Pollutant Release and Transfer Register and Civil Society

Summary

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Summary

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Contents

1. Introduction

This study embarks on a comprehensive exploration of the evolution of Pollutant Release Transfer Registers (PRTRs), shedding light on their historical underpinnings and the subsequent global proliferation of these registers. This report aims to strengthen civil society groups and the public's awareness of the need for integrated data and monitoring of toxic pollution, its sources, and its impacts on human health and the environment.

Within the broader context of PRTRs, the study emphasizes the different developed national PRTRs, offering a nuanced examination of their creation, evolution, and the mechanisms employed for data; seeks to exemplify the practical implementation of PRTRs at a national level. Beyond national boundaries, this study navigates the global landscape of PRTR implementation in many countries, not only in developed countries but also in developing and low-middle-income nations. The examination of the connections between PRTRs and international agreements or Inter-governmental Organizations is also presented in this study.

Moreover, it delves into the role of civil society in utilizing PRTR data for advocacy and awareness, presenting case studies from around the globe and serves as a guidebook for civil society and other stakeholders in Indonesia for establishing a good and transparent PRTR system, which is used as a tool for lowering releases of pollutants into the air, water as waste, and other transfers.

Information gathered in this guidebook is partly based on some previous studies (Havel et al., 2011; Petrlik et al., 2018; Petrlik and Man, 2016), including a desk study within the project "Transparent Pollution Control in Indonesia" (Septiono et al., 2023). Its preparation was funded by the European Commission under the budget line EuropeAid/168799/DD/ACT/Multi and co-funded by the Ministry of Foreign Affairs of the Czech Republic, Sigrid Rausing Trust, and Swedish International Development Agency via IPEN. Its content is the sole responsibility of Arnika and Nexus3 Foundation.

2. Pollutant Release and Transfer Registers (PRTRs)

A PRTR is a publicly accessible database or inventory that shares information on chemicals or pollutants released into the air, water, and soil and sent off-site for treatment. It compiles details about what chemicals are released, where, how much, and by whom (OECD, 2023a). The obligation to report data applies to companies defined either by the number of employees (e.g., more than ten) or by the quantity of emissions annually (Velek and Činčera, 2008). PRTRs typically mandate facility owners or operators to quantify and regularly report their chemical releases to governments, especially in manufacturing and mining, covering emissions from fixed and diffuse sources. The reporting threshold set by governments determines the range of facilities covered, from large industrial sites to small operations like dry cleaners (OECD, 2023a).

History

The first PRTR was established in 1978 in the U.S. state of New Jersey, where information on the production and use of 155 chemical substances (including their flows into waste) from more than 7,000 industrial facilities was collected in a one-time effort (Muir et al., 1995).

The Organization for Economic Cooperation and Development (OECD) developed Recommendations for Governments to Implement PRTR Systems through several workshops. OECD prepared a Guidance Manual for governments considering establishing PRTRs, published in 1996; the OECD Council adopted a Recommendation on Implementing PRTR in the same year (OECD, 2001).

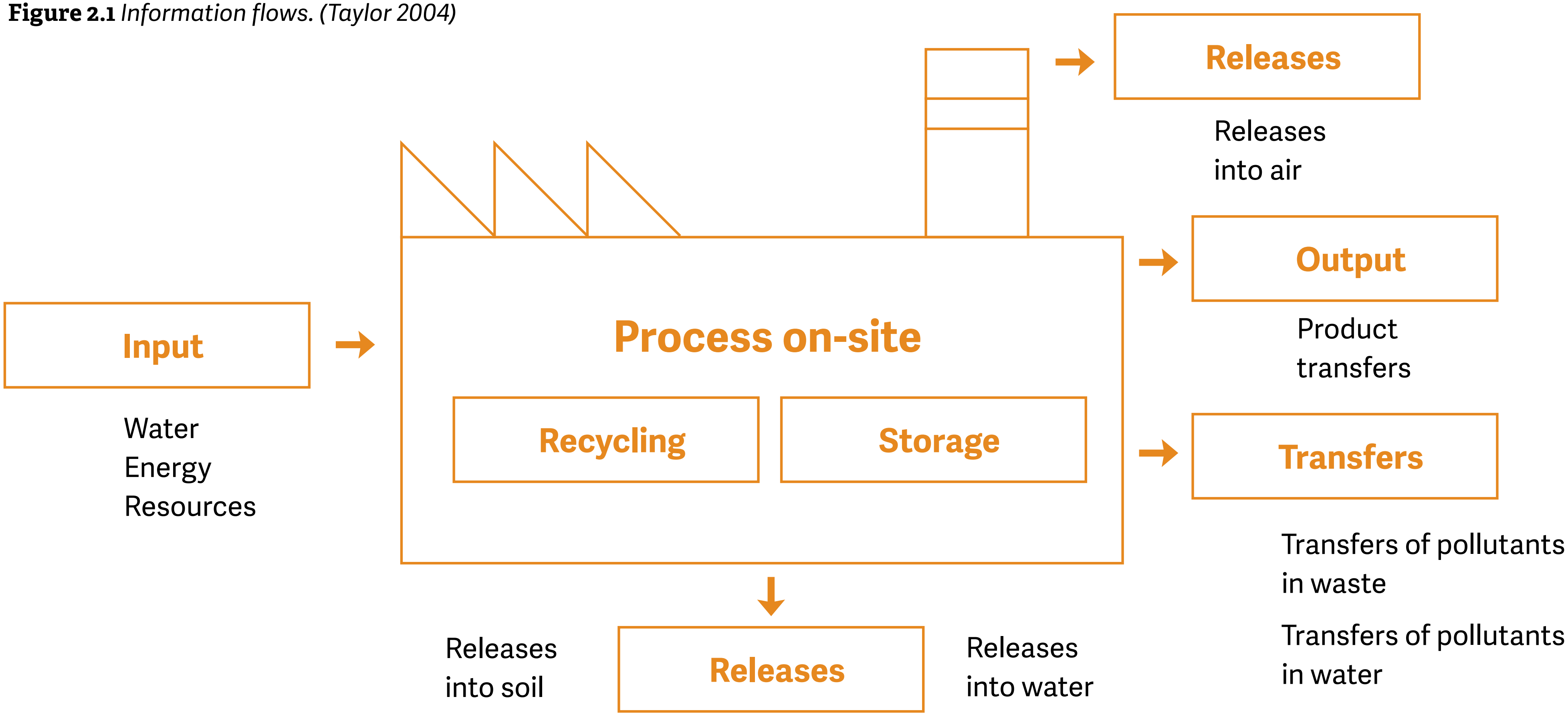
OECD started with PRTRs in the 1990s and, in 2021, released a Global Inventory of Pollutant Releases. Source: (OECD 2021)

