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**On the Use of PRTR Information in Evaluating Progress towards Meeting the
United Nations' Sustainable Development Goals: An Action Plan for Data Analysis
and Moving Forward**

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**On the Use of PRTR Information in Evaluating Progress towards Meeting the
United Nations' Sustainable Development Goals: An Action Plan for Data
Analysis and Moving Forward**

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among **FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD**

Environment Directorate

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris, 2019

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Foreword

In 2011, the OECD Task Force on PRTRs commenced to develop a framework that defines the role of PRTRs in sustainable development and illustrates how PRTR data and information can be used to assess progress towards global sustainability. The OECD published the result as a document, *Framework on the Role of Pollutant Release and Transfer Registers (PRTRs) in Global Sustainability Analyses* (OECD, 2017^[1]) (hereinafter referred to as “Framework”) in February 2017. Section 2.4 of the Framework describes the potential use of PRTR data to assess progress towards reaching some of the Sustainable Development Goals (SDGs) described in the United Nations’ (UN’s) publication, *Transforming our World: The 2030 Agenda for Sustainable Development* (UN, 2015^[2]).

As a follow-up to the completion of the Framework, the OECD Working Group on PRTRs (WG-PRTRs) initiated a project in summer 2017 led by the US, in which the Framework will be applied to the most relevant SDGs as a demonstration of the utility of PRTR data for global-scale sustainability analysis. This document lays out the path forward for the first phase of this project. Application of the Framework to the SDGs as described herein represents the first attempt at using PRTR data for global-scale sustainability analyses to address real-time global issues and inform decision making.

This document was prepared under the supervision of the WG-PRTRs and published under the responsibility of the Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology of the OECD.

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Abbreviations and acronyms

BAT	Best Available Techniques
Cr ³⁺	Trivalent Chromium
Cr ⁶⁺	Hexavalent Chromium
E-PRTR	European Pollutant Release and Transfer Register
EPA	Environmental Protection Agency
EU	European Union
GDP	Gross Domestic Product
GRT	Global Round Table
NEI	National Emissions Inventory
NPI	National Pollutant Inventory
NPRI	National Pollutant Release Inventory
PM	Particulate Matter
PM _{2.5}	Particulate matter - fraction of particles having an aerodynamic diameter of less than 2,5 µm
PM ₁₀	Particulate matter - fraction of particles having an aerodynamic diameter of less than 10 µm
POTW	Publicly-Owned Treatment Work
PRTR	Pollutant Release and Transfer Register
RETC	Registro de Emisiones y Transferencia(s) de Contaminantes
RSEI	Risk-Screening Environmental Indicators
SDG	Sustainable Development Goal
SETAC	Society for Environmental Toxicology and Chemistry
TOC	Total Organic Carbon
TRI	Toxics Release Inventory
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US	United States
ZDHC	Zero Discharge of Hazardous Chemicals

Executive Summary

This document describes the results of analyses on methodologies to use PRTR data and information for global-scale sustainability analyses including the:

- identification of SDG Target 12.4 on environmentally sound management of chemicals as the most closely aligned target with PRTR data;
- selection of 14 chemicals and pollutants to be used for the analysis based on the data availability in PRTR systems, the range of sectors that manufacture or use these chemicals and their adverse effects to human health or the environment (Table 1);
- suggestion to focus on manufacturing sectors in the OECD's Short Reporting Sector List (OECD, 2013^[3]);
- suggestion to focus on on-site pollutant release to air and water; and
- selection of seven PRTR systems around the world from which data will be obtained to include a sufficient number of different systems to provide geographic diversity (Table 2).

In addition, the document summarises the types of analyses to be conducted, starting from the development of snapshot analyses of the latest releases of pollutants, followed by trend analyses on key pollutants identified in the snapshot analyses. These results from multiple PRTR systems are compared to provide a starting point for examination of differences in releases for specific sectors and possibilities for information sharing or knowledge transfer on managing releases of pollutants. The use of toxicity-weighted release quantities and economic information as factors for the analyses is also described.

Furthermore, the document presents limitations inherent to PRTR data (e.g. not all facilities report to PRTR systems, different techniques are used to determine the releases), challenges in using PRTR data for global analysis with a summary of differences in PRTR systems that must be considered, and a project timeline.

The information provided in this document will be used to assess progress towards meeting specific SDG targets through examination of global trends of chemicals and pollutants, and is expected to accelerate progress towards these targets.

1. Background

PRTRs contribute to achieving the SDGs by encouraging companies to adopt sustainable practices and to reduce emissions of pollutants into the environment. Moreover, PRTRs facilitate the dissemination of information on sustainable production practices by ensuring that people have access to relevant data on management practices of pollutants. In addition, combining data from multiple PRTRs is expected to allow analyses at an international scale, which enables one to:

- evaluate global trends in chemical releases;
- evaluate impacts of environmental policies;
- gain insight into human and environmental health issues;
- characterise the trans-boundary movements of chemical wastes;
- identify pollution prevention opportunities, and
- assess environmental performance and efficiency globally.

The Framework (OECD, 2017^[1]) was finalised in 2017 to explore how PRTR data can be used to conduct global-scale analyses. The Framework specifically addresses:

- how data from different PRTR systems can be integrated or combined and used to conduct global-scale analyses;
- how differences among PRTRs in terms of chemical coverage, sector coverage, and reporting thresholds can be overcome;
- the limitations of PRTR data in global-scale analyses; and
- case studies that illustrate global PRTR analyses.

Section 2.4 of the Framework describes the potential use of PRTR data to assess progress towards reaching some of the SDGs (UN, 2015^[2]). Some of the SDGs are ambitious and it is difficult to quantitatively assess progress towards them. Nonetheless, having such goals inspires the global community to strive to move humanity closer to the improved state envisioned by the goals. This project supports that effort by applying a rich, useful international dataset to the tracking of some of those goals, and may even help to accelerate progress towards reaching them.

2. Objectives

There are three complementary objectives of this project which applies and demonstrates the utility of PRTR data to inform SDGs:

- developing approaches for using PRTR data for global-scale sustainability analyses;
- assessing progress towards meeting specific SDG targets through examination of global chemical pollution and management trends; and
- accelerating progress towards meeting specific SDG targets by investigating the drivers of observed trends and providing an opportunity for knowledge transfer among countries facing similar chemical pollution challenges.

