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Use of National Emissions Inventory and SPECIATE data for development of regulatory reporting requirements for volatile organic compounds in Canada

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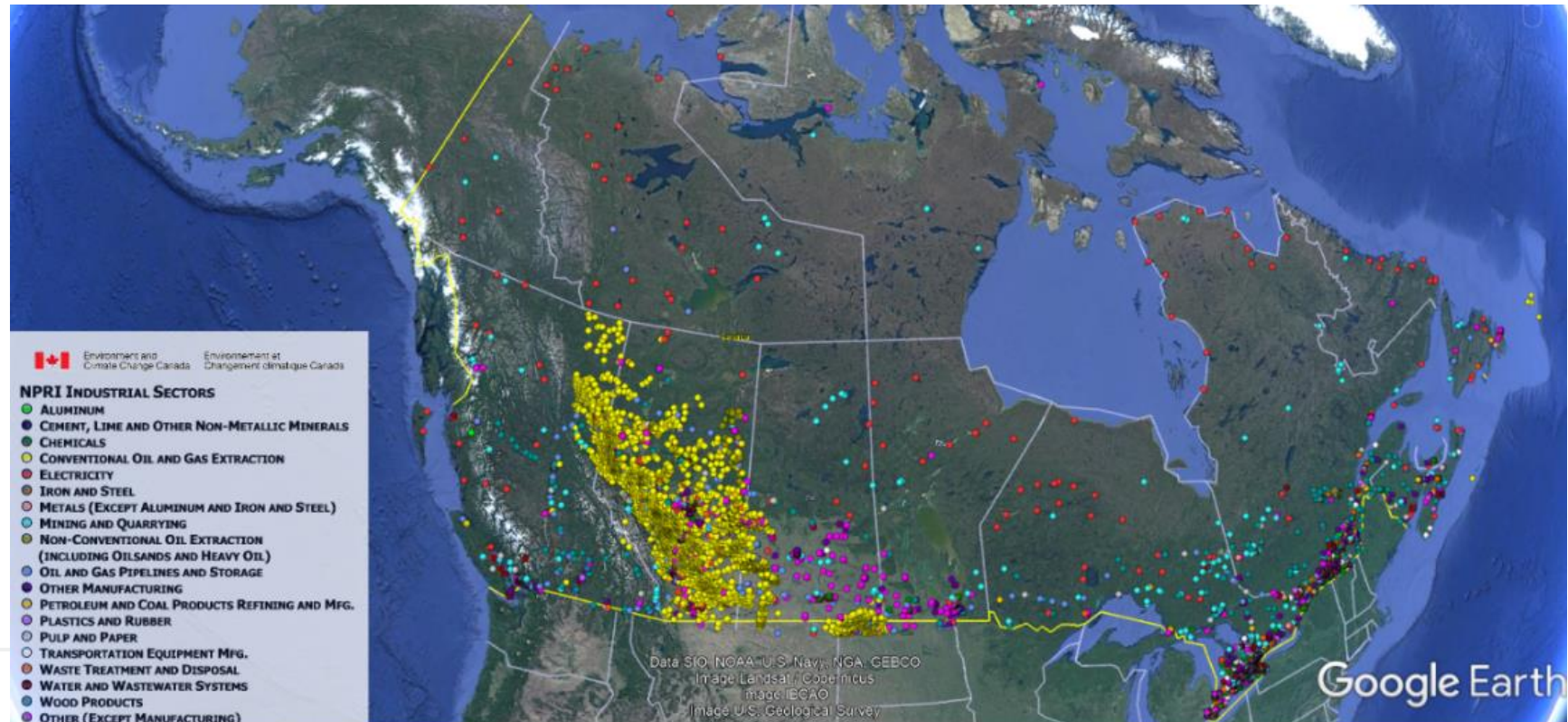
Canada 

The National Pollutant Release Inventory (NPRI)

- Canada's legislated, publicly accessible inventory of pollutant releases (to air, water and land), disposals and recycling
- Information collected from 7,000+ facilities on 300+ substances since 1993
- Mandatory annual reporting under the Canadian Environmental Protection Act



canada.ca/npri



The NPRI substance list

- Lists 300+ substances and groups of substances
 - Toxic substances and substances of concern (e.g., CFCs, ammonia, hexavalent chromium, mercury, hexachlorobenzene)
 - Polycyclic aromatic compounds
 - Dioxins and furans
 - Criteria air contaminants (CO, NO_x, SO₂, TPM, PM₁₀, PM_{2.5} and total VOCs)
 - 62 volatile organic compounds (“speciated VOCs”)

Why and how speciated VOCs were added to NPRI

- NPRI's speciated VOCs list was created in 2003 to provide more detailed data on individual VOCs for air quality modelling
- We used SPECIATE 3.0 to create the original list and v. 4.4 to refine the list in 2018
- Selected species and reporting requirements were designed to
 - Capture facilities releasing large quantities of total VOCs
 - Capture most common VOC species measured in ambient air in Canada
 - Capture the species with the greatest potential to contribute to the formation of ozone or particulate matter
 - Have ~80% of reported total VOCs broken down into individual VOCs

