, not an afterthought. It holds that resources must be treated on the basis of their future as well as present value. That approach offers genuine hope of economic development without environmental decline.

This plan was born out of an extensive national multi-stakeholder consultation process: 41 information sessions and 17 consultation sessions were held in towns and cities from coast to coast. The process culminated in 1990 with a two-day national wrap-up session in Ottawa.

The Green Plan represents the unique efforts and commitment of men and women of Canada from every sector of society working together, as partners, in national environmental decisionmaking. Clearly, only by strengthening existing partnerships (such as those developed and solidified during the Green Plan consultation process) and by forming new partnerships will we truly achieve sustainable development.

The National Pollutant Release Inventory

One section of the Green Plan calls for Canada "to develop a better understanding of the nature and quantity of toxic substances being released in Canada," and to this end, "the government will develop a national database for hazardous pollutants being released from industrial and transportation sources." It also states that "the reporting requirements for industry will be established by 1992 with the first report scheduled for public release by the end of 1994."

We were very impressed with the work done by the U.S. Environmental Protection Agency (EPA) and decided that Canada's database, which will be called the National Pollutant Release Inventory (NPRI), will be modeled after the Toxics Release Inventory (TRI). To obtain the maximum amount of exposure and public or industry input during the development of its NPRI, Canada has again decided to use a nationwide multi-stakeholder consultation process to determine the details of the reporting format.

We visited EPA's facilities in Washington, D.C., and were given detailed presentations on the different activities involved in collecting, compiling, and publishing release data. TRI's list of chemicals has remained basically unchanged since the program was started and only a few data handling procedures have been modified slightly. Although we're just beginning to work on Canada's National Pollutant Release Inventory, we will benefit tremendously from EPA's experiences with its TRI.

However, the structure of Canada's NPRI will differ from the United States' TRI. In the United States, Congress specified several of the parameters of the TRI, including the industrial sectors from which the reports would be obtained, the list of chemicals, and the threshold reporting limits. Initially, about 320 chemicals and 20 chemical categories were specified for investigation, and only industrial facilities with activities falling within the U.S. Standard Industrial Classification (SIC) codes 20 to 39 were required to report. The threshold reporting requirements for chemical use were specified at 75,000 and 50,000 pounds for the first two years, respectively, and then were fixed at 25,000 pounds starting in the third year.

If we look at the same group of industries in Canada and set our threshold reporting criteria at 10,000 kilograms (22,000 pounds) instead of the United States' 25,000 pounds, then we can expect to receive close to 2,000 reports. This compares to about 85,000 reports collected by EPA in 1990.

In trying to estimate the expected number of reports in Canada, we compared the Domestic Substances List to the chemicals covered by the TRI and discovered that only about half (160) of these chemicals show up in Canada. Not only were the companies asked to identify specific chemicals for the Domestic Substance List, but also they had to indicate a usage range for the different chemicals. Figure 2 shows the number of

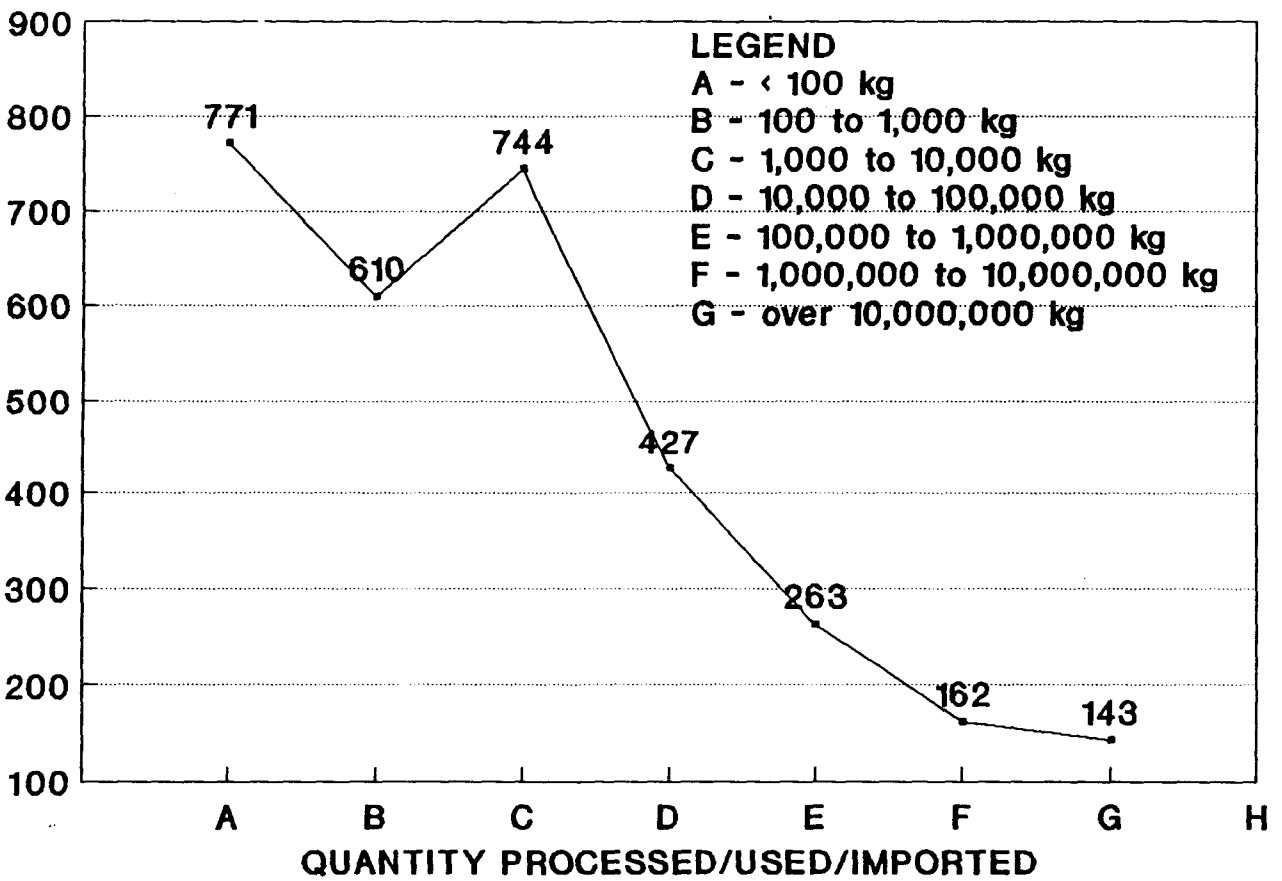

Figure 2.—Domestic Substances List records showing number of reports in different categories.

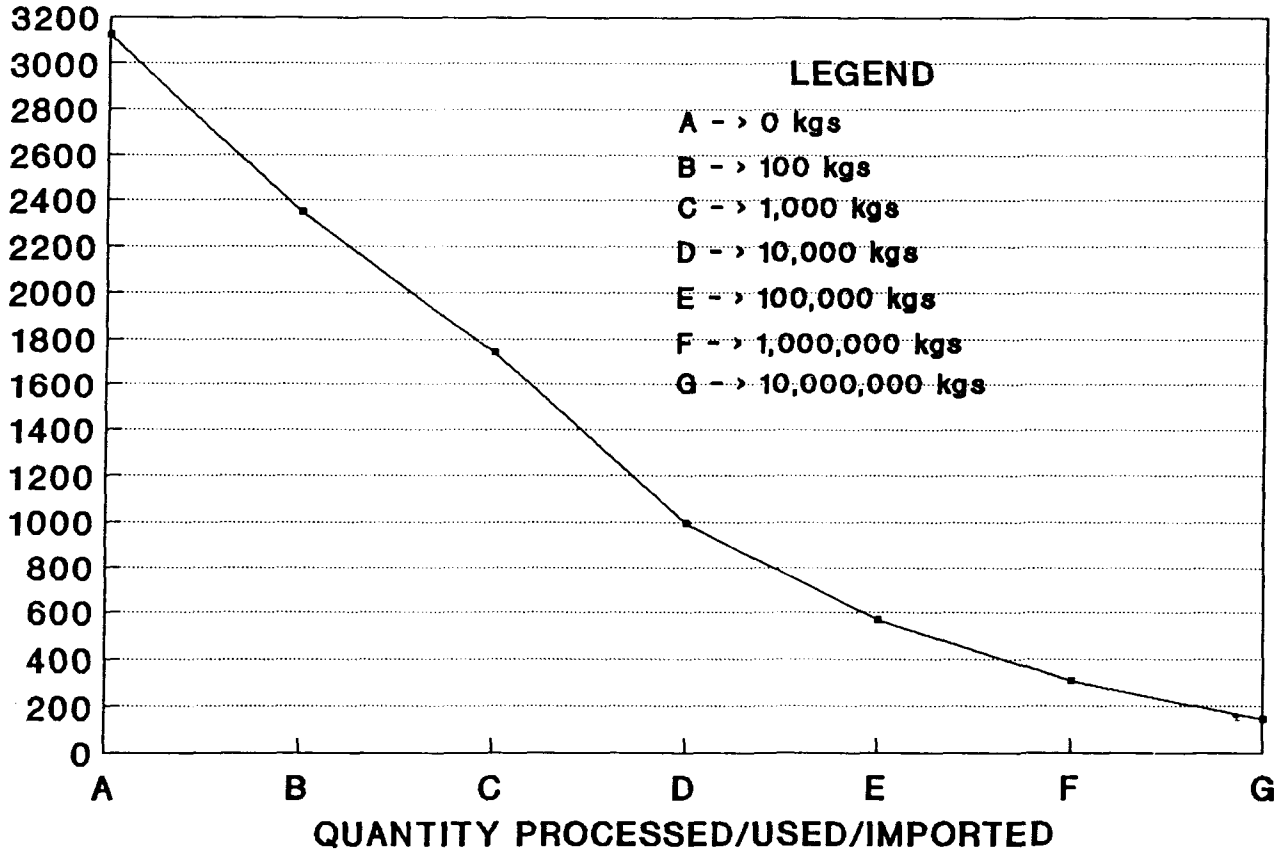

Figure 3.—Number of reports for TRI chemicals found in Canada.

facilities reporting in the different categories. Figure 3 illustrates the total number of reports versus different threshold reporting criteria.

We assumed that all quantities reported were equal to the median of their respective groups and produced Figure 4, which shows the expected percentage of release data captured versus an increasing threshold reporting criteria. As mentioned above, we intend to use a reporting threshold of 10,000 kilograms, which, as you can see from this last graph, will enable us to obtain reports on a high percentage of the total releases.

In spite of the fact that we are required to collect data from the transportation sector, as specified in the Green Plan, we will still have a relatively low number of reports to process and therefore will be able to look at a broader list of chemicals or other industrial sectors, such as mining, agriculture, or forestry.

Setting Up the NPRI

In trying to take advantage of the consultation process, an initial scoping was held with a limited number of stakeholders from various sectors. At this meeting, we decided that the best way to proceed would be to form a steering committee of 15 to 20 members made up of representatives of stakeholder groups, such as health, industry, environmentalists, and labor. Their mandate is to advise and assist in the development of the essential information and analysis necessary to set up Canada's National Pollutant Release Inventory and identify any varying opinions among the stakeholders regarding the design of this NPRI.

This steering committee will meet about five times over the course of 1992 and, if necessary, will designate smaller working groups to deal with specific issues. During this consultation process, a series of nationwide information sessions will be held to present the NPRI work to the stakeholders. Following the information sessions and most of the steering committee meetings, one or two consultation workshops will be held where the stakeholders can discuss the design of the NPRI. At these meetings, stakeholders will be asked to validate the steering committee's recommendations and try to resolve any outstanding issues. Associations and networks will be invited to select participants to represent them at the workshop.

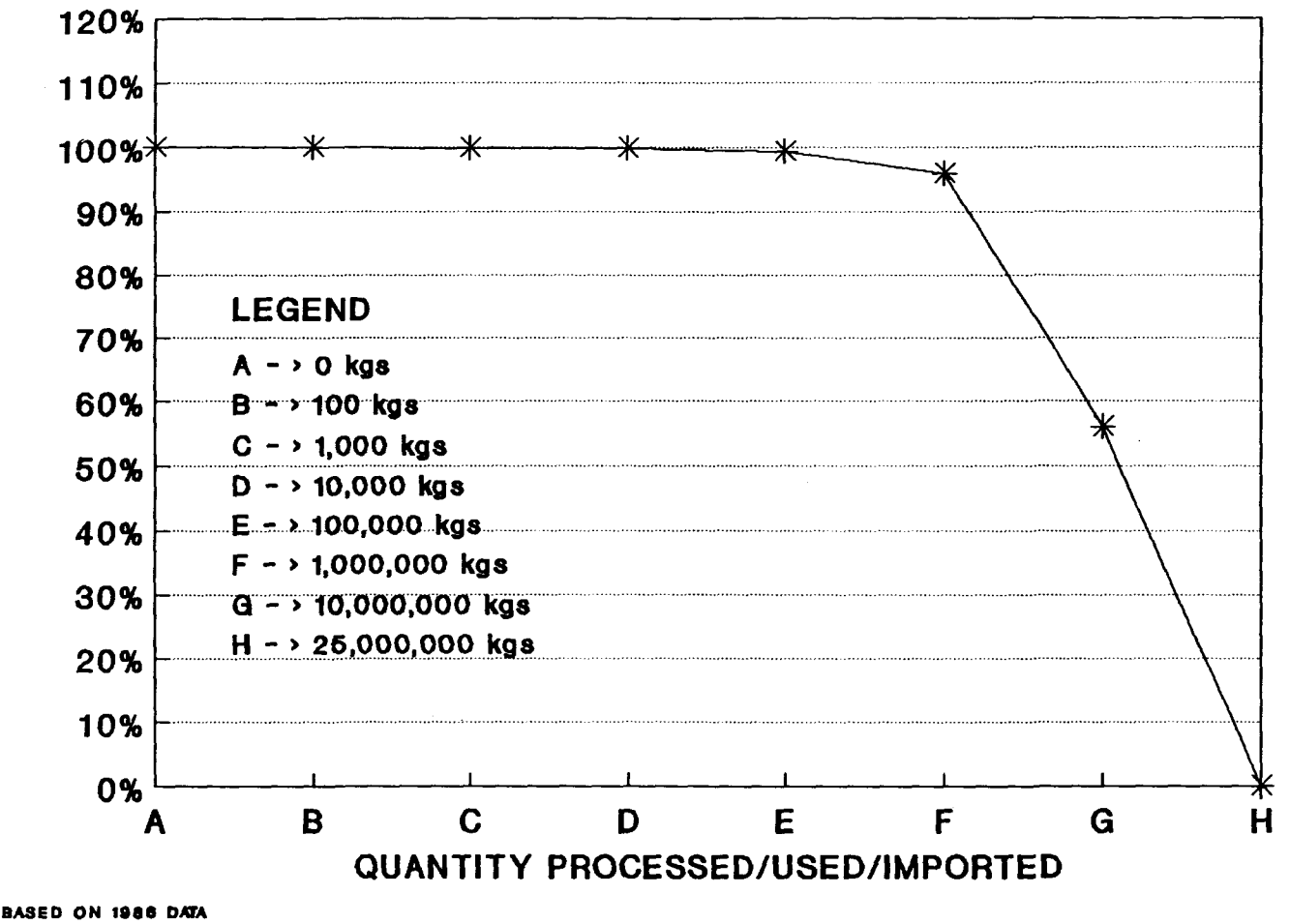

Figure 4.—Data collection effectiveness.

As a starting point, we will use TRI with very few modifications and present this to the committee for their consideration. We fully expect that our steering committee will recommend that we add other chemical substances to the TRI list and expand into other industrial sectors with our reporting requirements.

We are presently mailing information on the NPRI to about 1,800 environmental and 100 industrial associations. We also will try to contact as many of the industries as possible that may be required to report under the NPRI requirements. We hope to take advantage of the work done by EPA on its Toxics Release Inventory.

Conclusion

I would like to stress the importance of having a database like TRI. It is a tool that can be used as a pointer to identify hotspots or areas that merit our attention or as a benchmark or reference point for further investigation or regulation. Environmental agencies and public interest groups can use the data to encourage facilities to cut back on pollutant releases. These data will be used to help reduce toxic emissions and, in Canada's case, help implement our Green Plan goal of a healthy environment and a sound, prosperous economy.

A Public Interest Group Perspective

Gerald V. Poje
Green Seal
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ABSTRACT

In the information age, gathering and sharing data can be a powerful incentive for environmental improvement. Since 1988, the Toxics Release Inventory has altered American business, government, and public perceptions of toxic emissions. Armed with a ready-made, multimedia schedule of high priority chemicals and emission points, corporations, EPA, and state agencies have pursued a new pollution prevention agenda. Public and private partnerships, such as the 33/50 project, seek accelerated emissions reductions by using this national toxic chemical accounting system. States have approved toxics-use reduction audits and created pollution prevention institutes. Congress has passed additional toxic information provisions through the Pollution Prevention Act of 1990, and a Right-to-Know-More proposal now awaits debate before the current session.

Introduction

In September 1990, an international conference convened in Veszprem, Hungary, to discuss emergency planning for, response to, and prevention of chemical accidents. At that meeting, nongovernmental organizations met in a side session to develop a policy dealing with chemical information. Representatives from Bulgaria, Czechoslovakia, Germany, Hungary, Italy, Poland, Romania, the United States, the Soviet Union, and Yugoslavia later signed the 10-point agreement (Table 1) that focused on every citizen's right to be notified about and gather verified information on chemical substances, including quantities processed, stored, and used; specific management of these substances; effects to health and environment; accidents involving these chemical substances; routine emissions; and waste production from privately and government-controlled industrial activities.

These broad-based positions are held by many people operating in the public interest who are trying to alleviate chemical contamination around the globe. In the United States, the Toxics Release Inventory (TRI) has been key to mobilizing enormous public interest about toxic chemical problems.

Background

In the mid-1970s and on into the early 1980s, numerous abandoned hazardous waste sites were polluting communities across the United States. The resulting problems stimulated Congress to address this issue and, in 1980, it passed the Superfund Law, which created a fund to assist in the cleanup of these abandoned waste sites. By the end of the five-year term of that federal statute, the enormous groundswell of public dissatisfaction with the pace of the cleanup provoked Congress to revise the Superfund Law in 1986.

However, that reauthorization was informed by other events. Most notably, in 1984, the news of the tragic chemical release in Bhopal, India, had struck home in the United States, as investigations took place to find out how American

Table 1.—The Veszprem Declaration (September 1990).

Signatories resolved to:

I. Emphasize the principle that every citizen has both the need to have information about potential accidents for preventing their consequences and the right to have information for participation in democratic decisionmaking, and

II. Demand in accordance with the charter on Environmental Rights and Obligations of Individual Groups and Organizations that the governments of participating nations guarantee that:

1. Every citizen has the right to be notified about and to gather verified information about chemical substances (including radioactive materials), quantities processed, stored and used, specific management of these substances, effects to health and the environment of these substances, accidents involving these substances, routine emissions and waste production from private and government-controlled industrial activities.
2. Every citizen has the right to participate in emergency planning, specifically including rights of access to all hazard assessments and other information defining the potential for accidents and subsequent impacts upon workers and communities attributabel to these industrial activities and technologies and management of these risks. Emergency planning is an essential part of land use planning, and must be considered in the conception, design, construction, and operation of industrial facilities.
3. Every citizen has the right to participate in all licensing procedures which permit activities involving these chemical substances.
4. Licenses must be amended whenever technological innovations to reduce specific risks become available.
5. Industries and governments which create public risks associated with chemical activities must assure the public that progress is being made toward technological innovations that reduce these risks.
6. Citizen rights to be notified, to gather information, and to participate in licensing shall not be limited by national boundaries.
7. Every citizen has the responsiblity to utilize these rights of notification and public participation to assure environmental protection. Environmental protection is defined by activities which sustain the air, the water, the soil, and thereby nurture biological diversity.
8. At this moment of human endeavor, technological innovation must not only reduce the acute and chronic risks to public health and the environment in and of itself, but actually improve currently degraded environmental quality.
9. Every citizen has the right to employ technical experts of their choice to review technological information.
10. Nations of the European Community, the United States, and other economically advantaged nations through fees assessed upon activities threatening public health and the environment should support the growth and development of non-governmental organizations because they strengthen democratic values by providing public reassurance of progress toward environmental protection.

facilities of the Union Carbide Corporation were managing methyl isocyanate. It is important to understand that, when the gas escaped, very little information was publicly available about this chemical. Not until seven years later did the *Journal of the American Medical Association* publish a report documenting important toxicological information on methyl isocyanate, and only in 1991 did Union Carbide make a legal settlement toward restitution to the community most damaged by that chemical accident.

The Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments Reauthorization Act of 1986), the most significant federal United States' public policy on toxic emissions, was promulgated within this political context (Table 2). This public policy deals with chemical accidents and public rights of access to data on chemicals in their community.

