Enhancing PRTR Comparability to Address Global Sustainability Needs

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Executive Summary

With the heightened focus on sustainability around the world, there is a complementary need to paint a better map of global toxic releases that can identify pollutant hot spots and potential needs for environmental regulation. Pollutant Release and Transfer Registers (PRTRs) promulgated in more than 50 countries are one means of collecting information on releases. But there are significant barriers to comparing data from individual PRTRs, including varying thresholds for reporting requirements and substantial differences among the lists of included toxics. We identify five recommendations to enhance the comparability of existing PRTR data sets:

1. Rather than try to compare entire PRTR datasets, identify specific chemicals and/or sectors where comparisons can be made
2. Identify chemical classes to compare across countries with existing PRTRs
3. Identify normalizing factors to facilitate comparisons
4. Pursue a "relative comparison" approach
5. Create a global PRTR

We also address comparability issues in emerging PRTRs in developing countries.

Background

Pollutant Release and Transfer Registers (PRTRs)

Pollutant Release and Transfer Registry (PRTR) is a generic term used to describe a publically available database that contains information on the quantities of toxic chemicals or other pollutants released from industrial facilities or other businesses within a given country to air, water and land, or otherwise managed as waste (e.g. recycled, burned for energy recovery). A PRTR is usually measured annually, and established and maintained by a country's national environmental authority. The information contained in a PRTR is typically submitted on a regular basis by facilities that are required to report such information. Some PRTRs also include estimates of releases from diffuse sources, such as agriculture, transportation and the end use of products.

The primary purpose of a PRTR is to increase the public's knowledge of, and access to, information on the release and quantities of toxic chemicals in their communities. These data: 1) provide the public with knowledge on the dispositions of toxic chemicals in their community; 2) help enable citizens to make informed decisions regarding the consequences of such dispositions; and 3) enable citizens to take action.

PRTR data are also used by federal, regional, state, and local governments for prioritization purposes. The development and implementation of a PRTR adapted to national needs assists governments in: 1) tracking the generation, release, and fate of emissions of hazardous chemical substances and pollutants over time; 2) examining progress in reducing emissions; and 3) setting pollution prevention and sustainability priorities.

The U.S. PRTR system (the Toxics Release Inventory or TRI) is maintained by the U.S. Environmental Protection Agency, and is the oldest and most comprehensive PRTR system in the world. Environmental authorities in other countries are increasingly implementing their own PRTR programs, using the TRI as the benchmark prototype model upon which to base their respective PRTRs. As of 2012, there are at least 50 PRTRs in the world. In North America there are three: the TRI; the National Pollutant Release Inventory (NPRI, established in Canada and maintained by Environment Canada), and the *Registro de Emisiones y Transferencia de Contaminantes* (RETC, established in Mexico and maintained by Mexico's Ministry of Environment and Natural Resources).

Core Goals

Specific countries' programs are influenced by multiple conditions. The actual composition of a PRTR program is often contingent upon its founding principles. If, for instance, the PRTR was established primarily to stress public disclosure then it may include more transparent and readily available data. If it the program was implemented to induce voluntary action from industry, then the public disclosure aspects may be stressed less. When the goal of the PRTR is to measure regulatory performance, then it may only offer data on chemicals currently under the purview of the regulatory structure.

The core goals of all PRTR programs are shaped to the needs of stakeholders. There are three main stakeholders for any PRTR: the public, industry, and government. The U.S. TRI operates with the primary goal of informing the public of toxic chemical releases in their communities.[1] It also provides information that allows industry, various levels of government, and community organizations to make informed decisions about environmental impacts. The requirement for facilities to report other waste management quantities (e.g., quantities burned for energy recovery, quantities recycled) to the U.S. TRI was established in 1990 under the Pollution Prevention Act.

Existing Key Elements

The key elements currently exemplified for any PRTR through the U.S. TRI, OECD guidance and the European-PRTR are extensive. A summary of key elements currently in many existing PRTRs are as follows: [2] [3] [4]

- PRTRs should provide information that identifies sources of chemical releases and transfers that may have potential detrimental effects on human and environmental health. Information about releases and transfers of chemicals that are toxic to humans (e.g., benzene) or the environment, or are global hazards (e.g., greenhouse gases) should be included, as well as information about the source. Additionally, the route of emission (i.e., either air, water, land, or any combination thereof) should be included in the provided data.
- PRTR data should be used to encourage emission reduction through improvement in industry practices at the facility level and improvement of technologies throughout industry. The data collected in PRTRs should be able to aid decision-making processes at the public, industry, and governmental level, including with policy development and evaluation.
- The goals of each PRTR should be developed with the input of all stakeholders: government, industry, and the public. The resulting program should be one that explains the resulting benefits to all stakeholders concerned.
- The data from PRTR systems should provide the public and private sector with facility-specific information as it pertains to releases and transfers from a variety of industry sectors, including from federal facilities.
- To the extent that is possible, PRTR systems should be integrated with existing pollution information programs, such as licensing and operating programs.
- Reporting mechanisms will vary in their necessity to be voluntary or mandatory. These levels of reporting should be set in a way that best achieves the goals of the PRTR system. A method of compliance should also be determined through input by the stakeholders.
- The inclusion of various sources, industry sectors, and pollutants should reflect the goals of the PRTR and the environmental policy goals driving the program. This should take into account other national programs that may benefit from the data collected, as well as other benefits the data may provide to stakeholders.

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[1] EPA Toxics Release Factsheet. January 2012.
[2] Guidance Document for the Implementation of the European PRTR. European Commission. May 31, 2006.
[3] Pollutant Release And Transfer Registers (PRTRs). A Tool For Environmental Policy And Sustainable Development Guidance Manual For Governments. Organisation For Economic Co-Operation And Development Paris 1996.
[4] EPA Toxics Release Factsheet. January 2012.

- The data from PRTRs should be free, easily accessible to all, and produced on a timely basis. The data should be easily searchable and analyzable by a variety of set parameters.
- All PRTR systems should be flexible and allow for alterations as stakeholder practices and concerns develop over time.
- The data submitted to PRTRs should be valid and verifiable. The system should be able to provide geographic information of all releases and transfers.
- The development, implementation, and use of the PRTRs should be unbiased and transparent to all stakeholders. There should be few allowances for confidentiality in the overall development and operation.

Problem: The Ever-Growing Need for Comparability among PRTR Datasets

Pollution and Risk

Pollution knows no borders. The United States acknowledged cross-border pollution with the recently finalized Cross-State Air Pollution Rule (CSAPR), a rule that restricts power plant emissions that significantly pollute the air of other states. Pollution transport is certainly not limited to air pollution, however. Most of the world's major rivers, and their watersheds, cross international boundaries. Water pollution in one country can have major effects on the health and access to drinking water in another. In addition, pollution may be intentionally transported by trucks, trains, and boats.

This factor alone makes it important to understand pollutant releases and transfers on a regional or global level. Being able to compare data among PRTRs is necessary for judging the effectiveness of pollution control measures and for presenting pollutant production trends.[5] It is important to be able to determine if policy decreases pollution, shifts the pollution to another place, or moves production to a company or sector that does not have to report.

*The CEC attributes the following possible benefits to better PRTR comparability (*http://www.cec.org/Storage/127/15188_PRTR-ActionPlan-2005_en.pdf, p. 6)*:*

- *provide an improved picture of pollutant releases and transfers, helping protect human health and the environment;*
- *improve decision making for governments, industry and citizens;*
- *maximize scarce resources and increase efficiency among PRTR programs;*
- *strengthen scientific expertise and information exchange;*
- *inform the public and provide access to environmental information;*
- *simplify requirements for industry reporting, potentially reducing reporting burden;*
- *support international agreements with environmental information integrated into a single national register*

[5] Kerret, D. and Gray, G. What do we learn from Emission Reporting? Analytical Considerations and Comparison of Pollutant Release and Transfer Registers in the United State, Canada, England, and Australia. Risk Analysis, Vol. 27, No. 1, 2007 DOI: 10.1111/j.1539-6924.2006.00870.x

Assessing exposure to toxic chemicals emitted into the environment and subsequent risks to human health or the environment requires analysis of cross-border as well as inter-border emissions. The ability to study these cross-border effects could lead to a better understanding of the health effects and environmental risks of specific pollutants. Cross-border analysis is also important to address environmental issues in border zones. The North American Commission for Environmental Cooperation expects North American PRTR comparability to be a "key step" toward addressing environmental concerns in the US-Mexico border zone.[6] Efforts to mitigate environmental damage in this fast-developing zone require accurate information about pollution sources to ensure accountability of both companies and countries.

