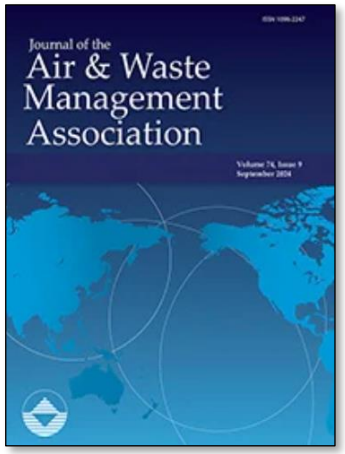
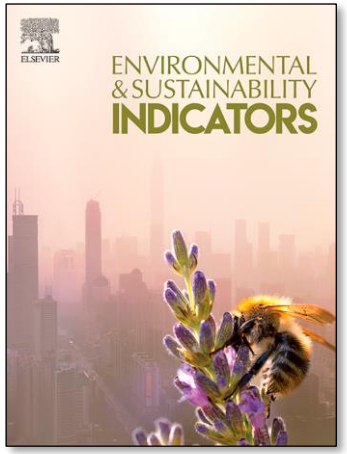
Environment and Climate Change Canada | Environnement et Changement climatique Canada

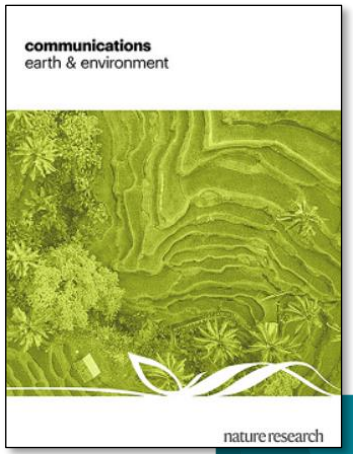
What can the data for off-site transfers tell us? New sustainability viewpoints using Canadian off-site transfer data



https://doi.org/10.1080/10962247.2024.2377327



https://doi.org/10.1016/j.indic.2024.100491



https://doi.org/10.1038/s43247-024-01595-1

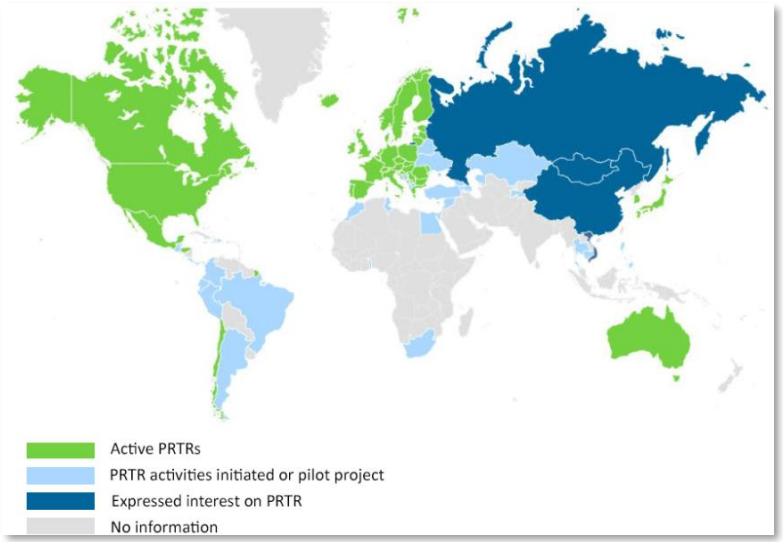
Commission of Environmental Cooperation
Public meeting of NA PRTR
Feb 2025
Alicia Berthiaume

Canada

NPRI: Canada's PRTR, 1 of 50+ globally

- **Audience:** interested stakeholders or rightsholders (e.g., Indigenous rightsholders, governmental and non-governmental organizations, industry representatives, researchers, public, etc.)

- **Objective:** to identify the locations and trends of point-source pollutants
  - incentive for facilities to reduce/prevent pollution and to gain social license to operate;
  - enable **informed decision-making** on pollutants **in the context of environmental sustainability.**



Source: UNITAR, 2018

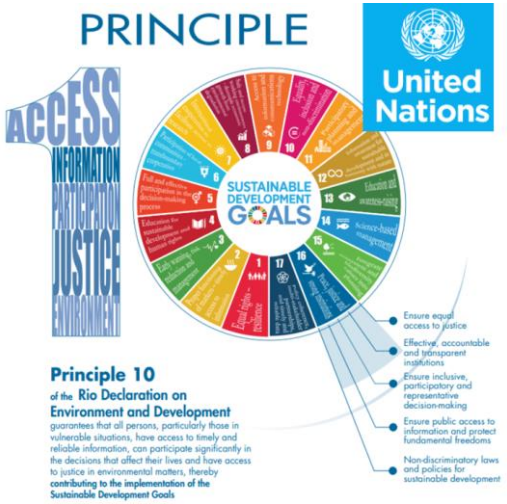
Example of NPRI stakeholders

Sustainability = sound management of chemicals

UN SDG 12: *while chemicals are recognized as an important part of modern society and economy**,** their sound management means that they are produced and consumed "responsibly."*

> ***Target 12.4**: …achieve the environmentally sound management of chemicals and all wastes in accordance with agreed international frameworks and reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment*
>
> ***Target 12.5**: …substantially reduce waste generation through prevention, reduction, recycling, and reuse*

UN SDG 16, Rio Declaration: Principle 10 – Access to information & participation in environmental decision-making



Current official SDG 12 indicators:

Target		Indicator(s)	
12.4	...Achieve the sound management of chemicals and wastes by significantly reducing their releases to air, water, and soil in order to minimize impacts on human health and the environment.	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
		12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment
12.5	...Substantially reduce waste generation through prevention, reduction, recycling, and reuse.	12.5.1	National recycling rate, tons of material recycled

OECD framework on using PRTRs in sustainability analysis

PRTR data

- Facility ID & location
- Industry classification
- Substance details, releases by media
- On-site disposals (by WM practice)
- Off-site transfers (by WM practice & destination)

Snapshots & Trends

Snapshots

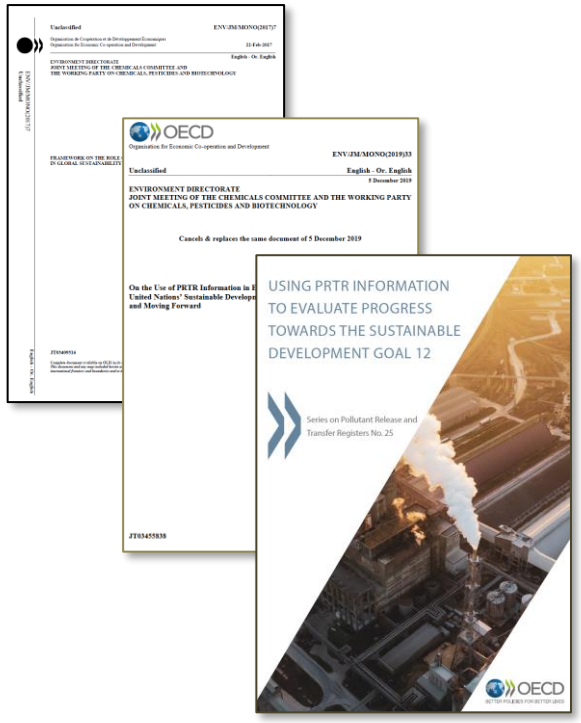
- What substances?
- What type of release, transfer or disposal?
- From where? To where?

Trends

- Reductions over time?

Analyses for SDG targets 12.4 & 12.5

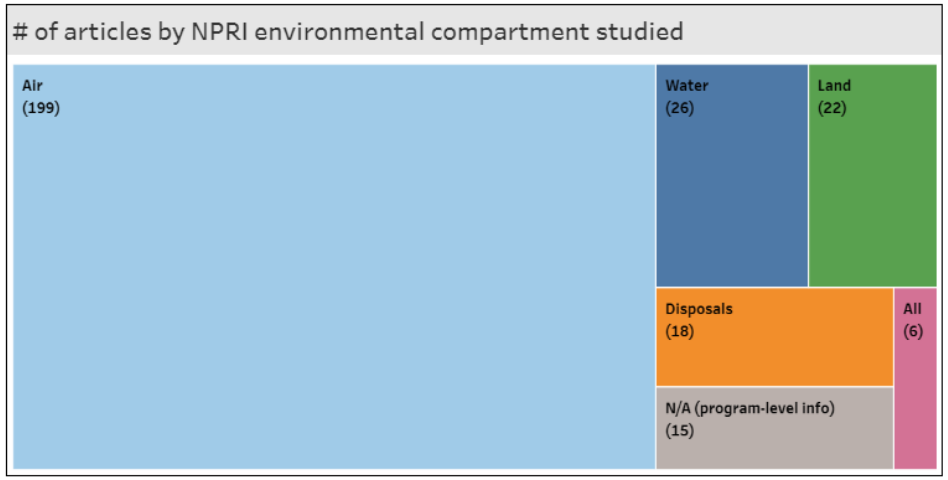
- Identify pollution prevention opportunities
- Characterize transboundary movement
- Understand environmental management performance & impacts
- Gain insights to human & ecosystem health issues
- Evaluate shifts in WM practices



Adapted from: [Publications in the series on Pollutant Release and Transfer Registers - OECD]

Crux

- Despite this availability of information, it is not well-used
- The NPRI has collected nearly 30 years of data on pollutants in waste (transfers and disposals), yet it has rarely been used in peer-reviewed environmental research.