This conference focuses on the issues surrounding the fourth point of Title III policy: collecting data on release of toxics and making it available to the public. However, those interested in Right-to-Know policy shouldn't lose sight of the first three points in which Congress required industry, the U.S. Environmental Protection Agency (EPA), and the public not only to know about the potential for accidents in their community but also to actively gather information about accidents and develop plans to prevent them. The 1990 amendments to the United States Clean Air Act will expand public access to detailed hazard assessments of industrial facilities handling extremely dangerous chemicals.

Table 2.—Major Provisions of the United States Emergency Planning and Community Right-to-Know Act.

1. Emergency Planning Requirements
2. Emergency Notification and Follow-up Notification after an accident
3. Right-to-Know Requirements about Possible Catastrophic Releases
4. Right-to-Know Requirements about Routine Releases

Other portions of the Right-to-Know Act that provide access to additional information, such as material safety data sheets, build upon this right for people in the workplace and expand it to the public at large. In addition, the act includes provisions for inventories or data about the housing, amounts, and types of hazardous chemicals being stored at industrial facilities and accidental and annual releases into air, water, and soil. With the Toxics Release Inventory, for the first time, Americans possessed multimedia, annual snapshots of the flow of toxic chemicals into the surrounding environment.

The Toxics Release Inventory

The TRI is a geographically based data set that identifies releases of carcinogenic and other hazardous chemicals to the environment. TRI data are incorporated into an annual report on these 300-plus chemicals and their emissions to air (both fugitive emissions as well as those from smokestacks), water, land, and waste sent to off-site facilities.

In 1987, one immediate focus of the TRI was on the chemicals' effect on plants and animals. EPA developed health effects information to augment the TRI, a good part of which deals with carcinogenic chemicals. Cancer is a disease of developed nations, and the United States has devoted many resources to combating it. During our history of testing chemicals for carcinogenicity, Americans have standardized toxicological evaluation and risk characterization, and therefore, data on the many chemicals that can cause cancer.

However, scientists in the United States are just beginning to understand the impacts of toxic chemicals on other systems. In July 1991, a major conference was held at the Wingspread Facility in Racine, Wisconsin, that addressed another aspect of toxic chemicals — their ability to interrupt normal sexual development of organisms. This concern was stimulated by environmental problems in the Great Lakes that have become widely known and feared. Some widely used chemicals are known to operate as hormonal disruptors. Depending upon the organism's stage of development, ingestion of these chemicals can produce dire consequences that may be observed only at the point of sexual maturation when organisms are no longer capable of carrying on normal reproduction. These data parallel fieldwork carried out in the Great Lakes that indicate a massive collapse in certain wildlife populations, particularly those dependent upon fisheries.

While information on health effects is important, TRI data have had impacts in other ways. On June 30, 1988, the day before the first release of the TRI data set, Richard Mahoney, the chief executive officer of Monsanto Company, made a bold announcement. He announced that, within four years, Monsanto would reduce by 90 percent its airborne emissions of toxic chemicals worldwide. This change in policy has set off a rush of activities toward pollution prevention.

American public interest groups use TRI data from one part of the country to influence policy and regulations under a different federal environmental statute. For example, Clean Water Action examined data on releases to water discharges in the Houston Ship Channel, an important industrial area of the United States that has received large amounts of industrial effluents. It used that information to designate the channel as a toxic hotspot, an area that requires a much higher degree of public investigation and regulatory rigor.

Chemical contamination is now ripping holes in the stratospheric ozone layer, producing an influx of ultraviolet radiation that some predict will result in millions of incidences of skin cancer over the next several decades. These data have caused global alarm and concern. Public interest groups, such as the Silicon Valley Toxics Coalition, are using TRI information in the United States to accelerate the schedule for reducing those particular chemical emissions as well as their usage.

Many people thought that the TRI would spur public debate about risk assessment. However, the center of debate has focused on pollution prevention — determining the process by which industry causes emissions. The TRI has identified opportunities for people to choose

- chemical and product substitution,
- process modifications,
- on-site closed processed recycling, or
- improved housekeeping at facilities

to change the way chemicals are being used and reduce pollution at the source rather than control it at the end.

Public interest groups have also used the citizen suit provisions of TRI to promote pollution prevention and education. In 1990, the Atlantic States Legal Foundation reached a $68,000 settlement with Murray Sandblast and Paint

Company in Buffalo, New York. Under the citizen suit provisions of the Right-to-Know Act, the foundation discovered that Murray Sandblast had failed to report information to the public, so it took the company to court, sued it, and settled outside of court. That settlement required the company to hire a pollution prevention expert to review its processes and reduce the toll on the environment. The foundation also set up conferences to educate citizens about this information statute.

Why does the TRI work? Among the many reasons, two are key. First, the information must be made publicly available in a computer-accessible data format — a revolutionary piece of public policy in the United States. Equally important are TRI's trade secrecy provisions. In 1976, the Toxic Substances Control Act was passed, but it has not been able to accelerate the growth of clean technologies, partly because of trade secrecy. Under TRI provisions, it is extremely onerous for industry to claim frivolously that it cannot disclose information. During the first year, fewer than 40 claims of trade secrecy were allowed for more than 78,000 different TRI reports. That's a real measure of TRI's success.

Future Uses of the TRI

A next step for Right-to-Know will be integration of the TRI data with other statutes and provisions of law as well as expansion of the Right-to-Know Act beyond this current statute.

One focus of integration will be to improve the protection of public drinking water supplies. Using the Graphic Exposure Modelling program and TRI data, EPA's Office of Toxic Substances will allow concerned citizens to locate their source of public drinking water and identify annual toxic discharges from upstream industrial facilities.

Today, American environmentalists are proposing a new law — the Right-to-Know-More legislation. This proposal would expand TRI's focus by increasing data about additional chemicals that could be released accidentally and expanding the right-to-know to include additional facilities. The Right-to-Know-More legislation would include data on all facilities that handle toxic chemicals.

The TRI is our annual snapshot. To propose explicit pollution prevention prescriptions, industrial facilities must be characterized far better than is done currently. Therefore, the public interest community seeks to include a maximum hourly rate of release to air, water, and soil and a description of the causes, source, and frequency of these maximum hourly releases of toxic chemicals, to set a much higher priority list for pollution prevention or clean technologies — and to keep the public focused on that issue.

One of the TRI's failures is that it avoids looking at many important chemicals, such as pesticides. Each year in the United States, nearly two billion pounds of pesticides are applied to the landscape. Put that into the perspective of 5.7 billion pounds of chemicals identified as the annual TRI emissions inventory for 1989 and you can see that TRI misses a major segment of toxic loading. Pesticide production in the United States has increased at an alarming rate: almost 2.5 billion pounds of active pesticides are being produced yearly. Conventional practices — agricultural (both on fields and crop systems), industrial applications, and home applications — amount to almost 1.1 billion pounds. The wood preservative industry uses a billion pounds of those chemicals.

These are just the active ingredients; in the United States, we describe the carriers for active ingredients as "inert ingredients" — a misnomer because those chemicals can be the same toxic chemicals identified under TRI as solvents.

Other cross-cutting issues involve boundary areas. The United States and Canada are studying the Great Lakes, which form an important liquid boundary between those two nations. The International Joint Commission that governs those waterbodies has established a scientific task force to investigate persistent pollutant problems in the Great Lakes Basin. This commission has called for virtual elimination of persistent chlorinated chemicals as well as toxic metals. Their report on virtual elimination recommends asking the countries and states that govern the Great Lakes to establish a sunset task force for some of the worst and most pervasive chemical problems. One recommendation was to investigate every use of chlorine by January 1, 1993, and issue a time schedule to eliminate this chemical in paper and pulp bleaching processes. Around the globe, environmentalists have accelerated interest in chlorine chemistry and challenges its rampant use, which has led to some persistent chemical problems.

The Veszprem Agreement declared that "citizen rights to be notified, gather information, and participate in licensing shall not be limited by

national boundaries." A Canadian group, Pollution Probe, has aggressively tracked toxics release inventories along the borders of the Great Lakes. Any consideration of computer-accessible databases within Europe must take into account movement of materials across borders and the vested interest that communities downwind and downstream have in understanding that process.

A final cross-cutting emergent issue deals with another major missing element in this release inventory — the loading of toxic chemicals into products for the home. All over the United States, communities are deciding how to deal with municipal waste. Should they bury garbage in landfills or incinerate it, and what happens if they do? What would complex mixtures of plastics and remains of liquid household solvents do to the environment around a landfill? In a nation where its use is widespread, many environmental groups are challenging the use of polyvinyl chloride packaging. TRI has prompted many Americans to think not just about the point of production but also about the justification of product lines. Currently, more Europeans think about a cradle-to-grave life cycle analysis of products than Amer-icans. They are concerned not only about production points and consumption of resources at that point of production but also the implications when products are used in households as well as disposed by municipalities.

Conclusion

Mismanagement of toxic chemicals and hazardous waste threatens environmental health and economic security. The increasing amount of chemical emissions and waste production is truly alarming. Existing and potential impacts of toxic chemicals on the environment and public health are monumental. Fish poisoned through accumulations of persistent PCBs and pesticides are now injuring humans and other species in the Great Lakes; in the United States, more than 20,000 serious hazardous waste sites require expensive cleanups; and the world's stratospheric ozone layer has become eroded from wasteful uses of halogenated compounds. Inefficient chemical management consumes scarce industrial and governmental resources that could otherwise be devoted toward improving industrial competitiveness and resolving other pressing economic and environmental issues.

Pollution prevention is the key to solving the toxic threat. Pollution prevention means source reduction: any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering any product or waste stream before recycling, treatment, or disposal. Pollution prevention is a public responsibility.

In the United States, TRI has raised the level of public debate about chemical consumption patterns of Americans and promoted pollution prevention. Every world citizen has a stake in increasing the scope and pace of this debate around the globe. One start would be expansion of publicly accessible multimedia emissions and usage databases.

An Industry Perspective on Reporting Releases of Toxic Chemicals

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ABSTRACT

The Toxics Release Inventory has created a valuable accounting system for emissions from selected facilities in the United States. These publicly available data have prompted companies to voluntarily set priorities and establish emissions reductions goals. The Emergency Planning and Community Right-to-Know Act is an excellent starting point, but it is not without problems. Care must be taken to use the Toxics Release Inventory appropriately, on a sound scientific basis, and set priorities to improve these data.

Introduction

The Emergency Planning and Community Right-to-Know Act (EPCRA) is a valuable law. For the first time, certain industrial manufacturers are required to quantify and publicly announce emissions of specific chemicals, including releases to the environment and shipments of waste to off-site facilities for treatment, storage, or disposal. These manufacturers must submit a Toxic Chemical Release Inventory (TRI) report to the U.S. Environmental Protection Agency (EPA) every year. EPA then compiles that information into a national computerized database that is publicly accessible in libraries, at governmental offices, and on-line through a computer. The manufacturer's efforts to compile data and the use of this information by manufacturers, regulatory agencies, and the public have been generally beneficial. The system is imperfect; it can be misused, but its mere existence has revolutionized environmental reporting.

TRI's Uses

Investigation and Measurement

Even without public accessibility, determining the total releases and transfers for a plant's toxics chemical release inventory is useful. For the first time, engineers have had to scrutinize their processes as a whole and quantify wastes released to all media. As an investigative and measurement tool, this multimedia inventory has helped provide a baseline of certain toxics releases and, in some cases, has revealed valuable information for process improvements that otherwise might not have received adequate attention.

Planning

As a planning tool, the TRI provides manufacturers with an excellent base to determine priorities for improvement and offers a starting

point on which to build other programs and set goals within a production facility. After a facility determines the amount of emissions and compiles data, progress toward an emissions reduction goal can be quantified, measured, and compared. Over the four years that Toxics Release Inventories have been required, individual facilities have used these data to improve their processes and operations. Progress is evident. Manufacturers have achieved emissions reductions, and downward trends in combined emissions have been reported yearly.

Communication

The TRI is also an excellent communication tool. Within a plant, the tremendous effort to put together data from numerous sources and departments has made every employee aware of toxic emissions. Public availability of the data and publication of numerous analytical reports have made many Americans, including industrial workers, regulators, private citizens, and special interest groups, more aware of emissions. Some companies have set up Community Advisory Councils to disseminate information on releases and the effects of chemicals.

A relatively concise tool, the TRI is a nationally uniform source of information about the quantities of and trends in chemical emissions from individual and various groups of facilities; data are available by industry, state, release, or chemical type.

Because EPCRA focuses on the community's right-to-know and not just the plant's compliance with environmental regulations, many jobs now focus on accommodating the community's information needs and concerns. Plant and environmental managers, even operators and plant engineers, now spend more time communicating with the public about emissions and operations, a change from past years when the plant or the technical community was the foremost focus. By hearing about citizens' concerns firsthand, manufacturers have realized that just making a good product is not enough. Being responsive to citizen concerns and communicating to make the public feel comfortable with plant operations has changed the way manufacturers do business.

Initiating Other Programs

The TRI has also acted as a catalyst to initiate other programs and trends. Without any regulatory pressure, many companies have volunteered to set emissions reduction goals, which vary for each company but range from Monsanto's plan (the first company to publicly announce a goal) to reduce toxic U.S. air emissions by 90 percent by 1992, to Hoescht's decision to stop underground injection of wastes completely, to Union Carbide's goal of reducing ambient toxic air concentrations to 1/1000 of the workplace standard, to Rohm and Haas' worldwide objective — to reduce its TRI air emissions 75 percent by 1996. Reduction levels range from 20 to 100 percent; target goal years range from 1991 to 2000 to "ultimately"; some goals address only carcinogens or CFCs, others address all waste; some goals are worldwide, others are U.S. only — but all will result in improvements that might not have been made if the TRI were not available.

Building on industry's initiative, the EPA has developed the 33/50 program, also known as the Industrial Toxics Project. A voluntary reduction program, 33/50 includes more than 200 of the companies invited to commit to reducing national aggregate emissions of 17 toxic chemicals from the 1988 TRI levels 33 percent by the end of 1992 and 50 percent by the end of 1995. These 17 chemicals were selected because they are released into the environment in large quantities or are toxic or hazardous pollutants and because the releases might be reduced through pollution prevention practices.

Some companies have already extended TRI-type reporting worldwide. Others have included additional chemicals in their inventories that may be present at a particular plant but are not toxic or not prevalent enough to merit inclusion in EPA's national database. Some companies have tried to determine the impact of their releases on surrounding communities by estimating ground-level concentrations of air emissions on a case-by-case basis. Facilities can use data appropriately for their unique situations to assess impacts on their local community. Employing the same impact analysis for all facilities nationwide would be a misuse of that data.

Partly because of the initiatives that came out of the TRI program, voluntary programs are being tested for other laws and regulations. More effective emissions reductions can often be achieved than with the old "command and control" strategy of past legislation and regulations. The Clean Air Act Amendments of 1990 include an Early Reduction Program: sources that achieve

an early 90 percent reduction from 1987 air emissions levels can be granted a six-year extension from the potentially more stringent standards for control that will soon be required. The regulatory reform agenda encourages cooperative and inclusive implementation, flexibility in regulations, and use of regulatory negotiations and roundtable discussions to address the concerns of all interested parties, including the regulated community, special interest groups, and regulators, during development of regulations. Numerous voluntary goals committed to by a variety of companies show that effective reductions can be made without a command from EPA to install pollution control devices.

TRI's Drawbacks

Burdensome Reporting

The reporting itself and addressing the issues that result from reporting are a tremendous burden, although the benefits seem to outweigh the problems. Fortunately, many companies find that generating emissions inventories for the TRI broadens employees' knowledge, organizes process information, improves communication and awareness, and reveals areas for process and product improvement. Many companies employ at least one person whose sole job is to read and interpret TRI regulations, guidances, notices, interpretations, and bulletins; participate in training courses and meetings about TRI; and facilitate reporting from the company's regulated facilities. Some companies develop calculation and internal guidance manuals, provide in-house training sessions every year, and set up extensive databases to handle the tremendous quantity of information generated to fulfill the reporting requirements. Staff at each facility must understand the regulations and communicate these standards to employees who identify emissions points and measure emissions.

To calculate pounds of emissions, staff tap data from numerous sources, including

- safety/health/environmental/ambient monitoring or stack tests,
- design specifications,
- operating instructions,
- basic chemistry/engineering/biology principles,
- accounting records,
- inventories,
- production records,
- raw material and product lists,
- upset or spill reports,
- licenses and permits,
- waste manifests,
- material safety data sheets,
- operating logs,
- compliance reports,
- performance tests, and
- process flowsheets.

Emissions determinations must be verified, documented, and defensible. Even the determination of whether a facility or chemical meets the reporting threshold or de minimis limits for inclusion in the calculations can be a major task. For the first year of reporting, the 13 Rohm and Haas manufacturing facilities and their corporate staff spent approximately $200,000 for monitoring and consulting and 7,000 hours to prepare TRI data. The burden has not changed much over the years. The TRI is a massive, complicated, and intricate program and database. Efforts to improve data quality are ongoing. Changes are continually being made to Rohm and Haas' operations and staff as well as to EPA's TRI program, so additional training is required.

Incomplete Representation of Toxic Chemical Releases

The TRI program and database, while called the national Toxics Release Inventory, does not represent all releases of toxic chemicals in the United States, nor does the TRI list of chemicals include all of the toxics released. In addition, not all of the chemicals on the list are toxic; some are there because companies use large amounts of these substances or because these chemicals affect the environment. The Congressional Office of Technology Assessment estimates that the TRI data represent only a portion of total toxic chemical releases to the environment.

Only manufacturers are required to report; however, processors and other users of chemicals emit toxics as well. (Automobiles are the major source of toxic emissions in the outdoor air we breathe. However, most exposures to toxic air emissions originate from products used indoors.) Lastly, the General Accounting Office estimates that almost one-third of those manufacturers covered by the regulation have not filed the required reports.

Misrepresentation of Off-site Transfers as Emissions

The TRI defines emissions as "releases to the environment and transfers to off-site facilities." Usually, the materials transferred to off-site facilities are treated further and rarely released to the environment.

- Organics can be degraded by bacteria in publicly owned treatment works (POTWs) or by incineration.
- Acids and bases can be neutralized to common salts.
- Ammonium sulfate, which accounts for the highest quantity of transfers to POTWs, is a form of fertilizer.
- Methanol, the second highest quantity of transfers, is decomposed by bacteria into carbon dioxide and water.

Transfers to off-site treatment or recycling facilities cannot be equated with environmental releases, especially if these data are used to evaluate or represent effects on human health and the environment. Therefore, the total TRI emissions represent some quantity between total waste generated and total emissions to the environment. Unfortunately, because a distinction is not made when releases and transfers are entered in the emissions database, the common usage definition of emission is applied to transfers as well. This practice interferes with setting appropriate priorities for release or risk reduction and forces goal setting to an intermediate step where achievement may have no effect on the quantity of chemicals released to the environment.

Diversion Away from Risk Reduction

The TRI includes only total pounds of emissions of certain chemicals, with an emphasis on reducing pounds of chemical emissions. No ranking exists to distinguish high from low toxicity chemicals on the list, nor can exposure be assessed on a national level to determine risk. Generally, the highest quantity of chemicals emitted have the lowest toxicity because the focus has been on reducing emissions of high toxicity chemicals.

Pounds are the unit of measure in the national database; therefore, industries focus on reductions in pounds and set different priorities than if they focused on reducing risk. For any given chemical, risk can be reduced by lowering emissions if the public is exposed to the chemical. But to lower risks from a variety of chemicals, toxicity and exposure are as important as pounds emitted. In addition, reducing the amount of chemicals sent for off-site treatment that converts organic materials to carbon dioxide and water or burns them for energy recovery will minimally reduce risk in comparison to similar reductions in actual releases to the air, water, or land. In fact, if coal is burned in place of a clean waste organic stream, risks increase from ensuing emissions of lead, mercury, nitrogen oxides, and sulfur oxides.

Right-to-Understand Problems

The public has a right to know and also a right to understand. Improvements in education and communications are needed to inform the public, legislators, regulators, regulated communities, and special interest groups who make the policy decisions. Laws or programs based on a misguided premise do not solve problems — some actions even exacerbate the situation. More data are not necessarily better. The paper quagmire generated by data collection can impede any effort toward improvement and effective management. An expanded TRI cannot solve every environmental issue; however, hysteria about toxics use and focusing only on specific risks without considering benefits do not serve the public good.

Conclusion

Industry wants to be given a tool that, along with regulations, can be used to improve both operations and the environment. The TRI is only part of a set of tools, not the whole picture. Priorities for exposure and risk must be incorporated with considerations for relative toxicity and the TRI emissions data. A holistic approach based on sound science, reason, and pragmatism that truly helps industries improve the quality of life is the only way to deal with today's environmental concerns.

Recommendations

With four years of reporting behind us, we have learned from our experience. Some recommendations for developing a reporting system have become clear.

■ **A release inventory should focus on releases.** The Toxics Release Inventory of emissions includes both releases and transfers to off-site treatment, storage, and disposal facilities. In 1988, over 25 percent of the pounds reported in the database were transfers, not releases. The misrepresentation of transfers as equivalent to releases distorts these data and obscures the priorities. The combined data make it difficult to measure progress on priorities set for release and risk reduction.