This broader analysis is especially important for pollutants of truly global significance, such as greenhouse gasses, ozone depleting chlorofluorocarbons, and chemicals such as mercury that upon discharge are known to undergo long-range environment transport to other regions or countries, where they pose environmental risks or risks to unsuspecting individuals. The local effects of these pollutants are minimal, but global tracking of total emissions are important for predicting future effects on climate and health. In addition, better accounting of global trends may help identify "hot spots" of pollution where reduction efforts should be concentrated.

The Growing International Scene

In the coming years many more PRTRs are expected to be implemented throughout the world, particularly in Central and South American countries. While regulatory in structure and implementation, the TRI has created a forum for the American industry, communities, and government to collaborate on best practices regarding toxic chemicals.[7] Similar outcomes have evolved in other countries that have established PRTRs. At present, regional systems have begun to complement single-nation PRTRs. Broader cooperation efforts are better equipped to tackle the larger problems associated with cross-border pollution.

Governments throughout the world are now, more than ever, making efforts through voluntary and regulatory means to achieve the goal of sustainable development to meet the needs of the present generation without compromising the ability of future generations to meet their own needs.[8] Sustainable development is beginning to be viewed as a global priority, rather than a goal of individual countries or even specific continents. To this end a practical but efficient mechanism for tracking environmental emissions and other waste management quantities of toxic chemicals throughout the world is needed. PRTRs help to synthesize national and international sustainability goals by providing the requisite data to policymakers. Emissions information systems allow countries to properly allocate resources, prioritize chemicals, and provide the basis for sound regulatory action.[9]

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[6] Action Plan to Enhance the Comparability of Pollution Release and Transfer Registers. September 2005. P. 6.
[7] US EPA Online Toxic Release Inventory Program: What is the Toxic Release Inventory? http://www.epa.gov/tri/triprogram/whatis.htm
[8] C.C. Brutland, "Our Common Future", The World Commission on Environmental Development, Oxford University Press, Oxford, 1987.
[9] Inter-Organization Programme for the Sound Management of Chemicals Pollutant Release and Transfer Registers Co-ordinating Group. "Emissions Inventories (Pollutant Release and Transfer Registers)." Third Session of the Intergovernmental Forum on Chemical Safety. Salvador da Bahia, Brazil. 2000

Developing countries have a host of challenges that take precedent over the already troublesome aspects of PRTR design and implementation. These countries may lack the resources and infrastructure required to create a PRTR system from the ground up. Short-term economic pressures may influence leadership to find that creating a PRTR may not be in the country's best interest. Specific steps will have to be undertaken in order to align these economic interests with a long-term plan that promotes sustainability and environmental welfare.

The barriers to an international PRTR are many and include multifaceted sources ranging from political feasibilities to simple cost constraints. In order to make progress on global sustainable development, these issues will have to be explored, understood, and codified into an international guideline.

Promoting Corporate Sustainability

As commerce becomes increasingly globalized, there is a new sense of urgency regarding international standards for toxic pollutants. Goods and their byproducts are transferred globally on a daily basis. Whereas a few decades ago one could expect harmful chemicals from industrial processes to remain primarily local and only require the response of local actors, international trade has brought about a host of interstate issues. A given end product may hold parts made in many countries, assembled in a second country, and sold in a third. As the emphasis on sustainability in production and disposal increases, it becomes more important to be able to accurately gauge how geographic shifts in production affect the sustainability of the end product. In this global environment, better comparability between PRTR systems can help countries and companies identify opportunities to reduce pollution and waste.[10]

Although innumerable complications make directly attributing declines in pollution to PRTRs difficult, the U.N. Economic Commission for Europe notes that PRTRs exert indirect downward pressure on pollution because no company wants to be listed as the largest polluter in a publically accessible dataset.[11] In addition, many marketing campaigns advertise sustainable production and environmentally friendly business practices. The combination of positive and negative reinforcement can make PRTRs a powerful driver for greater corporate sustainability.[12]

A risk to this incentive, however, is that companies will be encouraged to reduce their PRTR submissions without actually reducing their pollution footprint. Moving production to a country with less stringent or no reporting requirements, for example, will likely make production more sustainable only on paper. This is true even if a company truly wishes to emphasize sustainability.

Enhancing Public Participation and Decision-making

[10] Taking Stock: 2005 North American Pollution Releases and Transfers. Commission for Environmental Cooperation. June 2009.p. 3
[11] Kiev Protocol on Pollutant Release and Transfer Registers. United Nations Economic Commission for Europe. http://www.unece.org/env/pp/prtr.html. Accessed 3/30/12
[12] Action Plan to Enhance the Comparability of Pollution Release and Transfer Registers. September 2005. P. 2

A major reason for the initial development of PRTRs is to enable and promote public awareness of pollution in communities and promote public participation in decision-making. Cross-border pollution is an important part of a community's understanding of its environment for many of the reasons described above. Pollution, health concerns, and sustainability are important concerns as we decide where to live and what to buy. As with producers, consumer decision-making requires multi-state tracking of pollution, making PRTR comparability a necessity.

Governments have more recently begun taking steps to include the public in discussions about environmental policy. Principle Ten of Agenda 21 of the Organization for Economic Development's protocol for PRTRs asserts, "Each individual shall have the appropriate access to information concerning the environment that is held by public authorities."[13] This reflects a growing thought that pollution control is not simply a technocratic issue to be pursued by government agencies, but the responsibility of citizens who possess the right to remain informed on the state of their environment. Greater comparability among PRTRs is needed to enhance public participation.

Past and Current Efforts to Combine PRTR Datasets

Since the early 1990s, formal PRTR-related partnerships between federal environmental authorities have been established under the purview of international organizations. These partnerships not only serve as a means by which PRTR programs can share experiences and work collaboratively to address current and emerging issues, but also to encourage and assist other countries in implementing their own PRTRs.

In response to Agenda 21, a section of the United Nations Conference on Environment and Development (UNCED), the OECD began drafting recommendations in 1992 for developing PRTRs in member nations. In 1996, the OECD Council adopted the *Recommendation on Implementing PRTRs*. The goal of the OECD recommendations run similar to that of the U.S. TRI in that environmental information collected by the government is to be made available for public use and public comment in policy making processes.[14] The OECD developed these recommendations in response to many member states having implemented or begun to develop PRTRs of their own.[15]

Agenda 21 *– Signed by 178 governments in 1992, Agenda 21 is a "comprehensive plan of action to be taken globally, nationally, and locally" to encourage sustainable development.*

One specific recommendation that the OECD made was that member states share results of implementation and data from their own PRTRs with neighboring countries regardless of their OECD status.[16] Simultaneously, the Commission for Environmental Cooperation's (CEC) North American Pollutant Release and Transfer Register (NAPRTR) project began with the goal of reducing toxic releases

[13] United Nations General Assembly. Report on the United Nations Conference on Environment and Development. Rio de Janeiro, 1992 http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm
[14] [2]
[15] [3]
[16] [4]

and transfers throughout North America.[17] By collecting and disseminating information about toxic releases from industry in Canada, Mexico, and the U.S. the OECD recommendations and CEC NAPRTR were among the first quantifiable suggestions of cross-border PRTR data cooperation.