Reporting requirements for speciated VOCs

Facility requirements

A **facility** is required to report if

1. Total VOCs releases from the **facility** are ≥ 10 tonnes

AND

2. Releases of a speciated VOC from the **facility** are ≥ 1 tonne

Individual stack requirements ($\geq 50\text{m}$)

1. Total VOCs releases from the **facility** are ≥ 10 tonnes

AND

2. Releases of a speciated VOC from the **facility** are ≥ 1 tonne

AND

3. Total VOCs releases from the **stack** are ≥ 5 tonnes

Goals

- Simplify reporting requirements for reporting facilities and data users
- Capture significant releases of individual VOCs where total VOC releases are less than 10 tonnes
- Reduce “burden of reporting” very small stack quantities and focus reporting on stacks that are releasing significant quantities of speciated VOCs
- Minimal increase in reporting burden

Analysis

- Canada does not have a nation-wide, process-level inventory of air emissions from facilities and individual stacks
- We used total VOC emissions from the 2014 US National Emissions Inventory and SPECIATE 5.0
- Sensitivity analyses used to determine how changes to thresholds would affect indicators of data quality and reporting burden

Indicators

1. Facility release coverage: quantity of facility releases with thresholds as a percentage of facility releases with no thresholds
2. Stack release coverage: quantity of stack releases with thresholds as a percentage of stack releases with no thresholds
3. Facility coverage: number of facilities required to report a VOC with thresholds as percentage of all facilities releasing that VOC
4. Stack coverage: number of stacks required to report a VOC with thresholds as a percentage of all stacks releasing that VOC
5. Predicted number of facility reports
6. Predicted number of stack reports

$$N_{\text{Predicted}} = \left(\frac{N_{\text{US Changed}}}{N_{\text{US Previous}}} \right) \times N_{\text{Canada 2016}}$$

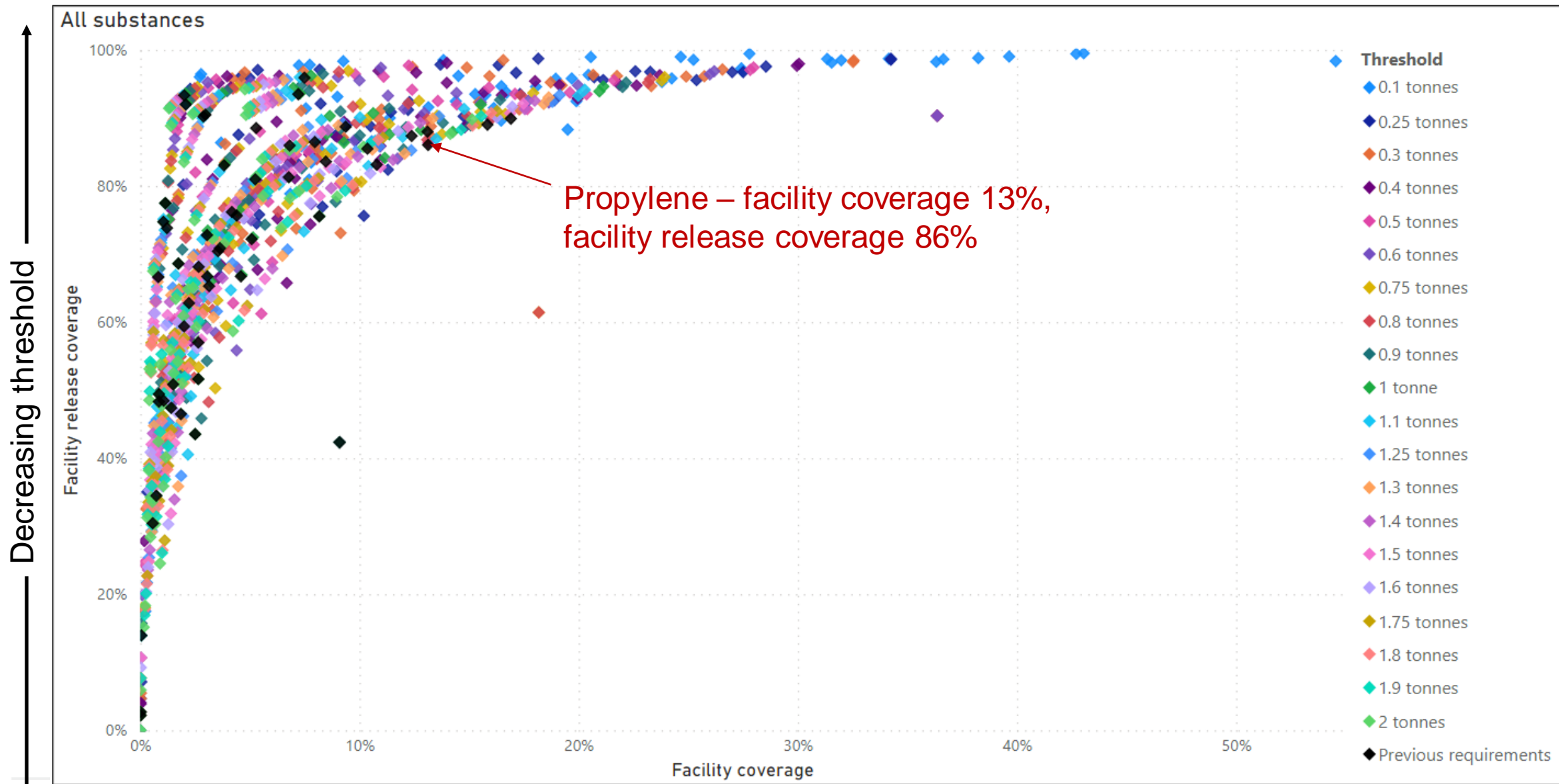
$N_{\text{Predicted}}$ = Predicted number of reports in Canada with changed requirements