■ **The chemical list must be developed based upon sound science, with the specific purpose of the TRI in mind and with care to include truly toxic chemicals.** The list of TRI chemicals, called the list of toxics, includes nontoxic chemicals and does not include some that are toxic. It was created by combining two preexisting chemical lists that were developed for other purposes. Some of the chemicals were listed because they are used in high quantities. No emissions are reported for almost 20 percent of the chemicals on the list, and some are not used by manufacturers in significant quantities.

■ **The regulated community should include the major emitters of toxic chemicals.** Only manufacturers in a given set of Standard Industrial Classification Codes have been targeted to report emissions for the TRI. Thus, emissions in the database are only from a select group of emitters and do not represent a complete inventory. Care should be taken, however, not to logjam the system by including small emitters of negligible quantities of chemicals.

■ **Efforts should focus on collecting useful data because this information determines goals and priorities.** The TRI database cannot solve every environmental problem but should be used as a tool in combination with other tools. Collecting extraneous pieces of information wastes time and energy, jams and overwhelms the system, and detracts from data effectiveness. More data are not always better. Essential to the process are key accurate data that can be used and managed to drive goals and address real problems. Collecting unnecessary information can obscure relevant data and push priorities away from risk reduction.

■ **A pragmatic, reasonable approach incorporating sound science and considering relative toxicities, risk, and exposure should be used to set priorities.** Laws, programs, and goals based on faulty assumptions or focused on intermediate waste handling steps will not affect releases to the environment and exposure to toxic chemicals. Collecting pertinent data and setting appropriate priorities is the only way to focus on and improve the quality of life.

Breakout Sessions

The Breakout Sessions presented the approach used by the U.S. Environmental Protection Agency (EPA) in implementing a significant right-to-know program concerning the releases and transfers of toxic chemicals. It is essential to note from the start that EPA's way of implementing these requirements is being discussed only to show that the concept can be successfully implemented, not to suggest that EPA's way is the only approach.

Implementation and Program Issues of the U.S. Toxics Release Inventory (TRI)

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Introduction

After two tragic accidents in 1984 and 1985 when chemicals were released in Bhopal, India, and Institute, West Virginia, the United States enacted the Emergency Planning and Community Right-to-Know Act (EPCRA) to improve local communities' ability to prepare for chemical emergencies and, more importantly, provide public access to information on local chemical hazards. EPCRA establishes a structure at the state and local levels to assist communities in planning for chemical emergencies and requires businesses to provide information on various chemicals used in their facilities.

One of EPCRA's requirements was a Toxics Release Inventory (TRI) that would compile industry reports on annual releases to the air, water, and land of over 300 chemicals and 20 chemical categories. The U.S. Environmental Protection Agency (EPA) was given the task to develop and implement the TRI. For this program, EPA must collect and maintain massive amounts of information on a database that is publicly accessible through an on-line computer system and other means, such as microfiche at local libraries.

To ensure consistent, accurate, and useful data, EPA carefully designed and coordinated the TRI program to balance the needs and burdens of all interested parties — government, industry, public interest groups, and the public. TRI's key components include: regulatory development, outreach, data management, public access, and enforcement.

Establishing TRI

In establishing the TRI program, EPA had to determine which facilities would report on which chemicals. The law mandated the basic reporting elements and required manufacturing facilities with 10 or more full-time employees to report annual releases of specified chemicals, including specific high volume industrial chemicals, carcinogens, and water quality priority pollutants. Because the list of chemicals was compiled from two prepared earlier by New Jersey and Maryland, it included some not currently in production and others that did not meet toxicity criteria. Therefore, EPA established a petition process to allow anyone to request addition or deletion of chemicals based on established toxicity criteria that include evidence of

- reproductive dysfunction or
- neurological disorders or
- heritable genetic mutations or
- cancerous, teratogenic, and/or other health effects as well as significant adverse effects to the environment.

EPA must respond within 180 days to any petition, and changes to the list must be made under federal regulatory procedures.

With the list of toxic chemicals as the focal point, EPCRA mandated that only facilities whose primary business activities are manufacturing products for use in commerce are required to report under the TRI program. Smaller manufacturing facilities must have 10 or more full-time employees and exceed specified reporting thresholds. The following separate thresholds were established for particular uses of the toxic chemicals: manufacturing (including importing), processing (incorporating) the toxic chemical into the final product, and any non-incorporative uses.

To ease the reporting burden, EPCRA required a phased-in threshold approach. Thresholds are based on the following culminative amounts per listed toxic chemical or chemical category over the calendar year:

- **Manufacturing (including importing) or processing:**
  - 75,000 pounds (approx. 34,000 kilograms) for calendar year 1987,
  - 50,000 pounds (approx. 23,000 kilograms) for calendar year 1988, and
  - 25,000 pounds (approx. 11,000 kilograms) for calendar year 1989 and annually thereafter.
- **Non-incorporative uses:**
  - 10,000 pounds (approx. 4,500 kilograms) annually.

Reporting TRI Data

While most of the parameters for determining which facilities should be subject to TRI reporting were set by statute, the format for reporting information was not. EPA had to design a format and data elements that balanced the need for useful data with the requirement to provide clear and concise guidance to the regulated community. Form R was the result.

Form R is used for two types of information: facility-specific and toxic chemical-specific. One Form R must be submitted for each reported toxic chemical or chemical category. The facility-specific information requested on the Form R includes not only physical location but also a facility identification number that links the TRI with other databases for different environmental regulations and for identifying economic activities conducted at the facility. Form R also identifies key personnel who can provide EPA or the public with further information on a facility's toxic chemical use.

To meet the toxic chemical-specific information requirements, facilities must report the identity and the use for each toxic chemical used in processes and indicate how much of each is released to the environment, transferred off-site for disposal, or treated on-site. Releases must be classified by medium (air, water, or land) and by source: point (discharges to surface water) or nonpoint (fugitive emissions from piping). If waste is transferred off-site, facilities must report the destination and the amount and type of waste treatment, disposal, or recycling.

In 1990, with the passage of the Pollution Prevention Act (PPA), reporting on waste minimization activities such as source reduction and recycling, became mandatory. The PPA aims to minimize waste generation by establishing a source reduction program at EPA and assisting states to provide information and technical assistance. Under PPA, facilities are required to estimate the total quantity of toxic chemical in waste that is released, treated, and recycled on- and off-site and provide a basis for those es-

timates. In addition, facilities must provide information on source reduction activities instituted in each reporting year and include information on how they identified the activity and what impact the activity had in reducing wastes.

Facilities are not required to collect new data but can use available data, such as process information, inventory records, data collected through monitoring required by other laws, and engineering estimates as the basis of estimates of waste quantity. No more than two significant digits of accuracy are required. Facilities must retain records of this information for three years.

Under EPCRA, only chemical identity can be claimed a trade secret. Facilities must supply a generic chemical name on Form R submitted for public use and substantiation of their trade secret claim to EPA. In general, only EPA and health officials have access to trade secret data; however, concerned citizens can petition for release of a chemical's identity.

Recognizing that many facilities receive incomplete information on chemicals contained in mixtures or trade name products, EPA has required companies that supply such mixtures or products to identify the name and concentration of any listed TRI chemical contained in them. This information has helped facilities accurately calculate how much, if any, of a listed TRI chemical they are using. The supplier notification requirement does not apply to consumer products, and certain activities that involve toxic chemicals are exempt from TRI reporting, including

- procedures that use mixtures containing *de minimis* concentrations,
- processes that incorporate toxic chemicals into articles (acids in batteries),
- laboratory activities,
- janitorial and motor vehicle maintenance, and
- transportation of toxic chemicals under active shipping papers.

Assuring Data Quality

To assure the quality of the TRI data, EPA has conducted telephone surveys and site visits to facilities to identify common errors. Telephone surveys identify reporting and estimation problems and provide guidance to improve data quality. Site visit audit surveys quantitatively assess the accuracy of data submitted from year to year. Generally, the results are positive: through increased communications with industry and clear guidance, data quality has been improving.

As revealed by audit surveys, the main errors occur during

- threshold determination,
- Form R completion, and
- release estimation.

Each year, EPA tries to reduce errors and increase compliance by focusing expanded outreach activities on specific industries where many errors occur and publicizing enforcement cases.

Ensuring Compliance

To enforce TRI participation, EPA takes action when either a Form R is not submitted or evidence indicates a significant data error. Enforcement can be triggered by comparisons of Form Rs from facilities in the same industry; referrals on the federal, state, and local level; and complaints. Computer algorithms are used to check TRI data and generate notices of noncompliance. The penalty policy promotes consistent actions and enforcement through EPA inspections as well as citizen suits to improve compliance, which currently stands at approximately 75 percent. EPA has been encouraging facilities to settle cases out of court through environmentally beneficial expenditures, such as instituting source reduction activities or providing equipment for local emergency response groups.

Outreach to industry, states, and the public is another important way EPA ensures compliance. Examples include training and technical support for industry, financial and technical assistance for states, and fee waivers and database assistance for community groups wanting access to TRI data.

Conclusion

After more than five years, the TRI program is still evolving and growing. EPA, Congress, and other environmental groups are exploring ways to enhance and expand the TRI program, including

- expanding the types of facilities required to report,
- adding other toxic chemicals to the list,

- requiring reporting based on actual releases rather than on use thresholds,
- reporting on peak releases as well as total annual releases,
- mandating data on listed chemicals entering as well as exiting facilitys' process(es), and
- requiring facilities to develop toxics use reduction plans.

EPA has learned many lessons from the years spent collecting data on toxic chemical releases. The Agency has determined that centralized reporting is critical. As technology improves, magnetic media reporting will help reduce the data management burden on this centralized system. Data quality depends on clear, consistent guidance and ongoing technical assistance, which must be periodically improved to reflect the needs of the respondents. Supplier notification provides critical data to users of mixtures and trade name products. Lastly, EPA has found that aggressive outreach and enforcement can improve compliance and data quality.

Information Management

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Introduction

In October 1986, the U.S. Congress passed the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). The Toxic Chemical Release Inventory (section 313) is one of the major sections of EPCRA. In defining TRI's purpose, section 313(h) provides that: "The release forms required under this section are intended to provide information to the Federal, State, and local governments and the public, including citizens of communities surrounding facilities."

Section 313(j) further states: "The Administrator shall establish and maintain in a computer data base a national toxic chemical inventory . . . [and] shall make these data accessible by computer telecommunications and other means. . . ."

EPCRA requires annual reports to EPA of the direct release of toxic chemicals to all environmental media (air, water, and land) or off-site transfer to sewage treatment plants (POTWs) or other off-site facilities, such as commercial landfills. All manufacturing facilities — from orange juice manufactures to car companies to members of the chemical industry — that have 10 or more full-time employees and manufacture or process more than 25,000 pounds or use more than 10,000 pounds of any one of approximately 300 chemicals and 20 chemical categories must submit these data, which form the Toxic Chemical Release Inventory (TRI).

When EPCRA was passed in 1986, EPA was faced with the task of developing a structure to handle Congress' requirements. Because this was a totally new endeavor, EPA worked closely with state and local governments, industry, environmental groups, information providers, and universities to develop and implement the information management aspects of TRI. In retrospect, it is clear that involving all of the parties with an interest in TRI early in its implementation has had a great deal to do with its success.

EPA's TRI Information Management Infrastructure involves collection, management,

distribution, and integration of the toxic chemical information. Procedures for each stage are outlined in the following paragraphs.

Collecting TRI Information

Before a single document was submitted to EPA, various tasks relating to the ultimate collection of data were undertaken. EPA developed guidance documents, held industry workshops, and established a place for industry to call for help. Staff were hired and a reporting center was established to handle the influx of data — an average of 85,000 forms per year from 23,000 industrial facilities.

Each year, facilities receive a reporting package that contains the TRI forms, an instruction manual for filling in the form, and a magnetic media package that enables them to file information electronically. Training is offered throughout the year at industry conferences and workshops to help avoid any mistakes in completing the forms. A TRI Hotline is also available to answer any questions a company may have about the form or the process (1-800-535-0202; 703-920-9877).

Managing TRI Information

To manage TRI information, systems were developed to keep track of all documents and store and aggregate data, allowing analysis. A comprehensive data quality program has been established, which includes quality management of data processing, industry review of release numbers, and release estimate assessments, including on-site evaluations.

The magnitude of the TRI data collection is illustrated by the following figures for number of individual chemical forms, by year, as of November 1991:

- 1987: 79,057;
- 1988: 84,693; and
- 1989: 82,513.

Facilities submit an average of 60 data elements per form for each reporting year. EPA entered over five million data elements from forms received for 1987 through 1990. In the fall of 1990, Congress passed the Pollution Prevention Act of 1990, effective for the 1991 reporting year and thereafter. The act added about 50 percent more data to TRI reporting and will lead to between eight and nine million data elements for 1991 reporting. Other activities underway that either increase the number of facilities required to report or the number of chemicals on which reporting will be required will affect this total.

Three procedures ensure data quality. The first identifies and corrects data entry errors. Next, errors in facilities' data are identified and, where possible, corrected. The final procedure enhances data submitted by facilities.

During data entry, computerized edits and algorithm checks are used to verify the keyed information. Edit checks, which occur at the point of data entry, prompt the keyers to verify a variety of critical fields, including:

- Facility name,
- State/city/zip code,
- Latitude/longitude,
- Possible duplicate submissions,
- Presence of negative values, and
- All release data over 100,000 pounds.

In addition, computerized algorithm checks are made on:

- chemical name/CAS number,
- facility Dun & Bradstreet number,
- parent company Dun & Bradstreet number, and
- NPDES permit numbers.

Four separate activities ensure a high level of data entry reliability. First, at least 25 percent of each keyer's work is verified. Following this step, random audits of data entry data quality are taken. (The accuracy rate at this stage is about 99.5 percent. After the next three steps, this rate is even higher.) Next, a variety of reports are used to identify aberrations, then each facility is mailed its release and transfer numbers to verify. Finally, high-level staff manually examine critical data elements after all data for a particular year have been entered.

Most numbers reported are relatively small; however, to study trends, scientists must be concerned with the many large numbers for releases and transfers found in the database, and the final checks before data release recognize this. All numbers over 500,000 pounds are verified. In addition, EPA verifies all release/transfer numbers that cause a facility to be selected as one of the top 25 in a state by total releases and transfers or one of the top 25 facilities in a state by environmental media. Additionally, the top 250 facilities by

amount of increase and the top 250 by amount of decrease are also verified. In addition, reports are sent to the regions and states for another look before public release.

In addition to these data quality procedures for EPA staff, a number of activities are undertaken to determine whether submitters have done their jobs correctly. Notices of Noncompliance are issued when the facility has made such a significant error that the data cannot be entered. Notices of Technical Error are issued when a computerized check of the submitter's data (verified by a person) indicates a problem in submission. Additionally, computer-generated changes are used to clean up table values and county names, verify zip codes, states, and counties, and where possible, correct submitted latitude and longitude numbers.

Because computers do not really "think," it is often necessary to normalize data categories to enhance usability. Some significant normalization has occurred with respect to county names, facility names, parent company names, inserting zip code centroid latitude and longitude, and inserting Federal Information Procedure System codes for state and county.

Distributing TRI Information

The wide range of users of TRI data has indicated a need for multiple products, training, and services. EPA makes TRI data available through "computer telecommunications and other means." The states and others (such as industry, environmentalists, the media, and health officials) also make these data available in various unique ways.

TRI information is distributed to a variety of users, including EPA employees in both Headquarters and the regions, local and state government employees, academics, librarians, health professionals, industry, and private citizens. National, state, and local governments are using the data to shape both voluntary and regulatory environmental programs, and many companies are deciding to make dramatic voluntary reductions in toxic releases. Private citizens are studying data on releases of chemicals in their communities. This information has created a strong demand for further analysis and facilitated comparison across the different environmental media.

These multiple users have varied needs, such as national or state data sets, extracts, and analyses, so information is distributed through different means. For example, while developing the original infrastructure, a partnership was formed between EPA and the U.S. National Library of Medicine, which added the Toxics Release Inventory to its previously established health and environmental information network. This online means of assessing TRI data has already answered over 300,000 database queries.

In addition to online service, EPA provides TRI data in other formats, including a national report that is an easy-to-understand summary of the database and microfiche located at over 3,300 U.S. libraries. Diskettes of each state's emission reports have been distributed to 50 state health and environment departments, and more than 500 libraries at universities across the United States have the database on CD-ROM. Magnetic tape is also available for those interested in adding the TRI information to their large computer system. All of these products are available at reasonable prices to anyone who wants them.

In addition, training sessions are held regularly for both industry and the user community. A TRI Hotline and a user support service line (TRI US) have been established to help less sophisticated users in programs and searches.

Integrating TRI Information

TRI continues to expand with each additional year of data added to the system. As the system grows and more users become familiar with the data, the number of uses and opportunities for integrating TRI with other databases will continue to expand. As of 1991, three years of data are available, which allows for multi-year trend analyses. Because of the geographic orientation of TRI, data can be displayed through the Geographic Information System.

TRI has been a driving force for linkage to other information sources. The use of common data elements (for example, facility name) allows matching with other databases to create new information sets. As the only publicly available database for multi-media environmental information, TRI and its uses will continue to grow.

Computer Tools for TRI Analysis

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Risk Assessment and Risk-based Decisionmaking

Toxics Release Inventory (TRI) data can support many risk-based decisions, including ones that establish priorities for follow-up risk evaluations and target subcategories of facilities, chemicals, industries, and geographic areas for voluntary reduction efforts, enforcement, or regulatory development. Such decisions must focus on relative rather than absolute and quantitative risks. Despite uncertainties in release estimation methods, range reporting, and limited coverage, TRI data are still extraordinarily useful for relative risk evaluations. This information can also provide a starting point for absolute risk evaluations that may be needed to support development of regulations.

Major features of risk assessment are usually incorporated in these analyses either explicitly or implicitly. The risk assessment process includes consideration of a chemical's toxicity to various organisms, release patterns and characteristics, and environmental transport and fate as well as the presence, size, and types of exposed populations.

Although several common types of TRI analyses (summaries of total releases and transfers, for example) do not appear to be risk-based, they can be considered so by using the following simplifying assumptions:

- The toxicities of all chemicals are the same,
- The potential for exposure is the same for each release medium,
- No differences exist in environmental conditions from facility to facility, and
- The size of the potentially exposed population is assumed to be equal or not regarded as significant.

Assessment Tools for Risk Decisions

Major TRI assessment tools that support risk screening applications include software for database management, graphic display and mapping, and statistical analysis; the Geographic Information System (GIS); and exposure and risk models. All can be used at several decision levels.

Such factors as available data and personnel, time, cost, and the degree of uncertainty acceptable in a particular decision influence the choice of tools. Typical TRI analyses performed on computers include simple combinations of releases and transfers, toxicity-weighted combinations, and use of TRI data with environmental models for semi-quantitative or quantitative risk estimates.

Simple Assessments

Simple combinations usually include summations of release data or releases and transfers. Most summaries can be compiled through database management systems by facility (across chemicals and release media), geographic area (county), industry sector, chemical, or medium. To support such analyses, EPA uses dBase, ADABASE, SAS, and the ARC/INFO GIS. The Office of Pollution Prevention and Toxics has developed a set of SAS routines, collectively called TRIPQUIC, that allow easy construction of summaries, which can be displayed as tables, graphs, or maps. These simple combinations are constructed directly from verified data contained in TRI submissions.

Weighted Combinations of Emissions

Weighted combinations of release data most often use information on toxicity endpoints of TRI chemicals to weight the releases and transfers. Such weights can be constructed on the basis of a toxicity ranking, either qualitative (high-medium-low) or quantitative (for example, 6 on a scale of 1 to 10). Weights can also be derived directly from toxicity values: LD_{50}, cancer potency slope factors, or acceptable dose levels.

Producing weighted combinations of release data is a relatively straightforward process when databases of toxicity information can be related to release data files by a Chemical Abstracts Service number. Reports can be created by choosing only selected carcinogens or by multiplying releases by a toxicity rank or concern level. TRI data have been used by analysts in several EPA regions, states, and interest groups to develop such weighted assessments. In most cases, though, these combinations do not include an exposure-based weighting scheme.

Qualitative Risk Screening

Using risk screening to develop relative indicators of concern incorporates additional exposure information and allows greater use of professional judgment in determining priorities. EPA's *TRI Risk Screening Guide* provides one suggested approach. Developed to support reviews of TRI data by local officials (especially those not already involved in conducting risk assessments), the guide suggests consideration of releases, toxicities (human and aquatic), environmental fate, receptor populations, and uncertainties or gaps in release and toxicity data. The primary output of a risk screening assessment (as described in the guide) is a grouping of facility- and chemical-specific releases into high-medium-low categories.

Risk screening assessment is most appropriate for small area comparisons, such as 10 to 50 facilities in a county, because of the time involved in manipulating the appropriate data. EPA is developing an automated version of the guide to support analyses of larger groups of releases, and various TRI data users are considering numerous other approaches to risk screening.