PRTRs were gradually being introduced by states all over the world. In 1996, Japan; 1997, Mexico; 1998, Sweden; and others. However, some large countries where environmental pollution is a significant problem, such as Russia, China, or India, are still lagging.

Ruled by the Kyiv Protocol, which is a part of the Aarhus Convention, PRTR emphasizes public access to information while upholding the community's "Right-To-Know". The protocol became a full-fledged part of European law in 2009. The United Nations Economic Commission for Europe (UNECE) is the guardian of this protocol (UNECE, 2011).

The European Pollutant Release and Transfer Register (E-PRTR) is an example of a regulatory framework established by Regulation 166/2006/EC. This regulation requires member states (EU Member States,

Figure 2.1 *Information flows. (Taylor 2004)*



Iceland, Liechtenstein, Norway, Serbia, and Switzerland) to harmonize reported data to be compatible with the pan-European database. The E-PRTR covers 65 industry types/economic activities and includes a mandatory list of 91 chemicals and pollutants to be reported in a standardized format.

Examples of the National PRTRs in EU Member States

Czech Republic

Preparations for the IRZ in the Czech Republic began in 1994 in response to pressure from international institutions and non-governmental organizations. The inclusion of IRZ in the draft law on integrated pollution prevention in 2001 marked its first appearance. Representatives of the Association of Industry and Transport of the Czech Republic (Svaz průmyslu a dopravy ČR) attempted to remove or at least weaken the IRZ from the draft law on integrated prevention. To help instigate the process, the Czech environmental NGO Arnika worked with local authorities, scientists, and prominent figures (DiGangi, 2011) to push the creation of IRZ. The efforts were successful, resulting in the establishment of the first Czech IRZ. There were originally 72 reported substances that are regulated, but it gradually adds up to 97 individual pollutants or groups of substances at the latest. The Government of the Czech Republic is also actively evaluating the effectiveness of IRZ in protecting the environment, such as tightening the reporting threshold for certain pollutants in response to incidents.

In 2003, Arnika proposed a much longer list of substances for the Integrated Register of Pollutants (IRZ) to Minister of the Environment Libor Ambrozek than was ultimately approved. The Ministry of the Environment suggested 122 substances. Still, other ministries in the government reduced the list to 72 substances in the first phase and 88 in the second phase of the IRZ's validity (Arnika 2003). Photo: Arnika, 2003

Netherlands

The PRTR database in the Netherlands collaborates with research institutes to effectively store emission data. It is responsible for data collection, emission calculations, and quality control. The database was set up to support national and international environmental policy, such as the Kyoto Protocol and UNFCCC. The Dutch PRTR encompasses a broader range of substances, with a notable focus on air emissions. However, it distinctly lacks information concerning the transfer of chemical substances in waste

PRTRs in Other Developed Countries

The PRTR system is not only applied within European countries but also in other developed countries though they are sometimes referred to by different names. This section discusses some countries such as the United States (Toxic Release Inventory), Canada (National Pollutant Release Inventory), Japan, and Korea.

Canada

The National Pollutant Release Inventory (NPRI) Canada has some valuable features. Polluters are required by law to report and can be charged if they fail to do so. Apart from that, a NPRI Multi-Stakeholder Working Group was also established, involving NGO representatives, the Canadian Association of Physicians of the Environment (CAPE), the Canadian Environmental Law Association (CELA), the Citizens' Network on Waste Management, Keepers of the Water, MiningWatch Canada, among others.

Japan

Japan PRTR encompasses several key aspects, such as Provision of Information to the Public, Promotion of Voluntary Improvement, Obtainment of Basic Data for Environmental Conservation, and many more. Since the establishment of the PRTR system in Japan, there has been a tendency for the total amounts of released and transferred substances to decrease. This suggests that the system has played a role in contributing to the reduction of environmental risks associated with these chemical substances.