The Commission for Environmental Cooperation (CEC) – North American Pollutant Release and Transfer Register

The CEC was established following the passage of the North American Free Trade Agreement and seeks to collect and aggregate data from each of the North American PRTR datasets: the United States' TRI, Canada's NPRI, and Mexico's RETC. The CEC makes this combined data available through its *Taking Stock Online* tool, as well in its annual *Taking Stock* report. The *Taking Stock Online* tool enables facile PRTR-related analyses across the North America continent, such as analysis of releases of pollutants that are common to all three North American PRTRs. The annual report also advises the governments on ways to better integrate data and analyzes their progress in doing so.

There is an especially long history of comparability between the United States and Canada, even before the creation of the CEC. Canada initiated its NPRI in 1993, six years after the first reporting period of the U.S. TRI, and based its list on the TRI chemical list as it existed in 1989; the NPRI list essentially a "sub-list" of the TRI list. [18] Subsequent additions to the NPRI chemical list were based on changes to the U.S. TRI's list.

The CEC's emphasis on enhancing the comparability between the PRTRs of North American countries served to increase the comparability between the systems of the United States and Canada, and more recently, Mexico. The relationship between the countries was further solidified in June 2002 when the CEC adopted its *Action Plan to Enhance Comparability among PRTRs in North America*.[19] The goal, according to CEC, was to "gain a more complete picture of the sources, quantities and handling of pollutant release and transfers in North America."[20]

Under the CEC's purview, the Canadian and the United States environmental authorities have taken several steps to make their PRTRs more directly comparable. Canada, for example, initiated reporting of off-site transfers in 1996; initiated reporting of pollution prevention activities in 1997; initiated mandatory reporting of transfers to recycling and energy recovery centers in 1998; expanded its chemical list in 1999; and expanded its pollution prevent reporting regime in 2002. In 1998, the United States increased the industry sectors covered by the TRI to match more closely with those covered by the Canadian NPRI. Both countries added persistent bio-accumulative toxic chemicals (PBTs) to their lists of covered chemicals in 2000, and set lower activity thresholds for reporting of these chemicals.[21] These

[17] [5]
[18] Recommendation of the Council on Implementing Pollutant Release and Transfer Registers. Organization for Economic Cooperation and Development. February 1996.
[19] Action Plan to Enhance the Comparability of Pollution Release and Transfer Registers. Commission for Environmental Cooperation. September 2005.
[20] Ibid.
[21] Ibid.

changes have increased the data that can be "matched" between the NPRI and TRI from 40 to 60 percent.[22]

Mexico's RETC was established relatively recently compared to the NPRI. In 1994, Mexico began the process to establish a national PRTR, adopting only a voluntary standard in April 2001, the Norma Mexicana (NMx).[23] Despite its relatively slower start, Mexican officials have collaborated with U.S. and Canadian officials via the CEC, and in December 2001, the Mexican Congress passed legislation to replace the NMx with a mandatory system. [24] According to the CEC, "the adoption of a mandatory requirement for RETC reporting and making the data publicly accessible are considered the most important steps towards achieving comparability among the three national PRTRs."[25]

Despite these efforts, there remain several hurdles to comparing data from the three North American PRTRs. When the TRI and NPRI included PBTs, for example, there remained differences between the two systems: the chemicals were not all the same, activity thresholds were different in some cases, the sources required to report were not all the same, and the definition for the reporting of dioxins and furans were not the same. Only seven PBTs included by the two countries in the 2000 reporting year were on both the TRI and the NPRI, with only three having the same reporting threshold.[26]

Some of the differences between the North American PRTRs are substantial. There is little overlap in named chemicals, with only 60 chemicals included in each of the three PRTR chemical lists. Employee and reporting thresholds also remain a barrier to comparability. Where Canada and the United States require facilities with 10 or more full-time employees to report, Mexico has no such requirement.[27] In Canada and the United States, the standard "activity" threshold for reporting is 10,000 kilograms (approx. 22,000 pounds) and 25,000 pounds (approx. 11,340 kilograms), respectively. In Mexico, the standard "release" threshold is 1,000 kilograms (approx. 2,200 pounds), while the standard "activity" threshold is 5,000 kilograms (approx. 11,000 pounds).[28] Only Canada requires reporting from public wastewater treatment centers, while the United States exempts the oil and gas industries. Further, the top three pollutants that U.S. power plants reported in 2011 do not even fall under the RETC list.

In addition, a lack of information on the ultimate fate of materials transferred across borders[29] makes drawing conclusions about trends in sustainability difficult. Finally, the biggest weakness is that the comparability effort is based on NAFTA-era trade. As globalization has become truly global, the US, Canada, and Mexico have increased their trade outside the continent. While Canada and Mexico are the United States' first and third trade partners by total trade, they make up less than one third of US global trade (See Table 1).[30]

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[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid.
[27] Taking Stock: North American Pollutant Releases and Transfers: 13. Commission for Environmental Cooperation, March, 2011. P. 68.
[28] Taking Stock: North American Pollutant Releases and Transfers: 13. Commission for Environmental Cooperation, March, 2011. P. 68.
[29] Taking Stock: 2005 North American Pollution Releases and Transfers. Commission for Environmental Cooperation. June 2009.p. 19
[30] Taking Stock: 2005 North American Pollution Releases and Transfers. Commission for Environmental Cooperation. June 2009.p. 19

Table 1.

	% of total merchandise exports to other NAFTA Countries*	*% of Total merchandise Imports to other NAFTA Countries*
US	31.6%	25.4%
Canada	74.7%	56.7%
Mexico	84.3%	50.8%
NAFTA total	47.9%	32.9%

**Merchandise includes agricultural produces, fuels and mining products, and manufactured goods (International Trade Statistics 2010. World Trade Organization. Geneva, Switzerland. 2010. P. 25. http://www.wto.org/english/res_e/statis_e/its2010_e/its2010_e.pdf).*

The European Pollutant Release and Transfer Register (E-PRTR)

Another regional effort, but one that is markedly different, is the European Pollutant Release and Transfer System (E-PRTR) that in 2006 replaced the European Pollutant Emission Register (EPER). The approach taken in the European Union to enhance comparability represents a top-down approach, where the European Commission provides the framework while giving each country the discretion to implement certain aspects individually.

The E-PRTR now covers 27 member states: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Additionally, it covers Iceland, Liechtenstein, Norway, Serbia and Switzerland.[31] The E-PRTR encompasses approximately 66.7% of exports and 64.6% of merchandise imports among the participating countries.[32] Many of these countries have also signed and ratified the Kiev Protocol on Pollutant Release and Transfer Registers, the first legally binding international agreement on PRTRs.[33] Broadly, the Protocol directs parties to "strive to achieve convergence among national pollutant release and transfer registers."[34] As of November 2011, there were 38 signatories to the Protocol, and it has been ratified by 28 countries.[35]

Since the 2007 reporting year, information gathered through the E-PRTR has been used to map and monitor pollution sources across Europe. According to the third formal review of PRTR data carried out in 2011 and covering reporting year 2009, 28,510 facilities reported under the system. Those facilities

[31] European Pollutant Release and Transfer Register online. http://prtr.ec.europa.eu/. Accessed April 1, 2012.
[32] International Trade Statistics 2010. World Trade Organization. Geneva, Switzerland. 2010. P. 18. http://www.wto.org/english/res_e/statis_e/its2010_e/its2010_e.pdf
[33] Kiev Protocol on Pollutant Release and Transfer Registers. United Nations Economic Commission for Europe online. http://www.unece.org/env/pp/prtr.html. Accessed April 1, 2012.
[34] Kiev Protocol on Pollutant Release and Transfer Registers, Article 3 of General Provisions. United Nations Economic Commission for Europe. May 2003. P. 4.
[35] Kiev Protocol on Pollutant Release and Transfer Registers. United Nations Economic Commission for Europe online. http://www.unece.org/env/pp/prtr.html. Accessed April 1, 2012.