The first objective, to develop approaches for using PRTR data for global-scale sustainability analyses, is the most overarching. At this moment, there is no large body of work that combines data from multiple PRTR systems, and as the Framework points out, there are challenges and limitations to comparing and combining PRTR data from different countries or systems. However, this project seeks to show that, through taking appropriate measures, PRTR data from multiple national and regional sources can be combined and compared to produce robust, informative analyses on the state of pollution and waste management at the global level.

After taking appropriate steps to compile and compare PRTR data from multiple national and regional systems, this project then seeks to use that information to assess progress, at both national/regional and global scales, towards meeting the specific SDG targets for which PRTR data are most relevant and applicable. This assessment will be conducted primarily by characterising and examining any trends in environmental releases of study pollutants (described later in this Action Plan) and, if trends in releases are identified, comparing how the quantities of these pollutants released over time have changed, and the relevance of such changes to each of the selected SDG targets. The specific SDG targets are described in more detail below.

Lastly, this project seeks to go a step beyond assessing progress towards the SDG targets by attempting to identify and characterise some of the drivers behind observed changes in pollutant releases over time. The value of such an investigation is that understanding why one country or region is making progress in reducing releases of a given pollutant while others are not may reveal circumstances that warrant separate follow-up. Additionally, such investigations have the added value of leading to lessons learned or best practices that can help other countries or regions accelerate progress towards meeting the SDG target.

3. Relevant Sustainable Development Goals and Targets

Based on careful review of the 17 Sustainable Development Goals, there are five SDGs, with seven associated targets, for which PRTR data are relevant and well-suited for application. For each target, the UN developed indicators to measure progress toward the target. This section discusses how PRTR data relates to each goal and target, how the data are to be used in this project, and which goal and target will be the focus of the first phase of this analytical project. Recent amendments to the OECD PRTR Council Act (OECD, 2018^[4]) embrace the role of PRTRs in meeting the five SDGs and respective targets discussed in this section.

3.1. Target 3.9

Box 1. Goal 3. “Ensure healthy lives and promote well-being for all at all ages”

Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Indicator 3.9.1: Mortality rate attributed to household and ambient air pollution

Indicator 3.9.2: Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)

Indicator 3.9.3: Mortality rate attributed to unintentional poisoning

Chemical pollution has recently been characterised as a great and growing global problem (Landrigan et al., 2018^[5]) (Landrigan et al., 2018^[6]). With the focus on “hazardous chemicals” as contaminants in air, water and soil, this target clearly relates to PRTR data on releases of such substances. Many human health related studies have been published that used PRTR data and have identified possible causal relationships between toxics emissions and negative health outcomes. PRTR data, in conjunction with additional information can serve as a starting point in the determination of potential impacts of toxics emissions on human health (Wine et al., 2014^[7]). However, it would be nearly impossible to characterise a definite causal relationship or robust link between releases of toxic (hazardous) chemicals (and other pollutants) and deaths or illnesses specifically due to exposure to those chemicals from available information. This is because of the many other unrelated factors (e.g. genetics, lifestyle activities, health status) that can contribute to mortality or morbidity. In addition, many of the toxic effects to human health (e.g. leukemia) caused by pollutants (e.g. benzene) occur following many years of chronic exposure. Hence, a causal relationship between emissions of a pollutant and the incidence of an illness it is known to cause would only be characterisable (if at all) from a long-term trend analysis that considered the many variables that contribute to human mortality and morbidity. While PRTR data can be used to identify trends in industrial emissions and, therewith, contribute to tracking progress towards the ambient air pollution aspect of this target, significant additional data would be required to assess the impact of the trends on mortality. In addition, since this target is already supported by three indicators, the added value of attempting to apply further information to its assessment through PRTR analysis

would be minimal. Therefore, while PRTR is relevant to target 3.9 this goal/target is not recommended to be the primary focus at the outset of this project.

3.2. Target 6.3

Box 2. Goal 6. “Ensure availability and sustainable management of water and sanitation for all”

Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Indicator 6.3.1: Proportion of wastewater safely treated

Indicator 6.3.2: Proportion of bodies of water with good ambient water quality

Similar to Goal 3, the mention of minimizing the releases of “hazardous chemicals” to water in this target makes application of PRTR data relevant to Target 6.3. PRTR data on releases of toxic chemicals or other pollutants to surface water could be analysed to determine whether releases of any of the study chemicals to water are increasing, decreasing or remaining constant. Any observed trends could inform progress towards this target of reducing chemical pollution in water. Data elements for on-site releases to water are also fairly consistent across different PRTR systems, which would aid in the feasibility of comparing chemical release trends globally. However, there are some limitations to using PRTR data to evaluate progress towards this target. For example, PRTR systems typically do not require disclosure of information on other factors that significantly impact water quality such as pH, dissolved oxygen content, presence of pathogens, and degree of sediment¹. Trends in water discharges of PRTR-reported chemicals alone would be limited as indicators of water quality. Similar to Target 3.9, PRTR data can contribute to tracking progress toward Target 6.3, but it is only one component of the data needed to characterise water quality, and is not recommended to be the primary focus at the outset of this project.

¹ Total organic carbon, TOC, (as total carbon or chemical oxygen demand COD/3) is covered under the United Nations Economic Commission for Europe (UNECE) PRTR and the European PRTR (E-PRTR) systems.

3.3. Target 9.4

Box 3. Goal 9. “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”

Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

Indicator 9.4.1: CO₂ emission per unit of value added

With a focus on increased resource-use efficiency in industry, PRTR data could be used to track adoption of pollution prevention practices (e.g. green chemistry implementation) and other best available technologies (BATs) for preventing or reducing pollution, and the resultant improvements in environmental performance. For example, an indicator showing PRTR releases per unit of value added or another proxy for production would show the change in resource-use efficiency, as declining releases per unit of production indicates improved efficiency. The UN Indicator² for this target, “CO₂ emissions per unit of value added,” can also be tracked as most PRTRs include data on carbon dioxide (CO₂) emissions. The US Environmental Protection Agency’s (EPA’s) Toxics Release Inventory (TRI, the US’ PRTR) does not collect carbon dioxide emissions data, but the US EPA’s Greenhouse Gas Reporting Program collects carbon dioxide emissions data from industry. Including or supplementing the CO₂ per unit of value added indicator with a similar emissions intensity indicator based on toxic chemicals and PRTR emissions data of these chemicals per unit of value added would provide a more complete picture of industry adoption of cleaner technologies. For example, trends in emission quantities of individual priority chemicals (e.g. mercury) or aggregated quantities of multiple chemicals would be invaluable in tracking progress in the adoption of cleaner and more environmentally sound technologies.