The process of risk screening requires data on chemical releases, toxicity information, chemical fate parameters, and distribution of human as well as wildlife populations and environmentally sensitive areas. A wide range of health and environmental effects were considered when the guide was developed, including chronic toxicity, carcinogenicity, human acute toxicity, and acute and chronic toxicity to aquatic organisms.

Toxicity ranking factors can be developed from existing regulatory levels, such as the Comprehensive Environmental Response, Compensation, and Liability Act's reportable quantities, or from data on effective dose levels, called "reference doses." Major toxicity data sources for risk screening include the *TRI Risk Screening Guide's* Appendix A, Roadmaps' PC database, the Integrated Risk Information System, other on-line data sources such as the Hazardous Substances Data Bank, the International Agency for Research on Cancer's chemical monographs, and the International Register of Potentially Toxic Chemicals' toxicity data.

Major site-specific data used in risk screening include:

- wind speed and direction,
- stream flows,

- soil characteristics, and
- receptor population information.

Data are often available from local weather stations, natural resource management agencies, and planning or health organizations. Information to support evaluations of receptor population can be derived from maps showing household distribution or from a census of population retrieved by using PC GEMS or GIS, which can also delineate sensitive populations (schools and hospitals) and environments (wetlands and parks).

The Office of Pollution Prevention and Toxics' Graphical Exposure Modeling System (GEMS) includes many features for risk screening applications. PC GEMS supports data management and retrieval, mapping of points or areas, and multimedia exposure modeling. However, the most frequently used TRI risk evaluations cannot support the amount of data required for a quantitative modeling assessment. PC GEMS also requires considerable hard disk space on a personal computer, and therefore, a subset, Screen GEMS, has been developed to support risk screening. The features of Screen GEMS include:

- Data on selected environmental characteristics, such as prevailing wind patterns and stream flows;
- Receptor information, including data to construct tables of populations living near sites and identify downstream drinking water intakes; and
- Integration tools that assist in developing site maps of population, rivers, and political boundaries.

Quantitative Risk Screening of TRI with Environmental Models

In risk-based decisions, TRI data often can be enriched by incorporating computerized models in the evaluation. Key issues in such assessments are the availability of additional input data and the degree of uncertainty that can be communicated readily to users. Models provide a convenient way to incorporate site-specific factors affecting exposure and may allow calculation of risk estimates on relative toxicity. However, the TRI reporting form does not include all the data necessary for a modeling analysis. If the decision to be supported allows their use, generic release input parameters may be appropriate. In other cases, additional site-specific data may be needed to support more accurate risk assessments.

TRI data can be evaluated by using semi-quantitative modeling with generic input data or quantitative risk modeling with site-specific information. The semi-quantitative approach employs the models' numerical results in a qualitative sense to support scoping or ranking. In such cases, the facilities or chemicals with the highest estimated risks can be grouped as a priority for additional action. A fully quantitative approach allows estimation of population risks to determine permit limits or other regulations.

The major differences between the two approaches are the data requirements, necessary expertise, and uncertainty of results. For example, significant additional data are needed to conduct an atmospheric exposure and risk assessment using a model in GEMS or PC GEMS. The Industrial Source Complex—Long-term model estimates annual average concentrations from stack, area (fugitive), or volume emissions. Major inputs to estimate data include site location, emission rate, and stack data (height, temperature, velocity, diameter), together with wind speed and direction. To additionally estimate exposure, data are required on population distribution around the site. Also, annual average concentrations and exposure can be used in conjunction with a cancer potency unit risk factor to estimate individual and aggregate cancer risks over a lifetime. The TRI form provides only the annual total emissions of each chemical (from all sources within a facility) and site location.

The Office of Pollution Prevention and Toxics employs semi-quantitative risk screening in the Existing Chemicals Process to target chemicals for possible regulation under the Toxic Substances Control Act and highlight possible facilities for voluntary emissions reduction of TRI chemicals. Such assessments are being developed for about 30 TRI chemicals, with all TRI sources in the United States modeled for each.

EPA has not attempted to develop reliable quantitative risk estimates for TRI chemicals using site-specific data. Such an effort would require contacting facilities for detailed data on most or all of the individual stacks or vents and better estimates of size and perimeter boundaries. TRI data reported by industry are summarized not only from many production processes but also from multiple release points within a process. In a fully quantitative assessment, such sources should be evaluated individually.

A major new analysis tool recently available within EPA and elsewhere, the Geographic Infor-

mation System (GIS), can support a variety of TRI analyses. GIS manages both geographic and geographically referenced "attribute" data; in TRI, these data are single points that represent facilities. Examples of geographically linked attribute data used in TRI risk screening include TRI releases and transfers, populations associated with census enumeration areas, stream flows linked to stream segments, and populations associated with drinking water utilities.

The GIS includes a standard database management system that can manipulate attribute data, and its ability to develop information about spatial relationships not assessed before is especially powerful. A simple example of a spatial analysis would be a total of all records within a single county, when the county name or code is part of the record. Such analyses can be supported in most database environments and in SAS.

An intermediate example of spatial analysis might be a summation of all points within a specified distance and direction of another point — such as populations or postal zip polygon centroids near a facility. An advanced example of GIS assessment might be a computation of total acreage of endangered species habitat within a floodplain downstream of a TRI facility, given the facility location, river trace, topography, and rainfall and species ranges. The GIS can also support development of models or scoring systems.

EPA regions are using GIS to integrate data collected to implement environmental laws and support risk-based priority setting. At least two regions have developed TRI scoring systems that assign weights to releases and transfers by degree of chemical toxicity concern.

Conclusions

The TRI is extremely useful for risk-based decisionmaking. Most applications involve some form of simplified risk assessment or screening to target application of scarce resources on releases presenting the highest risks.

Many decisions can be supported by TRI analyses; however, they may require assessments with different levels of specificity and accuracy. Because of uncertainties in emissions data and cost and time requirements to collect additional information, most decisions that rely on TRI analyses depend on relative risk between one group of chemicals, facilities, industry sectors, and geographic areas and another. Often, a high-medium-low ranking can be used.

Data needs for assessments vary according to which elements of risk are considered and the degree of uncertainty that is appropriate to a decision. Chemical toxicity data are needed for risk screening. Several kinds of site-specific data on environmental conditions and receptor populations are required to extend evaluations to include exposure factors.

EPA's *TRI Risk Screening Guide* outlines a process that results in high-medium-low rankings of facility-chemical combinations. Its appendices contain useful information on relative chemical toxicity and environmental fate parameters.

Numerous computer tools can provide access to data needed for risk screening and support various analyses. Notable examples include database management systems (ADABASE, dBase); statistical packages (SAS); the Geographic Information System (ARC/INFO and mapping packages); and environmental models (GEMS and PC GEMS).

Models make incorporation of most factors needed for risk-based assessment relatively easy. However, the results of modeling analyses, particularly those created with generic input assumptions, should be used cautiously. Such results can often be used qualitatively to help set relative priorities. Several EPA offices have found these approaches useful in performing TRI data analyses. Many other TRI data users are exploring the use of these and related techniques in their analyses.

Data Use and Analysis

Setting Environmental Priorities with the Toxics Release Inventory

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ABSTRACT

The Toxics Release Inventory (TRI) data are used at the U.S. Environmental Protection Agency to target resources and help establish priorities. This session will explore various initiatives in which EPA and private industry enter into cooperative joint ventures to prevent pollution using TRI data as the measure of success. It will also discuss regulatory activities at EPA that have been triggered by an analysis of the TRI data and its influence on laws passed by the United States Congress as well as by local governments in the United States. An analysis of TRI's role in focusing environmental inspection and enforcement activities will complement the description of its role in pollution prevention.

The Toxics Release Inventory is used by different people for different reasons. It is certainly used by the states and federal government, but also by the press, academic and citizens' groups, and industry. My presentation will focus on how EPA and Congress rely on TRI when developing legislation and regulations. EPA also uses TRI to enforce the regulations, assess environmental and health risks, and measure our environmental progress.

During this past year, a number of important federal activities were heavily influenced by TRI, including several pieces of legislation. The most important for the Toxics Release Inventory and the Office of Pollution Prevention and Toxics has been the passage of the Pollution Prevention Act of 1990, which puts into law EPA's policy to prevent pollution from being generated in the first place. This act establishes a source reduction program at EPA and provides state governments with technical support, particularly for smaller businesses, in determining pollution prevention opportunities.

The Pollution Prevention Act charged EPA to establish a pollution prevention office, now the Office of Pollution Prevention and Toxics. EPA has developed a strategy, set up grants for state and local governments, and established a source reduction clearinghouse that exchanges publicly available information on pollution prevention techniques, processes, and process changes. EPA also gathers information on source reduction, recycling, and changes in releases under the TRI reporting requirements.

We call the report collected under the TRI the "Form R" for releases. Basically, Form R tells companies to look aggressively and actively for pollution prevention opportunities, document what kinds of action they have taken to determine those opportunities, and, most importantly, to predict what they are going to do in the future.

The other uses of TRI at EPA are interesting. We perform a fair amount of targeting of our enforcement and inspection activities, using the toxics release information. Because these are multimedia data, we are able to compare the

reports for air and land emissions and, for the first time at EPA, to actually put together teams that will go out and do multimedia enforcement. Also, we can look at priority enforcement targets based on the amounts of emissions that have been reported because they are very high or do not look very logical and suggest that something may be wrong with the kind of report being used. TRI allows us to leverage our enforcement resources, to use them where they will do the most good.

In addition, we have been encouraging environmentally beneficial expenditures. EPA can fine a company for failing to follow regulations; however, if the firm can demonstrate that it has voluntarily engaged in substantial expenditures for pollution prevention, it will get a partial credit against the fine. This is one of the ways TRI has advanced EPA thinking on enforcement.

TRI has been used by other agencies to validate other laws. The Internal Revenue Service, the United States' tax collection agency, has compared emissions reports with the amount of taxes collected, thereby using TRI as an enforcement tool. State and local governments, particularly local municipalities, have also used TRI data to assess the appropriateness of different kinds of buildings in a particular neighborhood. For example, should a school be permitted to be in an area where emissions or releases have been reported? Banks have also used the data to determine the riskiness of financing the purchase of particular pieces of real estate.

EPA has been using TRI information to more narrowly focus risk assessments. The list of chemicals included under the TRI was given to EPA by Congress. EPA is evaluating this list systematically for potential new additions. Of the 77 TRI chemicals that have been subjected to priority screening so far, EPA's Office of Pollution Prevention and Toxics has identified 57 chemicals for more detailed testing that will undoubtedly influence regulations.

TRI is also being used by other EPA offices to assess risk and regulate activities. For example, the Office of Water has used the TRI to identify possible sources of well and groundwater contamination. TRI data are also used to identify sources of toxic discharges into nationally significant estuaries near our Great Lakes as well as in the Gulf of Mexico area, where EPA has major priorities. The TRI also helps to identify priority geographic areas of the country where EPA could concentrate efforts and resources.

The TRI also measures progress. To determine whether people really are reducing pollutants, EPA is studying pollution prevention practices, including kinds of activities, to create a TRI environmental indicator program.

One of the most publicly acclaimed programs at EPA is the 33/50 Project whose goal is to have selected corporations voluntarily reduce 17 selected TRI chemicals 33 percent by 1992 and 50 percent by 1995. Six thousand major U.S. corporations were asked to sign up for this program; to date, 700 have voluntarily promised to meet or exceed these goals for the 17 chemicals. A number of companies have voluntarily committed to meet the same goals in their international operations. The 1988 TRI data will be the baseline for measuring progress in the 33/50 program.

The new Pollution Prevention Act requires companies to identify the methods used to find pollution prevention opportunities and then report which process actually reduced pollution. An EPA clearinghouse will contain that data as well as the Form R reports, and they will be publicly available.

It has been difficult to determine, however, whether the environment is really better off. Now that EPA has three years of data, it can start assessing trends.

Other issues include changes companies make in methods of accounting and measurements to understand better how the law applies to them. Unfortunately, EPA does not have an easy way to determine the relative risk associated with the chemicals in the TRI because it cannot measure what an increase or decrease of 10 million pounds means for the environment as a whole.

EPA is now trying to develop a Toxics Release Inventory indicator that will determine whether the United States is better off and whether it is making environmental progress. This indicator, which is not a measure, is highly controversial because it will require some balancing of a number of scientific, policy, and philosophical judgments; i.e., things like carcinogenicity and reproductive and environmental hazards. But we are convinced that we need to go farther than simply announcing total pounds or total kilograms each year.

The TRI indicator is a priority of EPA Administrator William Reilly. EPA will use it to allocate resources so that they are sent to areas where risks can be reduced most efficiently and effectively.

Air Quality and the TRI

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ABSTRACT

The Office of Air Quality Planning and Standards, charged with implementing most stationary source regulations under the Clean Air Act, has used the Toxics Release Inventory for many purposes, most recently as a focal point for the debate over development of the list of 189 chemicals called for by the newly amended Clean Air Act. The staff have also employed the TRI to identify industry sectors that need additional regulation and guidance and to choose corporations to work with to voluntarily reduce emission levels. In the future, the staff will use these data to further develop office priorities.

Introduction

Chemical toxics. They can be found in improperly treated sewage wastewater, in stormwater runoff from farms and fertilized lawns, in emissions from chemical plants, and in automobile exhausts. No matter where it comes from, however, toxic pollution is a potentially deadly problem. The U.S. Environmental Protection Agency (EPA) has always worked aggressively toward eliminating toxics in the United States; the Office of Toxics Substances' accomplishments with the Toxics Release Inventory (TRI) affirms the importance of our activities.

Once, toxic problems were believed to be confined to industrial areas, but current research proves that the threat of contamination is much more pervasive. The TRI has presented opportunities within EPA by providing a powerful tool; the Office of Air and Radiation has turned those opportunities into action. We've used the data to build a clear picture of the toxics of most concern in our nation and pinpoint the sources of those toxics.

Picture a jigsaw puzzle that depicts the total of all the air toxics emissions in the United States. Some of the pieces are large and easy to pick out, such as a chemical manufacturing facility; others, such as the misapplication of pesticides by a farmer, are small and harder to locate. It takes all the pieces to complete the puzzle, but the only way to do that is one piece at a time. The Toxics Release Inventory, which provides us with information on 300 individual chemicals in 20 chemical categories, adds many pieces to our air toxics puzzle.

In the United States in recent years, the importance of air toxics control has grown immensely in the eyes of the public. One reason is the accidental release of air toxics in Bhopal, India; another is the publication of the TRI data, which has attracted attention from government officials, industry, environmentalists, and the media. That attention has given EPA's air quality staff momentum and enabled use of the TRI information to target reductions in air emissions of hazardous air pollutants.

Sources of Air Toxics in the United States

Sources of air toxics can be broken down into three categories: industrial point sources, area sources, and accidental releases. The latter are potentially the most serious, as we saw in Bhopal, India, but as the word "accident" suggests, do not lend themselves to the use of a database for regulatory purposes. Area sources, such as the misapplication of pesticides or the release of chemicals by a dry cleaning operation, are the sum total of many small sources that singly may not present a high risk but coupled together, present an unacceptable risk.

Those nonpoint sources are important, but they are not usually as great a risk as the multitude of identifiable point sources in the United States. A point source is a single source of air pollution that is definable. An example would be a manufacturing plant. The TRI has identified 1.7 billion pounds of toxic chemicals that were released to the air from point sources in 1989.

The Role of the TRI in Developing the Clean Air Act

Air emissions comprise about 42 percent of the total releases and transfers tracked by TRI from 1987 to 1989 (Fig. 1) — twice as much as any other category in the entire database and almost half of the whole total. By gathering that information, coupled with estimates of the risk involved, the United States has two more pieces of the puzzle and can establish priorities.

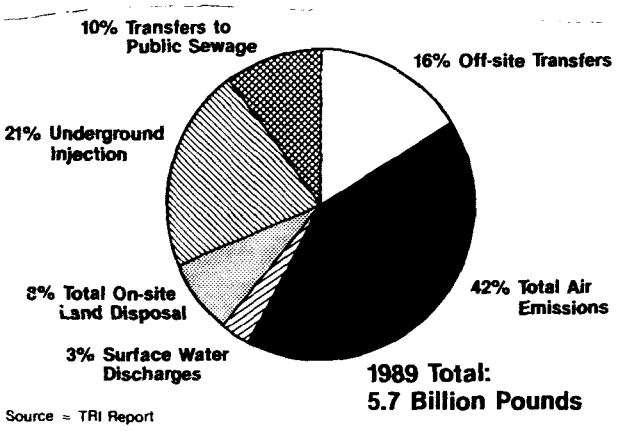

Figure 1.—TRI chemicals: environmental distribution of releases and transfers, 1987–89.

The TRI database helps us plan and delineate where we as a nation will place our resources and efforts and allows us to track our progress. In effect, it helps us keep track of the size of the puzzle.

The TRI data also provide us with much needed information on which toxic air pollutants each industry is contributing to the problem and how much each year. Figure 2 shows the various industries and the amount of air toxic emissions produced by each. EPA's Air Quality Office is developing better control techniques guidance for some of the industries, such as printing and the wood furniture coatings, and has assembled workgroups (called "clusters") to address them from a cross-media perspective.

The petroleum industry is one such cluster where Air Quality and other Agency offices are combining data and resources to reduce emissions to air, land, and water. Another industry being examined from a joint perspective is the pulp and paper manufacturers. TRI is one of the tools the Agency staff use to develop the complete picture of where the industry is located, how much pollution results, and how best it can be be controlled or prevented. Furthermore, EPA can take a look at specific chemicals being emitted in large quantities, information that helps determine priorities.

Currently, Air Quality is looking at hydrochloric acid, chloroform, ethylbenzene, acetaldehyde, and other chemicals as a result of the amended Clean Air Act (Fig. 3). The TRI was one source of information used by congressional staff to develop a list of 189 toxic chemicals that was included in the revised air toxics provisions.

CEO Voluntary Reductions

In March 1989, EPA published the first TRI reports. By providing the information in a format easily understood by the American public, the Agency created a powerful tool. We put a piece of the air toxics puzzle into the hands of everyone who was interested, and some Americans began using the data to assess air toxic problems in their community.

Zeroing in on cleaner air in 1989, Congressman Henry A. Waxman used the information to create public interest in air toxics issues. Representing California, one of our states with the most serious air pollution problems, Waxman

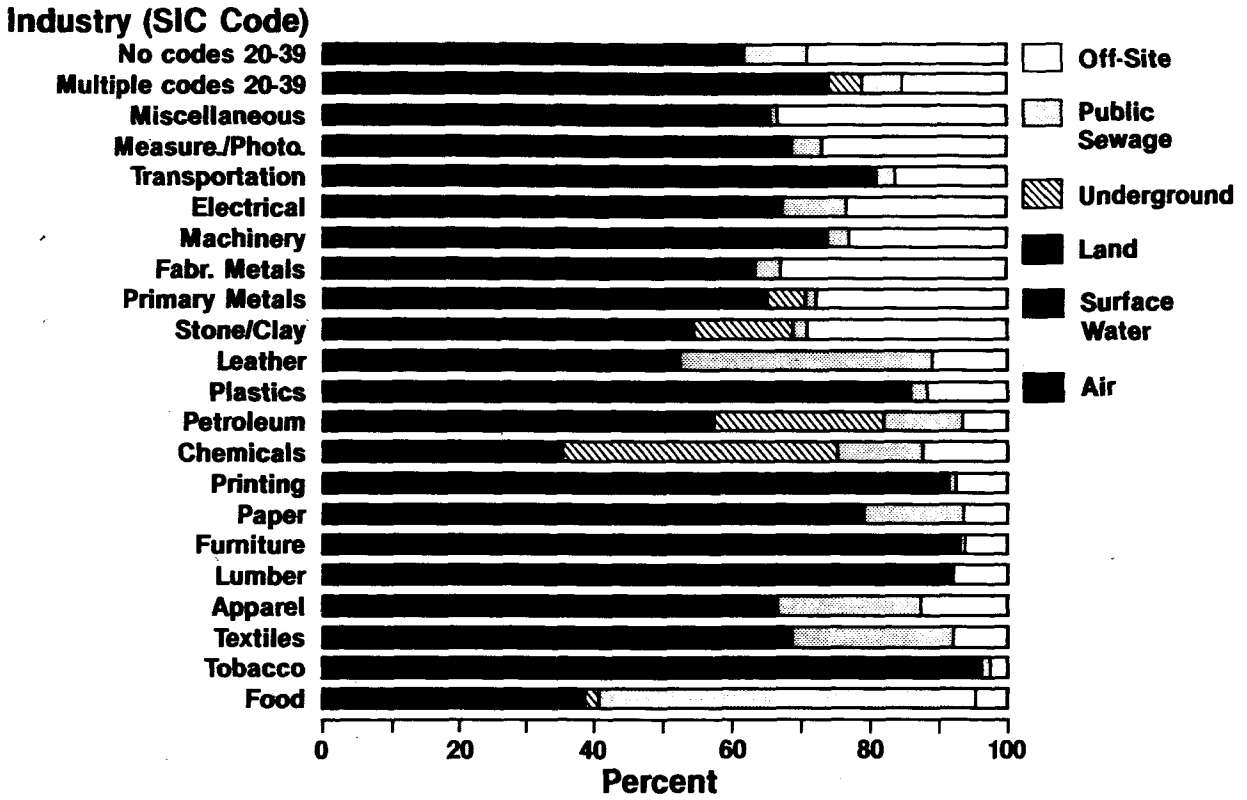

Figure 2.—The environmental distribution of TRI releases and transfers of each industry, 1989.