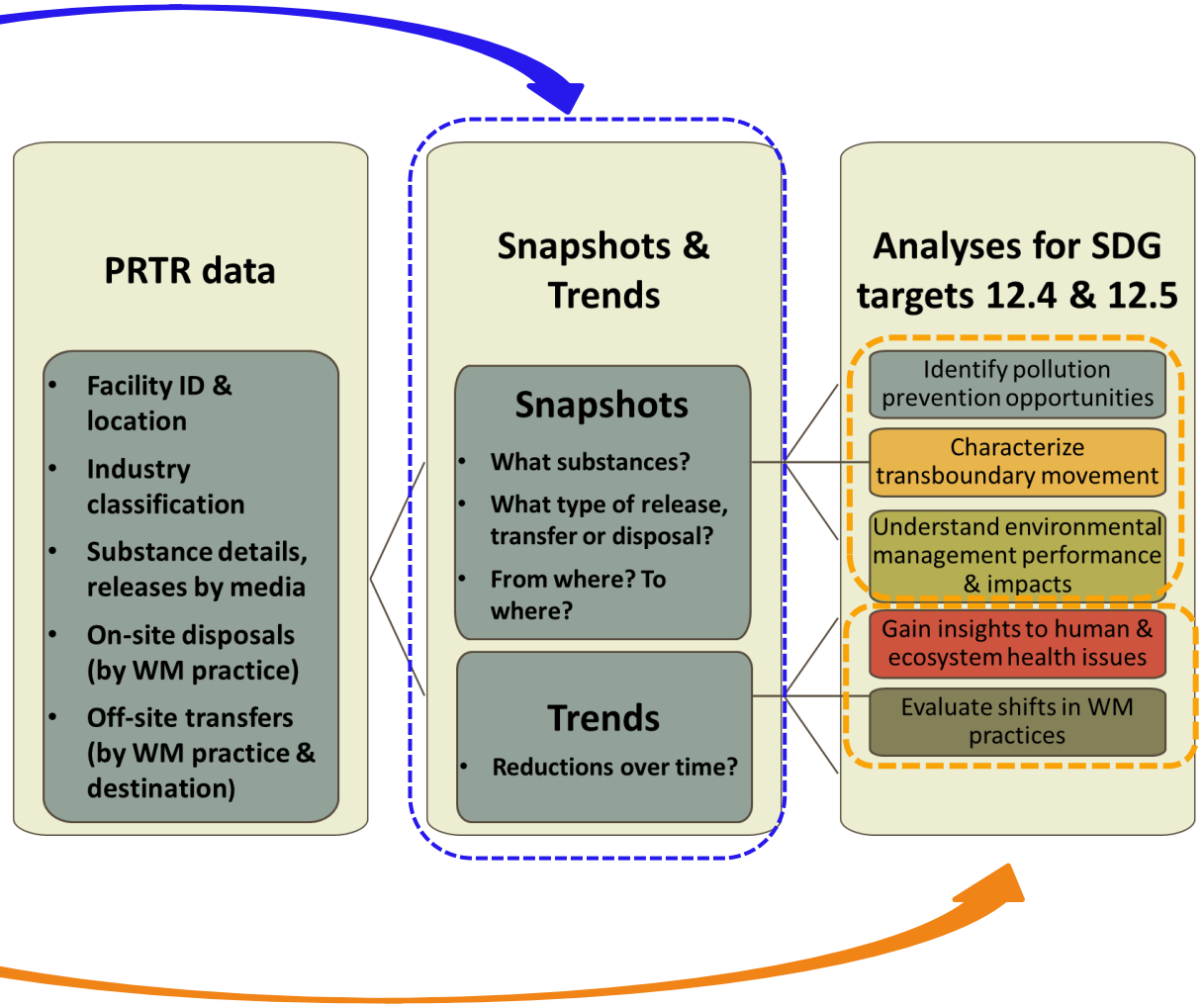
https://cdnsciencepub.com/doi/full/10.1139/er-2020-0122

- **There are opportunities to do so, in line with the OECD framework**

Objectives

1. To produce a foundational characterization of the NPRI transfers and disposal dataset, using OECD framework for PRTRs in Sustainability.

2. Conduct advanced SDG analysis using NPRI transfer & disposal data, set a global precedent for PRTRs

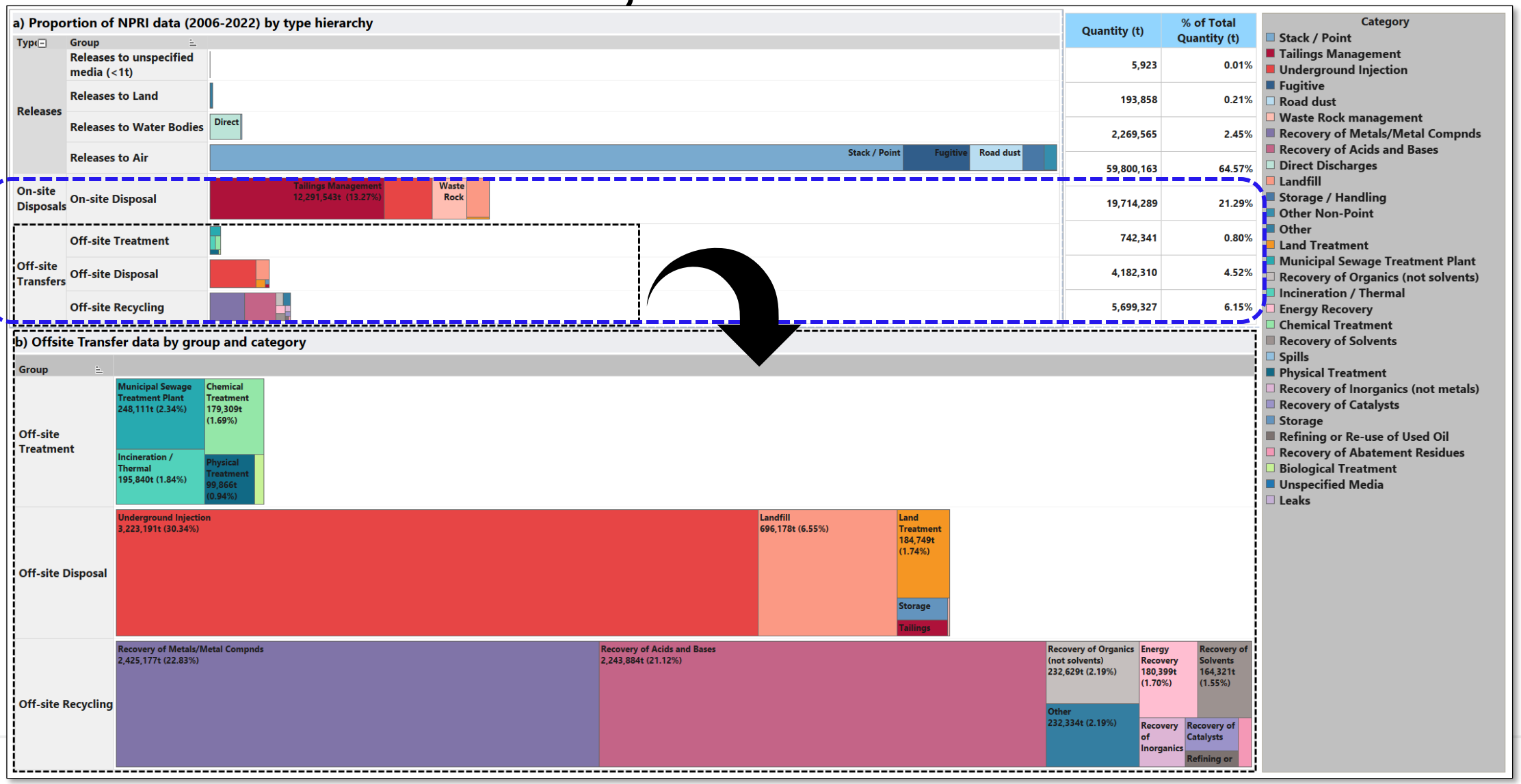


Part 1 Results: Foundational characterization

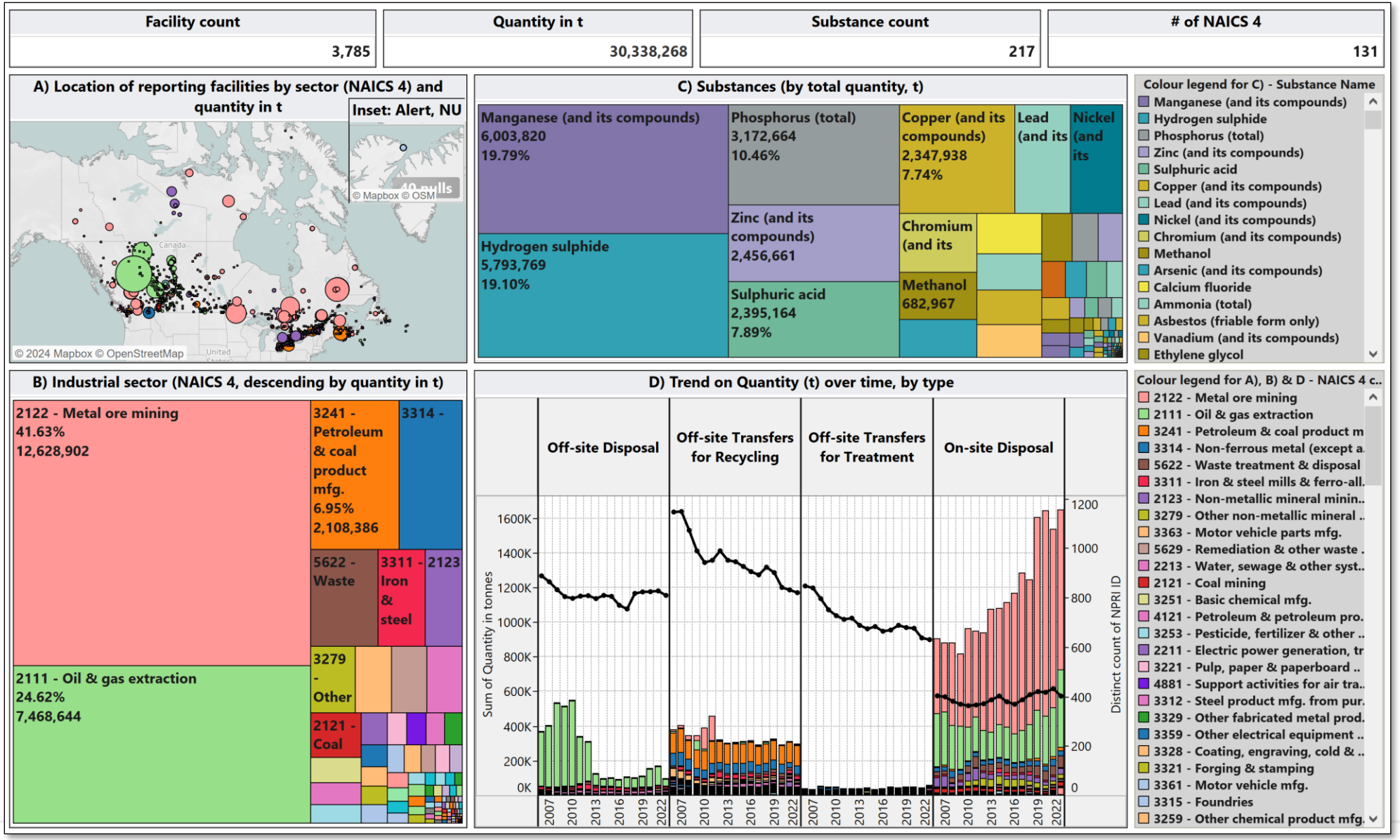
- Snapshots & trends
- What substance, sectors, and types of waste management (WM)?
- From where, to where?