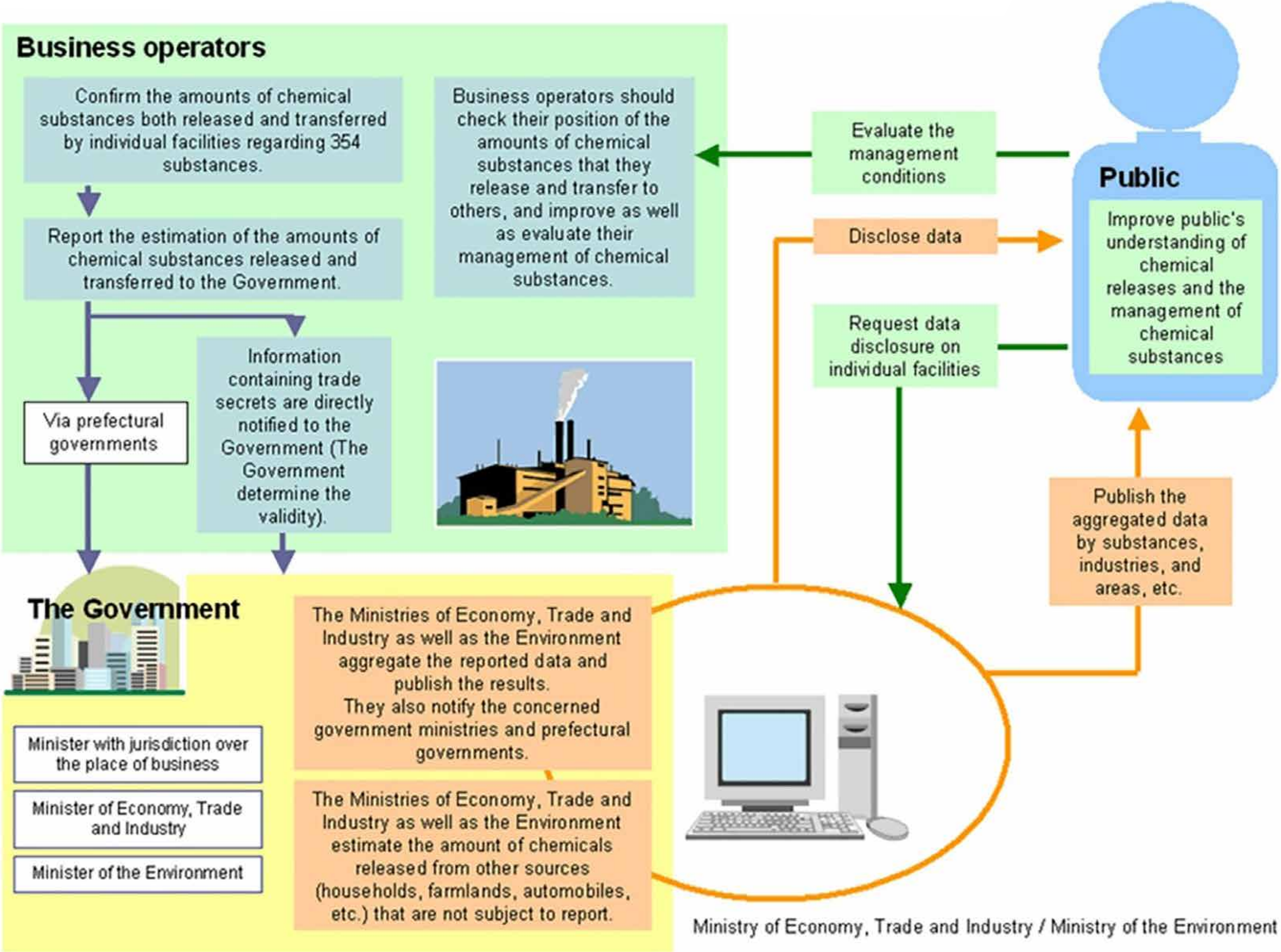
PRTRs in some Developing and Low-Middle Income Countries

Apart from the PRTR implementation in developed nations, the implementation of PRTR systems in developing and/ or Low-Middle Income Countries (LMIC) has taken place, which includes, Chile, Colombia, Bosnia and Herzegovina, Tajikistan, Kazakhstan, Moldova, and Thailand.

The countries have taken initiatives to implement PRTR in their own countries to the best of their ability. Chile has established the implementation of PRTR through the regulation *Administración del Registro de Emisiones y Transferencias de Contaminantes* (The Management of the Registry of Emissions and Transfers of Pollutants) in 2010 with 121 pollutants and nine physical and biological parameters regulated. Colombia embedded the implementation of PRTR into several policy documents throughout the years, including the Colombia National Action Plan (2013-2020), and planned to develop a pilot test of the PRTR with productive sectors and environmental authorities in 2019-2020.

Despite the acknowledgment of the importance of PRTR, Developing and Low-Middle Income countries are facing hurdles to sustain the development of PRTR. Not only does it take a long regulatory process to take the initiatives, but the lack and/or the absence of funding has become a major issue. Tajikistan, for example, still has no PRTR established due to the absence of funding in spite of many efforts having been taken to build their capacity. In Thailand, the problems

Figure 2.2 *The Japanese PRTR system. Source: (MoE-GoJ 2007)*



come from stakeholders that had misunderstandings about the private sector's implementation of PRTR with concerns like costs, technical issues, and data confidentiality. Moldova has even pushed legal frameworks, infrastructure development, capacity building, and international reporting to establish PRTR, but facing funding challenges and suggesting a hiatus despite functionality indications in 2018/2019. Furthermore, other issues on the implementation of PRTR are operational challenges, public access, and the intrinsic nature of voluntary-reporting that are still applied due to early development of the system.

Comparison of the Efficiency between Various PRTRs

Reporting emissions according to their potential risk may increase the correlation between risk and reductions. Dioxin releases in fractions of gram may not significantly affect the overall number of reported releases and transfers in PRTR, these are highly hazardous substances from a risk perspective. Differentiating between risk levels may increase the focus of reporting facilities on reducing the emissions of higher-risk substances, concluded Kerret and Gray (2007).

Kerret and Gray (2007) compared PRTRs in the United States, Canada, England, and Australia. Their analysis came with interesting outcomes: *"The four studied countries' results suggest no consistent relationship between various surrogate measures of risk and mass emissions. In some cases, reductions in mass may nevertheless increase risk. This could happen while reductions are focused on chemicals with a lower risk coefficient while, at the same time, the amounts of more risky substances are on the rise. These results support further research to unravel the reasons behind the differences among the countries and the relations between risk and mass trends."*

When analyzing and comparing the PRTR systems in the USA and England, it is crucial to note that very active NGOs used PRTR to exert pressure to reduce emissions from industrial operations (Taylor, 2004; Working Group on Community Right-To-Know, 1991; Working Group on Community Right-To-Know, 1997). To be objective, we must acknowledge that in Canada, CSOs also engaged in campaigns related to PRTR (CELA, 2023; Environmental Defence and CELA, 2004) data and used a system similar to Friends of the Earth UK (OECD, 2000; UNITAR, 2003), but such a campaign did not take place in Australia. The US EPA also announced the so-called 33/50 Program in the USA and actively utilized TRI data (Bi and Khanna, 2012; Khanna and Damon, 1999; USEPA, 1991).