turned in 40,198 reports of releases in air, water, soil, and transfer in water. Fifty-six types of pollutants were reported as being released to air, 74 types of pollutants were released to water, 65 were reported as transfers to water, and 24 types were reported as released to soil.[36]

The countries included in the system follow the framework of the E-PRTR but are free to use different techniques to determine their releases and transfers.[37] In some cases, this makes direct comparisons difficult. For example, in Liechtenstein, reporting of industrial releases to air or water is not required as it is in other countries. Further, reporting of waste transfers is not required in Serbia. No less important, but perhaps more surprising, only 19 of E-PRTR countries report accidental releases.[38] To account for these differences, the E-PRTR requires countries to provide and make publicly available the methods they use to determine the data.[39]

Despite these differences, the E-PRTR is a significant step toward comparability in the European region. The E-PRTR covers 91 pollutants, each one represented by a consecutive number, a Chemical Abstracts Service (CAS) number, and the name of the pollutant. Sixty-five industrial activities grouped in nine activity sectors are covered: energy; production and processing of metals; mineral industry; chemical industry; waste and waste water management; paper and wood production and processing; intensive livestock production and aquaculture; animal and vegetable products from the food and beverage sector; other activities. The threshold for reporting is based on the capacity of the facility's operations, and all releases are expressed in kg/year and include three significant digits. Data is published on a central website for all countries and includes aggregate and non-aggregate data, freely accessible from the last 10 years.[40]

Further comparability efforts in the European Union should also focus on integrating data from the Convention on Long-Range Trans-boundary Air Pollution (CLRTAP), UN Framework Convention on Climate Change (UNFCCC), and EU-ETS data. EU-ETS reports contain information on about five times more facilities than E-PRTR but produce comparable emissions totals for most countries. The 2009 E-PRTR report attributes these differences to the facts that the largest producers and industries were counted in both reports, and that biomass combustion was included in E-PRTR reporting. However, direct comparisons were difficult because of unspecified differences in the reporting structure.[41]

CLRTAP and UNFCCC datasets both attempt to include all anthropogenic emissions, as opposed to the large, point source focus of the E-PRTR data. As one would expect, most countries report higher emissions under CLRTAP and UNFCCC. However, twelve countries reported higher releases under E-PRTR,[42] which suggests inconsistencies in national reporting. In addition, pollutant categories do not

[36] E-PRTR Informal Review Report 2011. European Environment Agency's European Topic Centre Air and Climate Change ETC/ACM. October 2011. P. 4-5.
[37] European Pollutant Release and Transfer Register online. http://prtr.ec.europa.eu/. Accessed April 1, 2012.
[38] E-PRTR Informal Review Report 2011: covering the 2009 E-PRTR dataset. October 2011. http://acm.eionet.europa.eu/docs/ETCACM_TP_2011_6_RevRep_2009_E-PRTRdata.pdf
[39] European Pollutant Release and Transfer Register online. http://prtr.ec.europa.eu/. Accessed April 1, 2012.
[40] Guidance Document for the Implementation of the European PRTR. European Commission. May 31, 2006.
[41] E-PRTR Informal Review Report 2011: covering the 2009 E-PRTR dataset. October 2011. http://acm.eionet.europa.eu/docs/ETCACM_TP_2011_6_RevRep_2009_E-PRTRdata.pdf
[42] E-PRTR Informal Review Report 2011: covering the 2009 E-PRTR dataset. October 2011. http://acm.eionet.europa.eu/docs/ETCACM_TP_2011_6_RevRep_2009_E-PRTRdata.pdf

match up uniformly, and industry sectors are much more general (e.g. “agriculture) under the CLRTAP/UNFCCC systems.[43]

Barriers to Comparability

These above efforts shed light on some of the major problems in trying to combine PRTR datasets or at least compare information contained in two or more PRTRs. A particularly difficult challenge when examining or attempting to compare and utilize data in PRTRs from different countries has been a lack of the ability to adequately normalize and combine the data to present a comprehensive picture of pollutant release and transfer issues across the globe. Each country with a PRTR has engineered its register with its country-specific goals and objectives as the drivers behind PRTR structure.[44] As countries’ goals and objectives differ, therefore so do countries’ resulting PRTRs. The differences among PRTRs from different countries lead to comparability issues when trying to compare a PRTR from one country with that of another.

Many goals overlap among countries and are the same in basic principle; however, simply having the same goals does not necessarily lead to comparable PRTR structure among countries. For example, although Australia, Ireland, the Netherlands, and the US all have a goal of “voluntary pollution prevention and reduction, and cleaner production,” this goal is manifested differently among these countries due to each country’s specific circumstances.[45] These circumstances can include, among others, the country’s geographic location, level of economic development, available resources, and the level of importance placed on certain pollutants over others.[46] Other goals are either unique to certain countries or may be considered top priorities to some countries while others do not regard them as paramount. A major objective of the PRTR system in the US is to raise community, public, and industry awareness of toxic chemical releases; Japan’s main objective, however, is “to promote the businesses’ voluntary improvements in the management of specific chemical substances and to prevent any impediments of environmental protection.”[47]

A country’s goals and objectives shape the nature of its PRTR by influencing how the country addresses specific elements within basic component areas. PRTR construction is based on four key component areas: reporting and data requirements, chemicals, definitions, and management and administrative structure. Every country must tailor the key components to its goals and objectives, which inevitably results in inconsistency and comparability issues among countries’ PRTRs.

While giving countries the flexibility to design a PRTR system may allow that country to meet certain national goals, the resulting PRTR may also impede comparability efforts on a regional scale. While some countries may have the will and resources to create a comprehensive picture of their pollution output, others may want to dedicate resources to more accurately tracking particular pollutants. Some countries may choose to focus on large producers, and others may find it necessary to track nearly all producers.

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[43] E-PRTR Informal Review Report 2011: covering the 2009 E-PRTR dataset. October 2011. http://acm.eionet.europa.eu/docs/ETCACM_TP_2011_6_RevRep_2009_E-PRTRdata.pdf
[44] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[45] Ibid.
[46] Ibid.
[47] Ibid.

These focuses are often indirectly expressed as activity thresholds (sometimes called production thresholds), and employee thresholds. Activity thresholds generally refer to pre-established mass quantities of a chemical such that exceeding them, as a result of a predefined action involving the chemical and within a predefined interval of time, triggers reporting the chemical to an environmental authority. Activity thresholds directly target companies or industries that produce a certain amount of a specific pollutant. While some chemicals are mainly produced in large quantities and, hence, in large facilities, others are produced in small quantities on a per facility basis; the latter can often occur over a great number of facilities. In 1984, the US small quantity hazardous waste generators exclusion was dropped from 1000 kg to 100kg. This estimated to cover a ten-fold increase in generators across the country.[48] The employee threshold can have a similar impact. The United States and Canada each exempt from PRTR reporting facilities with fewer than 10 full-time employees or the equivalent thereof, but Mexico has no such exemption. This is likely one of the reasons that Mexico contributes 6% of facilities in the latest *Taking Stock* report but only 1% of releases.[49]

The entities which are required to report releases and transfers of pollutants also vary from country to country, typically based on industry sector. Some systems, such as the E-PRTR, focus on large point sources, while others, such as Mexico's RETC, try to capture all industrial point source emissions, and still others aim to report all anthropogenic emissions, including greenhouse gas emissions under UNFCCC. Variations are numerous. Personal and laundry services are included in Japan's PRTR, whereas these industries are not included in the TRI, or in most other countries' PRTRs.[50] Sectors such as metal ore mining, basic chemical manufacturing, oil and gas extraction, and waste management and remediation services are excluded in several countries.[51] For example, oil and gas extraction sector facilities are not required to report in the United States under the TRI; however, such Canadian facilities must report their releases and in 2006 accounted for over half of all the transfers and releases reported that year (roughly 1.4 billion kilograms).[52] Not accounting for this sector in the United States not only presents an inaccurate picture of releases for the country, but also prohibits true comparison of PRTR data.