https://doi.org/10.1080/10962247.2024.2377327

Overall, waste management 2006-2022
~ >30M tonnes, >30% of all NPRI data

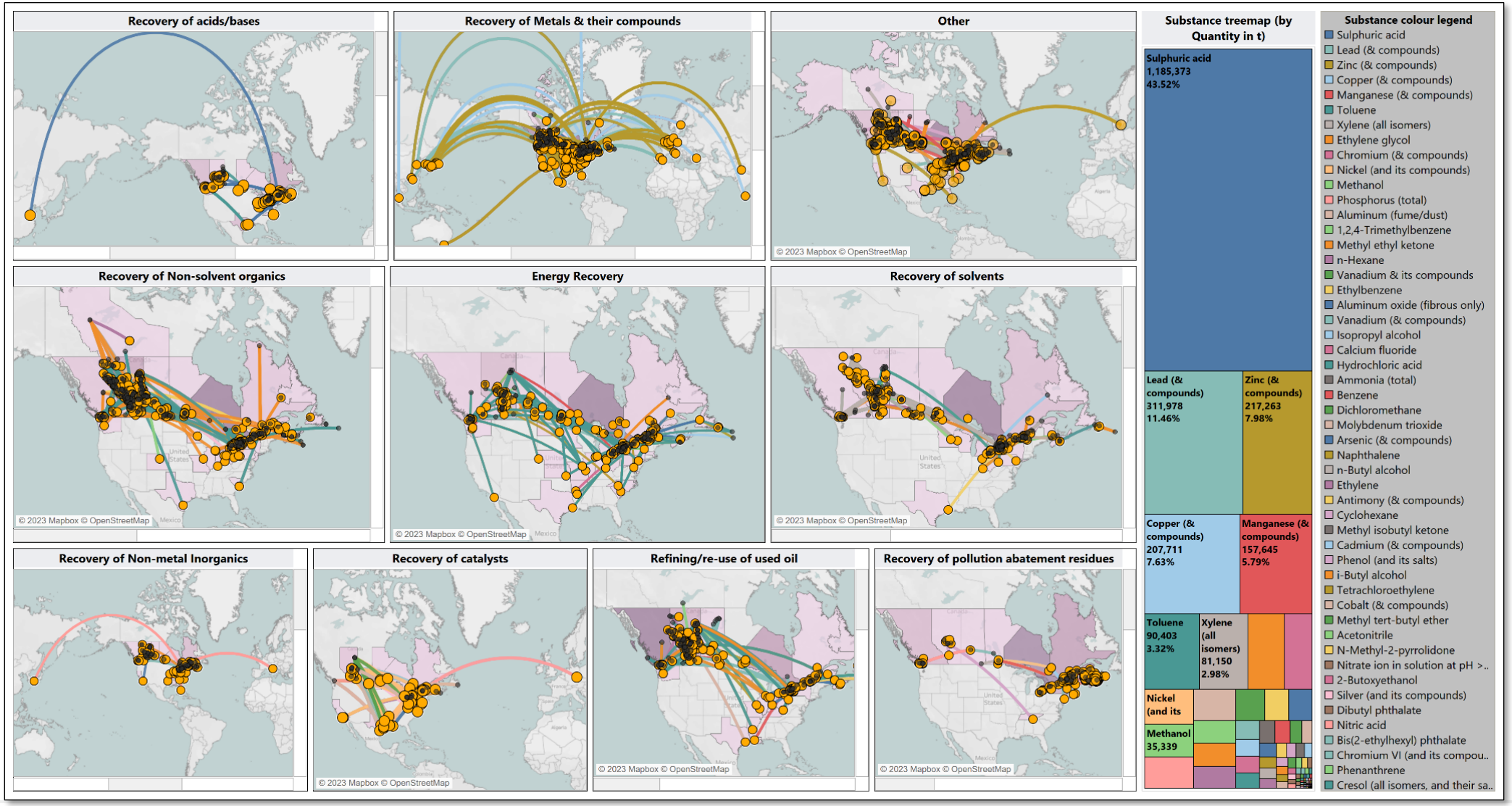


Overall – snapshot (on & offsite WM)



https://doi.org/10.1080/10962247.2024.2377327

Recycling: where from/to? (2013-2021)



https://public.tableau.com/views/NPRIOff-sitetransferroutemaps2013-2021/Off-siteMasterforTableauPublic?:language=en-US&:sid=&:redirect=auth&:display_count=n&:origin=viz_share_link

How can we use these maps?

The Guardian

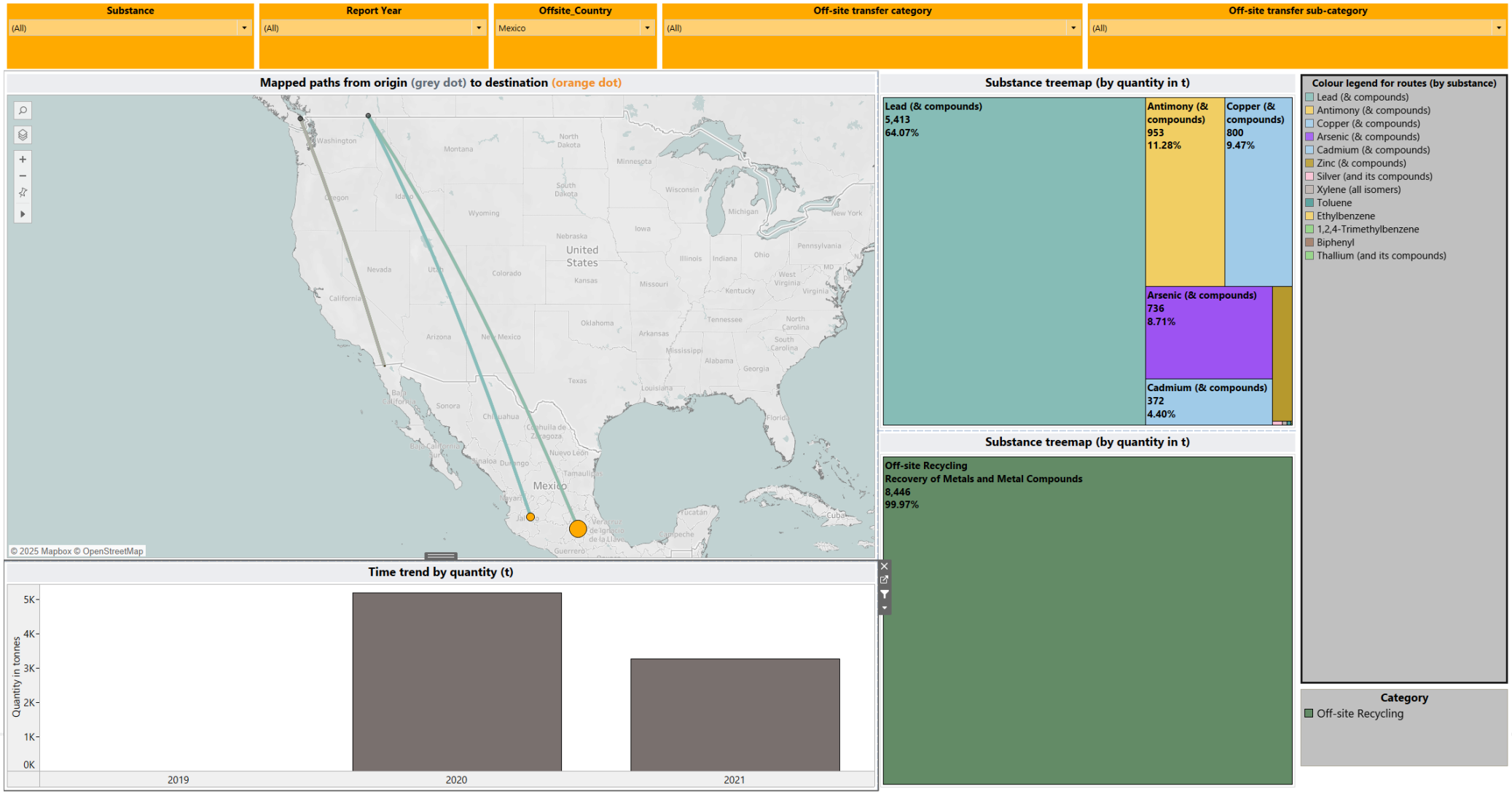
Int

‘A trash can for the US’: anger in Mexico and Canada over toxic waste shipments

The Zinc Nacional plant sits near a residential community in the Monterrey area. Photograph: Bernardo De Niz/Quinto Elemento Lab

As regards Mexico, some exporting companies that ship the waste advertise that they free the producers of the waste from their “cradle to grave” responsibility.

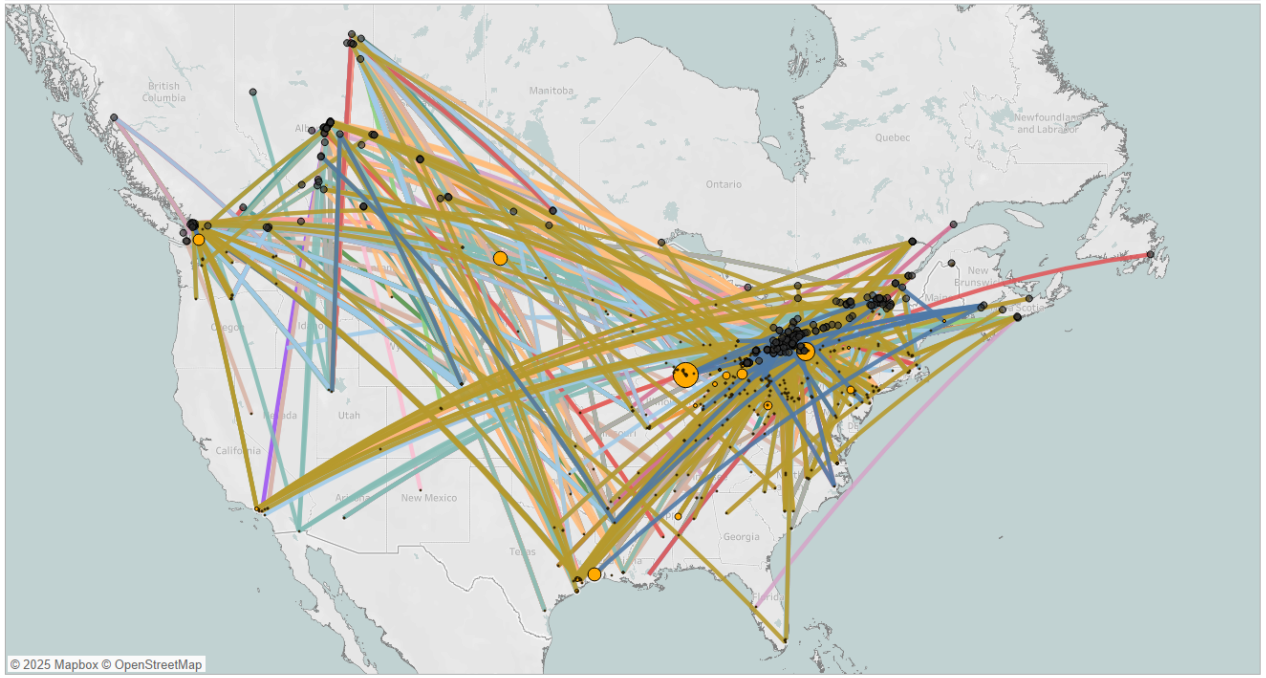
Exports to Mexico (2013-2021)