3. Multilateral Agreements, Inter-governmental Organizations and PRTR

UNITAR Guidance provides a comprehensive overview of the international framework of multilateral agreements and UN global initiatives related to PRTRs. Some of them build a base for establishing PRTRs in whole UN regions (UNITAR, 2018) and/or support their development globally (OECD, 2023b).

- **Principle 10 of the Rio Declaration** aims to safeguard the right to a healthy and sustainable environment for present and future generations. This principle also bridged the government's accountability with environmental protection.
- **OECD** encourages Adherents (i.e., members and non-members having adhered to the Recommendation) to design and establish PRTRs through a transparent and objective process after the Council adopted its "Recommendation of the Council on Implementing Pollutant Release and Transfer Registers" (OECD, 2001). The Council recommends that Adherents take into account certain principles in implementing PRTRs, which include fostering enhanced international comparability of PRTR data; making the data accessible to the public on a timely and regular basis and a user-friendly format; ensuring the quality and timeliness of the data; and regularly evaluating the effectiveness of the PRTR (OECD, 2023c; UNITAR, 2018)
- **Aarhus Convention** gives the public certain rights related to the environment, such as Access to Environmental Information, Participation in Environmental Decision-Making, and Access to Justice. The Aarhus Convention is also about government accountability, transparency, and responsiveness. It grants the public rights and imposes obligations on parties and authorities for information access, public participation, and justice. Additionally, it introduces a new process for public involvement in negotiating and implementing international agreements (UNECE, 2019).
- **Kyiv Protocol** is the first legally binding international agreement on Pollutant Release and Transfer Registers, ensuing from the Aarhus Convention, adopted in 2003 and entered into force in 2009. The protocol requires a PRTR based on a mandatory reporting scheme, annual, facility-specific, and pollutant-specific for releases; and covers different media, i.e., air, land, and water.
- **The Stockholm Convention on POPs** aims to safeguard human health and the environment from 32 Persistent Organic Pollutants (POPs) as of August 2023 (Chasek, 2023; Stockholm Convention, 2023). Incorporation of the reporting on chemicals listed under the Stockholm Convention into the PRTR system can become one of the tasks established in the National Implementation

Plan of the respective country(-ies) as defined in Article 7 of the Convention. POPs listed under the SC can even become the initial chemicals for the establishment of PRTR in the country, as there are guidance documents for their inventories available (UNEP and Stockholm Convention, 2013; UNEP, 2017; UNEP, 2017 a; UNEP, 2017 b) and they may help to calculate their emissions and transfers from certain sources within the country.

- **The Minamata Convention** targets mercury's adverse effects. Article 18 encourages using PRTRs for collecting and disseminating mercury data, emphasizing their importance in estimating annual quantities released, emitted, or disposed of through human activities (UNITAR, 2018).
- **United Nations Framework Convention on Climate Change (UNFCCC)** aims to combat climate change by limiting global temperature increases and dealing with its impacts. Parties report their emissions to monitor progress, aligning with principles of shared responsibility. This reporting parallels national Pollutant Release and Transfer Registers (PRTRs). The Convention also emphasizes education, training, and public awareness of climate change (UNITAR, 2018).
- **2030 Agenda: UN Sustainable Development Goals (SDGs)** outlines 17 goals to promote sustainable development. Existing reporting mechanisms, including PRTR data, are encouraged to measure progress. PRTR data aligns with specific SDG targets, such as reducing deaths from hazardous chemicals, improving water quality, promoting sustainable industrialization, upgrading infrastructure, achieving sustainable resource management, managing chemicals and wastes, reducing waste generation, and ensuring public access to information (UNITAR, 2018).

4. PRTRs and Civil Society

We have compiled examples showcasing how civil society utilized data from PRTRs. These examples are available in the following case studies.

Use of TRI by Civil Society in the USA

Following the establishment of TRI and Community Right-To-Know Law, A group of non-governmental organizations focused on working with the American TRI system emerged, later expanding its scope to various issues related to releasing toxic substances into the environment. It was named the "Working Group on Community Right-To-Know." This group published the "Working Notes" magazine every two months, from which the following examples of TRI utilization in the United States in the 1990s are derived.

The "Ozone Advocates" and the "Massachusetts Public Interest Research Group" (MassPIRG) used data obtained from TRI to advocate for the replacement of substances damaging the ozone layer and carcinogenic chlorinated solvents at Raytheon. After a campaign led by the "Ozone Advocates" and MassPIRG, Raytheon announced in 1992 that it would transition to ozone-friendly alternatives.

The environmental association "Blue Ridge Environmental Defense League (BREDL)" from North Carolina, USA, took the opportunity in 1996 to publish summary data on the amount of chemical substances released by DuPont. Only with the introduction of TRI were able to obtain an overview of the total amount of substances damaging the ozone layer or carcinogenic substances released into the environment from DuPont facilities in North Carolina.

The environmental movement CCE ("Citizens Campaign for the Environment") in New York led a successful campaign for labeling wastewater discharges. Over 3,000 industrial facilities and wastewater treatment plants have had to label their wastewater discharges visibly since 1997. In combination with this, they also had to disclose quarterly summaries of hazardous substances discharged into the water. The environmental movement gained 5,000 supporting letters and collected a quarter of a million signatures on a petition demanding these measures (Working Group on Community Right-To-Know, 1997)

Not only Civil Society, State environmental agencies in Massachusetts and New Jersey used it to reduce pollution effectively. These states had a better-developed system of supplementary information comple-

The Mossville community is a small, predominantly African American community suffering from PVC production in its neighborhood (Harden et al. 2005). Young residents of Mossville, Louisiana, play near PVC plants. Many families have been forced to relocate due to contamination and the expansion of industry surrounding Mossville (Toxic Free Future 2023). Photo: Gary Little, Greenpeace; Source: (Toxic Free Future 2023)

menting TRI, which they required from companies. Chemical companies could, therefore, better calculate how many raw materials were escaping due to poor material flow management or by not utilizing chemicals contained in waste. Both states exerted pressure to reduce the release of toxic substances at the source.