The types of facilities required to report also vary from country to country. Small and medium-size enterprises (SMEs) are often not required to report because their releases are usually lower than PRTR thresholds. The same can be said about non-point source facilities in most countries. Australia and the Netherlands, however, require reporting from both SMEs and various non-point sources.[53] Similarly, while all PRTRs require qualifying public facilities to report their releases, not all require privately owned or operated facilities to report their releases.[54] Further complicating this issue, many fledgling PRTR

[48] HWM textbook - HWM book p. 78
[49] Taking Stock: 2005 North American Pollution Releases and Transfers. Commission for Environmental Cooperation. June 2009.p. 23
[50] Ibid.
[51] CEC. *Taking Stock: North American Pollutant Releases and Transfers 13*. Commission for Environmental Cooperation, March 2011.
[52] Ibid.
[53] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[54] Ibid.

programs rely solely on voluntary reporting of releases. Though they typically evolve into mandatory reporting programs after some years, the data collected until they do is often inconsistent or invalid.[55] Mexico is currently the only country with a mixed voluntary and mandatory PRTR program, with mandatory requirements for "a few priority air contaminants" and voluntary aspects for various other chemicals.[56]

The format in which PRTR data is collected and reported also varies among countries. At a simplistic level, units of measure are often different – releases in the United States are measured in pounds, whereas the European Union's and most other countries' PRTRs measure releases in kilograms.[57] At a more in-depth level, the specific data elements examined affect the overall output of information. Some PRTRs use data elements that identify the specific pollutant source or facility, while some do not track the specifics and only examine overall chemical levels.[58]

Chemicals

Every country prioritizes releases of chemicals and pollutants differently. Therefore, the chemicals and pollutants that must be reported to a PRTR vary by type and release threshold from country to country. For example, the United States' TRI does not include particulate matter, while Switzerland's PRTR does.[59] Even when the same chemicals have to be reported, countries may use narrower or broader chemical categories. Focusing on North America, Canada's NPRI includes approximately 350 pollutants that are subject to reporting, Mexico's RETC includes 104 pollutants, and the United States' TRI includes approximately 600 substances.[60] These listed substances are only a small fraction of the total substances that could potentially be listed. This makes comparison difficult. For example, there are only eight chemicals that are common to all four of the US, UK, Australia, and Canada PRTR systems.[61] In 2010, an OECD task force combined the substances listed in five major PRTRs and obtained a list with 1,184 uniquely named pollutants.[62] One investigation into producing a common pollutant list found that CAS (Chemical Abstracts Service) numbers weren't in the same format.

- Different chemical names were used for the same CAS number
- Some entries had no CAS numbers but nearly the same names
- Similar entries described entirely different chemicals

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[55] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[56] Ibid.
[57] U.S. Environmental Protection Agency. *A Guide to Toxics Release Inventory Data and Information*. January 2012. Print.
[58] UNITAR. UNITAR Guidance Series for Implementing a National PRTR Design Project. *Designing the Key Features of a National PRTR System*. 1997. Supplement 2.
[59] U.S. Environmental Protection Agency. *A Guide to Toxics Release Inventory Data and Information*. January 2012. Print.
[60] CEC. *Taking Stock: North American Pollutant Releases and Transfers 13*. Commission for Environmental Cooperation, March 2011.
[61] Kerret, D. and Gray, G. What do we learn from Emission Reporting? Analytical Considerations and Comparison of Pollutant Release and Transfer Registers in the United State, Canada, England, and Australia. Risk Analysis, Vol. 27, No. 1, 2007 DOI: 10.1111/j.1539-6924.2006.00870.x
[62] Global Pollutant Release and Transfer Register: Proposal for a harmonized list of pollutants. OECD/BMG Engineering AG. Sept. 9, 2011.

- Different definitions were used for classes or chemicals
- Different categorization for various compounds of the same chemical (i.e. chromium III, chromium IV and chromium VI).[63]

All PRTRs include point-source facilities and listed pollutants from these facilities must be reported if they meet threshold levels; however, not all PRTRs require diffuse, or non-point, sources to be included.[64] Including diffuse sources in the reporting requirements of only some of the PRTRs leads to additional variation among countries' PRTRs and it therefore becomes difficult to normalize data between a country that includes a diffuse source and one that does not. Additionally, the inclusion of diffuse sources must be done through estimating the associated releases, which can lead to inaccurate results if estimation techniques are not sound.[65]

Definitions

Inconsistent definitions of key terms also hamper comparability efforts. While most PRTRs similarly define "releases" as those made to air, water, or land, there is slight variation among countries in regards to speciation of those media.[66] The definitions of "transfers," on the other hand, vary greatly from country to country. OECD defines transfers as "an offsite transfer of a reportable chemical for treatment or disposal."[67] According to OECD, views differ on "whether reporting should be required on the removal of certain chemicals in wastes from the place of generation to a recovery operation, treatment or storage or disposal facility (off-site), [and] whether potentially harmful chemicals in products should be reported."[68] Canada's approach to transfers changed in 1998 when it began collecting data on chemicals "transferred off-site for combustion for energy recovery and recycling;" it previously only captured data for off-site chemical transfers in cases of disposal and treatment.[69]

Different countries may also use different industrial sector categorizations, often North American Industrial Classification System (NAICS) or International Standard Industrial Classification (ISIC) codes. While it is relatively easy to identify the proper NAICS and ISIC code for a given industry, the breadth of a given category may vary between the coding systems. This may put a company under one category under NAICS and another under ISIC. A country may also choose to implement a PRTR that uses more specific or more general coding categories. European countries use both the Nomenclature for Economic Activity (NACE) system and the Nomenclature for Source of Emissions (NOSE) system, and other countries use national systems for "classifying sources or economic activities."[70] This results not

[63] Global Pollutant Release and Transfer Register: Proposal for a harmonised list of pollutants. OECD/BMG Engineering AG. Sept. 9, 2011.
[64] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[65] Ibid.
[66] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[67] OECD. *PRTR Implementation: Member Country Progress.* July 2000.
[68] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[69] Ibid.
[70] Ibid.

only in scope issues relating to the activities covered by a PRTR and the sources that are required to report data, but also in the inability to make direct comparisons.[71]

Another definition that has some ambiguity among PRTRs is that of "facility." The TRI definition of facility refers solely to stationary facilities, whereas portable facilities are included within the NPRI definition of facility.[72] Without a single, standardized meaning attached to "facility," the data received from one facility may not be comparable to that of another.

Management and Administrative Structure

Usefulness and reliability of PRTR data is dependent on the processes a country's government uses to "review and validate reported data, respond to errors, and integrate results into a database."[73] These processes are shaped by the specific goals and objectives of the PRTR. Therefore, data that is considered reliable and useful within one country may not be useful or comparable to data from another country. Even so, comparison is not possible if the information is not made available to interested parties or if reporting is enforced improperly. As with lax reporting requirements, lax enforcement may allow pollution reduction on paper that is not reflected in reality.

Once data on pollutant releases and transfers has been collected, it must be made public in an easily accessible manner for it to be compared with data from other PRTRs. However, differing goals among countries results in different ways in which the data is disseminated. Aggregated data is sufficient in cases where a goal of a PRTR is to publicly provide trends for chemicals; conversely, reported data would be necessary if the goal is to provide research or modeling data to academia or to the government, as it is better suited for measuring policy performance.[74] Similarly, some countries actively disseminate data to the public by making the information widely available via various media, while other countries use a more passive dissemination approach, such as providing data only upon request.[75] Comparing aggregated data from one PRTR with reported data from another PRTR, whether actively or passively disseminated, is a difficult task.