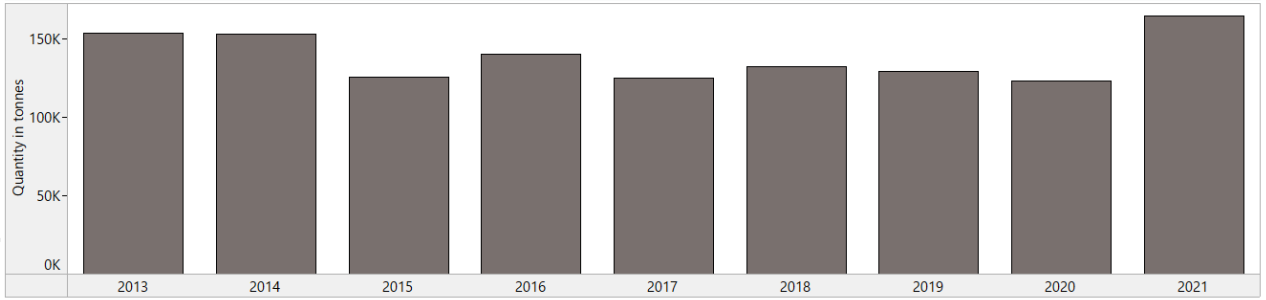
Exports to US (2013-2021)

Substance	Report Year	Offsite_Country	Off-site transfer category	Off-site transfer sub-category
(All)	(All)	United States	(All)	(All)

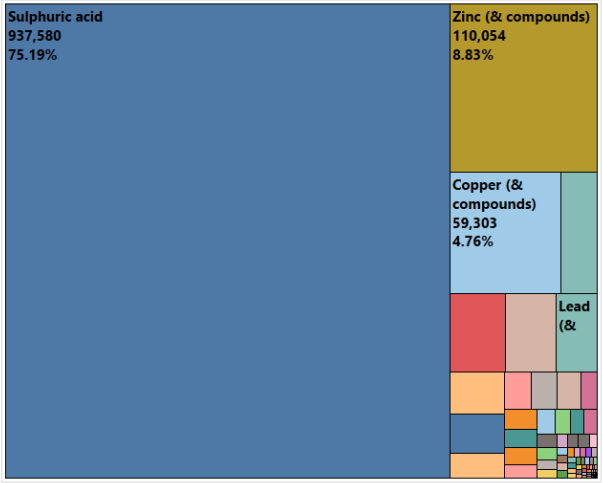
Mapped paths from origin (grey dot) to destination (orange dot)



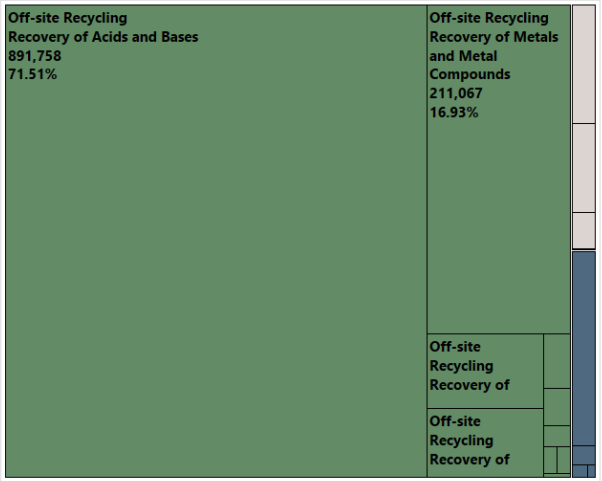
Time trend by quantity (t)



Substance treemap (by quantity in t)



Substance treemap (by quantity in t)



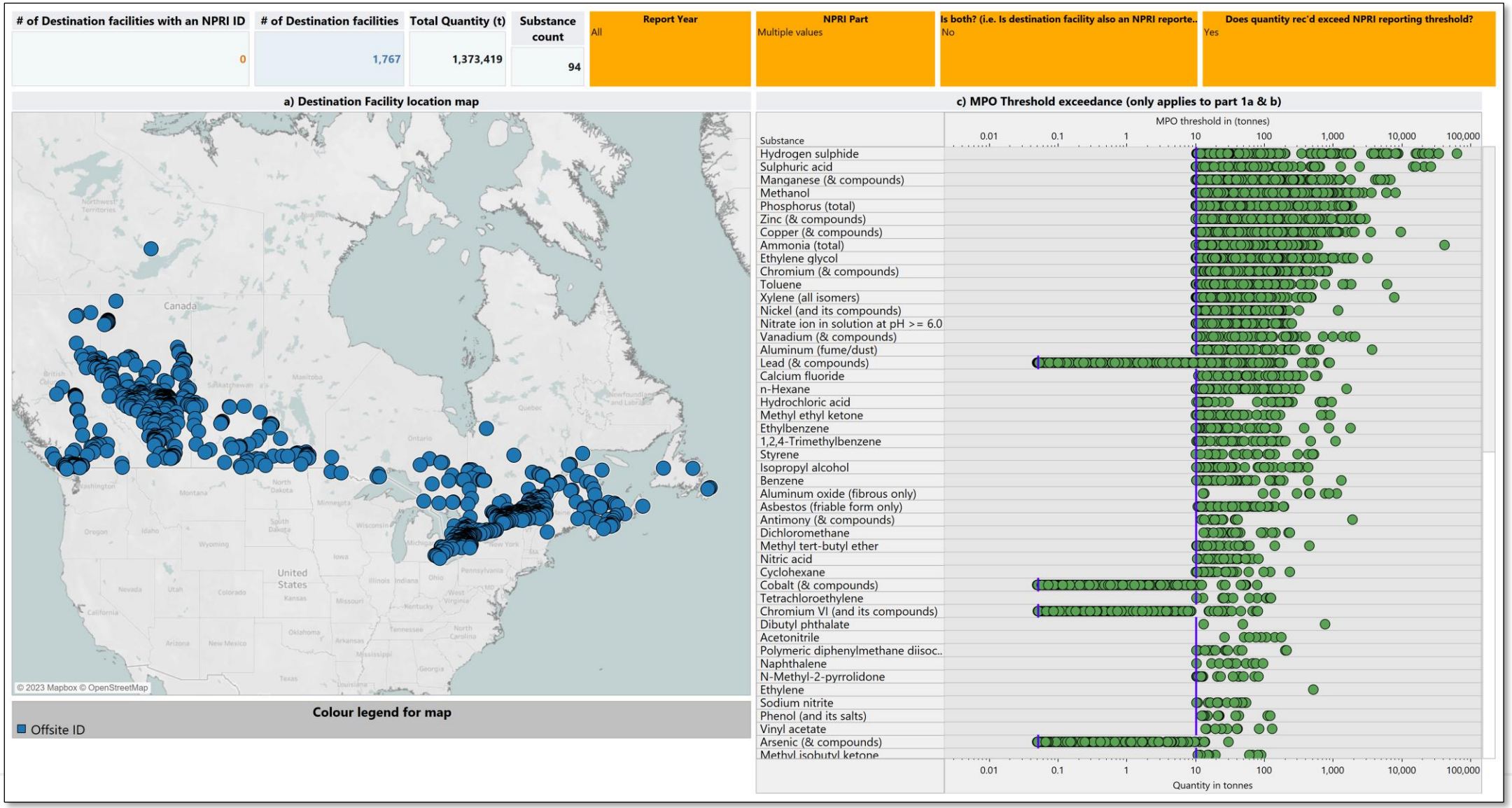
Colour legend for routes (by substance)

- Sulphuric acid
- Zinc (& compounds)
- Copper (& compounds)
- Vanadium (& compounds)
- Manganese (& compounds)
- Aluminum (fume/dust)
- Lead (& compounds)
- Nickel (and its compounds)
- Aluminum oxide (fibrous only)
- Sodium fluoride
- Phosphorus (total)
- Xylene (all isomers)
- Molybdenum trioxide
- Chromium (& compounds)
- Ethylene glycol
- Toluene
- Methyl ethyl ketone
- Nitric acid
- Isopropyl alcohol
- Methanol
- Hydrochloric acid
- Calcium fluoride
- Ammonia (total)
- 1,2,4-Trimethylbenzene
- n-Butyl alcohol
- Ethylbenzene
- Phenol (and its salts)
- Asbestos (friable form only)
- Methyl isobutyl ketone
- Silver (and its compounds)
- Cadmium (& compounds)
- Nitrate ion in solution at pH >= 6.0
- Cobalt (& compounds)
- Dichloromethane
- i-Butyl alcohol
- Mercury (and its compounds)
- 2-Butoxyethanol
- Arsenic (& compounds)
- Selenium (and its compounds)
- Chromium VI (and its compounds)
- Cresol (all isomers, and their salts)
- Dicyclopentadiene
- Antimony (& compounds)
- Methyl tert-butyl ether
- Dibutyl phthalate

Category

- Off-site Disposal
- Off-site Recycling
- Off-site Treatment

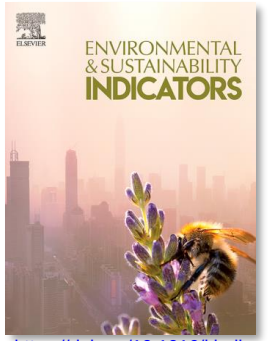
Facilities receiving ‘reportable’ amounts, but don’t repo



Uncertainty & Limitations

- Inherent NPRI limitations and uncertainty
  - FW to address Data quality: National Pollutant Release Inventory - Canada.ca
- Offsite destination data quality specifically:
  - duplicates from inconsistent facility names, addresses, etc.
  - Ownership changes hard to track, esp. in waste management sector.
  - Offsite ID not systematically linked to NPRI ID
- Opportunities for improvement are now being addressed

Part 2: Conduct advanced SDG analysis



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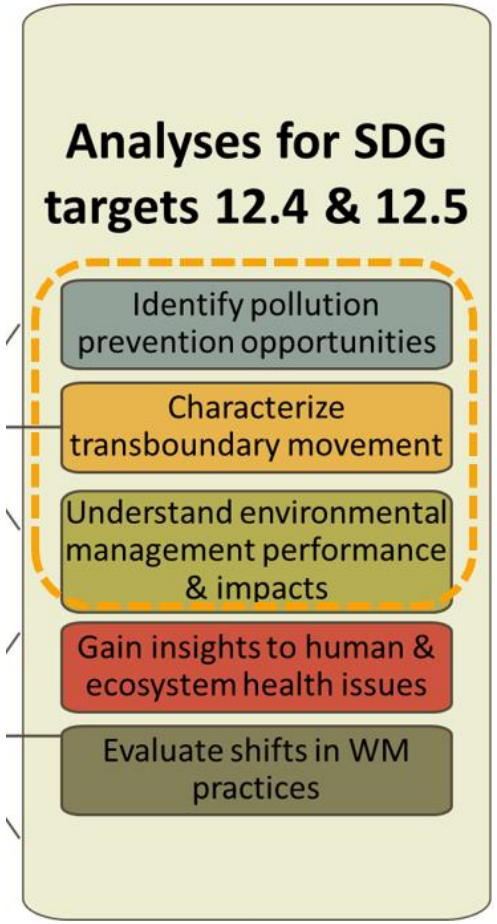
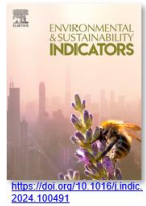