Factory Watch - Friends of the Earth UK Project in 1990s

Factory Watch, an award-winning website that monitored factory pollution, aimed to make pollution data accessible to the public and build public awareness regarding industrial pollution. Unfortunately, the project has been officially closed, ending its impactful journey (UNITAR, 2003)

Factory Watch published detailed tables ranking the top 100 factories based on various pollutants such as carcinogens, dioxins, toxic waste, and acid rain gasses (OECD, 2000; UNITAR, 2003). One of the notable impacts attributed to Factory Watch was its role in achieving a 40% reduction in releases of cancer-causing chemicals across England and Wales between 1998 and 2001. This reduction, from 15,100 to 7,800 tonnes, marked a substantial improvement in environmental conditions.

Despite its closure, Factory Watch's impact remains evident in the broader context of increased public awareness, policy changes, and establishing an Advisory Group for the UK's PRTR. The project has catalyzed positive environmental change and has significantly contributed to the discourse surrounding industrial pollution and accountability (Taylor, 2004; UNITAR, 2003).

Polluters Application in the Czech Republic

Arnika in the Czech Republic has developed its own web application using a map to manage publicly available data following examples of similar initiatives (projects) by civil society in other countries like the FOE UK Factory Watch project and/or similar project Pollution Watch (Environmental Defence and CELA, 2004) by Environmental Defence and Canadian Environmental Law Association (CELA).

Kronospan Jihlava, a manufacturer of chipboards, was the largest polluter with cancer-causing chemicals according to data published in IRZ (Czech PRTR system) for several years, e.g., for the reporting year 2009 (Petrlik 2013). Photo: Jan Losenický, Arnika, 2011

The Arnika web application is available at www.znecistovatele.cz and contains identical data to the government database. At the annual level, it is possible to see the rank order of the largest polluters in the Czech Republic for particular groups of substances or specific substances. The great advantage of the map application is that it allows citizens to find out whether there is a polluting facility near their homes. For the reporting year 2009, the Kronospan Jihlava wood processing plant (manufacturer of chipboards) was the largest producer of cancer-causing substances due to high formaldehyde emissions (Petrlik, 2013).

Thailand: CSOs as a Driver for PRTR Implementation

Thailand has experienced rapid economic growth, but has lacked adequate environmental regulation for a long time. As a result, factories have been operating for decades without limits, technology requirements, or audits to reduce pollution. This has led to the annual dumping of millions of tonnes of hazardous waste and the release of large emissions into the air and water. Despite adopting the Sustainable Development Goals set by the United Nations, the Thai government has shown a preference for investors over the environment. Even though the BAT/BEP approach has not been implemented, there has been a rise in demonstrations and petitions against pollution.

In 2001, the Thai civil organization, EARTH, called for a need to have the Pollutant Release and Transfer Register (PRTR) legislation in Thailand to solve the problem of industrial pollution that was intensifying in many areas. In addition, a lawsuit by citizen groups in Rayong province in 2009 aiming to halt the new investment of 76 petrochemical projects in Map Ta Phut and its vicinity areas had pressured the Thai government

Penchom Saetang, Director of EARTH, observes one of the local sources of pollution, the aluminum plant in Kao Hin Sorn. Photo: Ondřej Petrlík, Arnika, 2016.

to set up a pilot PRTR system with the technical assistance of the Japan International Cooperation Agency (JICA) (Saetang, 2022)

In 2012, EARTH helped detect chemical contamination in Loei Province around a gold mine by collecting environmental samples. The results showed that some samples exceeded the limits for arsenic found in drinking water and rice. Mercury and lead were also found in minimal amounts (Bystriansky et al., 2018; Mach et al., 2018). As of 2022, EARTH has collaborated with over 40 communities across Thailand, spanning 15 provinces. Through this collaboration, they have equipped local people with the knowledge and technical skills necessary to protect the environment. They believe that this effort will not only benefit the communities in contaminated areas, but also contribute to the advancement of civil society in Thailand and neighboring countries. Additionally, they aim to facilitate constructive dialogue between the community, academics, and industry, with the potential for mutual benefit.

In 2022, EARTH, EnLaw and Greenpeace – Thailand launched a joint PRTR law campaign to engage Thai citizens' awareness of the impact of pollution and participation in introducing a bill to the Parliament of Thailand.

Case Studies on Volatile Organic Compounds (VOCs)

Trichloroethylene in Czech PRTR (IRZ)

Trichloroethylene and tetrachloroethylene are used as solvents in dry cleaning and engineering commonly, present in some household products, and serve as a raw material in chemical industries. This chemical is classified as a probable human carcinogen (Group 2A according to IARC assessment) and has mutagenic effects (IARC Working Group on the Evaluation of Carcinogenic Risk to Humans, 2014).

After being major polluters in 2004, Federal-Mogul Friction Products a.s. in Kostelec nad Orlicí, Amati-Denak a.s. in Kraslice, and Galvamet s.r.o. achieved the most significant decrease in trichloroethylene emissions between 2004 and 2008. The Mayor of Kraslice responded to a report on the largest polluters of mutagenic substances, based on data from the IRZ, which resulted in Amati-Denak, a musical instrument manufacturer in Kraslice, installing new technology in response to pressure from the local government.