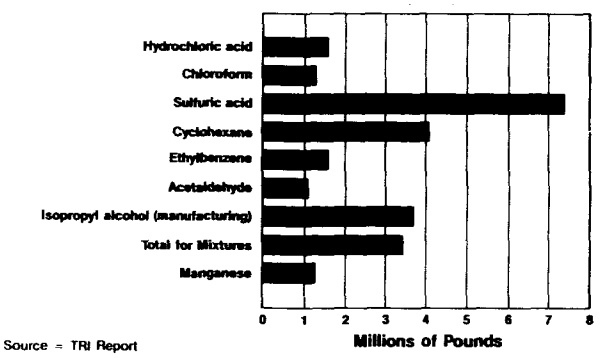

Figure 3.—Increases in emissions to air greater than one million pounds, 1988–89.

was later instrumental in amending the Clean Air Act.

As a result of the attention Congressman Waxman drew to the amount of air toxics produced by various industries, EPA Administrator William Reilly initiated a project for the Office of Air Quality Planning and Standards: to persuade the chairmen of 25 prominent United States corporations to participate in a voluntary, cooperative effort to reduce their industry's toxic emissions. The group was then narrowed to nine chief executive officers (CEOs) representing 40 of the 205 facilities whose emissions were believed to produce the highest cancer risks. Air Quality worked with these CEOs to identify ways in which their emissions could be lessened, and, in September 1990, they committed to reduce their companies' air emissions.

These commitments did not stem from regulation but are the direct result of public attention and creative cooperation between EPA and industry. They illustrate how the collection and use of data can facilitate toxic reductions. Two months later, in November 1990, the United States Congress amended the Clean Air Act.

The Clean Air Act

The chart in Figure 4 outlines the major components of the air toxics provisions of the amendments' air toxics provisions. Under the 1977 Clean Air Act amendments, EPA regulated air toxics by establishing a level of acceptable risks for toxic or hazardous air pollutants. This was a very difficult task, and all too frequently it ended in dispute and litigation. In the new provisions, hazardous air pollutants will be regulated by placing them into categories or groups and then determining the control technology or

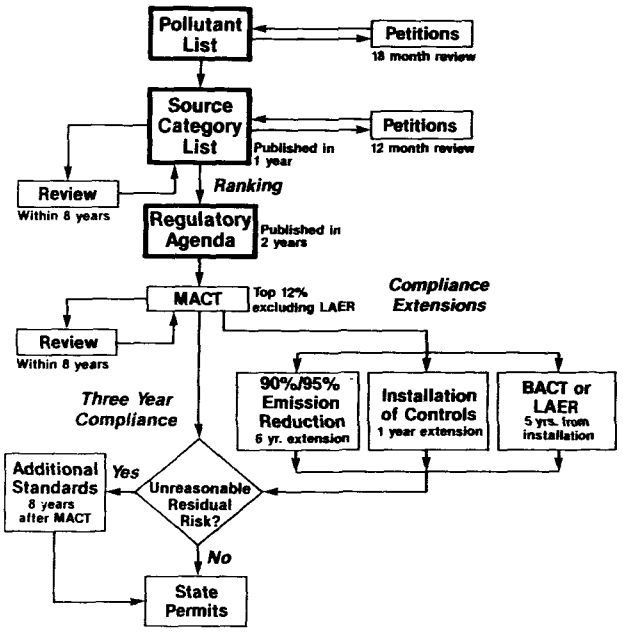

Figure 4.—Clean Air Act amendments: air toxics provisions.

technique that can maximally reduce the toxic air emissions.

In Figure 4, the three highlighted boxes indicate where the TRI plays an important role in our regulatory process. This is also true for media other than air, including solid waste and water.

The first box is the pollutant list. By examining TRI data on emissions from United States industries and evaluating scientific data on toxicity of certain pollutants, EPA will establish a list of toxic chemicals or pollutants to use as a basis for regulating air toxics. As a result, the Agency may modify the list of 189 chemicals established by Congress for the Clean Air Act.

The second box — source category list — represents the requirement that EPA list all categories and subcategories of sources of chemicals on the pollutant list. By using the TRI, Air Quality can identify some of these sources.

The third box — regulatory agenda — represents the Clean Air Act requirement that EPA determine the priority or order in which regulations are created for these categories. Again, these decisions can't be made in a vacuum; all available tools, including TRI, are needed to create this order. By using the data (the pieces of the puzzle), we can decide how and when the puzzle picture should be changed. As a large industrial nation, the United States cannot set new regulations for all its industries simultaneously. Priorities must be established.

The emission reduction box in Figure 5 refers to the Early Reductions Program. As part of the newly amended Clean Air Act Air Toxics provisions, companies may apply for a compliance extension by participating.

Early Reductions Program Under the Newly Amended Clean Air Act

During 1991, the Office of Toxic Substances has been working very hard to set up the 33/50 or Industrial Toxics Project, a voluntary program that encourages companies to reduce emissions to all media, including air.

In the Clean Air Act Early Reductions Program (Fig. 5), commitments made by companies are legally enforceable because the act excuses them from complying with the new air toxic standards for six years. Both programs expect to achieve significant reductions over the next four years. To comply with extensions, companies must reduce their emissions 90 percent (95 percent for particulates) from a baseline mutually agreed upon with EPA. The information on previous emissions reported to the TRI and other EPA databases will be used to establish that baseline and to monitor reductions. Note that trading between chemicals is allowed. Both the 33/50 and Air Toxics programs expect to achieve significant reductions through maximum achievable control technology (MACT) over the next four years (Fig. 6).

Early in 1991, Water Quality used the TRI database to select the names of 1,000 candidate companies for the Early Reductions Program. Although the program will not be final until January 1992, Air Quality has already begun to work with companies to identify how they can take part in it. Committed to participate are: Allied Chemical, Du Pont, Merck, 3M, and Monsanto, with many other companies expressing interest. Air Quality is planning to promulgate an air toxics standard for chemical plants and expects a heavy concentration of submittals from chemical plants in early 1992.

The Chesapeake Bay Program

Both the Early Reductions and the 33/50 programs will play a role in restoring and preserving the Chesapeake Bay, one of the United

- Incentive for industry to reduce toxic emissions early
  - Allows 6 year extension of deadlines
  - Industry must reduce toxic emissions by 90% (95% for particulates)
  - Provides flexible trading program between chemicals

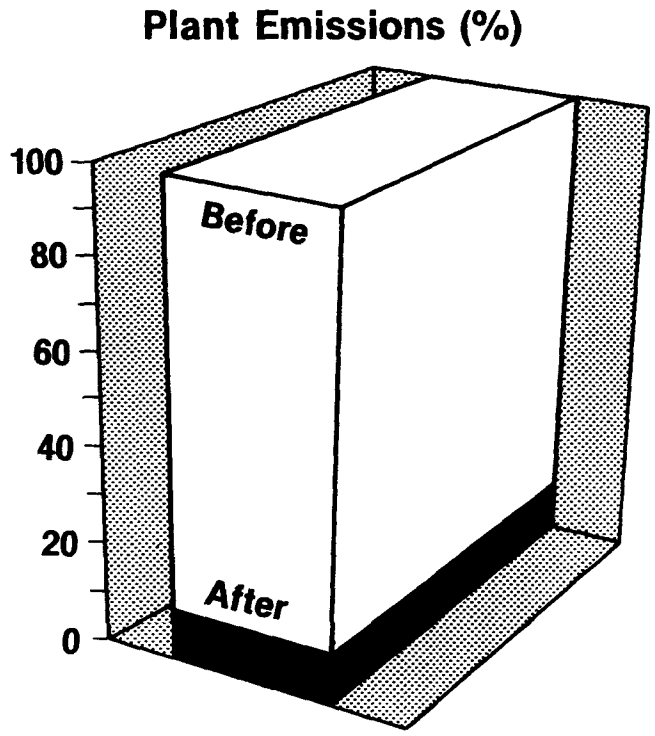

Figure 5.—Air Toxics Early Reductions Program.

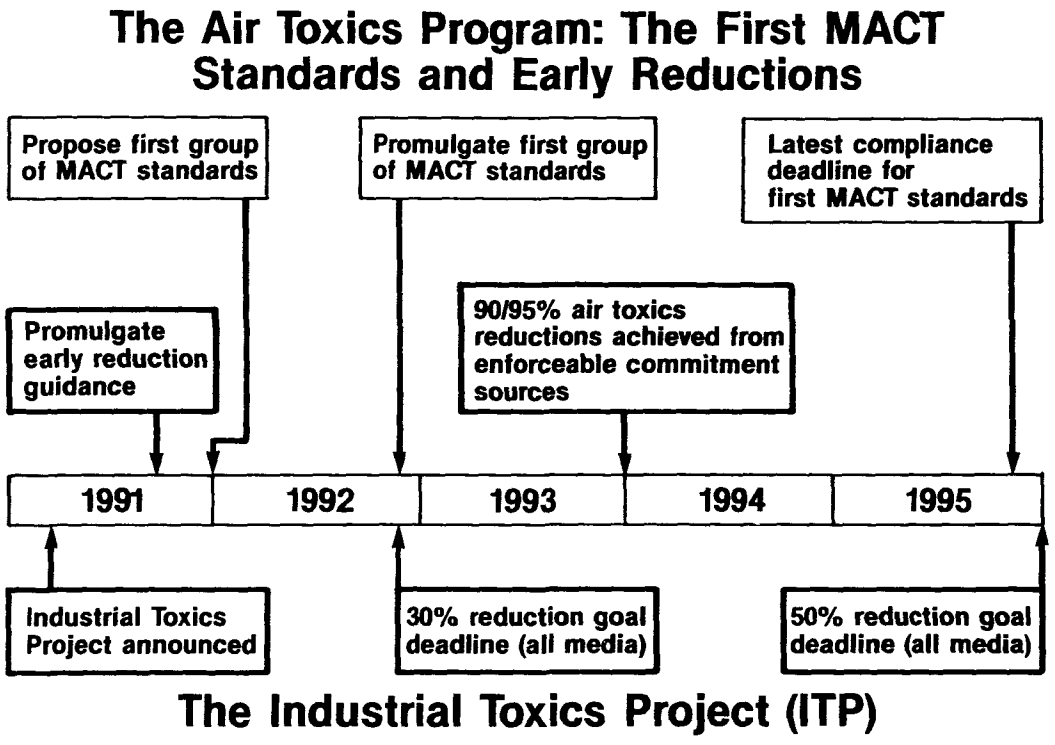

Figure 6.—The Early Reductions (top) and 33/50 (bottom) programs.

States' largest estuaries. The watershed for this bay spans six states along the Eastern Seaboard, from southern New York to southern Virginia.

The bay has been polluted by both point and nonpoint sources. As Figure 7 shows, air deposition accounts for approximately 47 percent of the toxics either released or transferred into Chesapeake Bay.

The Chesapeake Bay Program is an excellent example of how the TRI is used to strategically

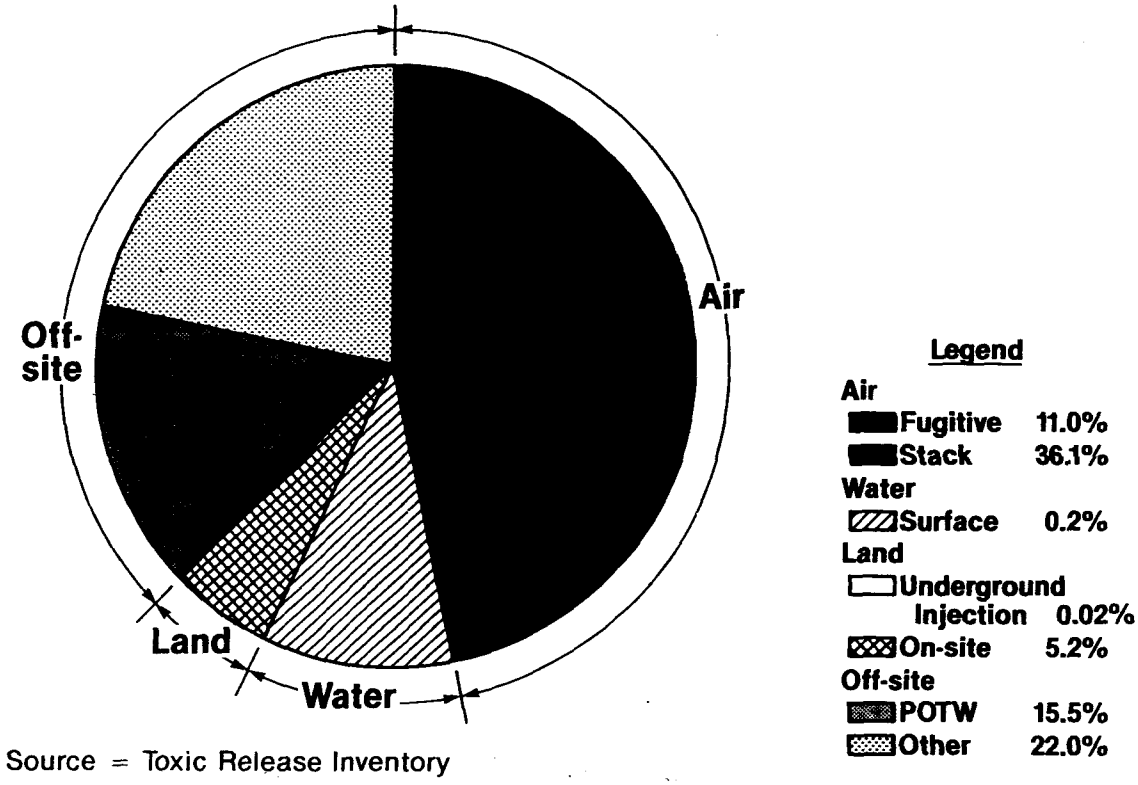

Figure 7.—The Chesapeake Bay: releases and transfers of TRI chemicals.

approach the cleanup of a polluted waterbody. EPA's Chesapeake Bay staff set the program up to proceed on different levels. First, it identified toxic chemicals in the bay's water, plants, and animals. Then, three monitoring stations were set up around the bay to confirm which pollutants are entering the bay's ecosystem. These stations mostly track air emissions.

Chesapeake Bay staff take the information gained from analyzing the biota, the monitoring stations, and the TRI along with other EPA and state databases to identify potential point sources of toxics. Figure 8 illustrates how different databases provide many pieces to the Maryland point source load puzzle. Maryland's state database provides staff with estimates of the number of municipal sources. After the state has identified the potential sources through the TRI, it uses computer models to verify whether these sources could have contributed to the problem. Figures 9 and 10 illustrate this process.

Figure 9 shows little progress between 1987 and 1988; however, Figure 10 indicates a more positive picture after the 33/50 program is fully implemented. Adding to these reductions are the goals of the Clean Air Act Early Reduction Program. Companies are just starting to commit to this program, so it is too early to tell which reductions will directly benefit the Chesapeake Bay or the totals. Merck (the pharmaceutical company) and Du Pont's Chemical Manufacturing Division, which have facilities in the six-state region surrounding Chesapeake Bay, are two companies that participate in the program.

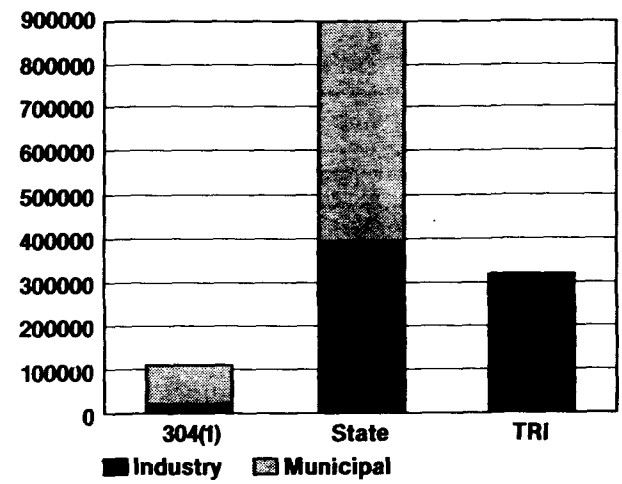

Figure 8.—The Chesapeake Bay: Maryland point source load estimates from different sources.

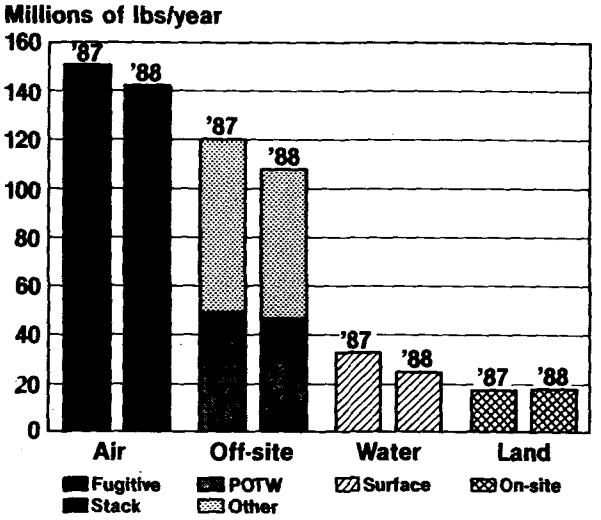

Figure 9.—The Chesapeake Bay: TRI releases to different media, 1987–88.

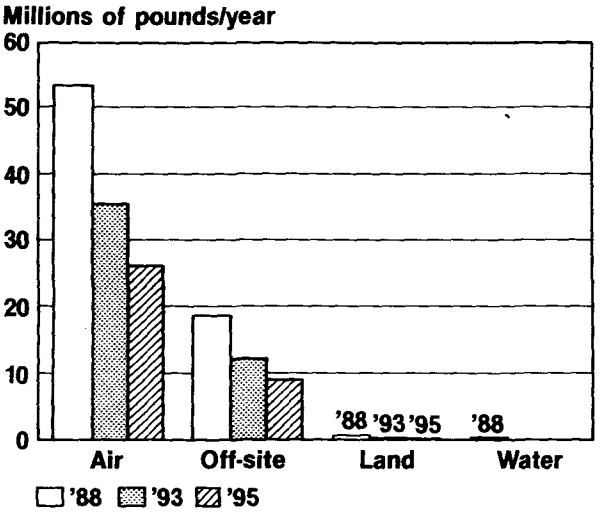

Figure 10.—The Chesapeake Bay: projected 33/50 reduction.

The Great Lakes

The Great Lakes region of the United States, comprised of five lakes and eight states, shares a common border with Canada. EPA's Great Lakes Program, in existence much longer than the one for Chesapeake Bay, is another example of how the TRI has helped focus efforts on an area. In addition to choosing priorities, the Great Lakes Program has used TRI to target geographic areas of concern that will take priority.

Program staff targeted sources from the TRI, which will be curtailing emissions through the 33/50 multi-media programs, hazardous waste sites on the National Priority List, and locations where hazardous spills have occurred.

In Chicago/Gary, Illinois, and Detroit, Michigan, the staff will use the TRI to reduce emissions from area sources. The Early Reductions Program will also reduce toxic air emissions in these targeted areas and to all the Great Lakes. So far, EPA has commitments from Monsanto and Allied Chemical plants in Region V. Both companies manufacture chemicals.

Conclusion

This presentation has attempted to illustrate a picture of the air toxics jigsaw puzzle in the United States and explain how EPA is filling in all of the pieces, both large and small, from the sources of air toxics to how the TRI data have helped determine priorities for action and identify both toxics and their sources.

I return you to this image because this is where the United States started: an assessment of the problem to draw the picture on the puzzle so we can begin to piece it together.

Toxics — they pervade the land, water, and air from sources too numerous to name, but they are a universal problem. The solution, then, is up to us. It takes creativity and determination to establish an inventory like the TRI. However, if we learn from one another and fill in the jigsaw puzzle one piece at a time, we will have a multi-pronged method of attack to identify and ultimately eliminate toxics from our picture.

The Toxics Release Inventory — American Journalism's New Arrow in the Quiver

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ABSTRACT

The American media still are on a learning curve in their approach to right-to-know reporting. Increasingly, however, environmental reporters use right-to-know programs and information to better inform local audiences about potential chemical risks. The best journalists now recognize that an emphasis on chemical release numbers alone is no longer sufficient. What do the numbers mean in terms of public health? What can be done to effectively manage releases? How valid are year-to-year or plant-by-plant comparisons? How can the newly available TRI information be used most effectively? These questions and more are leading reporters to increasingly use right-to-know to better inform audiences. Right-to-know provides American media with a valuable — and, used correctly — "straight" arrow in their quiver.