The emissions intensity indicator also could be complemented with anecdotal information on cleaner technologies available in some PRTRs, such as pollution prevention information compiled in the TRI and the Canadian National Pollutant Release Inventory (NPRI). The usefulness of the TRI in assessing the environmental benefits of adoption of green chemistry and other pollution prevention practices is well documented (DeVito, Keenan and Lazarus, 2015^[8]) (Ranson et al., 2015^[9]) (Gaona, 2018^[10]). An emissions intensity indicator, whether based on CO₂ emissions per unit of value added, toxic chemical emissions per unit of value added or both, has the potential to be highly useful. The development of such indicator could be a logical aspect of a later stage of this project, but this target and indicator will not be the primary focus of the analysis at the outset due to the complexity of developing such an indicator, and the need to maintain an appropriately limited scope in the early stages of this project.

² See <https://unstats.un.org/sdgs/indicators/indicators-list>

3.4. Target 12.4

Box 4. Goal 12. “Ensure sustainable consumption and production patterns”

Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their releases to air, water and soil in order to minimize their adverse impacts on human health and the environment.

Indicator 12.4.1: Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement

Indicator 12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

PRTR data can be used to support evaluation of progress towards this target in multiple ways. As mentioned above under Goal 3, many studies have shown that PRTR data, in conjunction with additional information can serve as a starting point in the determination of potential impacts of the toxics emissions on human health (Wine et al., 2014^[7]). Combining pollutant release data from multiple PRTR systems and characterising any trends in releases serves as a means to assess whether countries and/or regions are reducing their releases of pollutants to air, water, and land. For PRTR systems that collect information on other waste management methods (i.e. recycling, incineration, treatment), PRTR data could also be used to measure progress towards the more environmentally sound management of chemical waste. This target is the most directly relevant to readily available PRTR data globally, and will be the focus of this initial phase of the project.

3.5. Target 12.5

Box 5. Goal 12. “Ensure sustainable consumption and production patterns”

Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

Indicator 12.5.1: National recycling rate, tons of material recycled

Tracking progress toward this target could build upon the analysis performed for Target 12.4 (focused on on-site waste releases) through a more in-depth examination of waste management practices at facilities or transfers to other receiving facilities, where data may be available. This trend in waste management could be augmented with PRTR data on pollution reduction activities implemented, from the PRTR systems that collect such information. Analysing trend data on waste management activities (i.e. recycling), along with information on pollution reduction actions implemented by industry, can inform progress towards reductions in waste generation, as described in Target 12.5. However, an important caveat to consider in this area of analysis is that any given facility’s trend in releases can be influenced by both source reduction/waste management activities as well

as other factors such as production activity and economic drivers. Due to the limited availability of recycling and other waste management information from multiple PRTRs, this target will not be the primary focus at the outset of this project.

3.6. Target 12.8

Box 6. Goal 12. “Ensure sustainable consumption and production patterns”

Target 12.8: By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.

Indicator 12.8.1: Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

This target is much broader in scope than could be adequately measured or tracked using PRTR data. However, the availability of PRTR information to the global public could be a valuable “right-to-know” aspect of information awareness and access, and a simple count over time of publicly available PRTR data systems adopted and implemented may be a useful measure to include in the larger analysis for this project. PRTRs are currently being implemented in Asian and South American countries, and more are expected to be implemented in other countries in the coming years. Promoting information access and awareness is foundational for achieving global sustainability and harmony with nature, and as one component PRTR data may help support progress toward that ultimate objective. While this target will not be the primary focus at the outset of this project, it would be feasible to include in the preliminary analysis a simple count of PRTRs adopted and implemented around the world, which would provide a cursory indication of the availability of pollutant release and transfer information globally.

3.7. Target 16.10

Box 7. Goal 16. “Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels”

Target 16.10: Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

Indicator 16.10.1: Number of verified cases of killing, kidnapping, enforced disappearance, arbitrary detention and torture of journalists, associated media personnel, trade unionists and human rights advocates in the previous 12 months

Indicator 16.10.2: Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information

Similar to target 12.8 and its associated indicator, this target and its indicators are much broader than an analysis of only PRTR data could evaluate. However, the availability of PRTR data to the public could be one small, albeit informative, component of the larger aspect of public access to information described in Indicator 16.10.2. This target will not be the primary focus at the outset of this project.

In summary, of all the SDGs and respective targets, target 12.4 is the most closely aligned with readily available PRTR data from multiple regional and national sources, and it will be the focus of the initial phase of this project to apply PRTR data to evaluation of Sustainable Development Goals. Future iterations of this project will likely address additional SDG targets.

4. Countries/PRTR Systems to Include in the Project

Selecting which PRTR systems to include in this project is structured by two central objectives: including a sufficient number of different systems to provide geographic diversity and a robust global picture of PRTR trends, and not including so many PRTR systems as to create an impractical or even intractably large universe of data to analyse. It is also important to focus on PRTR systems that have been collecting data for enough years to enable identification of trends and meaningful trend analysis.

This project proposes to examine data from seven PRTR systems maintained by the following countries or political/economic union:

- Australia;
- Canada;
- Chile;
- European Union (EU, may include additional PRTR data from individual European countries not stored in the European Pollutant Release and Transfer Register (E-PRTR));
- Japan;
- Mexico; and
- the US.

Incorporating data from these PRTR systems into this project enables analysis of PRTR trends across five continents, providing as much global diversity as currently possible. For trends presented in this analysis, a baseline year of 2008 is proposed because all of these PRTR systems include data for 2008 and thereafter. While the Chilean PRTR system has data as of 2008, directly reported data (i.e. data submitted via the Chilean “Single Window PRTR”) began in 2014, therefore pre-2014 data from Chile will be assessed to ensure year-to-year comparisons are appropriate.