Recommendations for Emerging PRTRs

[71] Ibid.
[72] U.S. Environmental Protection Agency. *A Guide to Toxics Release Inventory Data and Information*. January 2012. Print.
[73] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[74] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Presentation and Dissemination of PRTR Data: Practices and Experiences. Getting the Word and Numbers Out.* 2000. No. 3.
[75] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.

One factor necessary in addressing the issue of global in comparability of PRTRs is determining what key elements should be added to existing or included in existing, emerging, or planned PRTRs. While the majority of PRTRs contain certain key elements, some have adopted additional elements that may benefit stakeholders on a global level. The twelfth OECD principle recommended for establishing a PRTR emphasizes development of systems that allow for international comparison through development of similar databases.[76] While most existing PRTRs were developed often through similar processes, their implementation was and is largely based on the needs and wants of the stakeholders in a given country, with less emphasis on comparability of the data with the data of other PRTRs. Unfortunately, comparison of all of the data from multiple PRTRs is nearly impossible. As documented earlier in this report, comparability among existing PRTRs is limited to a few countries. While pressure increases to ensure more comparability among emerging PRTRs, there is still a long way to go. This section includes suggestions for additional elements to be included in PRTRs moving forward or as programs are re-evaluated.

- Emissions of greenhouse gases are currently one of the most globally discussed pollution issues. The Kyoto Protocol is an example of the efforts that many countries are taking to address these emissions levels. Regardless of ratification, if any nation is implementing a PRTR, data should be reported from the major GHG sources within a nation because of the global impacts of these emissions.
- PRTRs don't provide information about facilities that stop reporting[77], which does not allow data analysis to take into account declines in emissions due to facilities that have been decommissioned, that have transferred processes to another facility, or that may no longer be manufacturing, processing, or otherwise using a chemical regulated by the PRTR system within the country. PRTR systems should attempt to better track the reasons facilities have for leaving the PRTR reporting system. This will help researchers determine if pollution is being reduced overall, or if facilities are being adversely affected by the reporting system. It may be difficult to obtain this information from facilities that have stopped reporting: If the facility has gone out of business, they will not respond to data requests, and it is unlikely that facilities would voluntarily respond to a separate data request if they have otherwise avoided PRTR reporting. Countries that may be interested in collecting this information should be given significant leeway in starting pilot projects to determine how and if it can be collected effectively.
- Inclusion of the reporting country's GDP will allow for comparison of emissions at the country development level. This information can be used to compare emission with other countries of similar development levels as well as make predictions about emissions in the future, or even suggest industrial changes that have already been implemented in other nations.
- Separating the reporting process to show offsite versus onsite transfers would allow for greater comparison among PRTRs as movement of emissions could be tracked and accounted for in greater capacity.
- Including a search parameter in the PRTR that is able to show results by emissions media (air, water, or land) can allow various countries to utilize data differently. Neighboring countries may

[76] Pollutant Release And Transfer Registers (PRTRs). A Tool For Environmental Policy And Sustainable DevelopmentGuidance Manual For Governments. Organisation For Economic Co-Operation And Development Paris 1996.

[77] Kerret, D. and Gray, G. What do we learn from Emission Reporting? Analytical Considerations and Comparison of Pollutant Release and Transfer Registers in the United State, Canada, England, and Australia. Risk Analysis, Vol. 27, No. 1, 2007 DOI: 10.1111/j.1539-6924.2006.00870.x

find data about emissions through shared borderlands and waterways more useful than countries in another hemisphere who may be concerned only with airborne emissions.

- Developing ISO 14001 environmental management systems will allow greater comparability across PRTRs. Most countries adhere to ISO standards for many products; developing an ISO standard for reporting of certain emissions may assist in creating at the very least, a standard for reporting emissions that have an impact at the global level.
- Countries should track company size by employee. Countries generally have leeway in setting reporting requirements, and this is an important way to allow individual countries to tailor their PRTRs to their goals and needs. However, differences in reporting thresholds like pollutant quantity and number of employees make inter-PRTR comparisons difficult. Employee thresholds could be easily controlled for if facilities were required to include their estimated number of full-time employees in their annual reporting.

All of these suggestions are possible ways to increase comparability among PRTRs existing or emerging. While they may not all be feasible or create PRTRs that are comparable, it is important to suggest a variety of elements that may play a factor in addressing the global comparability issue.

Helping Developing Countries with PRTR Implementation

Developing countries encounter myriad problems with ratifying and implementing successful PRTR programs. Because these issues are often unique to specific countries it is inherently difficult to install a PRTR construct that may have worked previously. Specific environmental needs, scale of economies, resources, political intransigence, and program expertise complicate the process of building a PRTR from the ground up. [78]

Steps can be taken to ensure that both country-specific issues and comparability needs are addressed. The first and most obvious difficulty is a lack of resources. Countries may have more immediate priorities and so either underfund the effort or never take up the mantle of pollution monitoring at all. While the answer in this case is to demand more international funding for developing countries that develop programs, a more nuanced step is to better match donors and their experience with countries that share cultural similarities.

Spain is currently active in multiple countries in Latin America assisting with the development of PRTR. They, along with the Central American Commission on Environment and Development, are working on a translation of the UNECE Guidance document for the PRTR Protocol. Chile is sharing its experience with neighboring Argentina. Norway has planned a sub regional workshop in Minsk to promote ratification of the PRTR Protocol in Eastern Europe, Caucasus, and Central Asia (EECCA). UNITAR has created a global pilot program that focuses on developing PRTR in two countries in each of the following regions – Latin America, Eastern Europe, and Asia. Sharing best practices has the effect of providing a framework and

[78] Environment Directorate Joint Meeting of the Chemicals Committee and The Working Party on Chemicals, Pesticides, and Biotechnology. "Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs. OECD Series on Pollutant Release And Transfer Registers. Number 4

enhancing comparability while not exasperating the countries' lack of institutional knowledge and expertise.[79]

Case Study in Emerging PRTRs: The Experience in Central America

A third regional effort to coalesce individual countries' PRTRs is currently underway in Central America and the Dominican Republic. This is the first such effort targeting emerging PRTRs in developing countries. If completed successfully, it could be a model for how to approach emerging PRTRs in the future.

In June 2010, at its XLVI Ordinary Meeting, the Central American Council of Ministers of Environment determined that the creation of a regional PRTR was a top priority and named the Central American Commission for Environment and Development (CCAD) as the entity responsible for overseeing its implementation. The CCAD would support the efforts in each Central American country and the Dominican Republic to design and put into place individual PRTRs that could feed data into a regional PRTR.[80] The countries involved have since held a series of technical meetings and are working toward a goal of implementing a pilot PRTR in 2012, with the exception of Nicaragua, which decided that implementation of PRTR was not a national priority.

A number of national and international players are involved in the formation of the regional PRTR system in Central America and the Dominican Republic, sharing their experiences at the technical meetings. The U.N. Institute for Training and Research (UNITAR) and Spain are supporting work in four of the countries: Guatemala, Honduras, Belize and Costa Rica. CCAD, with the support of U.S. aid, is supporting work in El Salvador and the Dominican Republic. UNITAR and the Strategic Approach to International Chemicals Management (SAICM) Quick Start Programme Trust Fund, a voluntary fund administered by the United Nations Environment Programme, are supporting the design of a PRTR in Panama. All worked is being coordinated by the CCAD, while outside government agencies such as U.S. EPA are closely involved in the formation of the regional system.[81]

The effort in Central America and the Dominican Republic will be successful if it results in a framework that allows for the nations to compile their data in a way that enables all reportable quantities to be viewed and analyzed on a regional level, as well as a country-specific level. If successful, the efforts in Central America and the Dominican Republic could serve as a model for other nations acting under a global framework. But there are several inhibitions, including a lack of technical knowledge on the part of the Central American countries involved and of the CCAD. In their individual efforts to create national PRTRs, countries are also grappling with whether they should emulate the model of the United States or the protocol put forth by the OECD. The question still remains of whether countries will focus on comparability in the creation of their PRTRs, or whether they will focus on their national priorities. An increased emphasis on regional meetings should help to overcome some of those limitations.