Styrene in Czech PRTR (IRZ)

The Czech Republic has seen an upward trend in styrene consumption. However, workers exposed to high short-term concentrations of styrene face neurological risks. Additionally, the International Agency for Research on Cancer (IARC) has classified it as a probable carcinogen (Group 2. A) (IARC, 2023).

The increasing use of styrene in recent years suggests a rise in emissions of this substance into the air. In this regard, the IRZ serves as an essential source of information. A well-documented example of emission reduction is demonstrated at the Laminates Klimeš facility in Benešov u Semil. At this plant, installing a catalytic unit for continuous VOC oxidation, coupled with a high-pressure supply fan, resulted in a substantial decrease in styrene emissions. The reduction was not only due to reporting to the IRZ but also in response to community feedback and the proactive approach of the facility operator.

Naphthalene in an Industrial Facility Adjacent to the River

Between 2012 and 2016, there was a threat that Carborundum Electrite, a branch of Tyrolit in Benátky nad Jizerou, would establish the production of abrasive wheels using naphthalene. The naphthalene would be stored in the facility right next to Jizera River in Central Bohemia which is the source of drinking water for the city of Prague.

If naphthalene were to reach the river in an accident, it would significantly harm its cleanliness. Arnika used data from the IRZ to argue against the planned operation's environmental impact. The proposal faced strong opposition from the citizens of the Central Bohemian town, leading to a petition campaign supported by approximately a quarter of the residents. The company abandoned the proposal after a four-year campaign by local residents with the support of the Arnika association.

Naphthalene is classified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC, 2023). It is also toxic to aquatic organisms and may cause long-term effects in the aquatic environment. Bioaccumulation of this chemical may occur along the food chain, for example, in fish (National Center for Biotechnology Information, 2024).

Case Studies on Toxic Chemicals in Waste Transfers

Arsenic in Waste Transfers

Arsenic is known for its carcinogenic, neurotoxic, and mutagenic properties, oxidative stressors, endocrine system disruption, and inflammatory action. Even low-level exposure to inorganic arsenic has been associated with an increased risk of several cancers, including skin, lung, bladder, and kidney cancers.

Human activities, such as fossil fuel combustion, metallurgical processes, dye manufacturing, and more, contribute to arsenic pollution (Zevenhoven et al., 2007). Arsenic is also present in leachate from power plant fly ash, with drainage water from sludge-drying beds containing arsenic in concentrations up to several mg/l. Research indicates that lignite combustion can impact soil contamination by arsenic, PRTRs and Civil Society and in the Czech Republic, areas around Chomutov and most show the highest values (Ustjak, 1995)

Major contributors to arsenic transfers in waste, reported in the IRZ from 2004 to 2008, include the power plant Elektrárna Mělník I (Energotrans a.s.), ranking first, and the heating plant Teplárna Otrokovice a.s., ranking second over these years. The facility Kovohutě Příbram a.s., is the third-largest source of arsenic and its compounds in wastes during this period.

This information is crucial for understanding the plant's waste management practices. The waste is utilized for landscape reclamation, including the sludge-drying bed for fly ash in Bělov. In 2010, plans were made to use residues from lignite combustion in Otrokovice to back-fill a clay pit near Vážany (Kroměříž). Without data from the IRZ, vital information about up to 7.5 tons of deposited arsenic compounds per year in the area would be unavailable, highlighting the importance of such data in environmental impact assessments.

Estimation of Dioxins in Waste based on PRTR Data

Arnika and IPEN used data about transfers in wastes from national PRTRs for the estimation of dioxins (PCDD/Fs) in waste incineration residues for their study focused on waste incineration fly ash global control (Petrlik et al., 2021). We calculated an average of PCDD/Fs reported in WI residues by waste incineration companies to the Czech PRTR system in 2012 – 2019.

Among the largest producers of PCDD/Fs in waste in the Czech Republic, according to IRZ data, are metallurgy and waste incineration with some transfers reported as recycling. Two studies by the IPEN network and Arnika addressed the issue of dioxins in ashes from waste incineration, highlighting potential dioxin leaks into the surrounding areas where these wastes are managed (Katima et al., 2018; Petrlik and Bell, 2017). Data from the Czech PRTR aligns with findings of high dioxin and dioxin-like PCB concentrations in eggs from backyard chickens near metallurgical operations (Jelinek et al., 2023a; Petrlik et al., 2022a).

Beyond NGOs: Expanding Horizons of PRTR Data Utilization

Data from Pollutant Release and Transfer Registers (PRTRs) serve not only governments (or ministries or environmental agencies) or NGOs, but also individuals, communities (Bui and Mayer, 2003), local associations, scientists, and potential investors (Abashidze et al., 2019). They also serve society as a whole (Skårman and Sjödin, 2013), which places high demands on the usability of the available data. For the companies themselves, it can serve to evaluate progress in implementing new, cleaner production technologies (identifying opportunities, creating a set of input data for design, implementation and monitoring) (Kolominskas and Sullivan, 2004).

One of the most visible results of PRTR implementation is the reduction of toxic emissions. The PRTR is uniquely suited to assess the progress that different industrial sectors, or specific facilities within them, have made in adopting green chemistry practices and the effectiveness of these practices in preventing pollution. In the U.S., access to publicly available data not only significantly reduced overall pollution but also transformed the role of the Environmental Protection Agency into a facilitator of information sharing and voluntary pollution reduction (Jobe, 1999).

Information reported by companies often appears in academic articles. Through this, we can examine the relationship between toxic releases and their impact on human health (Osornio-Vargas et al., 2011) and even real estate prices affected by the disclosure of emission information in PRTRs in specific locations (von Graevenitz et al., 2016). PRTR data are generally valuable for research and have significant potential for identifying priority research needs that can influence policy, management, and human health.