5. Chemicals/Pollutants to Include in the Project

Four criteria were considered in selecting which chemicals or other pollutants to include in this analysis:

- the pollutant is included in at least four of the PRTR systems used for this project;
- the pollutant is included on national or international priority lists, or is otherwise considered to be a pollutant of priority in a given country or region;
- the pollutant is manufactured, processed or otherwise used by a variety of sectors, or widely used in a variety of applications, and routinely released into the environment from industrial facilities; and
- the pollutant is known or suspected to cause serious adverse effects to human health (e.g. cancer) or the environment.

The initial project proposal presented at the WG-PRTRs meeting in June 2017 listed nine candidate chemicals for consideration:

- benzene;
- ethylbenzene;
- 1,2-dichloroethane;
- di-(2-ethylhexyl)phthalate;
- trichloroethylene;
- tetrachloroethylene;
- dichloromethane;
- styrene; and
- nickel and nickel compounds.

Of these chemicals, all nine are covered by four of the proposed PRTR systems (Australia, Canada, Japan, and the US). The EU covers eight out of the nine, Mexico covers five out of nine, and Chile covers three out of nine. In addition, these chemicals are considered to be a priority chemical by at least one environmental authority, such as: the European Chemicals Agency (under the REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals - regulations³), Japan's National Institute of Technology and Evaluation (under Japan's Chemical Substances Control Law⁴, Japan Priority Assessment), the European Parliament and Council of the EU (under the EU Water Framework

³ See <https://echa.europa.eu/regulations/reach/understanding-reach>

⁴ See

https://www.meti.go.jp/policy/chemical_management/english/cscl/index.html?LINKControlLaw

Directive⁵), and the US EPA (under the Toxic Substances Control Act⁶, List of Work Plan Chemicals). All nine chemicals are categorized as known or suspected carcinogens, and each one is also shown to cause other serious health effects such as neurological, hematological, developmental, renal, respiratory, immunological, or reproductive effects.

During the presentation of this project proposal at the WG-PRTRs meeting in June 2017, work group members were asked for recommendations on other pollutants to include in this project. This request led to valuable discussion in which several other chemicals and chemical categories, and another pollutant were proposed for inclusion. These additional pollutants are:

- cadmium and cadmium compounds;
- chromium and chromium compounds;
- sulphur dioxide; and
- particulate matter (PM).

The rationales for including these additional pollutants in the project are that the above metals and metal compounds are major water pollutants in many parts of the world, and sulphur dioxide and PM are major air pollutants that cause significant impacts on human health. The metals (cadmium and chromium and their compounds) are covered by all seven of the proposed PRTR systems, although for chromium, reporting in Australia and Japan is limited to trivalent chromium (Cr^{3+}) and hexavalent chromium (Cr^{6+}) and their respective compounds.

Some discussion on the unique aspects of metals and PRTR reporting of metals is warranted here. Chemicals that are metals (e.g. nickel, cadmium, chromium, and mercury) are different from chemicals that are entirely organic in that metals can exist in different forms and persist indefinitely in the environment. Metals are often released into the environment or otherwise managed as waste in either their neutral (Metal^0) or cationic (Metal^{X+}) forms. In the latter case, the metal is connected to an inorganic or organic component through ionic bonds. Organometallic compounds, such as dimethyl mercury or tetraethyl lead, are compounds in which the metal portion is bonded to the organic portion(s) via covalent or other non-ionic bonds.

Different forms of the same metal can vastly differ in their physical and other properties, including toxicological properties. For example, Cr^{6+} is known to cause cancer in humans following chronic inhalation exposure, whereas Cr^{3+} is not known to be carcinogenic. However, in soils trivalent chromium can speciate between trivalent and hexavalent chromium under certain environmental conditions.

Some PRTR systems do not require facilities to distinguish between different forms of a metal, or require reporting of specific metal compounds as individual chemicals. Rather, these PRTR systems require reporting of the metal as a member of a metal compound category. In the US and other countries, for example, when filing a PRTR report for a chromium compound, facilities are not required to disclose the specific oxidation state (species) of chromium (e.g. trivalent or hexavalent chromium) or the specific chromium

⁵ See <https://eurlex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060>

⁶ See <https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act>

compound when reporting emissions and other waste management quantities. They report the quantities of chromium as a member of the “chromium compounds” category.

Hence, interpretation of analytic results of emissions of chromium and chromium compounds in regard to risk of cancer in humans will be challenging due to the differences in toxicities between hexavalent and trivalent chromium, the interconversion of these species in the environment and not knowing whether the oxidation state of a chromium compound reported to a PRTR system as released to environment is in hexavalent form or trivalent form.

The US EPA’s Risk-Screening Environmental Indicators tool (RSEI tool⁷, discussed later in this document) calculates hazard and risk score for emissions of chromium compounds based either on facility-specific or sector-specific information about the speciation distribution. Within the automotive manufacturing sector, for example, the presence of chromium in the hexavalent form ranges from 5% to 34%, depending on specific subsector. Perhaps a similar approach can be used in the analyses of chromium compounds put forth in this Action Plan.

The relevance of speciation to the toxicities of different forms (oxidation states) of the other metals stated above is not as well characterised as it is for chromium.

Sulphur dioxide and PM are included in four of the proposed PRTR systems, with differences in the scope of PM coverage (PM_{2.5} and PM₁₀ are covered in Australia, Canada and Chile, while the EU includes PM₁₀ only). In the US, sulphur dioxide and PM emissions are not covered in the TRI, but are available from the US National Emissions Inventory (NEI). US NEI data, however, are not updated annually but are updated every three years. Cadmium and its compounds are also considered regulatory priorities under the EU Water Framework, and chromium and chromium compounds are included as target chemicals in the Zero Discharge of Hazardous Chemicals (ZDHC) programme.