Two case studies:

1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (int'l), XBR (domestic)

2. Minamata Convention on Mercury (int'l)

Case study: Basel Convention

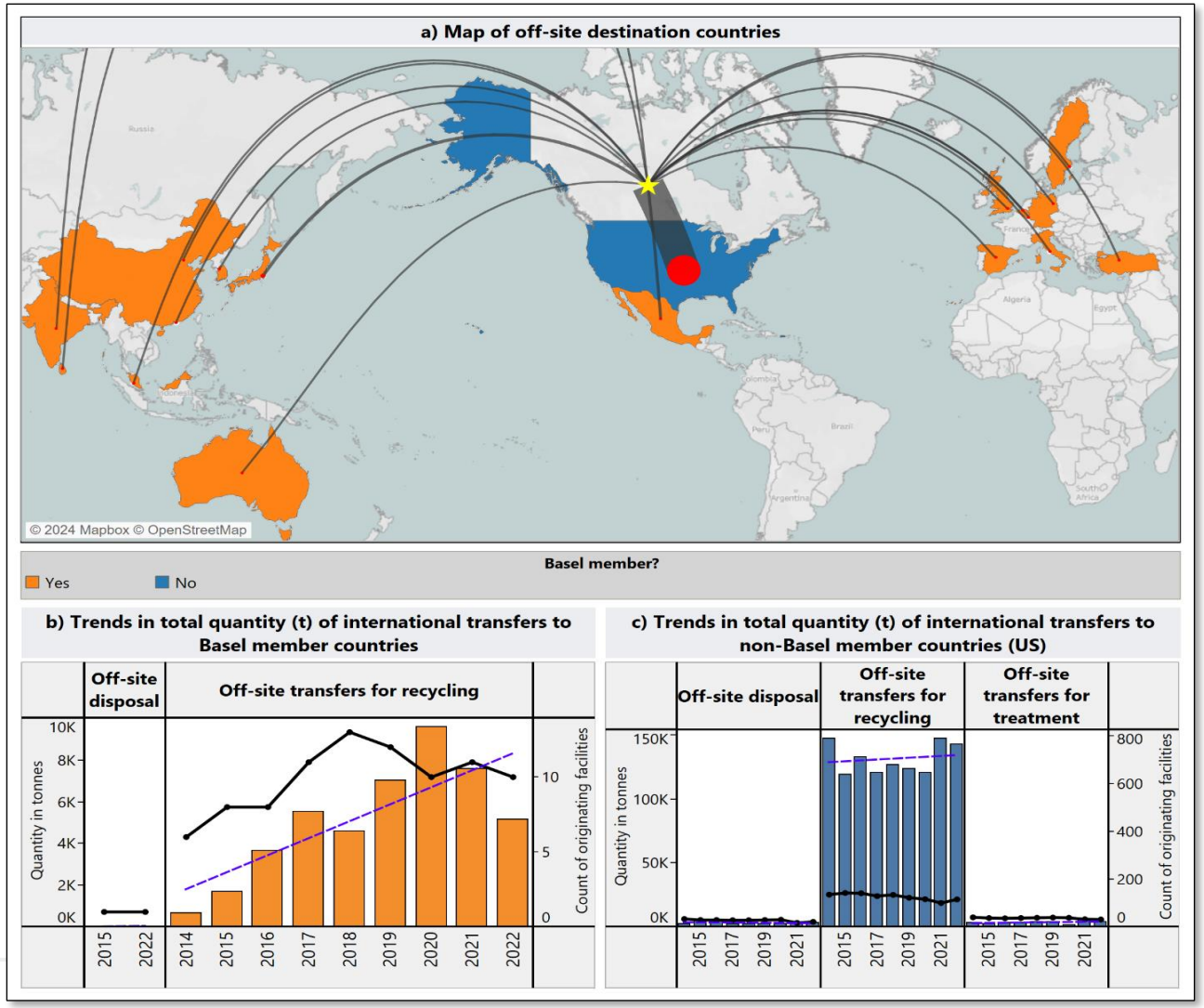


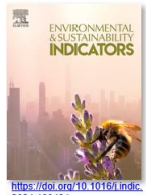
https://doi.org/10.1016/j.indic.2024.100491

- [Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal]
- Objectives:
  - minimize the generation of hazardous waste,
  - prevent the international movement to waste havens,
  - keep waste as close to the source as is practical.
- Canada = 100% reporting compliance

NPRI data show that:

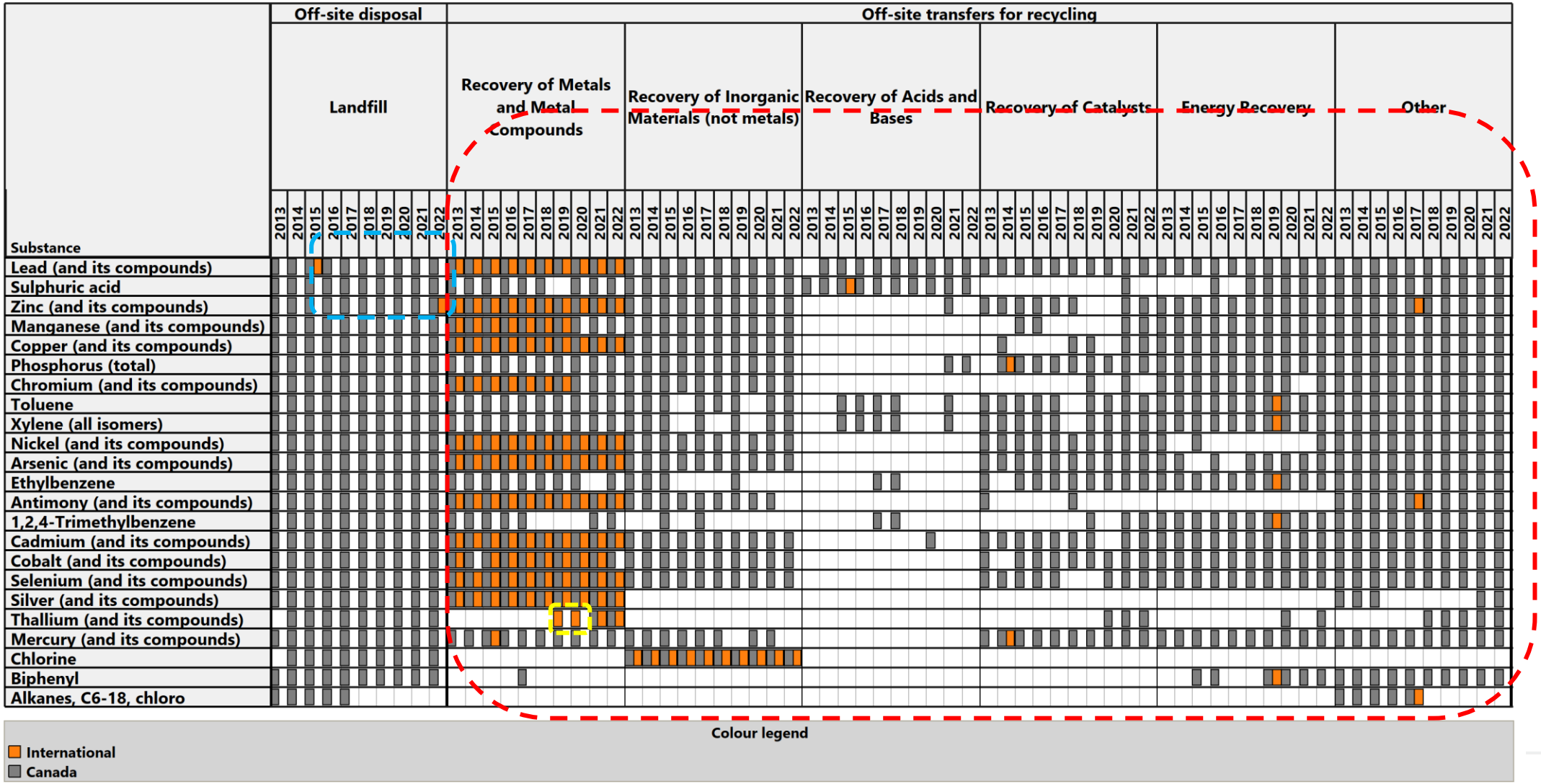
- All destinations are Basel-compliant
- But international transfers to Basel members are increasing.





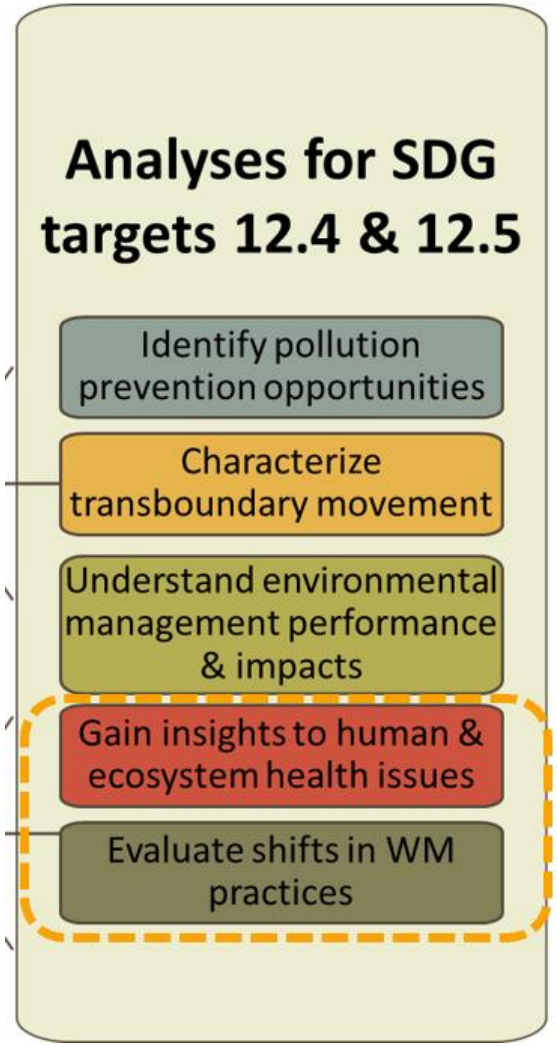
https://doi.org/10.1016/j.indic.2024.100491