Environmental journalism in America has a new and promising arrow in its quiver of information resources as a result of data now available — and gradually maturing — under the Emergency Planning and Community Right-to-Know Act, passed by the Congress in 1986.

Within that opening statement lie the major points I hope to make about the American media's use, non-use, and occasional abuse of the motherlode of information available through the Toxics Release Inventory (TRI) database. Let's step back and take those points one at a time.

The first refers to environmental journalism in America. Make no mistake about it: environmental journalism is a permanent institution in print and broadcast newsrooms across the United States, just as environmental protection per se is a permanent and ongoing domestic program throughout this country.

American journalism has come a long way since the time just 20 years ago when it was widely held that any reporter could cover any story on a moment's notice — and do it well. Like its big brother, science journalism, environmental journalism has developed into a refined and respected specialty beat, with reporters specifically trained on the job to cover and communicate effectively on the subtleties and nuances, the shades of gray involved in that beat. Just partial testimony to that point is the recently established Society of Environmental Journalists in the United States. This two-year-old organization now claims nearly 600 members nationwide; its first annual meeting, held in October 1991, attracted more than 250 registrants notwithstand-

ing severe financial difficulties and slashed travel budgets facing the news media because of the current economic slowdown.

The TRI — A New Resource

Enter the Toxics Release Inventory. Availability of a computerized database on certain manufacturing businesses' releases and emissions of more than 300 hazardous chemicals comes to American journalism as another trend is rippling through American journalism schools and news organizations: computer-assisted reporting.

"Because that's where they keep the money." That memorable response is attributed to famed gangster Willie Sutton when he was asked, "Why do you rob banks?" Former Providence, Rhode Island, reporter Eliot Jaspin — widely recognized as a pioneer in computer-assisted reporting in the United States — makes essentially the same response when asked why journalists should use computers and databases in their reporting. "Because that's where they keep the information," Jaspin says. Plain and simple.

While TRI is an increasingly valuable resource for American environmental journalists, using it to inform citizens about potential chemical risks in their communities is a relatively new phenomenon. In fact, the data are still embryonic in terms of application, development, and potential. Computer-assisted reporting overall — and effective use of the Toxics Release Inventory in particular — is a bullish element in U.S. environmental journalism. Most reputable environmental journalists are just learning how to take better advantage of the fruits that can be harvested from the TRI.

One can argue that the allure of the TRI, its promise of riches to be mined for those willing to do the exploring and digging, accounts in some significant part for journalists' increased interest in environmental news. The promises of more responsible and compelling information through TRI have made reporters more receptive not only to mining those particular lodes but also the riches of computer-assisted journalism, and, therefore, to further honing their environmental reporting skills.

If it is true that the temptation, the romanticism, if you will, of dialing a distant database, punching a keyboard, and downloading valuable community-specific chemical information is attractive to environmental reporters, what products can we point to as emerging from that interest?

It is important to underscore that this new and promising information resource for American journalists is just that — new and promising. Reporters, editors, and graphic artists must fully learn how to use this resource most effectively; therefore, it will take time for the promise of potential to become a full-blown reality. The good news is that much progress has been made.

How Journalists Use the TRI

One thing we have learned is that major new environmental initiatives in the United States inevitably go through a lengthy and sometimes trying gestation period. That is the case also with journalists' use of this new arrow in their reporting quiver. Perhaps the most significant evolution is that the TRI story has gone from being an annual July 1 report based solely on numbers — the millions of pounds of emissions and releases reported by covered manufacturers — to being an integral part of reporters' year-round reportage. Decidedly, that does not minimize the recurring annual stories on numbers alone but rather points out that, along with those stories, we now see more reporting, frequently in the form of a major series or three- and four-part project feature that integrates not only quantitative information but also qualitative considerations. In effect, we're seeing more and more reporting not only on what TRI data <u>are</u>, but also, and importantly, on what they are <u>not</u>.

That gradual but continuing maturation of reporters' uses of Right-to-Know information reflects both a growing sophistication on their part in using and understanding the raw numbers and, at the same time, one of their greatest frustrations. What do the numbers mean? What do they tell us about potential risks, both perceived and real? The numbers alone do not easily translate into answers to those most important questions, and reporters and their editors increasingly are aware of that shortcoming and frustrated by that reality. Numbers are an important part of the environmental story that knowledgeable reporters want to tell their audiences; however, reporters are loath to write a story based solely on raw numbers.

The gradually maturing use of the TRI — not only by reporters and editors but also by their graphic arts departments — has the potential to

bring so much more understanding and insight to sheer words and numbers. Take a look at some of the kinds of graphics presentations Right-to-Know has helped bring to print media audiences. Maps, pie charts, bar graphs, spreadsheets, line graphs — all are features of the most informative reporting done using the TRI. At their best, these graphics can capture and communicate masses of complex and otherwise abstract numbers and polysyllabic chemical names; at their worst, they can unjustifiably inflame and heighten needless fears.

In that respect, the TRI database is like any other major environmental program in the United States and perhaps anywhere else in the world: it offers great potential for effective use, but it can also be misused and abused. However, in it and through it, reporters and their audiences will find new kernels of understanding, questions to be explored, and communications challenges to be overcome for the benefit of a more informed citizenry.

The most perceptive reporters will see enormous potential in the TRI database for responsibly informing audiences on actual and potential chemical risks they may face in their communities. They seek to derive every last ounce of valuable and credible information from the TRI. And, at the same time, these reporters will recognize the inherent limitations of that same information — limitations well known to all who understand the data best in terms of flow rates, exposure data, gaps and omissions, and timeliness.

Conclusion

It would be foolhardy to pretend that the TRI is or ever will be as much of an environmental reporter's tool as, say, the telephone or personal interview. It's not, and it's not meant to be, nor will it ever replace a time-tested reporter's techniques as a means of informing readers, viewers, and listeners. But as a new and valuable information arrow in their arsenal, the TRI already has contributed much to environmental reporters' growth and audiences' understanding of chemical risks in the community.

The best news is that, as the data mature, TRI's role will expand and evolve along with the environmental reporters' own responsible understanding and use of that information.

Initiatives Generated by the TRI

Industry Initiatives at the National Level

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Monsanto Chemical Company
St. Louis, Missouri

ABSTRACT

As public perception about the environment evolves, companies with chemical operations find it ever more important to voluntarily stretch their efforts beyond legal requirements. Monsanto's approach to waste elimination is driven in large part by the size of the enterprise, its diversity, and growing knowledge of its effects on the environment. Information such as the Toxics Release Inventory and the analysis thereof lead to an ever-growing sense of voluntarism regarding the environment. Monsanto's vision of corporate environmental stewardship is embodied in programs to reduce 90 percent of toxic air emissions, obtain a 70 percent reduction in all high priority wastes from chemical operations, and make the Monsanto Pledge a part of each employee's approach to the job.

This presentation is a view from inside a major corporation — a corporation that was changed dramatically by events occurring outside. Three voluntary initiatives are presented here: a program for air emissions, a program for multimedia emissions on a different time table, and a comprehensive program — the Monsanto Pledge.

Monsanto Company is a large enterprise with approximately 100 sites around the world, 41,000 employees, and five very diverse operating units, each diametrically different from the others. It is an enterprise that, in 1987, released 18 million pounds of materials judged toxic to the air — a piece of information that was a shock to many within the company.

In 1987, the total releases of organics and toxic inorganics to air, water, and land were 350 million pounds. Also in that year, more than 1,000 Monsanto employees spent a majority of their time working on environmental matters.

In the long history of legislation in the United States, the passage of Title III in 1986 was the most important for Monsanto Company. Title III enumerated substances in a list of materials that sparked establishment of Monsanto's 90 percent goal for reducing air emissions. It was a significant event for Monsanto's employees when our chairman told the world that the corporation was committed to achieve this goal. Shortly afterward, in 1989, Monsanto Chemical Company, one of the five parts of the corporation, committed to making a 70 percent reduction in emissions to all media — not just air — by the end of 1995. And in 1990, the corporation issued the Monsanto Pledge (Fig. 1), which has an ultimate goal of zero effects.

The 90 Percent Program

The 90 percent air emission reduction goal for Monsanto started from a base of roughly 18 million pounds of emissions in 1987. As of last year, data (in part for TRI reporting) showed that, within the United States, Monsanto had achieved a 58 percent reduction in listed materials. The corporation appears on target to achieve 90 percent reduction by the end of 1992.

- *Reduce toxic and hazardous releases; ultimate goal of zero effect*
- *No undue risk to employees and communities*
- *Achieve sustainable agriculture*
- *Ensure groundwater safety*
- *Open plant to community*
- *Benefit nature*
- *Eliminate waste from operations*

Figure 1.—The Monsanto Pledge.

Many people in the corporation are highly committed to the 90 percent reduction goal and driven to accomplish it; however, some are concerned because many projects take a long time to define, get approved, get the large equipment on order, and have it arrive, be installed, and start up. Monsanto is confident that it will accomplish the intent of this goal; however, the emission percentage may be 89, 92, or 93 percent, and it may be accomplished in February instead of December. The effort is ongoing and the impact on the environment will be reduced by approximately 90 percent.

Monsanto's original goal, which was based on U.S. law and focused on U.S. operations, was expanded rapidly to include compounds around the world. Residents and officials of other countries identified other toxic substances of concern to them. Since then Monsanto has added materials called "local concern chemicals" to the list and undertaken a program to reduce them as well. Progress is slower globally than it is in the United States in part because of a late start and also because of the large volume of some of these local concern chemicals. Nevertheless, people in plants outside the United States are as actively or even more actively pursuing reduction of emissions and their impact on the environment, in part because of TRI.

The 70 Percent Program

The 70 percent program is different from the 90 percent program in several ways. First, it's a multimedia program — it pertains to air, water, and land. Second, the goal is a 70 percent reduction. The challenges are some 20 times greater than they are for air alone. And the third difference is that, to date, this program focuses on Monsanto's chemical company.

Prioritization mechanisms deal with wastes and methods for treating them. Division coordinators — people within each division and business who are experts in operations, business, and nature of the materials released — are accountable for the performance of their individual divisions on waste elimination. Monsanto also has an informal network of staff persons who have taken responsibility to do something about the amount of waste. A steering committee, consisting of four vice presidents and two staff, meets regularly to discuss major policy issues.

Monsanto has an internal priority system that ranks a substance's priority on a scale of one through five. Priority one includes materials, such as those on the SARA list. We judged a few substances more hazardous than those on that list, so we added these chemicals and deal with them. After all, we know more about those streams than do the regulators.

Monsanto also uses a familiar hierarchy of methods for dealing with wastes. For us, the most important thing is to put in alternate product technology, for example, improving yield from converting raw materials into products. If 500 million pounds of adipic acid is produced annually, increasing yield by 1 percent gives five million more pounds of things that you can sell in the marketplace — along with five million less pounds going to the environment.

The Monsanto Approach places a relatively high priority on recycling and reusing materials and on selling the byproduct or coproduct. You might call these things "waste"; however, if I show up in your office with a brochure to sell you something that would normally be called a "waste," I'm going to call it a "coproduct" — a product of high purity and high quality that is ideal for your needs!

Monsanto's lowest priority is the destruction of material because that in itself is a waste. We give higher priority to those steps that will eventually allow progress beyond 70 percent reduction.

In the corporation, we have enumerated rules for how to "count" things and what to do with them. The rules are simple and easily understood. Our rules are on a process, not a site or a business, basis. They focus on recurring activities, those things that continue and have a significant effect on the environment. Other staff deal with events or spills. We focus on released materials for air and generated materials for liquids and solids. Calculations are done on a dry weight basis.

Monsanto has rules for other companies that operate on our sites; we don't let them get away with practices that are not acceptable to us. Those residents who live outside the fence of a Monsanto facility don't care who owns the plant in the middle. What they're concerned about is the effect on the environment.

There have been a few surprises along the way. In Figure 2, the vertical axis is total reduction as a cumulative percentage. The horizontal axis is the cost in capital dollars per pound reduced. Notice the shape of the curve; it drops precipitously at first because some of the things that were done early on were inexpensive. But notice something else, that the intercept of the curve doesn't occur at zero but at -10 because 10 percent of the reduction was free. During the introduction of the program, employees were told the objectives and they changed their operating practices. Some waste reduction was achieved for zero capital cost. But also notice the other end of the curve. At the 70 percent level, it's starting to get expensive, and, if you push things to 75 percent, it's very expensive.

Now that's the way things looked in 1990, but the lines have shifted. We got smarter; one year later, we discovered that we had figured ways to do things just a little cheaper than our estimates.

Within Monsanto, there is tremendous competition for resources. The person asked to reduce the waste is the same person who is trying to make the product more "white" (purer) so it will sell better and is also trying to save energy and improve the yield.

More capital is spent on Monsanto's air program, per pound, than on the other programs. Also, there's an imbalance of capital expenditure versus operating expense versus risk because we've set deadlines and driven people to accomplish them. On occasion, people will spend more money for capital than is required to achieve higher certainty.

The programs differ inside Monsanto's various operating entities. We are working to iron them out so that someone from Monsanto Chemical Company won't say one thing while someone from Monsanto Agricultural Company says another.

Monsanto is a chemical company by history, so it has the best solutions for concentrated chemical wastes — but also the least-developed

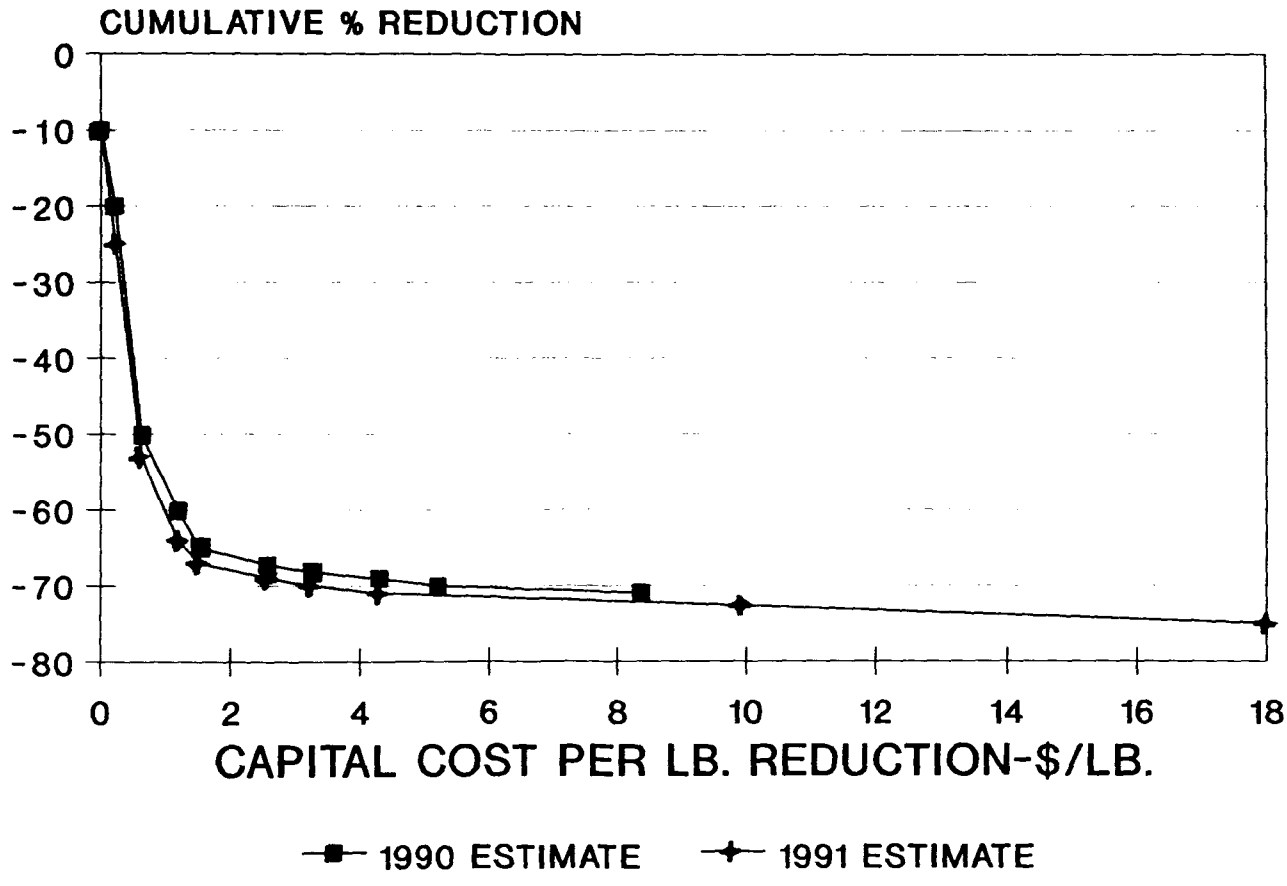

Figure 2.—Total waste reduction versus cost.

resolutions for dilute wastes, which require biological solutions.

Along the way, we've discovered a number of public and international issues. One is that, by making our situation public, we attract help: people find out what our situation is and come to our aid by offering solutions (sometimes by offering to sell us things). We gain support from our employees because, if we mail the *Environmental Annual Review* (our "green book") to everybody in the community and the neighbors read it, they talk to the Monsanto employees and say "Get on with it! We want to see those numbers go down in future issues."

Monsanto endeavors to be a global corporation. In the green book, we do not say U.S. and ex-U.S. Instead, we say "global." We've included local concern materials in our programs because we probably didn't get the list right in the United States.

Today, Monsanto has three initiatives: a 70 percent program, a 50 percent program in the agricultural company, and a 90 percent program for air. What is under consideratin and referred to in our green book is a uniform corporate-wide program for all emissions.

The Monsanto Pledge

The Monsanto Pledge contains a number of elements. The words were written by wordsmiths, but frankly, the intent is there, and it says that we will be good corporate citizens wherever we do business. Focus on the last line: "We will eliminate waste wherever we have operations by finding the best possible technology." That's my job.

Conclusions

External publication enhances employee commitment. Publishing statistics, telling the world about them, standing up in front of the public and explaining the data makes employees work harder. The result is obvious progress in waste reduction.

When talking publicly about our corporate commitment, we attract people who have truly innovative and creative solutions.

We write goals for our people — waste elimination coordinators and those in the environment — that incorporate our expectations.

Constant support from Monsanto's top management is essential to its program. Managers participate in reviews and, frankly, they must react to the presentation.

International uniformity in regulations applied to the chemical industry is very desirable. For companies like Monsanto, dedicating resources to meeting a myriad of different regulations is, generally, a poor use of resources. Uniform lists of materials and practices allow companies to turn energies and efforts to actually eliminating waste.

Implementation of TRI practices has triggered and catalyzed a visible change in Monsanto Company — and in other responsible companies in the chemical industry.

Local Initiatives in TRI Reporting: The *SCORECARD* Model

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ABSTRACT

In 1986, the National Institute for Chemical Studies (NICS) began working with residents of West Virginia's Kanawha Valley to assess emissions from local chemical plants. Because chemical facilities had claimed decreases in emissions, community residents wanted a credible report to evaluate these assertions. NICS invited government representatives, environmental activists, and industry leaders to discuss a reporting mechanism for the evaluation, and *SCORECARD* was born. NICS, a non-aligned third party, prepares the report, and a broad-based advisory committee assures that the concept, format, and information are balanced and acceptable to the general public. The Toxics Release Inventory reporting serves as the basis for NICS' annual *SCORECARD* and is supplemented by voluntary submission of both facility descriptions and emission data by state chemical facilities. *SCORECARD* is unique because the cooperation fostered by NICS has allowed timely community access to credible and comprehensive information about industry success or failure to reduce emissions of toxic chemicals.

Introduction

The National Institute for Chemical Studies (NICS) was founded in early 1985 by West Virginia business, labor, and government leaders, academicians, and others seeking ways to reduce risks posed by chemical plant operations and, at the same time, support continued economic growth. NICS is neither an industry-based trade association nor a quasi-public agency with regulatory or enforcement powers. Nor is it an environmental advocacy group. NICS' unique function begins with the basic premise that the public plays an important role in the management of chemical risks.

NICS is a nonprofit organization. Financial support is broad-based, coming from federal and state government, local business, chemical companies, and foundations.

In 1986, NICS began working with residents of West Virginia's Kanawha Valley to assess emissions from the numerous local chemical manufacturing facilities. The valley is also home to the largest United States producer of methyl isocyanate (MIC), the chemical compound identified in the Bhopal, India, disaster in 1984. Kanawha Valley residents were thus alarmed by the potential for both short-term disasters and long-term health problems related to this local concentration of chemical manufacturers.

Because chemical facilities began publicly reporting their efforts to reduce routine emissions as well as the potential risk of accidents, valley residents requested some mechanism for annual tracking and verification of their progress. They also pressed for right-to-know legislation, which is now in place across the United States. Right-to-Know, or the Emergency Planning and Community Right-to-Know Act (EPCRA), required

emissions data reporting, but the community wanted a customized report for the local area.