At the OECD WG-PRTRs meeting in June of 2017, representatives from countries and organisations were also provided the opportunity to propose other pollutants following the meeting. Inclusion of mercury and mercury compounds was recommended in late August of 2018, during peer review of a previous version of this Action Plan by members of the WG-PRTRs. Since the aim of the project described in this Action Plan is to use PRTR data to evaluate progress towards some of the UN’ SDGs, it is important to include substances that are of priority to the UN. Mercury is of high priority to the UN, as evidenced by the Minamata Convention on Mercury: a global treaty to protect human health and the environment from the adverse effects of mercury (including mercury compounds). Mercury and its compounds are covered by all seven of the PRTR systems proposed for inclusion in this project. Hence, inclusion of mercury and mercury compounds in this project is easily justifiable, and they will be included among the other chemicals and pollutants to be studied in this project.

In summary, the chemicals/pollutants proposed for inclusion in this analytical project are in Table 1.

⁷ See <https://www.epa.gov/rsei>

Table 1. Proposed chemicals/pollutants for analysis

Chemicals	Initial proposal in 2017	Proposal for addition in 2017	Additional proposal in 2018
Benzene	included		
Nickel and nickel compounds	included		
Tetrachloroethylene	included		
1,2-dichloroethane	included		
Di-(2-ethylhexyl) phthalate	included		
Dichloromethane	included		
Ethylbenzene	included		
Trichloroethylene	included		
Styrene	included		
Cadmium and cadmium compounds		added	
Chromium and chromium compounds		added	
Sulphur dioxide		added	
Particulate matter		added	
Mercury and mercury compounds			added

6. Industrial Sectors to Include in the Project

This project proposes to focus on manufacturing facilities that report to the previously mentioned PRTR systems for the purposes of tracking and evaluating progress towards achieving Target 12.4. This subset of industrial facilities would include the 30+ categories of manufacturing listed in the OECD's Short Reporting Sector List, included in Annex 2 (OECD, 2013^[3]). This would allow the project to examine pollutant releases from facilities involved in a wide variety of industrial operations (e.g. food and beverage manufacturing, chemical manufacturing, textile manufacturing, and fabricated metal product manufacturing), but would limit the scope of analysis to sectors represented in a majority of the PRTR systems included in the project. It is also important to concentrate on those manufacturing sectors where the pollutants listed previously are most likely to be manufactured, processed, or used in order to maximize the utility and meaning of the project results. Focusing on the manufacturing sectors will achieve a balance between examining a sufficient number of different types of industrial operations and limiting the analysis to a feasible and useful subset of data that is consistent across PRTR systems. Depending upon the results of the sector-based analyses, more specific sub-sector based analyses may be warranted and, if so, will be performed.

7. PRTR Data to be Compiled and Analysed

The first phase of this project will focus on data on on-site pollutant releases to air and water, which are applicable to tracking Target 12.4 as discussed previously. Release data of the chosen pollutants are readily available, and focusing on air and water releases will maximize the comparability of data sourced from multiple PRTR systems, as distinctions in how land/soil releases or disposal are defined and reported create additional challenges when attempting to combine data from multiple PRTR systems. Additionally, applying toxicity weights to release quantities (discussed in more detail below) is most appropriate for air and water releases based on the toxicity data currently available. Focusing this analysis on air and water releases will enable the most robust incorporation of toxicity information to provide context to absolute release quantities. Moreover, among all of the quantities of a given pollutant managed as waste by a facility (e.g. quantities recycled, burned for energy recovery, released into the environment or treated), it is the air and water release quantities that are most expected to lead to any adverse effects to human health or the environment and therefore are the most relevant to the application of PRTR data for global-scale sustainability analyses. Additionally, as fewer PRTR systems collect data on non-release waste management quantities (e.g. quantities recycled, burned for energy recovery or treated), it seems reasonable to concentrate first on the most relevant and widely available information. Examining other waste management and pollution reduction data will be explored in a later stage of this project.

When interpreting results of trend analyses, it will also be necessary to consider factors that may be responsible for an observed trend. Thus, the impact of production and economic status over the timeframe of the analysis and specific to each country or region of analysis must be considered, as these factors can greatly influence the extent of manufacturing output and therefore emissions. Another contributing variable that will need to be considered is the implementation of regulations that could potentially impact release quantities of the study chemicals and/or activities of the study sectors. In instances where implementation of regulations have impacted emissions such information should be communicated in the interpretation of the results to provide the appropriate context to changes in pollutant release quantities.

The primary source of data for the listed chemicals in Table 1 will be the seven PRTR systems in Table 2 that are the focus of this project.

Table 2. Primary source of PRTR data

Country/Region	PRTR system
Australia	National Pollutant Inventory (NPI)
Canada	NPRI
Chile	Registro de Emisiones y Transferencias de Contaminantes (RETC)
EU	E-PRTR
	Potentially individual PRTR systems of countries comprising the EU, to obtain data not included in the E-PRTR
Japan	Japan's PRTR system
Mexico	Registro de Emisiones y Transferencia de Contaminantes (RETC)
US	TRI

In addition, the NEI will serve as a source of release data for PM and sulphur dioxide within the US, as these pollutants are not covered by the TRI.

It will also likely be useful to look at additional sources of data needed to develop indicators, such as chemical-specific toxicity data and production and/or economic data specific to each country or region of analysis. Sources for these data are discussed below.

8. Analyses to Investigate

8.1. Snapshot Analyses

To create a starting point for this project, an initial step will be to develop “snapshot” analyses of the release quantities of the aforementioned pollutants contained in the sources mentioned in the preceding section. Based on the most recent year of data readily available (2017 for annual datasets; earlier for data that is collected less often than annually), these snapshots will show, for each chemical:

- total releases in each chosen country or region (PRTR system):
 - air releases per country/region; and
 - water releases per country/region.
- global releases (as represented by the seven included PRTR systems):
 - global air releases; and
 - global water releases.

It may be informative to aggregate global releases across chemicals in addition to conducting separate global analyses of each pollutant. Such aggregations could be done for both absolute quantities of chemical releases as well as toxicity-weighted quantities of releases (discussed later) for those chemicals for which toxicity weights (sometimes referred to as characterisation factors) have been derived. (Toxicity weights/characterisation factors have not yet been derived for sulphur dioxide or PM).

It will be useful to develop snapshot analyses based on industry. This might include a list of the top five to ten types of manufacturing sectors reporting each of the study pollutants, based on total releases as well as releases by air and water.

These snapshot analyses will provide a picture of the current global state of releases of the study pollutants and the major manufacturing industry sectors influencing those release quantities.