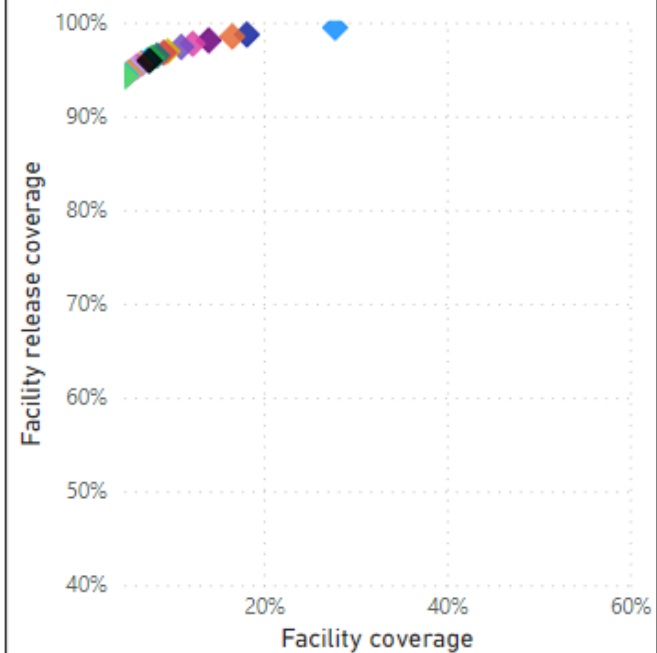
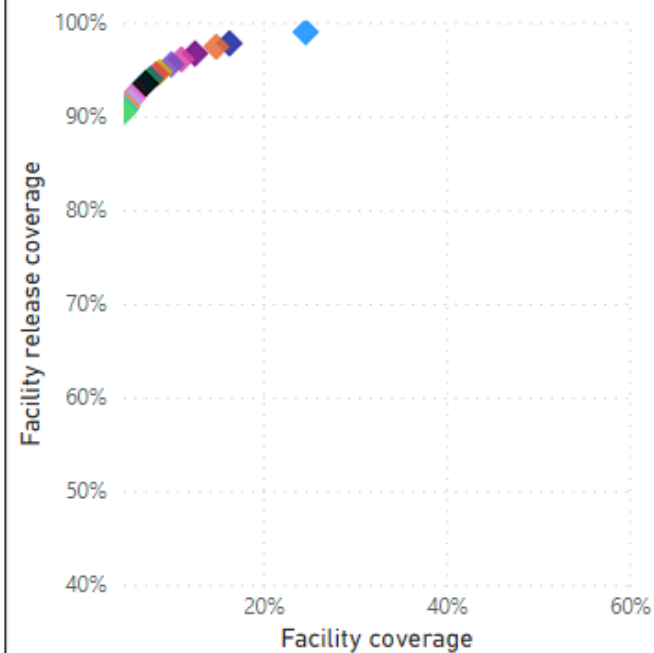
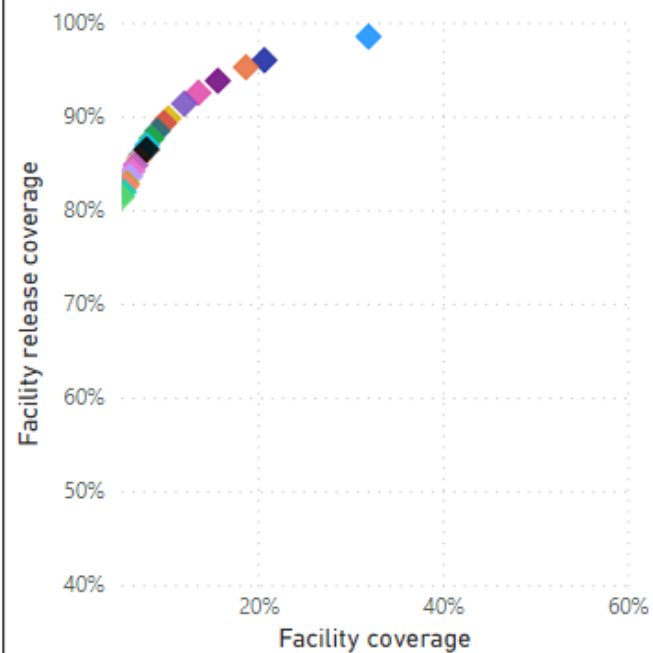
$N_{\text{US Changed}}$ = Number of US reports with changed requirements