[79] Source: International PRTR Coordinating Group, Sixth Meeting, Thursday October 6, 2011
[80] United Nations Institute for Training and Research online. http://prtr.unitar.org/index.php. Accessed April 1, 2012.
[81] United Nations Institute for Training and Research online. http://prtr.unitar.org/index.php. Accessed April 1, 2012.

Recommendations for Enhancing Comparability among Existing PRTRs

Recommendation 1: Rather than try to compare entire PRTR datasets, identify specific chemicals and/or sectors where comparisons can be made

This recommendation looks for areas where more meaningful comparisons could be made while avoiding some of the inherent difficulties in combining data from different systems. Rather than combining entire datasets, for example, initial comparisons could be made by analyzing a set of chemicals of special concern, or those that are especially harmful for humans, that are especially toxic to the environment, that have attracted wide public interest, and that have the lowest thresholds for reporting releases. Pollutants should be identified through a combination of methods, beginning with a survey of existing literature to identify the top-reported chemicals among nations with PRTRs. The CEC's ongoing analysis of PRTR data from Canada, Mexico and the United States, for example, identifies the top reported releases each reporting year, with data updated online as soon as it is available. Top-reported chemicals include ammonia, arsenic and its compounds, asbestos, chlorine, chromium and its compounds, lead, and sulfuric acid, among others.

Existing literature can also be used to identify where areas of overlap occur between chemicals lists in PRTRs. The Commission for Environmental Cooperation has found that Canada, Mexico and the United States have 60 pollutants in common. In a recent study, OECD found that Australia, Canada, the European Union, Japan and the United States had 88 pollutants in common to at least four systems, and 171 pollutants in common to at least four systems. Targeting the chemicals that occur most often among chemical lists will provide meaningful analysis, as those chemicals signal where global priorities lie.

Chemicals of special concern can also be chosen by identifying chemicals reported by facilities with the highest releases. The 2005 *Taking Stock* report notes that high release-quantity facilities make up the bulk of releases for most chemicals. Of the three countries considered in the report, their respective PRTRs reported that more than 50% of total land releases came from the ten reporting facilities with the largest releases. The E-PRTR 2009 report found similar results. 44% of reported air emissions of methane were from two facilities, and the top five facilities contributed between 19% and 67% of total emissions of most heavy metals. In a somewhat extreme example, 53% of Europe's hexachlorobenzene emissions were produced by a single facility in Italy.[82]

Focusing on these industries and pollutants enables comparisons among different datasets and facilitates analysis. These pollutants, because they are produced in large facilities, will generally circumvent employee threshold issues, since larger facilities will almost undoubtedly have many employees. They should also avoid most activity thresholds since the production is concentrated in only a few manufacturers. Starting with chemicals that are emitted mainly by large facilities may also present an opportunity to examine data that is more accurate. Large facilities may also be less likely to illegally fail to report and more likely to have sufficient internal tracking protocols. It is important to note that under this method, small- and medium-sized releases would not be captured, even if their concentration in a region is high enough to trigger harm to public health and the environment. These facilities would be addressed by an approach that utilizes normalizing factors.

[82] http://acm.eionet.europa.eu/docs/ETCACM_TP_2011_6_RevRep_2009_E-PRTRdata.pdf p. 130 – 2009

A list of chemicals of special concern would not be complete without collaboration with governmental environment agencies in countries with PRTRs, such as U.S. EPA, Environment Canada and the European Environment Agency. A survey should be sent to all entities to answer the following questions: What chemicals have regulatory agencies identified as their priorities? What chemicals do other environmental laws in these countries target? Has monitoring done through other environmental laws or mechanisms shown any chemicals to be of special concern?

Once chemicals of special concern are identified, some basic secondary research into this list will be necessary to confirm that the chemicals are not produced in significant quantities by manufacturers that exist outside the PRTR parameters. Certain chemicals, even if PRTR data shows them to have focused sources, may in fact have significant untracked releases. Examples include mobile-source emissions or natural emissions. It is also important to note that there may be discrepancies in data due to the methods that facilities have chosen to measure or estimate their releases. One operation, for example, may be monitoring their actual streams of emissions. Another may be using already-calculated emissions factors. Unfortunately, information regarding how facilities have calculated their emissions is not readily available; solving this limitation is beyond the scope of this study, as it may require increased monitoring of facilities or changes to PRTR requirements.

This recommendation necessitates that chemicals and industrial sectors are coded within the same coding system before meaningful comparisons can be made. Pollutants should be coded using some universal system such as their specific Chemical Abstracts Service (CAS) number, rather than by chemical name(s), which are often ambiguous or not universally recognized. Industrial sectors should be classified according to the fourth revision of the ISIC, as adopted by the United Nations Statistics Division. Alternately, sectors could be coded in a system that links directly to the ISIC, such as the E-PRTR's NACE Rev. 2 system.

Recommendation 2: Identify chemical classes to compare across countries with existing PRTRs

An alternate approach to identifying pollutants of special concern would be to identify groups, or classes, of chemicals and to compare releases of these groups among the countries with PRTRs. This approach could be used separately or in conjunction with the previous recommendation to create a more comprehensive and meaningful picture of pollutant releases.

Identification of groups of chemicals can occur on many levels. Chemicals can be grouped according to their structure, their uses, their physical properties or their radiological properties.[83] The Agency for Toxic Substances and Disease Registry, a branch of the U.S. Centers for Disease Control, groups chemicals in the following way to address hazardous substances:

- Benzidines/Aromatic amines
- Dioxins, Furans, PCBs (contain phenyl rings of carbon atoms)
- Hydrocarbons (contain hydrogen and carbon atoms)
- Inorganic substances
- Metals/Elements (the simplest forms of matter)

[83] Agency for Toxic Substances and Disease Registry.

- Nitrosamines/ethers/alcohols
- Organophosphates and carbamates
- Pesticides (chemicals used for killing pests, such as rodents, insects, or plants)
- Phenols/phenoxy acids
- Phthalates
- Radionuclides (radioactive materials)
- Volatile organic compounds
- Warfare and Terrorism Agents (used in acts of war or terror)

In its efforts to create a global list of chemicals for inclusion in PRTRs, the OECD uses the following 12 groupings:

- Persistent organic pollutants (POPs)
- Heavy metals
- Inorganic substances
- Chlorinated and brominated organic substances
- Greenhouse gases and ozone depleting substances
- Other gases
- Polycyclic aromatic hydrocarbons (PAHs)
- Other organic substances
- Active substances of plant protection producers or biocidal products
- Colors and dyes
- Active pharmaceutical ingredient (API)
- Non-grouped organic substances

These classes were further divided into groups: Persistent organic pollutants, for example, include pesticides, industrial chemicals and polychlorinated dioxins and furans. A full list of groups can be found in the OECD's *Proposal for a Harmonised List of Pollutants*.[84]

The method(s) chosen for classification of chemicals will largely depend on the priorities of those doing the classifying. If the priority is to replace harmful chemicals in production processes with more benign ones, then classifying chemicals by use may prove helpful. If the priority is to identify releases of the most toxic substances, classification by structure may be preferred. We recommend consultation with government environment agencies to assess their priorities. Once classification into groupings is complete, EPA may wish to include greater specificity and further delineate those classes into their corresponding groups.