NICS, as a third party, brought together industry, government, and environmental and activist groups to discuss development of such a mechanism. The term "scorecard" was chosen by the broad-based committee to reflect what they envisioned. In essence, they wanted to comparatively score the environmental emissions of the chemical facilities.

Getting Started

Putting together a well-balanced advisory committee was not easy. NICS sought a commitment from all parties that they would be willing to work toward progress for a mutually agreeable reporting system not overly burdensome to any party. At the same time, all agreed to keep in mind that no formal system existed for generating emissions data. The committee spent almost two years developing a mutually agreeable format for reporting data.

One of the key components for NICS was securing corporate commitments both to reduce emissions and participate in the *SCORECARD* program. NICS gained the voluntary endorsement of corporate chief executive officers before developing the first report, much as the U.S. Environmental Protection Agency (EPA) is doing in the United States today with the 33/50 Program.

After several months, the committee agreed that chemical facilities should provide

- data on emissions to air, water, and land,
- a narrative that described what pollution prevention steps were being taken at the site and how these were reflected in the data, and
- goals for further reduction.

Collectively, these items would shed light on both short- and long-term commitments of the companies involved and provide a public record to scrutinize industry efforts.

The advisory committee specified that chemical compounds should be separated into two sections: carcinogenics and other toxics. A third category, nontoxic wastes, was added. Although everyone unanimously agreed that at-source pollution prevention was the ultimate goal for companies, the committee felt the community would be best served by assessing all reduction, treatment, and management practices being used by chemical manufacturers. Committee members agreed that this information would also shed light on other issues, such as costs, technological successes and failures, and trends for certain production units or types. In the final analysis, they felt the community had a right to this information and a right to comment on it.

A major stumbling block for the committee, however, was the lack of standard emissions reporting protocols. At the time, companies calculated emissions using various formulas and equipment, with no government specification or oversight. The committee's problem was how to make the information uniform so that all facilities provided readily comparable data.

Toxics Release Inventory (TRI) Availability

As a result of EPCRA, the first TRI data became available in mid-1988. This system of reporting on the levels of pollutants released solved many of the problems encountered by the committee. It standardized methods for data generation and, because data had to be reported annually, provided a continuous method for tracking industrial facilities' progress or lack of it. NICS is finding that companies more readily volunteer to participate in the *SCORECARD* program because they are required to submit data to the U.S. government.

TRI also solved the problem of which chemicals to list and track through the *SCORECARD*. Because EPA had compiled an extensive list of chemical compounds, the *SCORECARD* Committee simply subdivided this group as previously described, tracking a group of carcinogens of local concern in Section A and tracking all other TRI data in Section B. It retained the right, however, to suggest additional chemicals in the future.

The First *SCORECARD* (1989)

By using the 1987 and 1988 TRI reports, NICS was able to conduct statistical comparisons of the 11 major chemical manufacturers in the Kanawha Valley for the two-year period. Companies were requested to submit their data directly to NICS when filing the reports with EPA. In this way, NICS gained much quicker access to the data and, consequently, could report more timely data to the public.

The first *SCORECARD*, which was supported by private foundation grants, was published in December 1989. The initial report showed that local companies had decreased carcinogenic pollutants by almost 6 percent with a net overall decrease in toxic compounds of about 2 percent from 1987 to 1988. While these reductions were not impressive, they established a baseline to judge future claims and, more importantly, provided a plant-by-plant review of what the companies were doing to prevent pollution and publicly established goals for future reductions. Numerous statistics and graphics for water, land, air, and off-site disposal also were generated for the first time.

The Second *SCORECARD* (1990)

The second *SCORECARD* built upon the baseline report and compared TRI data from 1987, 1988, and 1989. Further analysis revealed a 25 percent reduction in carcinogenic pollutants from 1987 levels, while overall environmental discharges increased almost 20 percent. The increase was attributed to more stringent reporting requirements of EPCRA, market changes, and increased production. A primary finding of the report was that companies were focusing on the pollutants of greatest public concern — the carcinogens. The public demand for decreases in this category has brought about positive and responsible action by the facilities.

Expansion of the *SCORECARD* Model

NICS has now expanded Kanawha Valley's *SCORECARD* to include chemical manufacturers from the entire state of West Virginia. Twenty-three facilities are now participating in the program, which seeks to further expand the use and comprehension of TRI data. Industry and environmental organizations alike have asked NICS to expand the program, which is now supported by an EPA grant.

Environmental activists have commented that they view the report as supporting documentation that can be used in directing their criticisms and/or praise to facilities that have a poor or noteworthy performance record. Before *SCORECARD*, facilities had data (now a matter of public record) synthesized and interpreted by various groups and individuals; there was no commentary, explanation, or dialogue from industry. Because this led to inaccurate and one-sided reporting, facilities from other states and regions have expressed interest in *SCORECARD*, which is a balanced mechanism for discussing and interpreting TRI data.

NICS is currently expanding *SCORECARD* to other regions across the United States. However, the data are often found to be most useful when customized into regional or local reports that address and summarize information to meet citizens' needs. By developing a factual, scientifically credible report for smaller geographic regions, community leaders, local industry, and environmentalists can work together for progress in their own communities, states, or regions.

Industry Initiatives

The chemical industry in the United States has recently taken a proactive stance on communicating with the public regarding emissions and sources of public risk. Chemical industry councils (CICs) have been formed (or are forming) in most states that have chemical manufacturers. The CICs and other state associations are encouraging compilation of documents similar to *SCORECARD*. The Baltimore, Maryland, CIC and Louisiana Chemical Association's compilations of TRI are good examples of this type of effort by industry.

What those documents contain, however, is usually not governed by a citizen-government-industry committee with balanced points of view, so the results are usually greeted skeptically by the public. Likewise, reports by strong environmental advocates are questioned by the public — but to a lesser degree. NICS's balanced approach and straightforward interpretation provide the most acceptable mechanism for public communication of TRI. By establishing the National Institute for Chemical Studies as a nonaligned third party, we have generated trust and credibility with all parties. This process, in turn, makes TRI meaningful and useful for local public involvement in continuous TRI reduction and pollution prevention.

Recap: Why *SCORECARD's* Process Works

The National Institute for Chemical Studies' *SCORECARD*:

- Provides an understandable discussion and analysis of TRI (narratives included with the data assist in interpretation),
- Works directly with chemical facilities, with faster local reporting than through the national database,
- Gives regional and local analyses of data that are meaningful to those most affected by emissions,
- Empowers communities to encourage pollution prevention,
- Creates some competition among companies to do a better job,
- Makes company goals and commitments public,
- Involves the public in generating and overseeing the report,
- Gains better acceptance as a credible report when published by a third party with assistance from a broad-based advisory committee, and
- Provides a model easily adapted to other geographical areas.

Public Initiatives at the National Level

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ABSTRACT

Under section 313 of the Emergency Planning and Community Right-to-Know Act, the U.S. Environmental Protection Agency is required to make industry-submitted Toxics Release Inventory data available to the public through telecommunication with a computer database and by other means. Numerous reports with a national focus have been prepared using these data. This presentation will discuss some of these reports and their impacts.

A few years ago when the Toxics Release Inventory (TRI) had just been enacted into law and before the first data were collected, EPA asked Hampshire Research Associates, Inc., to help figure out what, in addition to the legal requirements, would be the best ways to get the information out to the American public. In response, Hampshire Research phoned 150 persons and groups at all levels and locations around the country — everyone from lawyers to local government officials to scientists — to ask "If you had this type of data, would you be able to use it, how would you use it, and what would be the best ways for you to get the information?"

The most significant conclusion from that study was that these particular data have unbounded uses and users. At the national, regional, state, and local levels, there is interest in information about chemicals, industry, and the other types of data available from the TRI. We could not define any limited number of most important uses or most important users because there was such an unbounded array.

Indeed, that has still proven to be the case now that three years of data are available in the United States. Data have been the basis of voluntary industry programs. Boards of directors have been seeking data about their companies and the rest of the industry to see where they stand in relation to other similar companies. Congress not only enacted the Toxics Release Inventory but expanded it with pollution prevention legislation and provisions for early reductions in the Clean Air Act that are, in part, grounded in TRI.

Law firms have been using TRI to find defendants. States have been incorporating TRI as the basis for integrated permitting approaches, for assessing taxes, for targeting technical assistance programs, and for establishing pollution prevention planning programs. Those states particularly high in TRI releases are using TRI as a rationale to establish stronger pollution control programs.

Environmental groups have been using TRI to identify important targets and set priorities within states. TRI has influenced Ohio Citizens Action, an environmental group, to focus many of its activities in support of a local group in Lima, Ohio, where the British Petroleum plant is by far the largest source of TRI releases and transfers in the state.

TRI data have been used to create reports on air pollution — a report card on a company, to look at why changes are occurring in TRI, interstate transport of waste, and what is not being reported to TRI. Other companies look at the relationship of TRI releases and transfers to socioeconomic patterns to determine whether cer-

tain ethnic, economic, or racial groups are disproportionately associated with high concentrations of TRI releases and transfers.

Some people have looked at the releases and transfers in conjunction with number of pounds per dollar of sales in various industries. And some industries and outside groups have incorporated TRI data in product lifecycle analysis; in other words, they look at what pollution is associated with the production of one type of material versus an alternative type.

EPA's National Report

Hampshire Research has been involved in the production of EPA's national report on TRI data. Each year, EPA has issued a book, such as the 1987 report, *Toxics Release Inventory — A National Perspective*. This publication includes literally hundreds of tables and charts, loads of maps, and analyses that try to provide most national and state perspectives on TRI data. Each year Hampshire Research picks and chooses to feature slightly different types of information.

All the data used to prepare this report are available to the public as we prepare the report. In fact, that's a bit of a problem because producing a report of this size takes a few months; meanwhile, anyone else can get the data and quickly publish summaries. So we always try to include some unique features each year in the report.

Hampshire Research is not doing anything when producing this report that the public cannot do. Indeed, this firm does not possess a mainframe; we produce virtually the entire book and all the analysis on our office personal computers — and you can, too.

This report gets through EPA review relatively easily because all the data are available to the public. If we tried to include some special analysis or reflect some bias, we would be immediately subject to independent review by the public. In the report, the facts are the facts.

If we don't name the top 50 facilities, Clean Water Action or someone else will — so we put them in. No particular policy spins are put on this report, which basically lays out the data. In fact, one of the unique features about TRI is that there's no way that EPA can control the spin on this database. TRI data are just out there and Hampshire Research and EPA are analysts and users like anybody else.

Report Features

Certain features of the TRI report have proven essential for the success of this program. The reporting is done on a specific chemical basis — the only relevant way of handling the multimedia approach. Look at the TRI list; nothing there involves reporting on mixtures or undefined materials (no reporting on turpentine or complex process wastes or other like chemicals). So we're looking at the full range of ways these materials are entering the environment.

Trade secrecy provisions are narrow. Over the last three years, nearly 250,000 forms were filed in the United States, but only 25 are now held confidentially. Even then, we know who made the claim and how big the releases and transfers are; in fact, we know everything but the exact chemical name.

The reporting is highly structured and standardized. It allows for easy generation of bar charts, pie charts, and aggregates. With TRI, data can be used in a wide variety of contexts and easily turned into computerized graphics. Also, the data can be actively disseminated to the public.

Almost all of the air, water permit, and hazardous waste permit information is available to the public in the United States. However, these data may be in files, in written form, poorly copied, or on a pile on the floor. The information is certainly scattered all over this country. To try to get a uniform picture from what is publicly available is a next to impossible task. TRI pulls the data together in a single location.

TRI is independent from pollution control provisions; in other words, the listed chemicals are not tied to regulations. Therefore, the data are not distorted by the priorities, policies, and nomenclatures in our various, rather incompatible pollution laws. Lastly, TRI provides a computerized public record of revisions.

Ways to Improve TRI

TRI would be dramtically strengthened by the inclusion of six data elements that add important throughput information: namely, the amount of the material coming into, going out of, and being produced and used up as reagent at the plant as well as the beginning and ending inventories for materials.

A number of important industrial toxic chemicals not on the TRI list should be included. The scope of TRI reporting should be expanded

internationally. Also, other industries not on the list that are equally important contributors should be included. In the United States, government facilities are not required to report and, certainly in many states, they are the major contributors of toxic pollutants, so they should report under TRI.

Less Important Aspects

Some aspects of TRI have proven less important or less of an obstacle than originally expected. When Congress was briefed about the possibilities of TRI, it was skeptical because the data were based upon industries' best estimates as opposed to required numbers. Experience has shown that this is not a problem.

EPA cannot control how TRI is perceived and used or prevent people from misusing the information. However, the Agency can help people use TRI data. In addition, public education is not as important as once thought to the success of the Toxics Release Inventory.

Lastly, risks have not proven to be as important as we thought, and pollution prevention has become more important, especially reporting treatment efficiencies.

Conclusion

How practical is TRI? TRI contains information about industry that companies should know about their operations. TRI is the lowest-cost way found to date to achieve major environmental improvements. The costs to industry are often fully offset by pollution prevention savings.

TRI does not require major computing capabilities. Hampshire Research can handle the entire TRI in the United States on its microcomputers. Certainly any of the countries in Europe could handle the same data on such a computer as well.

Much has been learned from the TRI. The proposed 1991 Form R is a valuable starting point, as is the TRI list of chemicals. The TRI is a demonstrated success and most multinational companies are already experienced in TRI reporting.

In sum, the TRI is a compelling new approach to environmental improvement that is broadly applicable around the world.

Public Interest Group Initiatives at the Local Level

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ABSTRACT

In August 1988, the Silicon Valley Toxics Coalition was the first group in the United States to compile and publicly release data from the new Toxics Release Inventory. The data — which documented millions of pounds of toxics released into the environment by the largest and most famous Silicon Valley electronics giants — were reported by the media throughout California and the United States. This coalition urged the self-described "clean industry" to drastically reduce its chemical use and emissions (particularly the CFC 113 discharges that proved to be the largest in the nation). Since then, and after other significant national media attention, the high-tech industry has significantly reduced its reliance on CFCs. In addition, the Santa Clara County Manufacturers Group — the local trade association for the Silicon Valley industry — began publishing an annual report in 1989 that documents its annual emissions as reported under TRI.

Production of synthetic chemicals in the United States, which became a significant industry in 1918, has expanded enormously since World War II. Figure 1 graphically depicts this escalation and highlights industrial usages of synthetic chemicals, including high-tech electronics.

Until rather recently, most people in the United States and throughout the world thought that the electronics industry was not part of the toxics release problem — that it was, as self-described, a "clean" industry. However, over the past decade we have learned that the "clean" industry was in fact highly polluting. More Superfund sites are located in California's Silicon Valley — a hotbed of high-tech industry — than anyplace else in the United States. (Superfund sites are so polluted that the U.S. Environmental Protection Agency (EPA) has put them on a priority list for cleanup.) Groundwater pollution at 29 of these sites directly stems from the use and misuse of solvents used in high-tech industry.

In addition, a high incidence of air pollution and ozone depletion from these industries, as well as occupational health hazards, has been noted. Occupation-caused disease among semiconductor workers is about three times that of the national manufacturing average.

Introducing Right-to-Know in Silicon Valley

In response to this situation, the Silicon Valley Toxics Coaltion produced a booklet, *The Legacy of High-Tech Development: The Toxic Life Cycle of Computer Manufacturing,* which states that the industry presents some significant problems. We were able to determine this through the development of the right-to-know movement in the United States, of which the Toxics Release Inventory (TRI) is but one aspect.

You might think that right-to-know legislation was introduced without difficulty. In fact, it has a rich history of struggle in the United States dating back to the 1970s when, coming out of the labor movement, the concept of worker right-to-know was introduced in the first attempt to pry

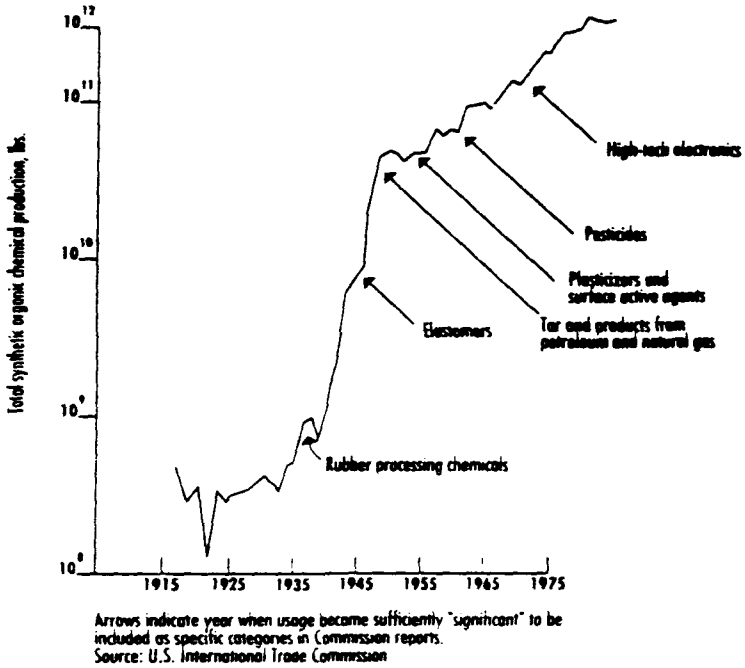

Figure 1.—Production of synthetic organic chemicals in the United States from 1918 to 1976. Arrows indicate year when usage became sufficiently significant to be included as specific categories in Commission reports. Source: U.S. International Trade Commission, 1978.

loose toxicity and chemical information and organize to combat industrial diseases.

This difficult, laborious process took place in many different industries. Mining is one of the main examples, with its high incidence of black lung disease. The community right-to-know movement started at the local level in the early 1980s when communities began developing and passing right-to-know ordinances.

The Silicon Valley Toxics Coalition was one of the first groups to pass a right-to-know ordinance, back in 1983. We had to overcome significant resistance from industry and government, who were uncomfortable with the notion of making this kind of information public for a variety of reasons, including concerns about proprietary or trade secrets. (Industries also cited additional paperwork as a possible problem.)

When we started organizing for right-to-know ordinances in the Silicon Valley, some communities and industries drafted a proposal that requires companies to report toxics information to the local government but made it a crime to distribute that information to the public. We had to organize to overcome that type of approach and eventually ended up with a local right-to-know ordinance in 1983 that became California law in 1985. Subsequently, the federal government picked up the idea.

Our history with federal right-to-know dates back to 1988, when the Coalition compiled and released data to dramatize some of the hazards associated with high-tech production technology to the Silicon Valley and communities across the country. This was long before EPA had compiled the data — or anybody else for that matter. We didn't have access to a computer system; we got a box-load of paper from our state agency and sat down one weekend and typed information into a personal computer using a database program. This information showed beyond a doubt that millions of pounds of toxics were being released, discharged, and transported off-site from a relatively small number of companies.

Initially, we compiled a list of 25 companies. When we surveyed the top 12 companies in Silicon Valley, we found they were releasing millions of pounds of toxics, data that we put in a report and gave to the media (Table 1). Because this shocking information was being reported for the first time, it received quite a bit of attention. Some of the following information was presented:

Twenty-five major area companies are dumping millions of pounds of toxic chemicals into the environment each year according to data recently filed with EPA and the California Office of Emergency Services. This new information, required pursuant to Title III of the Superfund Amendments of 1986, is now publicly available as of July 1, 1988. The composite data for Silicon Valley reveals that 25 companies with 41 facilities in Santa Clara County admitted discharging over 12 million pounds of 34 different toxic chemicals into air, land, and water. Almost 2 million pounds went to the air through stack emissions, another 2 million pounds were classified as fugitive emissions, and about 8 million pounds were discharged into sewage treatment plants or otherwise disposed of.

Under the current legal regulations, this type of pollution is largely legal although considered immoral by many. The Silicon Valley Toxics Coalition has charged that industry has enjoyed a free ride to use the air as an open sewer for its waste disposal and has issued a call for industry to implement toxics use reduction and source reduction measures to cut down on their use and disposal of these chemicals.

Some companies are already beginning to respond to community pressures in other parts of the country. Monsanto, for instance, has acknowledged almost 18 million pounds of discharges nationwide but has promised to reduce those emissions by 90 percent in four years and is approaching a zero discharge or zero tolerance stance.

Table 1.—The TRI "Dirty Dozen" for Silicon Valley for 1987–88 reporting years.

NAME	1987 + 1988 TOTAL RELEASES (lbs)
IBM	2,798,000
Xidex	2,237,000
UTC	1,955,000
National Semi	1,630,000
South Bay Circuits	1,477,000
Hewlett Packard	1,214,000
Lockheed	1,198,000
Siliconix	1,140,000
LSI Logic	996,000
Del Monte	781,000
Advanced Circuit Tech.	778,000
FMC	609,000

Source: Title 22-TRI Data

We also publicized our letter to IBM, urging it to follow Monsanto's example — to disclose their yearly emissions of freon worldwide and pledge prompt phaseout of these ozone-depleting chemicals. IBM's San Jose plant listed more than 1.3 million pounds of ozone released into the atmosphere, which turned out to be the largest single source that we have uncovered. This material can be found in our booklet, *The Citizen's Guide to the New Federal Right-to-Know.*

Next, we compiled two years' worth of data on combined releases, showing that companies that had been deemed largely "clean" were in reality releasing millions of pounds of pollutants into the environment.