8.2. Trend Analyses

The next step will be to build upon the snapshot analyses by conducting trend analyses on releases of the study pollutants for the included PRTR systems. These trend analyses will provide an understanding of how pollutant releases have changed over time to result in the current state shown in the snapshot analyses.

This project proposes, where possible, to use 2008 as the baseline year, as this is the earliest year for which data from the majority of the included PRTR systems are available. For systems whose data collection started in later years or which added more data elements in later years, their baseline year may need to be adjusted accordingly.

Trend analyses would examine:

- changes in releases per pollutant over time:
 - by each PRTR system;
 - globally (i.e. all included PRTR systems); and
 - aggregated by characterisation factors where possible.
- changes in releases by media (air and water):
 - for each pollutant in each PRTR system;
 - for each pollutant globally; and
 - aggregated by characterisation factors where possible.
- changes in releases by top industry sector:
 - for each pollutant in each PRTR system;
 - for each pollutant globally; and
 - aggregated by characterisation factors where possible.

8.3. Comparative Analyses

As stated earlier, the focus of this project at the outset will be SDG Target 12.4, and how PRTR data can be used to inform progress toward achieving it. Conducting comparative analyses utilising the assorted PRTR data and related information compiled during development of the previously described snapshot and trend analyses will be the initial core objective of this project. Comparing trends over time across chemicals, PRTR systems, and industry sectors can provide starting points for questions that can lead to further action and support decision-making that could contribute to progress towards Target 12.4 and the other related SDG targets.

For example, if releases of a given pollutant are decreasing across most of the PRTR systems except for one, it could be informative to further examine what differences might be at play in that one PRTR, and what changes might lead to a reversal of the anomalous trend.

It may also be useful to compare releases within a given industrial sector across multiple PRTR systems, to determine if there may be the possibility of information sharing or knowledge transfer if a given industrial sector's releases of a certain chemical are significantly higher in one country or region than in the others.

The questions that will need to be asked through comparative analyses cannot fully be predicted until the trend analyses are underway, and it becomes more apparent what the data stories are and where anomalies might be that could be expanded upon through deeper investigation of PRTR data. Through comparative analyses, and the incorporation of other related information along with PRTR trends nationally and globally, this project can contribute both to tracking progress towards meeting Target 12.4 (and eventually the other SDG targets discussed previously), as well as potentially accelerating that progress.

8.4. Toxicity-Weighted Pollutant Release Quantities as an Indicator

While the *magnitude* of the quantities of a chemical(s) or other pollutant(s) released from a facility to the environment is a practical indicator of the environmental performance of the facility, it has limited use as an indicator of the potential health impacts posed by the released chemical(s), as it does not represent other important factors that contribute to potential human health outcomes or environmental impact. Factors such as the seriousness of the toxic effect(s) caused by the chemical, environmental fate of the chemical, and the extent and duration of exposure of susceptible individuals to the chemical must be considered to assess the potential risk of it causing an adverse effect.

Expression of mass emission quantities of pollutants as toxicity-weighted emission quantities provides additional insight to the extent to which changes in release quantities of a pollutant or pollutants may impact human health, and allows for a more meaningful aggregation of releases than adding absolute quantities (such as kilograms) of chemicals. Also referred to as “toxicity-weighted releases,” toxicity-weighted emission quantities account for the magnitude of a chemical’s release and the chemical’s toxicity. It is calculated by multiplying the mass quantity released (e.g. kg released to air) by the quantitative value that expresses the single most sensitive adverse effect caused by the chemical. It is a descriptor of relative hazard.

While not a descriptor of potential risk, toxicity-weighted releases enable one to delineate the change in overall hazard for release quantities aggregated for a single chemical or multiple chemicals. For example, a large increase or decrease in total aggregate releases of multiple chemicals from one year to the next does not mean there is a corresponding large increase or decrease in overall hazard. However, a toxicity-weighted value determined for each year would provide quantitative expressions of any year-to-year changes in overall hazard.

The US EPA developed the RSEI tool specifically to characterise trends in the potential hazards and relative potential risks of releases reported to the TRI, and to compare and help identify geographic areas, industry sectors, and chemical releases that may be associated with significant potential human health risks. RSEI models the fate and transport of TRI chemicals reported by facilities as released to air or water, or transferred off-site to Publicly-Owned Treatment Works (POTWs) or for incineration, and combines modelled exposure estimates with toxicity information and population estimates to calculate a RSEI Score. A RSEI Score is a unit-less value that accounts for the magnitude of the chemical release, the fate and transport of the chemical within the environment, the size and location(s) of potentially exposed human populations, and the chemical’s toxicity.

RSEI Scores indicate relative potential risk to human health. When a facility has a high RSEI Score, it indicates that aggregated emissions of TRI chemicals from the facility may pose greater risk than releases from a facility that has a lower RSEI Score. A more refined assessment using different tools and information would be needed to determine actual risks and the significance of the risks. The toxicity information reflected in a RSEI Score includes cancer and non-cancer human health impacts from chronic (continuous or frequent) exposure. Ecological effects and human health impacts following acute exposure are not considered. Both RSEI Score and RSEI Hazard provide greater insight on potential impacts than consideration of TRI release quantities alone.

USEtox is a tool that is useful for assessing the potential impacts of chemical emissions on human health and aquatic organisms. Developed under the United Nations Environment Programme (UNEP) and the Society for Environmental Toxicology and Chemistry’s

(SETAC's) Life Cycle Initiative, USEtox is based on scientific consensus providing midpoint characterisation factors for human and freshwater ecotoxicological impacts of chemicals in lifecycle impact assessments. USEtox operates on two scales: the continental scale and the global scale. The continental scale consists of six compartments: urban air; rural air; agricultural soil; natural soil; freshwater; and coastal marine water. The global scale has the same compartmental structure, but without urban air. The USEtox model considers environmental fate, exposure, human toxicity and toxicity to freshwater organisms.