$N_{\text{US Previous}}$ = Number of US reports with previous requirements

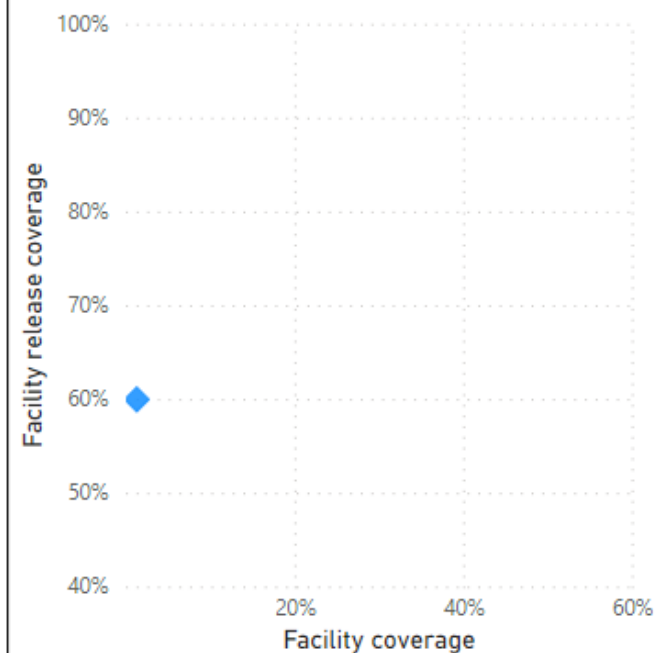
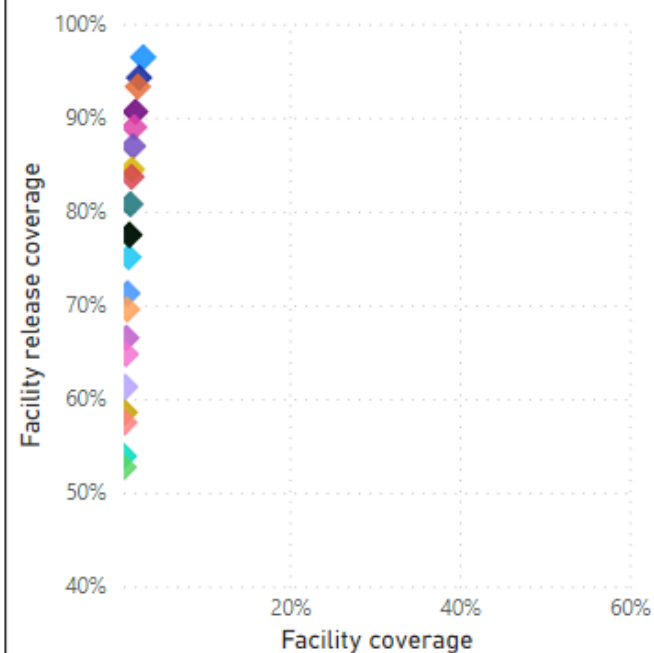
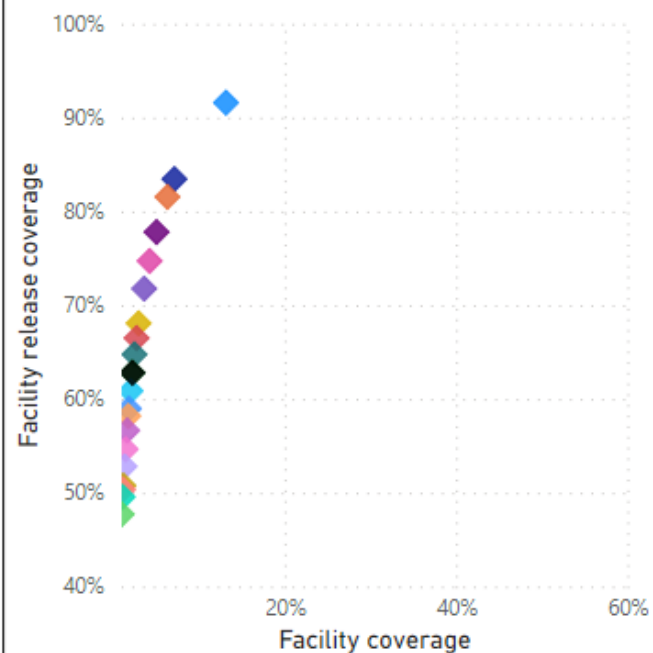
$N_{\text{Canada 2016}}$ = Number of Canadian reports in 2016