An interesting sidelight concerns a company called Advanced Micro Devices. When we published our initial list, this company's releases — over 2 million pounds in the first reported year — placed them at the top of our list. The company took great offense at this and, to restore its credibility, placed a full-page newspaper ad to accuse the Coalition of deliberately distorting and misstating the information. Fortunately, EPA also saw this ad and looked into its records, where it discovered that we had simply published EPA data. The Agency then wrote a letter to that effect, which helped set the record straight. Advanced Micro Devices later filed amended reports with release data that removed it from the "Dirty Dozen" list.

Using Right-to-Know Information

The Coalition used right-to-know information not only to publicize and dramatize the problems but to put out some challenges to local industry and, in particular, to companies that were discharging the largest amounts of chlorofluorocarbons (CFCs) — the largest source of the discharges into the atmosphere.

Table 2 is a compilation of the 1987 data, by chemical, on the companies in Silicon Valley. We took this information — particularly the IBM data — and, on Earth Day 1989, organized a large rally with other groups in front of IBM's plant gates and invited Ralph Nader, a well-known environmental and consumer advocate in the United States, to speak. We challenged IBM to adopt aggressive goals and timetables to completely eliminate CFCs.

At the time, IBM didn't have much to say; it was not ready to set phaseout goals and timetables. However, IBM reported to the media that it would comply with the Montreal Protocols — the international treaty to phase out CFCs — which would take effect in the year 2000. The Coalition replied that, because of the huge volume IBM was discharging, it should set an example and take much more aggressive action.

By Earth Day 1990, IBM had come up with a new program. It committed to an aggressive phaseout of CFCs, not only in San Jose but worldwide, with a phaseout date of 1993, which at that point was the most rapid of any of the major electronic companies in the world. IBM also invited the Coalition and other groups to tour its Silicon Valley plant and view a new process that ultracleaned disk drives without using CFCs, just soap and water, a fairly low-tech solution to an enormous environmental concern. Now, IBM is rapidly phasing out the use of that class of chemicals.

We surveyed the 25 largest CFC dischargers in northern California, asking them for goals and timetables for complete phaseout of CFC production processes. We then published a list of companies that had set aggressive goals and timetables and those that hadn't and called them

Table 2.—1987 data on chemical emissions from Silicon Valley industries.

CHEMICAL NAME	FUGITIVE EMISSIONS (lbs/yr)	STACK EMISSIONS (lbs/yr)	TOTAL AIR EMISSIONS	OTHER DISCHARGES & OFF-SITE DISPOSAL[1]	TOTAL
Freon	1,448,299	376,710	1,825,009	20,142	1,845,151
TCA	316,212	440,132	756,344	191,452	947,796
Hydrogen chloride	0	274,065	274,065	0	274,065
Acetone	100,675	94,745	195,420	196,577	391,997
Methylene chloride	73,220	110,010	183,230	13,642	196,872
MEK	31,489	64,713	96,202	54,939	151,141
Xylene	15,055	42,566	57,621	111,872	169,493
Styrene	27,000	3,600	30,600	0	30,600
Tetrachloroethylene	29,800	0	29,800	0	29,800
Sulfuric acid	0	28,888	28,888	274,074	302,962
Methanol	8,500	6,200	14,700	52,600	67,300
Sodium sulfate	0	9,283	9,283	2,969,326	2,978,609
Phosphoric acid	102	7,677	7,779	86,226	94,005
Sodium hydroxide	0	6,577	6,577	425,060	432,437
Hydrogen fluoride	0	6,300	6,300	61,849	68,149
Glycol ethers	0	4,776	4,776	76,030	80,806
Phenol	0	3,900	3,900	11,600	15,500
Aliminum oxide	0	0	0	395,381	395,381
Nitric acid	0	0	0	84,961	84,961
Copper & compounds	0	0	0	73,714	73,714
Hydrochloric acid	0	0	0	53,500	53,500
Ethylene glycol	0	0	0	43,125	43,125
TOTAL[2]	2,062,277	1,975,994	4,038,271	4,926,804	8,965,075

[1] Including discharge to sewage treatment plants
[2] Total includes category "others"

"leaders and laggards." Laggards were largely defense and aerospace contractors who were hindered by military specifications that required using CFCs. Military standards continue to be a big problem in the United States. The Coalition is trying to help speed up the process whereby the military will revise those specifications.

After we generated a number of reports that focused on emissions and called for reductions, the Santa Clara County Manufacturing Group, a trade association that represents most of the electronic manufacturing companies in our area, decided to start compiling this information and putting their own spin on it to publicize emission reductions. For the last couple of years, it has been publishing a report that identifies specific reductions by chemical and plant.

We've come a long way — from the initial resistance and hostility to the point where industry is putting out emission reports. In some cases, some of these reductions can be as simple as housekeeping — putting lids on solvent tanks or educating employees about handling solvents — and process changes that can be accomplished with relative ease. Of course, in some significant areas, solutions will not include short-term, easy fixes but substantial research and development to find safer production processes that use clean technologies.

Another Coalition effort involves the Campaign for Responsible Technology, started by labor, environmental and local public interest groups, and computer professionals all around the country who are focusing on problems at SEMATECH, the research consortium based in Austin, Texas. We are asking this consortium of the 14 largest semiconductor companies to develop safer production technologies in partnership with the federal government because we realize that individual companies cannot do this kind of research economically. The progress being made at the consortium is impressive, not only in terms of CFC reductions but also in ways to move away from using toxic gases in semiconductor processing.

Conclusions

The TRI has been useful in dramatizing toxic emissions and encouraging reductions. However, pollutants don't respect boundaries. Multinational and transnational companies also want uniform reporting. With standard regulations and requirements, companies are less likely to play different jurisdictions off against each other.

This approach to reductions is often largely voluntary and nonregulatory. Although 85,000 companies report, EPA does not have 85,000 inspectors to verify the data, so enforcement is pretty spotty. That's where some of the nongovernmental organizations come into play — to enforce compliance through citizen action.

The Silicon Valley Toxics Coalition, as well as a number of other U.S. groups, has been trying to negotiate good neighbor agreements with companies that are major polluters in our neighborhoods to get them to meet goals in reductions and also allow citizen inspection.

Lastly, it is important to make the distinction between waste reduction and decreasing toxics use. Increasingly, the United States and some countries in Europe are looking at the product itself — distinguishing between waste and toxic chemical production and use. Many of the chemical companies are making great progress in reducing waste, but often the product they make is toxic.

Our focus on the electronics industry has been to help it wean itself away from toxic products. That's why IBM's switch from CFCs to nontoxic soap and water is such an important example.

If we can begin to round off the tremendous increase in the production of synthetic organic chemicals, we will see the light at the end of the tunnel.

Closing Plenary

Closing Plenary: Implications of Toxics Release Reporting for Other Countries

MODERATOR: Richard P. Wells
Abt Associates Inc.
Cambridge, Massachusetts

Shinichi Arai
Organization for Economic Cooperation and Development
France

Andrew Lees
Friends of the Earth
United Kingdom

Hans-Peter Baars
TNO—Environmental and Energy Research
The Netherlands

Christopher Ian Pickard
IPC Policy Unit, Department of the Environment
United Kingdom

Jack Holland
Commonwealth Department of Arts, Sport, the Environment, Tourism and Territories
Australia

Mariá Kazmuková
OUZP ZILINA
Czechoslovakia

Representatives from four countries — The Netherlands, United Kingdom, Australia, and Czechoslovakia — and one multinational organization — the Organization for Economic Cooperation and Development (OECD) — as well as a spokesperson for the non-governmental organizations (NGOs) addressed the final session of the conference. Their comments provided a perspective from non-United States representatives at the conference on key issues raised by the international application of a concept similar to TRI and key potential benefits and obstacles to such a program. In addition, several countries described experiences with similar programs. These comments addressed a number of common themes as well as topics that were specific to each country represented.

■ The first common theme was *the need for international coordination in the development and implementation of national programs modeled on the TRI.* A number of countries already have programs similar to TRI in place; others are considering them. During the conference, representatives from industry noted that, in the absence of coordination, a patchwork of inconsis-

tent national programs would create substantial reporting burdens; users of these data said they would face potentially insurmountable data compatibility problems.

Shinichi Arai, speaking for the OECD, addressed the theme of coordination of programs. He noted that an international system would

- focus on a common set of chemicals,
- provide common basic information that countries could use as a basis for further cooperation (for example, prioritizing chemicals and identifying candidates for international actions, such as the OECD risk reduction program), and
- encourage the development of national right-to-know programs.

Mr. Arai also said, however, that a number of points should be considered when developing an international system. In particular, he noted that, while some countries already collect the kind of data found in TRI, collection systems vary. Some countries use licensing or permit systems, while others have safety reporting systems. Countries also differ in the use they make of these data. Some countries use risk-based approaches (taking into account exposure and toxicity), while others rely exclusively on emissions data. Finally, each country has different traditions and existing laws that govern the public's right to know about environmental releases. In addition, Mr. Arai also raised the need to address certain more technical issues — such as a common standard for reporting criteria and a harmonized list of chemicals.

Mr. Arai felt the first step in encouraging an international system is to facilitate the international exchange of information received by OECD. He felt that adoption of TRI by member countries would make it easier for others to introduce a similar system. Finally, Mr. Arai felt that the OECD might be the most appropriate organization to undertake the harmonization work needed to introduce TRI internationally. Since the OECD is a consensus organization, general support from member countries will be needed for this activity to succeed.

Andrew Lees of Friends of the Earth UK, who represented the NGOs attending the conference, also addressed the need for coordination as part of six points about TRI presented by the NGOs (Table 1). Mr. Lees called on industry to operate everywhere to the highest prevailing world standards of health and safety and environmental protection and called on industry to extend the TRI approach beyond the United States. He argued that consistent standards are important because "there is little point . . . in having a perfectly green developed world if all the hazardous technology...is merely exported to the potentially new markets of the developing world."

Table 1.—Six points presented by NGOs to the International Conference on Reporting Releases of Toxic Chemicals.

1. A public right to know is a fundamental attribute of democracy.
2. The environment belongs to us all, and everyone has a right to know about the sources (potential and actual), nature and impacts of industrial hazards, and pollution.
3. Industry should be required to operate everywhere to the highest prevailing world standards of health and safety and environmental protection.
4. Transnational industrial companies (TNCs) should be required to provide regulatory bodies and, through them, the public with TRI-equivalent data for all of their facilties worldwide. Such TNCs should be seen to set an example in good neighbor relations.
5. The legislative and other actions indicated above should be actively supported by both the U.S. Environmental Protection Agency and the Commission of the European Communities as well as governments.
6. The TRI methodology should be extended to encompass the full range of industrial operations that affect the environment.

Mr. Lees also argued that transnational companies that collect management information for the TRI on U.S. operations should report these data for their non-US operations as well. These transnationals, he stated, "should play a leadership role and release the information independently of the degree of enlightenment of governments and the cultural perspective of regulators. If industry truly wants to prove world leadership when it comes to environmental protection, we throw down this gauntlet: make the TRI equivalent data available for all your operating sites wherever they are."

In his final two points, Mr. Lees called for concerted international support for the adoption of a TRI-equivalent system. He also proposed that the Commission of the European Community support adoption of a TRI and called for the extension of TRI methodology "to encompass the full range of industrial operations that impact on the environment."

Hans-Peter Baars of the Netherlands Organization for Applied Scientific Research, Toegepast Natuurwetenschappelyk Onderzoek (TNO), described the Dutch emissions registration system and compared it to TRI by illustrating the key differences between the two (Table 2). The Dutch system has both a collective and an individual component. The collective component applies to smaller industrial facilities that would not meet reporting thresholds under TRI and to certain non-industrial activities, such as emissions from traffic, shipping, households, sewage treatment, and agriculture. Emissions estimates for these activities are based on volumes of activity and emissions factors. The individual component applies to specific facilities with 10 or more employees and is based on specific calculations.

Table 2.—Comparison of the United States' TRI and the Netherlands' reporting system.

U.S. TOXICS RELEASE INVENTORY	DUTCH EMISSIONS REGISTRATION SYSTEM
Toxic chemicals (320)	All substances (700)
Air/water/soil/off-site	Air/water
Facility totals	Detailed
Yearly totals	Emission periods
Every year	Every other year
Releases	Emissions
Estimation by company	By TNO & company
Selected activities	All activities
Selection >25,000 U.S.	Weighting system
Enforced by law	Voluntary cooperation
Right-to-Know	Trade secret

Information gathered by the Netherlands' emissions registration system is generally more detailed than that gathered by the TRI. Unlike TRI, which is based on annual facility chemical release totals, the Dutch system covers individual units within a facility, such as boilers or cracking units, and provides data on throughput, pollution control equipment in place, and the timing of releases during the year. In addition, the Dutch system covers all emissions of concern from a given facility, including acid rain chemicals, such as sulfur dioxide gases, and chemicals associated with global warming, such as methane and CO_2.

The scope of the Dutch emissions registration system is somewhat narrower than that of the TRI. When started in 1973, it covered all facilities with 10 or more employees; the number of facilities included in the system has, however, been reduced from 6,300 in 1973 to 700 in 1990. Data have identified that a smaller number of companies cause most of the pollution. In addition, this system covers releases to air and water only; off-site transfers and solid wastes are not included.

Although reporting under the Dutch system is voluntary, few companies have refused to participate. Unlike TRI where emissions are estimated by each company, the Dutch government, through TNO, provides technical assistance to companies in estimating emissions. Mr. Baars noted that this approach is important from a quality assurance viewpoint because it ensures use of a consistent method at all similar facilities. However, this approach is resource intensive: the initial round covering 1973–78 required 500 person-years of labor. By 1990 when the number of companies in the system had been reduced to 700, resource requirements had been reduced to 30 person-years.

Christopher Ian Pickard of the United Kingdom's Integrated Pollution Control Policy Unit, Department of the Environment, reported on a system to provide environmental data to the public that was installed in April 1990. Unlike those in the United States and the Netherlands, this system is tied directly to plant operating permits. Plants in the most seriously polluting industries are required to obtain a permit to operate those processes. The United Kingdom is now looking at these industries sector by sector, determining what constitutes best available techniques for the industry, deriving limits based on those techniques, and imposing those limits on industry. Operators are then required to maintain the permitted processes and supply monitoring data to the government, which is now proposing to aggregate the information annually and make it available through public registers, along with detailed data about application and permitting.

Two other speakers described issues facing countries that are just beginning to consider making emissions data available to the public. **Jack Holland**, from the Commonwealth Department of Arts, Sport, the Environment, Tourism and Territories, outlined initial efforts underway in Australia, where the government has recently released a public discussion paper on the proposed national waste minimization and recycling strategy, which is closely tied to an emissions inventory. Australia also recently announced it will establish an Environment

Protection Agency. Separating the environment from the Commonwealth Department of Arts, Sport, Tourism and Territories will give it much greater prominence.

No timetable has been set yet for the development of an Australian release inventory, and a number of issues have to be resolved before the inventory can be fully developed. Chemical control in Australia is a state matter; the states license all facilities. The new Australian Environment Protection Agency will not have the same degree of authority over state matters as the U.S. Environmental Protection Agency. Unlike Europe and the United States where environmental statutes pertaining to chemicals have been in place for some time, Australia's Chemical Notification and Assessment Act has been operative for less than 18 months, and industry is still absorbing the effects of this act. Mr. Holland was not sure how industry would handle additional requirements that followed closely on the Chemical Assessment and Notification Act; however, he recognized that multinational businesses with overseas parent companies are already introducing these requirements into all operations.

Other issues that must be addressed relate to types of facilities included in a release inventory. Australia's chemical industry is based largely on imports. Recently, a large storage facility went up in flames, an incident that created a great deal of public interest in chemical storage and distribution facilities rather than chemical manufacturing facilities. Australia needs to determine whether to confine the release inventory to manufacturing or to extend it to other industries. In addition, Australia must look at threshold reporting levels.

Mariá Kazmuková described the situation in Czechoslovakia and other post-Communist countries:

> *Many of the things I've heard sound so much like beautiful poetry and science fiction of the future, but the problems of my country, Czechoslovakia, as well as of other post-Communist countries, are quite different. Our messy political situation as well as an economic slowdown make people less interested in environmental problems. For the past 40 years, we have been unable to obtain correct and full information about our environment. Technologies that consume too much energy, a lack of economically based behavior, missing information and measurements, together with the absence of not only environmental but even of democratic education — that is a very sad picture. I would like to express my hope that this situation will be soothed step by step.*
>
> *I think such a situation is dangerous because people, not only in Czechoslovakia, but in many other poor countries as well, will not care about the environment, but simply prefer to satisfy temporary social needs. That's the danger, but I hope this situation can be improved. This conference is evidence that the problem is not only one for the developed countries; it is also a problem of a global approach. We all clearly have a common future.*

■ A question that arose repeatedly in commentary by non-US participants in the conference was *the question of public access to environmental data.* In large measure, the power of TRI derives from the fact that it is available and readily accessible to the public. Members of the public with access to quite common information technology can, moreover, easily obtain detailed plant- or location-specific data. Data availability has made TRI, in effect, a powerful public report card on industry's environmental performance, and many corporate actions to reduce releases can be traced to this fact. In other countries, the traditions of public access to environmental data are not as completely established as in the United States. Several speakers anticipated that their countries would resist making release data widely available to the public.

Shinichi Arai stated that an international TRI would encourage the development of right-to-know laws in member countries to ensure public access to information on chemicals or facilities. Mr. Arai noted that OECD also has some systems to facilitate public access to information that may prove useful to developing a release inventory. In applying these systems, however, it is important to recognize that individual countries' situations differ.

Andrew Lees emphasized that public access goes beyond making data available:

> *A right to know is not a right to know if you know where to look, if you know how to ask a technical question. A right to know is a civil or public service ethos among regulators and administrators that makes it easy for the public to exercise their right to know. What we have seen from the NGO perspective, exemplified by the staff from EPA, is that enlightened attitude, that 'how can we help*

you?' attitude that really empowers the public in their right to know.

Mr. Lees also argued that:

No one actually owns the environment (from a philosophical perspective). We all have common rights in it, but we cannot regard it as a common whereby we seek to maximize our exploitation of it before somebody else grabs their share. We've got to take that common interest perspective on the environment. That means, in effect, that if somebody wishes in the service of their own private or corporate interests to make use of the environment, they have a responsibility to use it right in a careful, caring way, but they also have a moral obligation to make public everything that they're doing. Because the environment is a public good that is subject to the impact of their activities. Therefore, we would say you have no right to claim that you can hide everything. There may be a justification for trade secrets to be protected, but again the EPA rule is good there: a reasoned case must be made; you have to prove your case. So it should be a stringent test to have a claim of commercial confidentiality or trade secret to protect your interests from public scrutiny.

Hans-Peter Baars noted that the Netherlands' voluntary system is not available to the public on a plant-specific basis: "The Community Right-to-Know Act does not exist in our country yet. We can only publish aggregated data, and only the government has access to these detailed data."

Christopher Ian Pickard noted that the United Kingdom is now proposing to provide data to the public on authorization permits for seriously polluting industries. Detailed data concerning both the permits and operator monitoring of the processes to which the permits apply will be made available through public registers.

Australia, also, has no tradition or law about community right to know, according to **Jack Holland.** Because states and other Commonwealth departments have considerable influence, Mr. Holland said, "We will have to examine if such laws will be enacted. Again, this will require cooperation from the states and from other Commonwealth departments. From what I've heard this week, the value of a release inventory is very much diminished if excessive use of trade secrecy provisions can be made."

In Czechoslovakia and other post-Communist countries, according to **Mariá Kazmuková,** the situation is made even more complex by the absence of information and measurements and a democratic tradition. These circumstances and the economic situation in the post-Communist world are dangerous because "people . . . will not care about the environment but simply prefer to satisfy temporary social needs."

■ Finally, some of the speakers addressed other topics that pertain to the *relationship between a release inventory and other aspects of risk management.*

Shinichi Arai noted that approaches to risk differ among OECD member countries, with some countries focusing only on release data while others couple release data with toxicity and exposure data to develop risk-based approaches.

Christopher Ian Pickard underlined the relationship between an inventory and an integrated pollution control approach. He noted that, in the United States, TRI had been an impetus for the development of an integrated pollution approach, whereas in Europe an integrated pollution approach might result in an emissions inventory.

The OECD has made a ministerial recommendation for an integrated pollution prevention and control approach. A European Commission directive is being negotiated for an integrated approach, and the United Kingdom has recently started to integrate its approach to pollution prevention.

Jack Holland reiterated these points:

As we have all heard very strongly and repeatedly, a release inventory provides many opportunities for pollution prevention and source reduction. These two concepts lie at the heart of our waste minimization and recycling strategy. We [the United Kingdom] think a public emissions register is something that goes along very closely with that.

INTERNATIONAL CONFERENCE ON REPORTING RELEASES OF TOXIC CHEMICALS

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