Advantages of the USEtox model over the RSEI model for this project is its broad chemical coverage (can model thousands of chemicals), its inclusion of factors related to life-cycles of pollutants (particularly relevant for target 12.4), continental and global scale applicability, and its applicability to freshwater organisms. The RSEI tool only models relative hazard and relative potential risk to human health, while USEtox provides results for both human health and ecological impacts. Neither USEtox nor RSEI model PM or sulphur dioxide at this time. The application of USEtox to E-PRTR data pertaining to point source emissions to air and water in Sweden as a first step in developing a national chemical footprint was recently reported (Sörme, Palm and Finnveden, 2016^[11]) (Nordborg et al., 2017^[12]) and an EU project that is developing environmental indicators is also using USEtox.

Consideration of the pollutants' toxicity data along with the pollutants' release data would help to provide insightful context to trend information about an aggregated set of pollutants. Depending on the relative characterisation factors of the study pollutants and the direction(s) of the release trends for those pollutants, the trend in toxicity-weighted kilograms may be more revealing than the trend in kilograms of releases, and that would be an informative aspect of this project worth further exploration. It might also warrant a two-pronged approach to tracking progress towards Target 12.4: aiming for reductions in both aggregated pollutant releases as well as reductions in the combined toxicity-weighted kilograms of those pollutants.

Sources of toxicity data might include the US EPA's RSEI Hazard Score and the USEtox database.

8.5. Economic Information as an Indicator

It would also be informative to analyse PRTR release data with economic information to develop an indicator that would enable more robust comparisons across multiple PRTR systems. PRTR data can demonstrate whether releases (toxicity weighted or otherwise) of toxic chemicals are increasing or decreasing, but PRTR data alone generally cannot show why those changes are happening. Economic information can serve as a proxy for production trends to help to provide context about the influence of production levels on changes in releases at the facility and industry levels. An indicator such as "kg released/\$ value added" allows for normalized comparative analysis of release rates among countries.

Sources of economic data would include comparative global data such as that published by the UN Statistics Division on annual Gross Domestic Product (GDP) by country.

9. Limitations and Challenges

As with any project, there are limitations that should be considered in the development and implementation of this effort, and challenges that should be accounted for in the analytical methodology.

9.1. Limitations Inherent to PRTR Data

- Not all facilities that release, transfer, or manage chemicals or other pollutants (including those chosen for this effort) report to PRTR systems. Therefore, a given PRTR does not include all industrial release and other waste management quantities of a given pollutant.
- Not all toxic chemicals or other pollutants are reported to PRTR systems.
- From time-to-time, additional information will be required to provide the context needed to interpret PRTR data more completely, but this information may not be readily available or not available at all.
- The quality of PRTR data depends on the techniques used to determine the data, and may vary among different PRTRs or even within the same PRTR system.

9.2. Challenges in Using PRTR Data for Global Analysis

Differences among PRTR systems present challenges in using PRTR data from multiple countries or regions to conduct a global-scale analytical project. The differences that must be considered when designing such a project include:

- differences in covered chemicals or other pollutants;
- differences in the universe of facilities required to report to PRTRs:
 - definition of “facility”;
 - reporting thresholds; and
 - sector coverage.
- differences in the data collected by each PRTR system:
 - data elements;
 - units of measure; and
 - optional reporting fields.
- differences in timeframe:
 - available years; and
 - reporting period.
- differences in format and availability of published data.

These challenges will be accounted for in this project to the extent possible, and have informed the selection of the chemicals/pollutants and PRTR systems included in the project, the timeframe over which PRTR data will be analysed and compared, and the way that the results of this project will be interpreted and communicated.

10. Interpretation and Communication of Results

Interpretation of the analytical results will be an iterative process within the WG-PRTRs and may include others, as the interpretation leads to follow-up questions and analyses that will feed into the longer-term phases of this project. For the initial phase, interpretation will be based on analysis and results that inform Target 12.4, and presentation of those results will likely be centred on visualizations of the data. The interpretation will be included as part of the communication of the analytical results.

Presenting the results of the analyses (and interpretation thereof) through various data visualization options will be the most effective way to communicate the findings of the trend and comparative analyses performed in this project. Using graphical displays and maps will enable the sharing of a host of different data stories most efficiently and using minimal space. Perhaps a formal data visualization platform could be employed, and would provide a central portal through which all results of this project could be explored⁸. Providing access to project results through an online portal would enable stakeholders to link to the results, and could encourage further utilisation of the results for related research efforts or outreach initiatives related to PRTR and/or the SDGs.

⁸ Data visualization software are now being used to access, analyse and interpret PRTR data. For example, in recent years the US EPA has begun to use Qlik Sense data visualization software in its annual TRI National Analysis, to better enable users to analyse and interpret TRI data through visual displays of analytical results.

11. Project lead and users

11.1. Project lead

While the US is charged with the lead on developing and implementing this project, other members of the WG-PRTRs are encouraged to provide input on the project at various stages, including the interpretation of results from the preliminary phase(s) of analysis.

11.2. Users of the results

Primary users of the results (including the interpretive findings thereof) of the analyses described in the Analyses to Investigate section of this document are the UN and the OECD. The UN is the organisation that spearheaded the establishment of the SDGs and is tracking the progress countries are making in meeting the SDGs. One potential venue for publication of the analytical findings is the UN' "Sustainable Development Goals Report"⁹ which is an annual publication intended to review progress toward achieving the SDGs and their targets. While to date none of the published Sustainable Development Goals Report mention PRTR, this report is perhaps the most appropriate place to highlight the results and interpretive findings of this project as it would enable the results and interpretations to be accessed by multiple intended consumers, including the UN as well as environmental authorities in the countries included in the study and those in countries contemplating the value of implementing new PRTR programmes.

The role of the OECD as a user cannot be overstated. Since 1996, the OECD has played a key role in the development and implementation of PRTRs in member countries. Through its Task Force on PRTRs (known now as the Working Group on PRTRs), the OECD has developed numerous technical guidance materials and disseminated information, among other activities, to encourage and facilitate implementation of PRTRs, and improve access to PRTR data. In recent years, the OECD has actively promoted the role that PRTRs can play in assessing progress towards global sustainability, and championed efforts to make data from different PRTR datasets more harmonised and comparable. These efforts are discussed in detail in the *Framework on the Role of Pollutant Release and Transfer Registers (PRTRs) in Global Sustainability Analyses*. As the world's premiere promoter of PRTRs and the application of PRTR data and information, the OECD is clearly a main user of this activity. Additionally, the OECD is the ideal organisation to publish the analytical approach and the results and interpretation of the results of the analyses described herein in detail. Other users include all PRTR stakeholders.