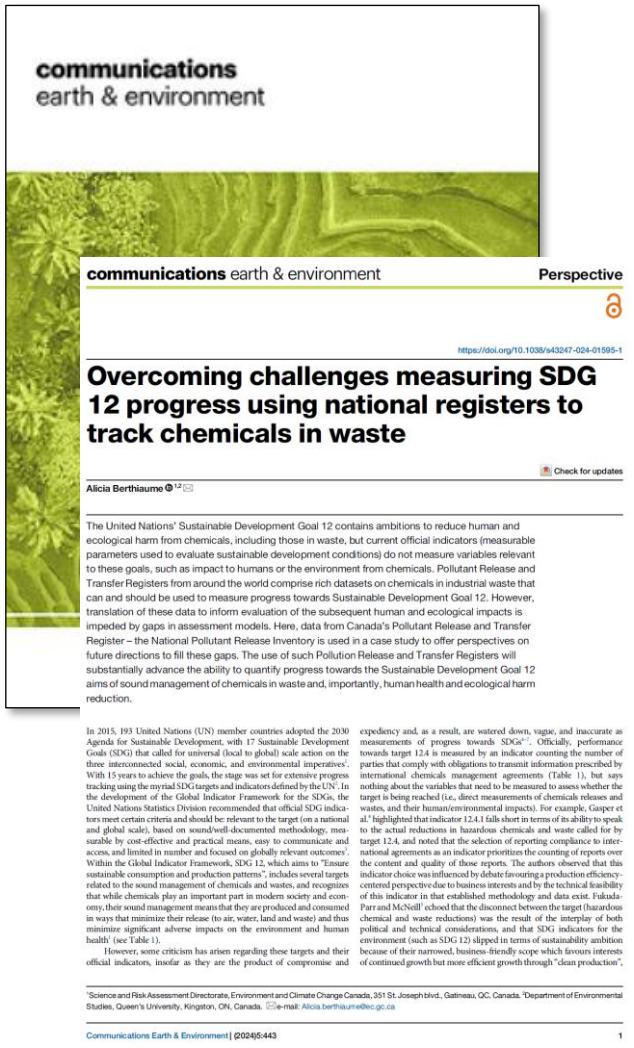
Keeping waste closest to source…



Part 3: More advanced SDG analysis

Hypothetical case study to identify and address challenges in understanding human health and environmental impact from pollutants in waste

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communications earth & environment Perspective

https://doi.org/10.1038/s43247-024-01595-1

Overcoming challenges measuring SDG 12 progress using national registers to track chemicals in waste

Check for updates

Alicia Berthiaume[1,2]

The United Nations' Sustainable Development Goal 12 contains ambitions to reduce human and ecological harm from chemicals, including those in waste, but current official indicators (measurable parameters used to evaluate sustainable development conditions) do not measure variables relevant to these goals, such as impact to humans or the environment from chemicals. Pollutant Release and Transfer Registers from around the world comprise rich datasets on chemicals in industrial waste that can and should be used to measure progress towards Sustainable Development Goal 12. However, translation of these data to inform evaluation of the subsequent human and ecological impacts is impeded by gaps in assessment models. Here, data from Canada's Pollutant Release and Transfer Register – the National Pollutant Release Inventory is used in a case study to offer perspectives on future directions to fill these gaps. The use of such Pollution Release and Transfer Registers will substantially advance the ability to quantify progress towards the Sustainable Development Goal 12 aims of sound management of chemicals in waste and, importantly, human health and ecological harm reduction.

In 2015, 193 United Nations (UN) member countries adopted the 2030 Agenda for Sustainable Development, with 17 Sustainable Development Goals (SDG) that called for universal (local to global) scale action on the three interconnected social, economic, and environmental imperatives[1]. With 15 years to achieve the goals, the stage was set for extensive progress tracking using the myriad SDG targets and indicators defined by the UN[2]. In the development of the Global Indicator Framework for the SDGs, the United Nations Statistics Division recommended that official SDG indicators meet certain criteria and should be: relevant to the target (on a national and global scale), based on sound/well-documented methodology, measurable by cost-effective and practical means, easy to communicate and access, and limited in number and focused on globally relevant outcomes[3]. Within the Global Indicator Framework, SDG 12, which aims to "Ensure sustainable consumption and production patterns", includes several targets related to the sound management of chemicals and wastes, and recognizes that while chemicals play an important part in modern society and economy, their sound management means that they are produced and consumed in ways that minimize their release (to air, water, land and waste) and thus minimize significant adverse impacts on the environment and human health' (see Table 1).

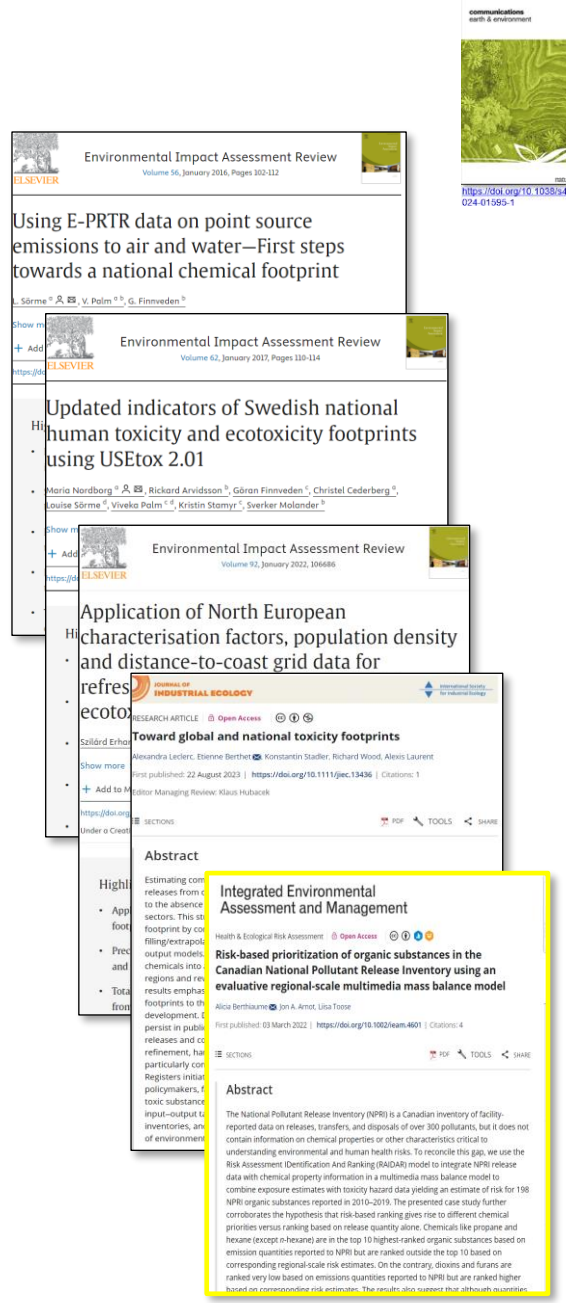
However, some criticism has arisen regarding these targets and their official indicators, insofar as they are the product of compromise and expediency and, as a result, are watered down, vague, and inaccurate as measurements of progress towards SDGs[4–7]. Officially, performance towards target 12.4 is measured by an indicator counting the number of parties that comply with obligations to transmit information prescribed by international chemicals management agreements (Table 1), but says nothing about the variables that need to be measured to assess whether the target is being reached (i.e., direct measurements of chemicals releases and wastes, and their human/environmental impacts). For example, Gasper et al.[8] highlighted that indicator 12.4.1 falls short in terms of its ability to speak to the actual reductions in hazardous chemicals and waste called for by target 12.4, and noted that the selection of reporting compliance to international agreements as an indicator prioritizes the counting of reports over the content and quality of those reports. The authors observed that this indicator choice was influenced by debate favouring a production efficiency-centered perspective due to business interests and by the technical feasibility of this indicator in that established methodology and data exist. Fukuda-Parr and McNeill[9] echoed that the disconnect between the target (hazardous chemical and waste reductions) was the result of the interplay of both political and technical considerations, and that SDG indicators for the environment (such as SDG 12) slipped in terms of sustainability ambition because of their narrowed, business-friendly scope which favours interests of continued growth but more efficient growth through "clean production",

[1]Science and Risk Assessment Directorate, Environment and Climate Change Canada, 351 St. Joseph blvd., Gatineau, QC, Canada. [2]Department of Environmental Studies, Queen's University, Kingston, ON, Canada. e-mail: Alicia.berthiaume@ec.gc.ca