Ji & Lee (2016) undertook an interesting study in South Korea. In summary, traditional methods for testing drinking water have limitations, leading to delays in responding to water incidents. To overcome this, global trends suggest using risk analysis systems. This study used a data system (PRTR) to assess the potential risk of harmful chemicals in drinking water facilities. By looking at factors like the total amount of chemicals, distance to a city, and chemical toxicity, they identified the riskiest city using a calculated approach and a statistical method. The study found that PRTR data helps understand and prevent risks in water supplies. Although the method may not capture all types of chemical accidents, it provides a useful way to compare risks between cities, helping prioritize efforts to reduce potential risks for drinking water facilities (Ji and Lee 2016).

5. Crucial Elements of Good PRTR

OECD Recommendations

In 1996, the OECD Council officially adopted the "Recommendation of the Council on Implementing Pollutant Release and Transfer Registers,". This recommendation urges OECD Adherents to transparently establish PRTRs, incorporating principles such as international comparability, public accessibility, data quality assurance, and continuous evaluation. OECD's ongoing efforts focus on providing practical tools, guidance, and support to countries for PRTR installation, emphasizing data quality improvement, exploring applications, and harmonizing PRTRs globally (OECD, 2023b; OECD, 2023c; UNITAR, 2018)

Key points of the recommendations are the establishment of PRTR systems, principles for PRTR systems, data sharing, and incorporation of essential elements into the system. The Annex of the Recommendation enumerates specific principles that should guide establishing PRTR systems. Some of these include Identification and Assessment of Risks, Prevention of Pollution, Cooperation with Stakeholders, Involvement of Public and Private Sectors, Integration with Existing Sources, Data Accessibility, Mid-Course Evaluation and Flexibility, and Transparency.

PRTR as a New Database: Complementary Rather Than Competitive or Canceling Existing Ones

In most countries where reporting to the PRTR is newly established, other databases where polluters report information about pollutants already exist or have existed. In the Czech Republic, for example, these included the Registry of Air Pollution Sources (REZZO) (CHMI, 2023) and the Hydroecological Information System (HEIS) (TGM WRI, 2023), among others. A similar situation is documented in the development of the PRTR in Moldova (Petrlik, Septiono, 2023). Managers of industrial facilities often have to repeatedly report similar or identical data to these databases, leading to resistance against introducing another system like PRTR.

The situation in Moldova appears to be similar to that in the Czech Republic when the introduction and initial years of operation of the IRZ system faced challenges in coordinating the reporting of environmental data into various inadequately coordinated databases (such as the air pollution register REZZO, hydrological register HEIS, etc.). The issue was only resolved by a separate law on integrated reporting systems on the environment (ISPOP), which interconnected the databases and eliminated the potential for double reporting of data into state-established registries focused on environmental data (Maršák 2008a; MV ČR, 2008). Using Moldova as an example, it can be seen that the failure to address this issue may hinder the further functioning of PRTR itself.

Civil Society Organizations as Stakeholders of PRTR Design Process

Engagement of the civil society is indirectly listed among basic guiding principles for the establishment of PRTR, as mentioned earlier in this guide: "In designing or modifying a PRTR system, the government should consult with affected and interested parties to develop a set of goals and objectives for the system" (OECD, 1997).

Mexican environmental NGOs successfully influenced the government to switch from voluntary to mandatory reporting for RETC (Mexican PRTR system). Many NGO representatives who advocated for mandatory reporting are now part of the Mexican consultative group for RETC. They regularly meet with the RETC team at SEMARNAT, showcasing a successful collaboration between environmental NGOs and the government. Many see this as a notable success story in environmental advocacy (Pacheco-Vega, 2015).

Czech NGOs Children of the Earth (Děti Země), and since 2001 also Arnika, participated extensively in the design and implementation of PRTR in the country beginning in the 1990s, long before the country became an EU Member State. To help instigate the process, Arnika worked to generate more than 10,000 signatures on a petition that called for PRTR and included local authorities and scientists as signatories (DiGangi, 2011). The chemical industry initially opposed the process, but eventually conceded that the PRTR could cover more substances than the European Pollutant Emission Register (EPER), which was the predecessor of the E-PRTR

Civil society organizations have become advocates for presenting PRTR data to the public in an easily understandable format, eliminating the need for extensive navigation between pages.

Concerns of Industrial Companies

Industrial enterprises and their associations generally do not welcome the implementation of the PRTR. A common worry of industrial firms is that disclosing the quantities of consumed and emitted substances through such specific reporting will reveal their trade secrets. However, this is an unfounded concern. A robust PRTR system allows them to keep sensitive data confidential for trade secret reasons. However, they usually must demonstrate to the state administration authorities collecting data for the PRTR that the request for confidentiality is genuinely due to trade secrets and not for other reasons, such as concerns about public reactions.

Before the launch of the PRTR, reporters typically had significant concerns, which led to exaggerated demands for data confidentiality options. Foreign experiences have shown that the proportion of requests for confidentiality in various systems ranges from a few percent to a few thousandths of reports submitted.

During a lecture in the Czech Republic, Royall (2000) highlighted several benefits of implementing the PRTR for industrial enterprises beyond economic savings. These advantages included improvements in reputation, elimination of communication barriers with the surrounding community, demonstration of a commitment to environmental protection, engagement of local residents, a basis for technological improvements, scaling of production efficiency and emission reduction, better resource management, and inspiration for technological innovation.

Chemically Specific Reporting About Waste Transfers

In the Czech Republic, information about the quantities of chemical substances in waste is only centrally compiled in the IRZ database. Details regarding the chemical makeup of waste can be found in documents related to waste transportation and may also be documented in records of waste management facility operations.

The transfer of chemical substances typically does not require new measurements to be taken. It is necessary to determine the chemical composition of waste leaving industrial facilities, considering the specific limitations for waste disposal or utilization at each facility.