A potential user is the recently established Global Observatory on Pollution and Health (see Landrigan, et al., references 2 and 3). The core mission of the Global Observatory on Pollution and Health is to aggregate, analyse, archive, and disseminate data on pollution (including chemical pollution) and pollution-related disease in cities and countries throughout the world. The Global Observatory on Pollution and Health will examine trends and patterns of pollution and will make information on pollution widely available to researchers, policy makers, and other stakeholders. The Global Observatory on Pollution

⁹ See <https://www.un.org/sustainabledevelopment/progress-report/>

and Health will utilise a variety of media and data platforms to disseminate findings to multiple audiences, and plans to publish updated information on global trends and patterns in pollution as well as on progress in pollution control in the form of a series of scientific reports. The Global Observatory on Pollution and Health may be a useful means to present and communicate the results and interpretation of the results of the analyses described herein in detail to interested parties.

12. Project Timeframe

12.1. Completed Work: Q2 through Q3 2019

As stated above, the focus of the initial phase of this project is on using PRTR data to track and potentially accelerate progress towards meeting Target 12.4 of the SDGs. The analytical methodology in support of this objective will concentrate on PRTR data that most readily lends itself to trend and cross-system analysis: data on releases of pollutants to the air and water. The goal of this initial phase was to produce initial results for presentation to the OECD WG-PRTRs meeting and at the PRTR Global Round Table (GRT) meeting held in Geneva, Switzerland in November 2018. The initial results, described below were presented to the WG-PRTRs and at the GRT meeting.

- August/September 2018:
 - shared draft Action Plan with WG-PRTRs and others to get feedback/input;
 - begun compiling data from the included PRTR systems or other sources (e.g. EPA's NEI):
 - emissions/release data for air and water;
 - identified chemicals as described in Table 1;
 - identified PRTR systems as described in Table 2;
 - conducted snapshot analyses; and
 - conducted and interpreted trend analyses using 2008 as the base year.
- September/October 2018:
 - applied USETox tool to assess relative toxicity-weighted release quantities and trends therein; and
 - interpreted and used results of trend analyses to develop and explore comparative analyses and possible data stories warranting further investigation.
- October 2018:
 - developed graphical presentations (visualizations) of trend and comparative analyses most relevant to Target 12.4.
- November 2018:
 - presented results of preliminary analyses at WG-PRTRs and GRT meeting.
- May 2019:
 - presented project overview and preliminary analyses to Dr. Landrigan of the Global Observatory on Pollution and Health.
- June 2019:
 - updated Qlik visualization platform with 2017 PRTR data from all included systems.

- July-September 2019:
 - began developing profiles for each of the project chemicals with snapshot and trend analyses of releases.
 - revised the Action Plan based on development of initial analytical profiles and other ongoing work.

12.2. Near Term: Q4 2019 though Q2 2020

Building from the initial works and results, the project could implement the following activities:

- publish the Action Plan as final document according to comments received from WG-PRTRs;
- present most recent analytical outputs and findings at the October 2019 meeting of the WG-PRTRs; and
- recommend that the UN publish the findings of the first-stage analysis in its next issue of its “Sustainable Development Goals Report”.

12.3. Long Term: Q3 2020 and onward

Looking forward, the scope of this project will likely expand once the initial phase has demonstrated the feasibility and utility of this analytical approach. Expansions of the initial project plan would likely include:

- Updating the initial analyses as new data become available. This could be as frequently as every year, or less often depending on data availability.
- Further investigating the trends observed in the initial phase of the project to identify factors contributing to differences among PRTR systems that could lead to lessons learned to accelerate progress toward achieving the SDGs.
- Expanding the list of pollutants included in the project:
 - other pollutants common to multiple PRTR systems;
 - pollutants related to specific environmental issues:
 - ozone-depleting substances;
 - greenhouse gases; and
 - smog-causing chemicals.
 - pollutants related to specific human health effects.
- Expanding or changing the list of PRTR systems included in the project. Could incorporate new data as new PRTR systems make data available for a sufficient number of years.
- On-going investigation of new or updated characterisation factors for existing and new pollutants and media.

- Applying this methodology to additional SDG targets.
- Could focus more on waste management and pollution reduction activities rather than or in addition to releases.
- Sharing the results more broadly through various online resources.
- Inclusion of findings in each annual issue of the UN' "Sustainable Development Goals Report".
- Routinely provide the findings to the Global Observatory on Pollution and Health.
- Identify a PRTR Indicator or Indicators, and recommend that the UN adopt the PRTR Indicator(s).
- OECD to periodically (every 1 to 2 years) publish a document that contains the latest analyses, analytical results, and WG-PRTRs' interpretation of the results.

13. Perspective

PRTRs have been established throughout the world to track emissions and other waste management quantities of potentially harmful chemicals and other pollutants. PRTRs have proven to be practical and powerful tools to inform decision-making at the country, regional or continental levels. More PRTRs are anticipated. Currently, several countries are piloting PRTR systems, and other countries plan to implement PRTRs in the coming years.

Given the emphasis on sustainability as an international priority, the need to evaluate progress towards reducing emissions and other waste management quantities of harmful chemicals and other pollutants at the *global* level has become increasingly apparent. PRTRs have suddenly been pulled into a new era - an era in which information collected and made available by PRTRs will be used to assess progress towards prevention of pollution globally and worldwide sustainable development. Application of the *Framework on the Role of Pollutant Release and Transfer Registers (PRTRs) in Global Sustainability Analyses* to the most relevant SDGs as described herein represents the first attempt at using PRTR data for global-scale sustainability analyses to address real-time global issues and inform decision making.

As with any novel undertaking, many challenges will be encountered that will need to be overcome, and many lessons will be learned along the way. However, much knowledge will undoubtedly be gained, perhaps more than what is anticipated. What is certain is that there is now, more than ever, a need for improved harmonisation of PRTR data, to better enable comparability and analysis of the data. Perhaps this undertaking will stir a desire among the authorities that have or will implement PRTRs to make the data and information they collect through their respective PRTRs more comparable with that of other PRTRs.

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