Results – facility thresholds

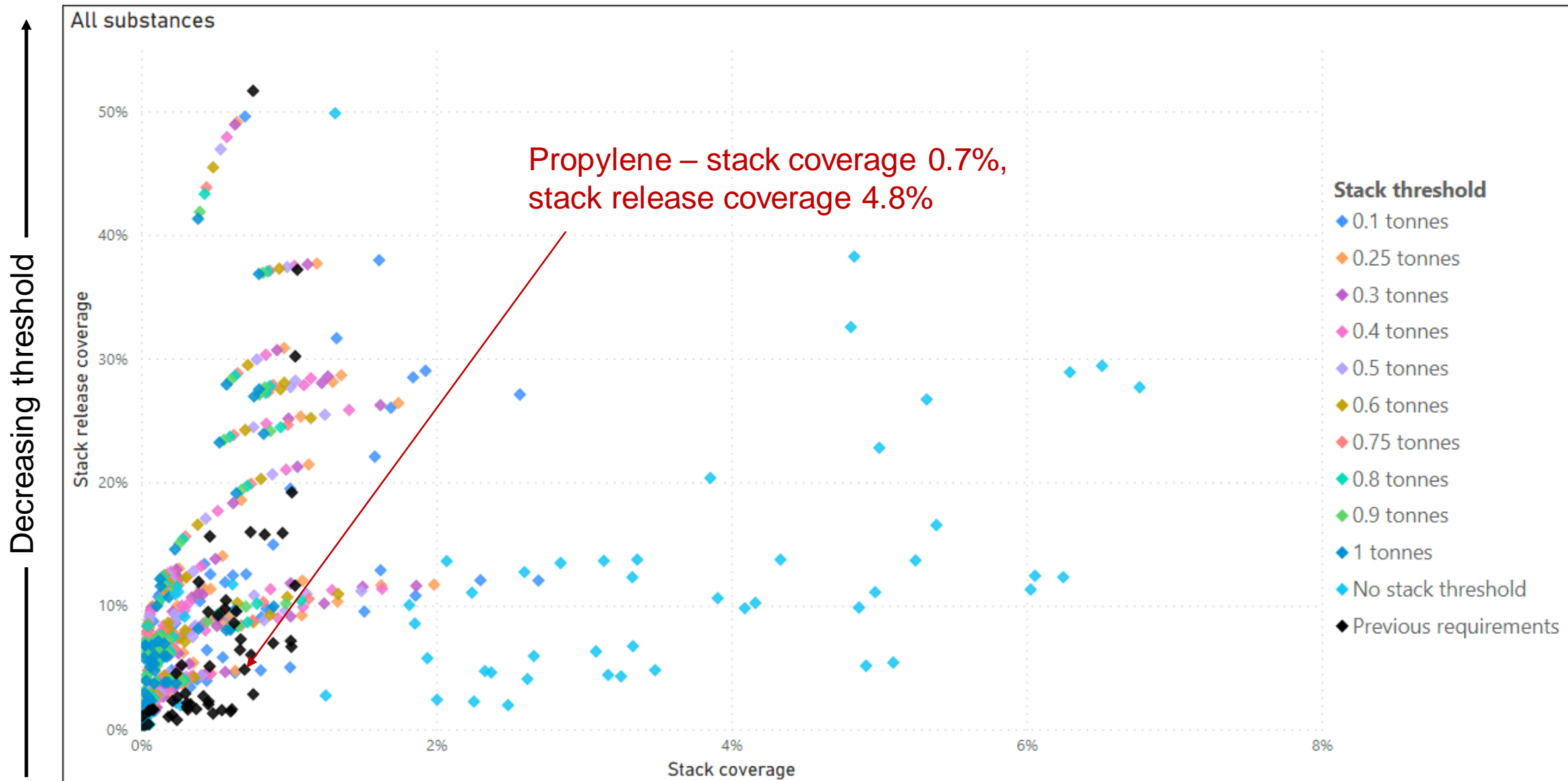


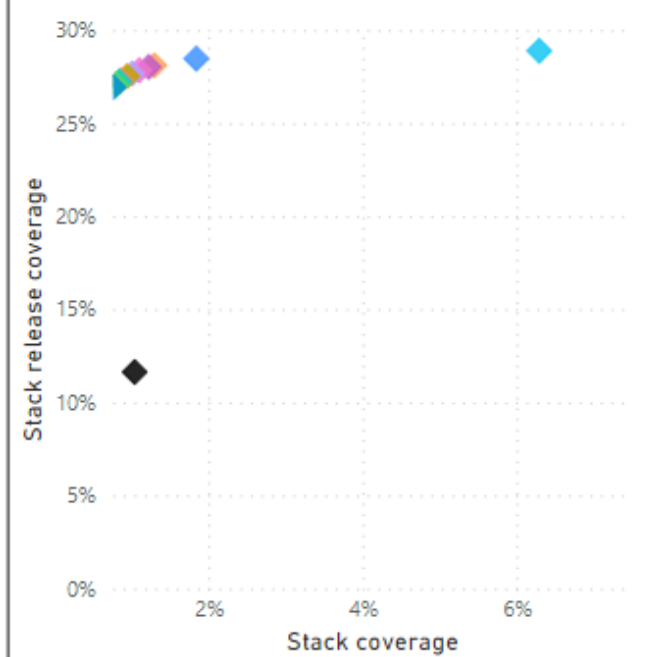
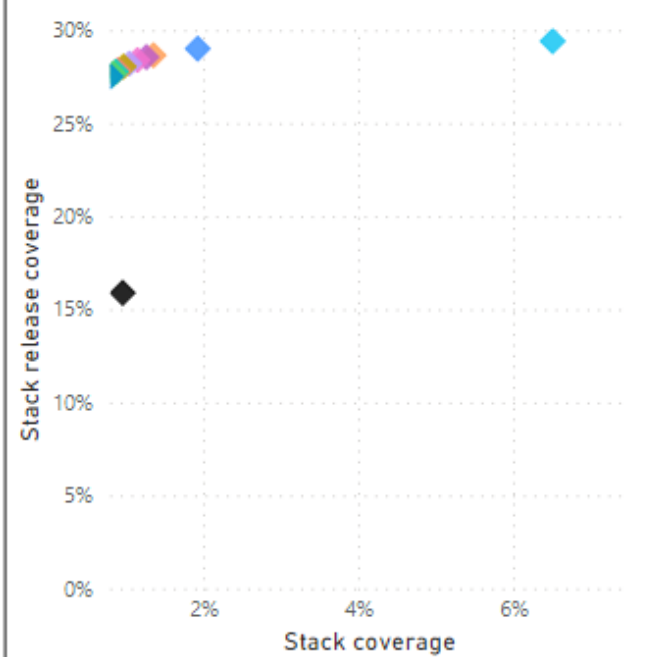
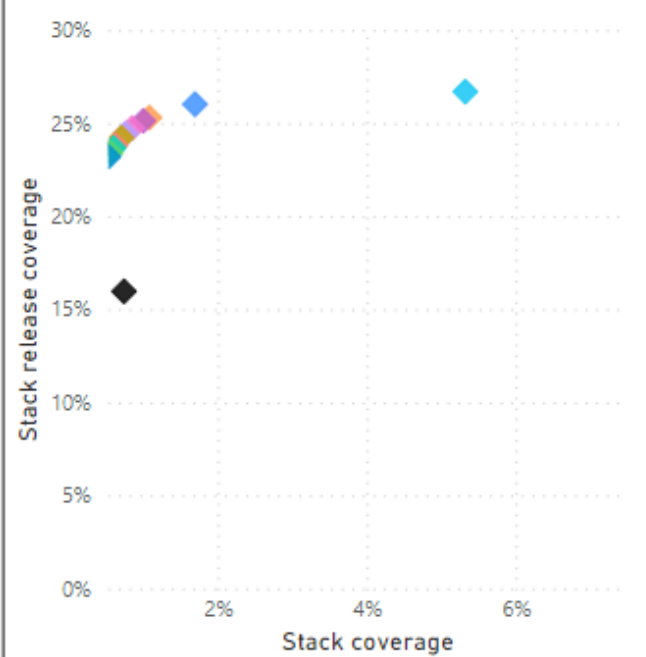
Ethanol**Methanol****Benzene****Facility threshold**

- ◆ 0.1 tonnes
- ◆ 0.25 tonnes
- ◆ 0.3 tonnes
- ◆ 0.4 tonnes
- ◆ 0.5 tonnes
- ◆ 0.6 tonnes
- ◆ 0.75 tonnes
- ◆ 0.8 tonnes
- ◆ 0.9 tonnes
- ◆ 1 tonne
- ◆ 1.1 tonnes
- ◆ 1.25 tonnes
- ◆ 1.3 tonnes
- ◆ 1.4 tonnes
- ◆ 1.5 tonnes
- ◆ 1.6 tonnes
- ◆ 1.75 tonnes
- ◆ 1.8 tonnes
- ◆ 1.9 tonnes
- ◆ 2 tonnes
- ◆ Previous requirements