https://doi.org/10.1038/s43247-024-01595-1

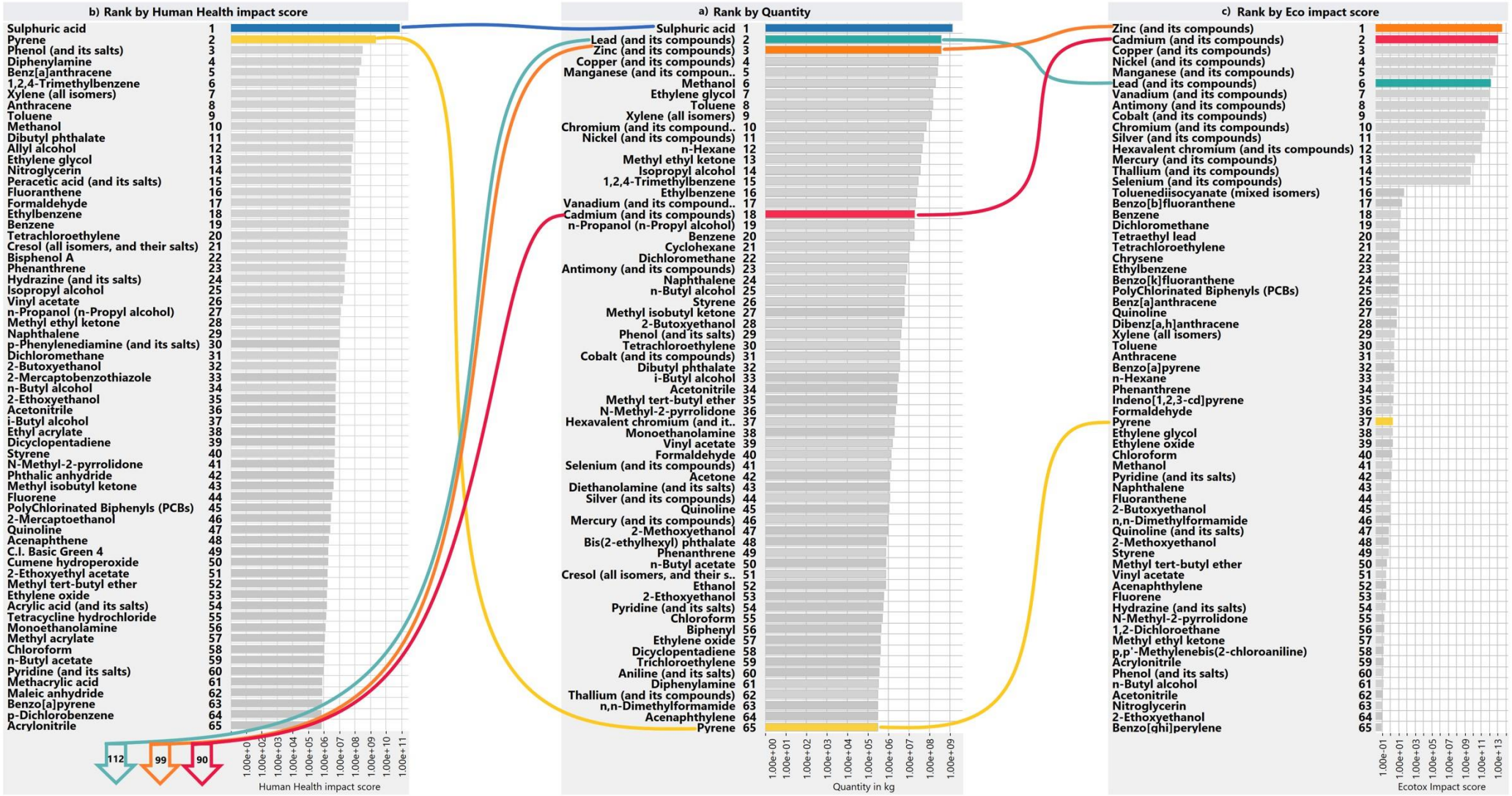
Insight to human/eco impacts

- Burgeoning approach = PRTRs (release data) + LCIA (Lifecycle Impact Assessment models)
- But PRTR waste data don't fit:
  - US EPAs Risk Screening Environmental Indicators (RSEI)
  - SETAC's USEtox (only air, water, land, only humans and freshwater organism impacts)
  - EXIOBASE, an environmentally-extended multi-region input/output model (only supply-use emissions, not emissions from waste)
- But, hypothetically…. Use characterization factor for "emissions to land" as a proxy for disposals??

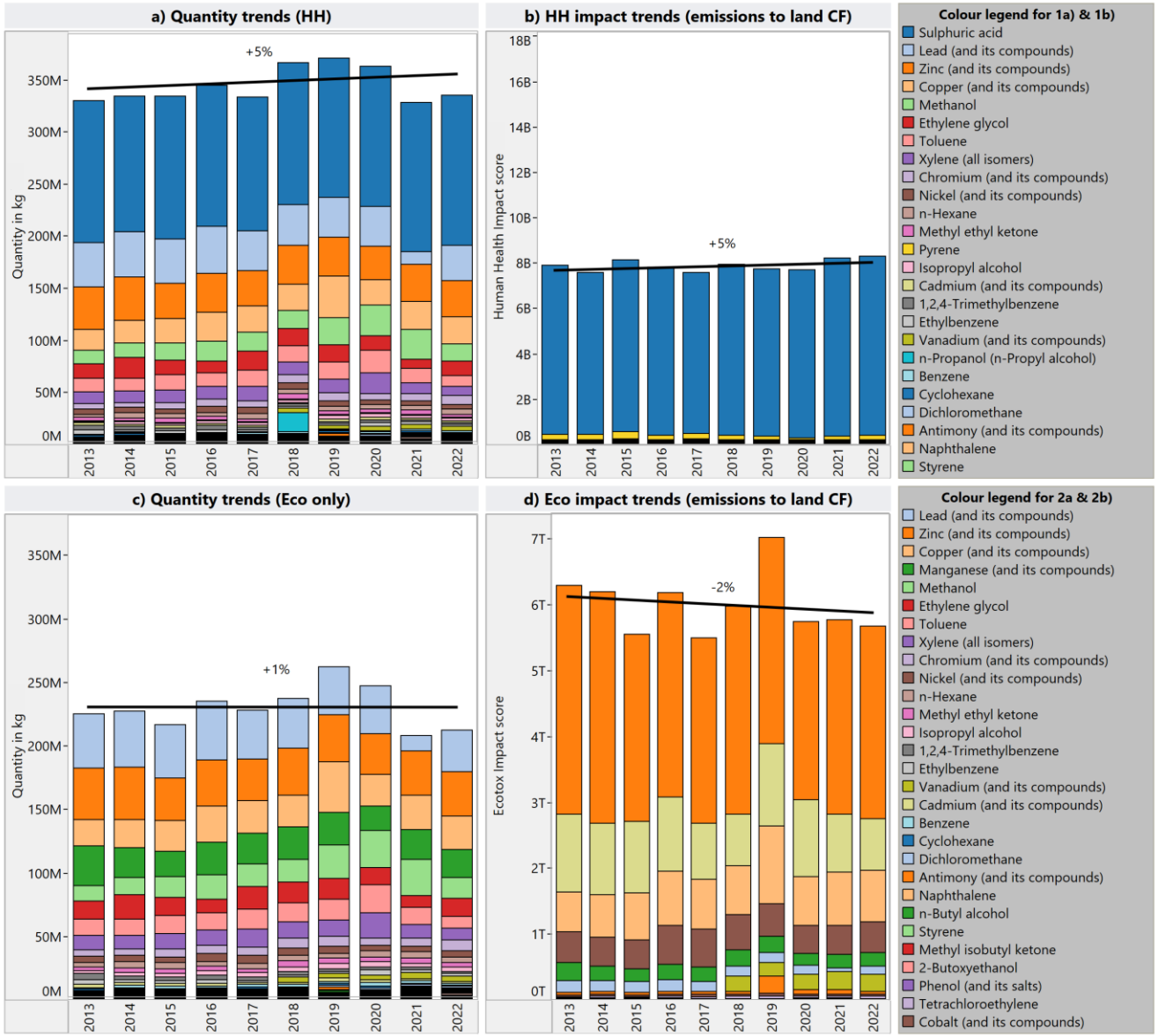


https://setac.onlinelibrary.wiley.com/doi/full/10.1002/ieam.4601

Hypothetical: Use characterization factor for “emissions to land” as a proxy for waste impacts (2013-2022)



Trends by quantity contrast trends by impact



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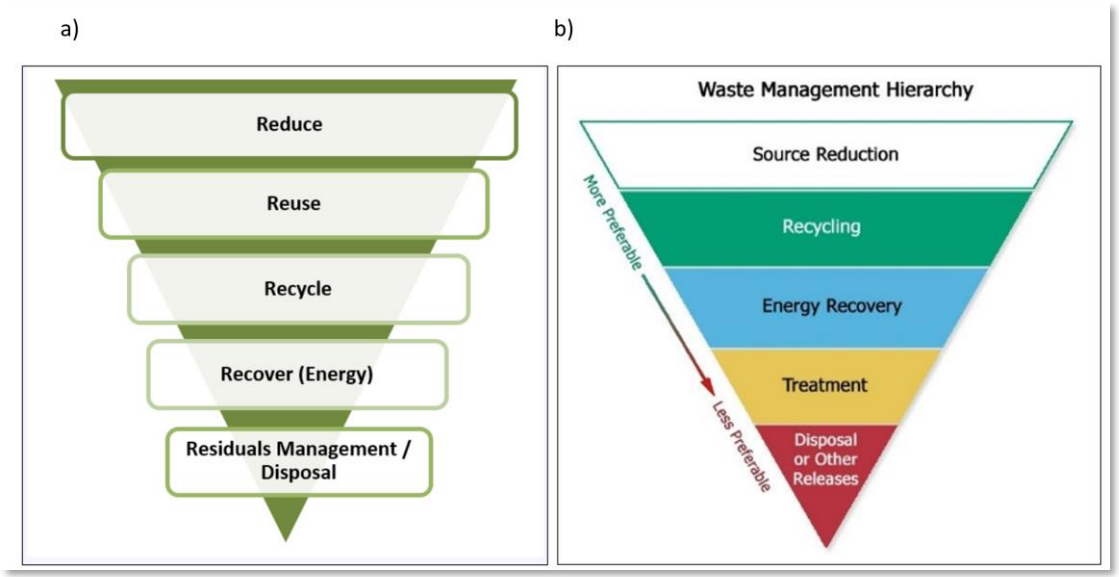
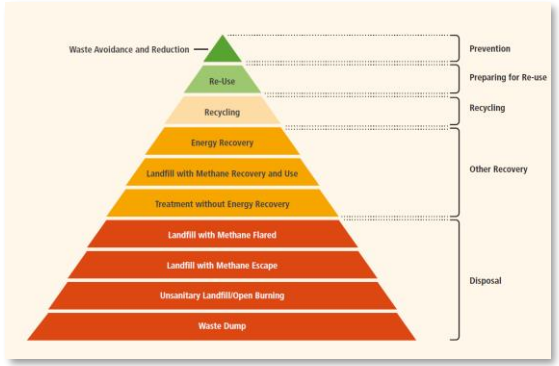
https://doi.org/10.1038/s43247-024-01595-1