There are limitations to working with only chemical classes. Chemicals are defined differently among PRTRs; in one country, for example, there may be seven pollutants that comprise the family of polycyclic aromatic hydrocarbons, whereas in another country it may be just two or three. Categories used in PRTR systems may also not distinguish between toxic and non-toxic forms of chemical compounds. This can be troubling, especially in the case of chromium. Hexavalent chromium, or chromium VI, is a highly toxic form of the chemical, while chromium III, or trivalent chromium, is not and is in fact required in trace amounts for sugar and lipid metabolism. Using the classification "chromium and its compounds" would

[84] Global Pollutant Release and Transfer Register: Proposal for a harmonised list of pollutants. OECD/BMG Engineering AG. Sept. 9, 2011.

not capture how much of the reported release is actually toxic. But some PRTRs, including Mexico and the European Union, require reporting of just "chromium and its compounds." This would need to be clearly acknowledged when carrying out this recommendation.

Several of the limitations noted in the previous recommendation, including chemicals that fall outside PRTR parameters and difficulty in determining how releases were measured by individual operations, also apply.

Recommendation 3: Identify normalizing factors

Significant sector differences make it infeasible to use a single multiplier to compare across countries. However, there may be some specific normalizing multipliers that could help estimate the differences caused by the employee and activity thresholds mentioned earlier in this analysis. Small plastics manufacturers, for example may have similar reported quantities for the same chemicals across countries. If analysts can determine what portion of the quantities reported by all facilities that manufacture plastics in a given country are from small manufacturers, this information could be used to extrapolate to a country that does not track emissions or other (reportable) waste management quantities from small facilities that manufacture plastic.

A good place to start would be comparing countries with fairly similar industrial footprints: for example, two European countries, or the United States and Canada. The estimated multiplier could then be used to compare other similar industries across countries to see if it meets other estimates. This will necessitate further research into data on the number of manufacturers in each country. For example, according to the 2005 *Taking Stock* report, 57% of US manufacturing facilities have fewer than 10 full time employees. Canada reports a fairly similar 48% but Mexico reports that 92% of its manufacturing facilities have less than 10 full time employees.[85]

Using this information, analysts would first identify chemicals and specific industry sectors that overlap across selected PRTRs. These chemicals and industries will serve as the focus of the analysis. Analysts would then identify any specific PRTR employee threshold or other reporting differences between countries, and other potentially confounding variables. Such variables could include easily accessible information such as:

- The overall economic development level of the specific county
- The economic output of the industry in the specific country
- The geographical region where the country or facility is located
- A simplified characterization of the pollution measures required by law (on a 1-5 scale)

Analysts could then perform a regression analysis using readily available software, controlling for identified confounding variables, and develop a model normalizing function of individual chemicals and/or industry sectors.

[85] Taking Stock: North American Pollutant Releases and Transfers: 13. Commission for Environmental Cooperation, March, 2011. p. 20.

Recommendation 4: Pursue a "Relative Comparison" Approach

This approach attempts to avoid some of the more specific difficulties encountered when comparing PRTR data by analyzing trends instead of absolute emissions or other reported data. Analysts can examine both intra- and inter-country changes in reported PRTR data. Intra-country analysis can focus on changes over time in specific industries or for specific chemicals. In addition to analyzing individual chemicals, type of reported quantity (e.g., release), and mass, analysts can also assess an overall change in environmental and health risk. When making intra-country comparisons, it may be most productive to compare later-year trends to the first year of the PRTR system[86] and use unique polluter identification numbers to track chemicals and individual facilities that have remained in the system.

A relativistic approach can also be useful in an inter-country analysis. Identifying trends, and differences in trends, will also be an important avenue into future research. Important questions include:

- Do countries with higher employee and activity reporting thresholds have fewer or less reported PRTR quantities, implying that they are seeing a decrease in reporting of chemical pollution, but not necessarily in the pollution itself?
- Do a country's major trading partners or geographic neighbors tend to have opposite emission trends, implying that the country in question is simply "moving" its manufacturing, and therewith its emissions of chemicals, across a border?

Questions like these do not necessarily produce quantitatively comparable results from country to country. They do, however, help us judge the effectiveness of PRTRs and environmental laws. Analysts can rate, through objective and subjective means, how each country's PRTR accomplishes the goals and priorities that led them to create a PRTR.

This strategy also allows comparisons between just two or three countries. This can greatly increase the number of useful comparisons that can be made with existing data. For example, while only 60 chemicals (or chemical groups) that are common among the U.S., Canadian, and Mexican PRTR systems, 256 pollutants or pollutant groups are present in at least two of these PRTRs.[87] Many of these chemicals have their most important effects within a local geographic region, so a comparison of just two countries could be very useful for health and environmental risk analysis. Analysts can also examine the type of release (air, water, solid), to determine if a regional, watershed, or active transfer analysis is most appropriate.

Unfortunately, this method is less suitable for analyzing overall production/consumption sustainability. Tracing production and consumption is difficult. It requires an analysis of many countries that may be separated by significant distance. Areas of the world with small countries and close borders may also be unsuitable to this comparison. In these areas, pollution is likely to cross many borders, making it necessary to identify chemicals that are common in three or more PRTRs, which, as we have seen, is quite limiting.

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[86] Kerret, D. and Gray, G. What do we learn from Emission Reporting? Analytical Considerations and Comparison of Pollutant Release and Transfer Registers in the United State, Canada, England, and Australia. Risk Analysis, Vol. 27, No. 1, 2007 DOI: 10.1111/j.1539-6924.2006.00870.x

[87]

Recommendation 5: Global PRTR

Ultimately, a global PRTR should be constructed such that it enables comparison and aggregation of the PRTR data in all or most of the countries that either have a PRTR or will have one in the future. Such a PRTR would allow sustainability to be assessed on a global scale, enhancing efforts that are already underway. A global PRTR would also help facilitate transitions to green chemistry and green engineering by providing the necessary data on the dispersion of traditional chemicals used in materials.

The principles set forth by the OECD provide a good starting point. The OECD is comprised of representatives from 30 industrialized countries across the globe.[88] These countries have agreed to develop PRTRs, and the OECD's 1996 PRTR Council Act outlines the basic components necessary for an effective national PRTR. While it would be difficult to apply these components as-is directly to a world-wide PRTR system,[89] they should be extrapolated to a global scale; doing so would be possible when other factors are considered.

The global PRTR should not only be comprised of multiple countries' similar yet individual PRTRs, but also should be one comprehensive worldwide database that is considered the standard. Sub-categories that allow for some variation in the global PRTR requirements, yet not enough variation to make the data incomparable, would be necessary in order to account for the differences among countries and permit the inclusion of lesser developed and non-industrialized countries. These sub-categories would include weighted variables for each country such as development level, geographic location, and age of their PRTR in years that would help normalize data across different country types.

A world-wide PRTR would rely on the agreement and consent of multiple countries. The more countries that agree to join the global PRTR, the more comprehensive the resulting data will be. The scope would need to be much broader than the 30 OECD member countries, with a goal of adding additional countries each year until at least every country recognized by the United Nations has committed to the global PRTR. A consensus among member countries must be reached regarding the structure of the PRTR, which would include components such as overall framework, chemicals included, reporting requirements and thresholds, and management and administrative structure. An annual meeting of member countries must occur in order to reach agreements regarding PRTR format and to discuss the inclusion of additional countries. Such a meeting would also allow for the appropriation of funding to member countries, as well as to potential members, to aid in PRTR adoption within each country and to provide support to countries lacking the means to create or enact the PRTR on their own.

While a global PRTR is necessary to normalize country data, it is possible that such a PRTR will not allow for countries to attain their country-specific goals and objectives. Because of this, it will be necessary for many countries to maintain their own country-specific PRTR in parallel with the global PRTR. This is a challenging task, both administratively and monetarily, that may prove cost-prohibitive for many countries. However, with the assistance of resources and funding from the global PRTR group, both country PRTRs and a global PRTR could be implemented in tandem. It would then be possible to examine efficiencies and economies of scale between the concurrent PRTRs.

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[88] OECD. OECD Environmental Health and Safety Publications: Series on Pollutant Release and Transfer Registers. *Why Pollutant Release and Transfer Registers (PRTRs) Differ: A Review of National Programs.* 2001. Number 4.
[89] Ibid.