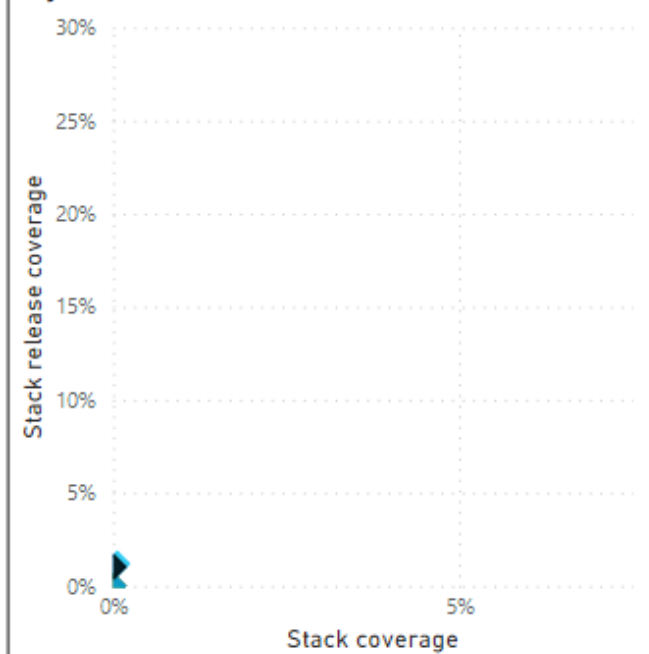
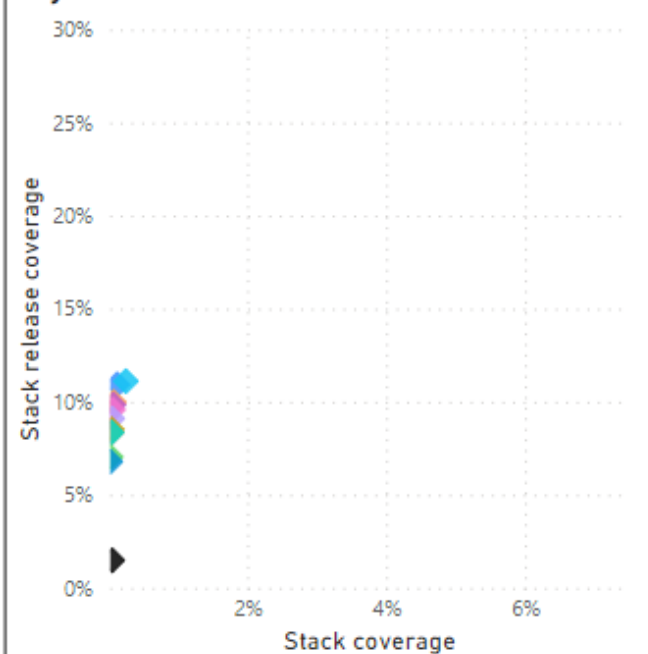
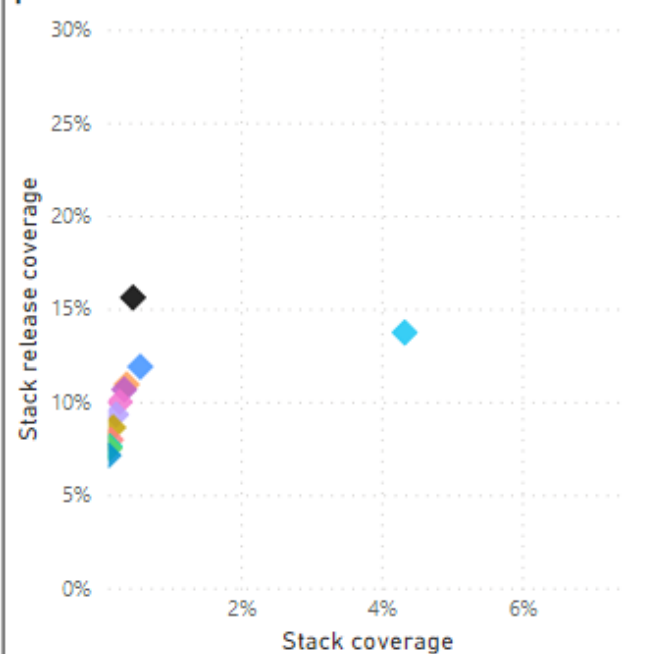
Cyclohexene (all isomers)**Myrcene****p-Dichlorobenzene**

Results – stack thresholds



Ethanol**Methanol****Benzene****Stack threshold**

- ◆ 0.1 tonnes
- ◆ 0.25 tonnes
- ◆ 0.3 tonnes
- ◆ 0.4 tonnes
- ◆ 0.5 tonnes
- ◆ 0.6 tonnes
- ◆ 0.75 tonnes
- ◆ 0.8 tonnes
- ◆ 0.9 tonnes
- ◆ 1 tonnes
- ◆ No stack threshold
- ◆ Previous requirements