Shifts to “preferred” WM : lacking consensus



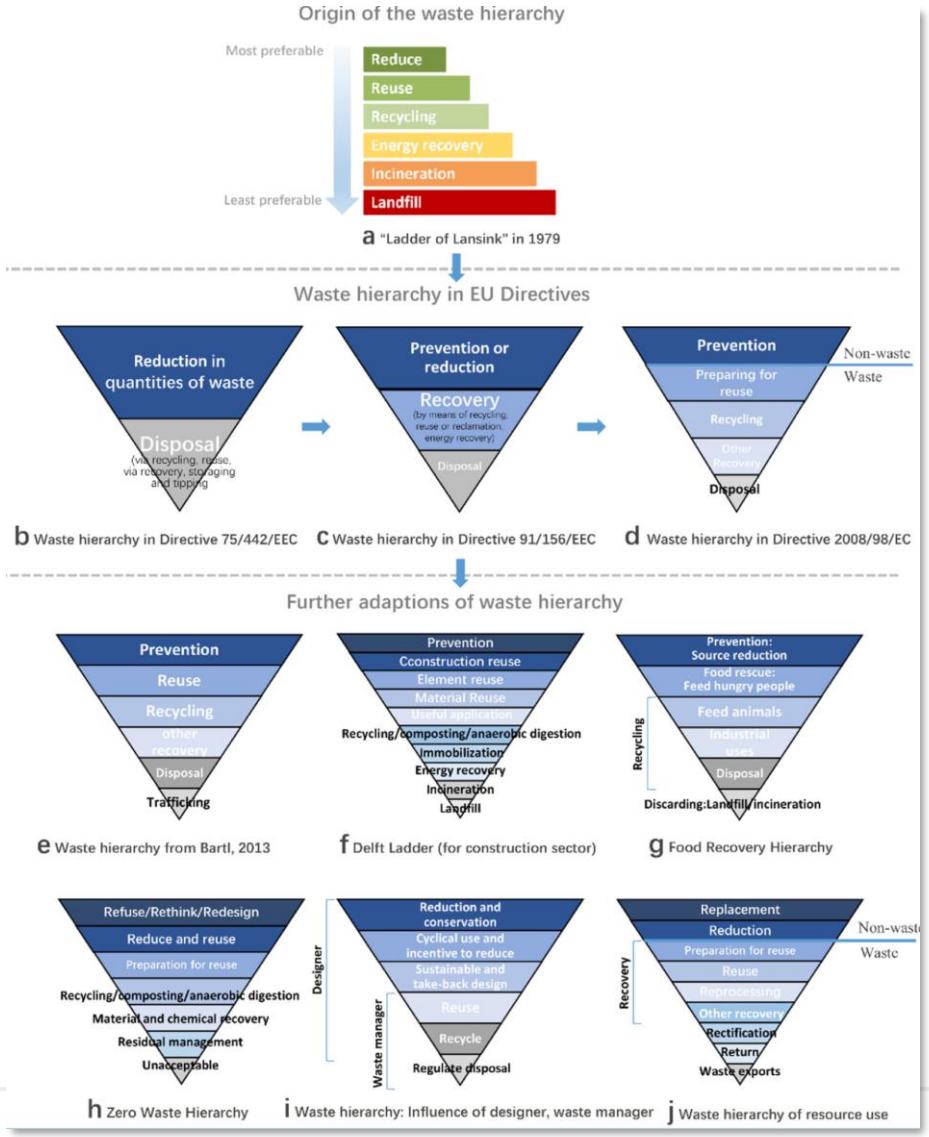
Source: CCME
https://ccme.ca/en/res/state_waste_mgmt_in_canada-secured.pdf

Source: US EPA
https://www.epa.gov/trinationalanalysis/waste-management



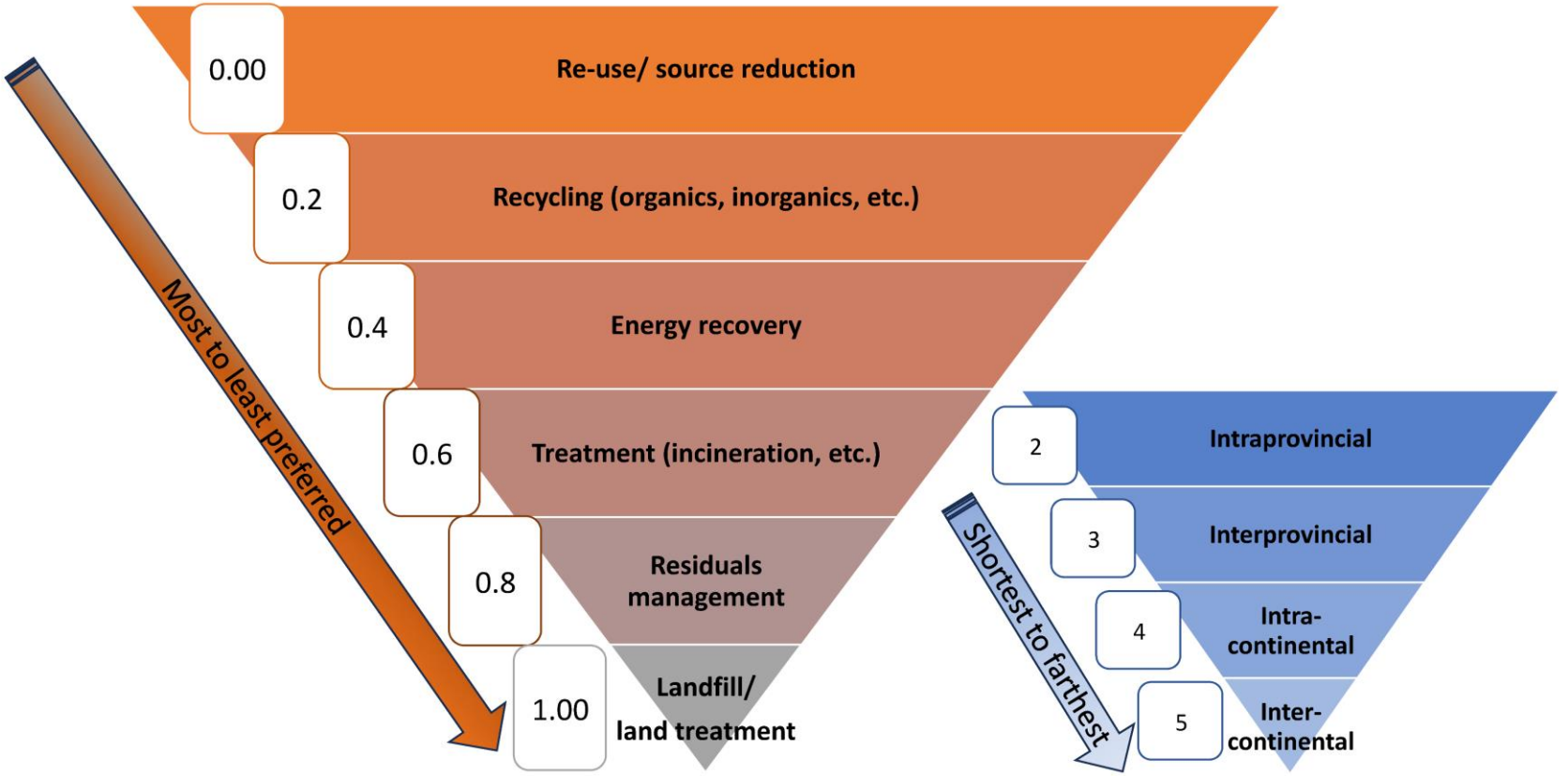
Source European Commission, 2008: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2008:312:FULL

Source: US EPA https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy

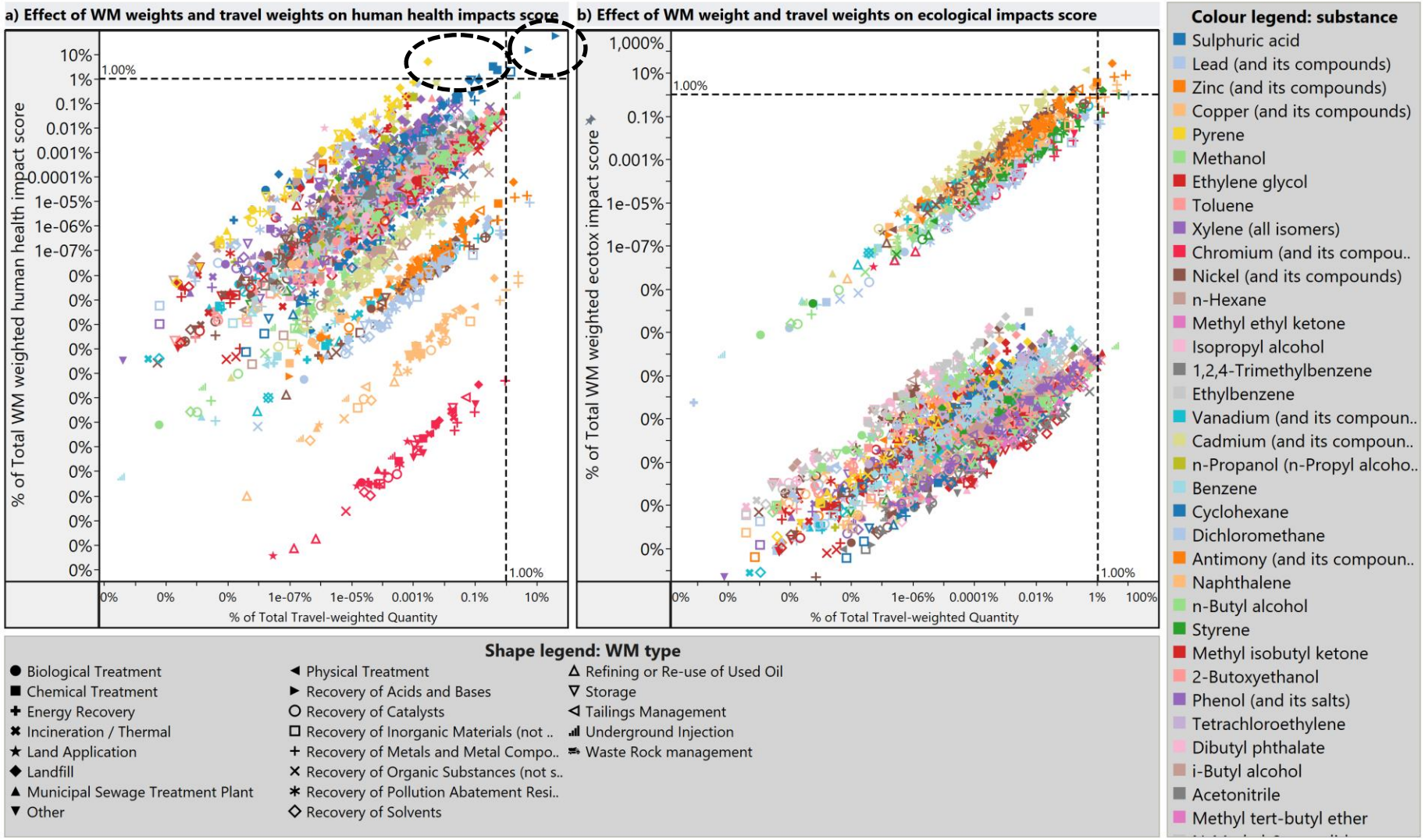


Source: Zhang et el., 2022: https://doi.org/10.1016/j.scitotenv.2021.149892

Better proxy, but still hypothetical…



New views accounting for WM type and travel distance



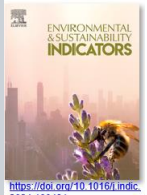
Conclusion

Goal: raise awareness of NPRI transfers and disposal data availability and content & present case studies showcasing the usefulness of the NPRI as a direct indicator of SDG 12.

https://doi.org/10.1080/10962247.2024.2377327

Re: Transboundary movement and environmental policy performance -The findings challenge the premise that progress in the current SDG 12.4 indicator also leads to progress on overall SDG 12.4 waste-related aims.

Re: human health/eco impacts - model advancements needed to fully interpret PRTR data



https://doi.org/10.1016/j.indic.2024.100491

NPRI can complement existing official indicators to show these more detailed stories, and better guide decision-making to correct course. To fully do so, model advancements are needed.

https://doi.org/10.1038/s43247-024-01585-1

This sets a precedent for connecting PRTRs to SDG 12 progress can be a template for other public audiences to do so.