Some systems, like the European PRTR, need companies to report what chemicals they send to public sewerage facilities. But when it comes to other scenarios like recycling, the focus is on whether the transfer is hazardous or not. It was concluded in a very recent study focused on PRTR data (Hernandez-Betancur et al., 2023). The problem is, if we only collect data on chemicals going to sewerage systems and not all End-of-life scenarios, it could create a skewed picture (imbalanced data) for future models. This can make it tough to build accurate models, potentially causing mistakes when categorizing End-of-Life activities (Hernandez-Betancur et al., 2023). This problem aligns with a broader concern highlighted in a recent European Court of Auditors review addressing hazardous waste (ECA, 2023). The review notes that, despite decontamination efforts, recycled materials, including paper, plastics, rubber, and textiles, still contain a range of hazardous substances (Behnisch et al., 2023; DiGangi et al., 2011; ChemSec, 2021; Strakova et al., 2023a; Straková et al., 2018; Strakova et al., 2022). The lack of information on the chemical composition of the waste treated by recyclers is a key factor contributing to this issue (BiPRO, 2017).

We propose that addressing this knowledge gap could be achieved by enhancing reporting on the flows of toxic chemicals, as outlined in the PRTR reporting scheme. We believe that increased knowledge about the flows of toxic chemicals (listed in the PRTR reporting scheme) in waste transfers could significantly fill the gap in "lack of information on the chemical composition of the waste" treated by recyclers.

Estimation of the Releases - Tools

For the determination of annual releases and transfers of substances for reporting to the PRTR, there are essentially three basic options: 1) direct measurement and calculation based on it; 2) estimation using emission factors determined (calculated and published) for a specific type of industrial activity and level of technology; and 3) expert estimation (OECD, 2005). Most laws implementing the PRTR allow for all three options.

Handbooks have been created to assist in the calculation of national inventories of emissions and transfers of certain substances for the purposes of international conventions. In 2005, the OECD released a guide on the selection of estimation techniques. It provides a procedure for deciding which estimation technique to choose and describes details about their usage. The guide also discusses the uncertainty that cannot be avoided in determining and estimating annual releases/transfers. This document is certainly recommended for everyone starting with PRTR, whether they are involved in creating the register or are reporters (OECD, 2005)

Coverage of the Most Important Pollutants and Modifications of Their List

The PRTR should not be a static system because the use of chemical substances in industry is rapidly evolving, and some already prohibited substances are slowly disappearing. This recommendation reflects the need to revise the list of substances in PRTR systems at the international and national levels (Zettl et al., 2021).

Most PRTR systems other than the U.S. TRI and Czech IRZ lack substances like PFAS (Audrlická Vavrušová et al., 2022; MŽP, 2021b; USEPA, 2022a), whose flows would be important to monitor due to their toxicity even at low concentrations (Chang et al., 2016; Strakova et al,. 2023b; Szilagyi et al., 2020). Although PRTR systems track chlorinated dioxins (PCDD/Fs) (Petrlik et al., 2018), they have omitted similar brominated dioxins (PBDD/Fs), which are equally toxic substances (Behnisch et al., 2023; Birnbaum et al., 2003). PRTR systems appear inflexible in reflecting the most toxic substances released into the environment (Johnston Edwards and Walker, 2019)

Specific Case: PRTRs and Fisherman

PRTR does not regulate industrial activities but collects valuable information from them for fishermen. At the same time, PRTR, in combination with public data accessibility, puts pressure on industrial operations to better monitor and reduce their releases of toxic substances. In the case of accidents, PRTR helps to quickly identify the polluters.

Cyanide poisoning on the Bečva River in September 2020. Photo: Stanislav Pernický, Czech Fishermen Association

Fishing communities, recreational anglers, and their families are highly vulnerable to water pollution and aquatic ecosystem degradation. Pollution of rivers and waters affects them in several ways: 1) leaks of substances toxic to fish destroy their food source or the object of their interest; 2) accumulation of toxic substances, which do not kill the fish but accumulate in them, can also accumulate in the bodies of anglers or people consuming the fish, and 3) accidental spills can be a disaster for entire communities.

In January 2000, a retaining wall failed at the Aurul gold processing plant in Romania, releasing a wave of cyanide and heavy metals that moved quickly from one river to the next through Romania, Hungary, the Federal Republic of Yugoslavia and Bulgaria, killing tens of thousands of fish and other forms of wildlife and poisoning drinking-water supplies (Cunningham, 2005).

In 2006, there was a cyanide leak from the chemical plant LZ Draslovka Kolín into the largest Czech river, the Elbe, contaminating an eighty-kilometer stretch of the river (Svobodová and Sehonová, 2021). In September 2020, similar cyanide poisoning happened in the Bečva River resulting in massive fish mortality over a 40 km stretch of the river (Čtk, 2023). In response, Arnika issued a call for "Rivers without Poisons," demanding tightening the reporting threshold for cyanide transfers in waste from 500 to 50 kg/year. The call garnered support from more than 7,000 people (Arnika, 2020b). The requirement was also endorsed by committees of the Parliament of the Czech Republic (Čtk, 2023).

Research in the USA found that: 'an individual's consumption of freshwater fish is potentially a significant source of exposure to perfluorinated compounds. The median level of total targeted PFAS in fish fillets from rivers and streams across the United States was 9,500 ng/ kg, with a median level of 11,800 ng/kg in the Great Lakes' (Barbo et al., 2023). However, when we look at PRTR systems, we find that only two require reporting of some substances from the large group of PFASs.

Mercury is also among the significant pollutants accumulating in fish. Monitoring not only emissions into the air and direct discharge into the water, but also the handling of waste containing mercury and soil contamination is important, as documented by examples of chlorine chemicals, smelters, or coal-fired power plants and contamination of fish in their vicinity (Mach et al. 2016). As the USEPA states: "Nearly all fish and shellfish contain traces of mercury, no matter what body of water they come from" (USEPA, 2023a).

Looking at many incidents that could jeopardize fishermen and coastal communities, PRTR comes as a tool for preventing such incidents from happening especially in maritime countries, like Indonesia.

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