Cyclohexene (all isomers)**Myrcene****p-Dichlorobenzene**

Change to facility requirements

Previous facility requirements

A **facility** is required to report if

1. Total VOCs releases from the **facility** are ≥ 10 tonnes

AND

2. Releases of a speciated VOC from the **facility** are ≥ 1 tonne

Changed facility requirements

A **facility** is required to report if

1. Releases of a speciated VOC from the **facility** are ≥ 1 tonne

Change to stack requirements

Previous individual stack requirements (≥50m)

1. Total VOCs releases from the **facility** are ≥10 tonnes

AND

2. Releases of a speciated VOC from the **facility** are ≥1 tonne

AND

3. Total VOCs releases from the **stack** are ≥5 tonnes

Changed individual stack requirements (≥25m)

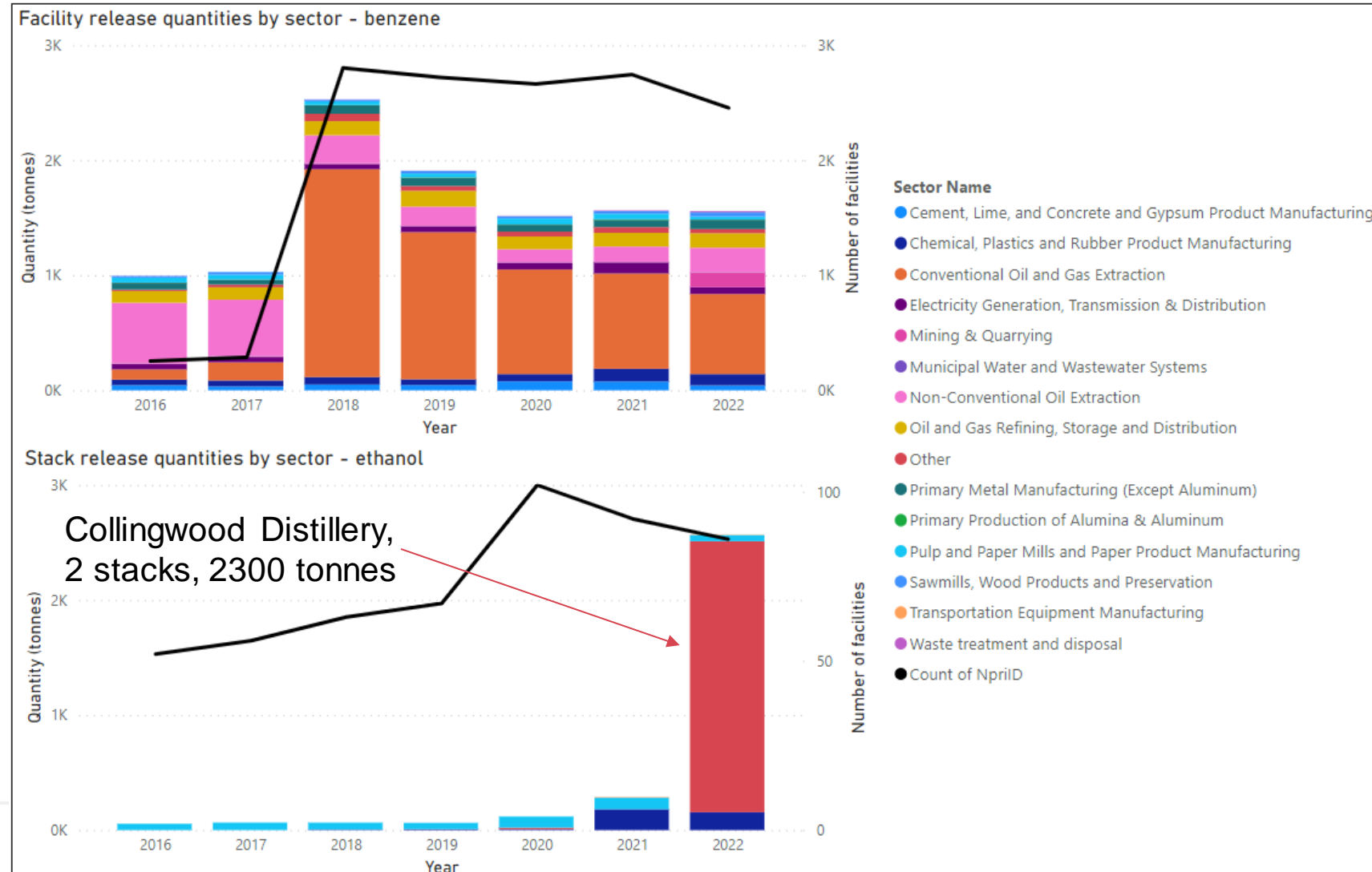
1. Releases of a speciated VOC from the **facility** are ≥1 tonne

AND

2. Releases of a speciated VOC from the **stack** are ≥0.25 tonne

Predicted vs. reported

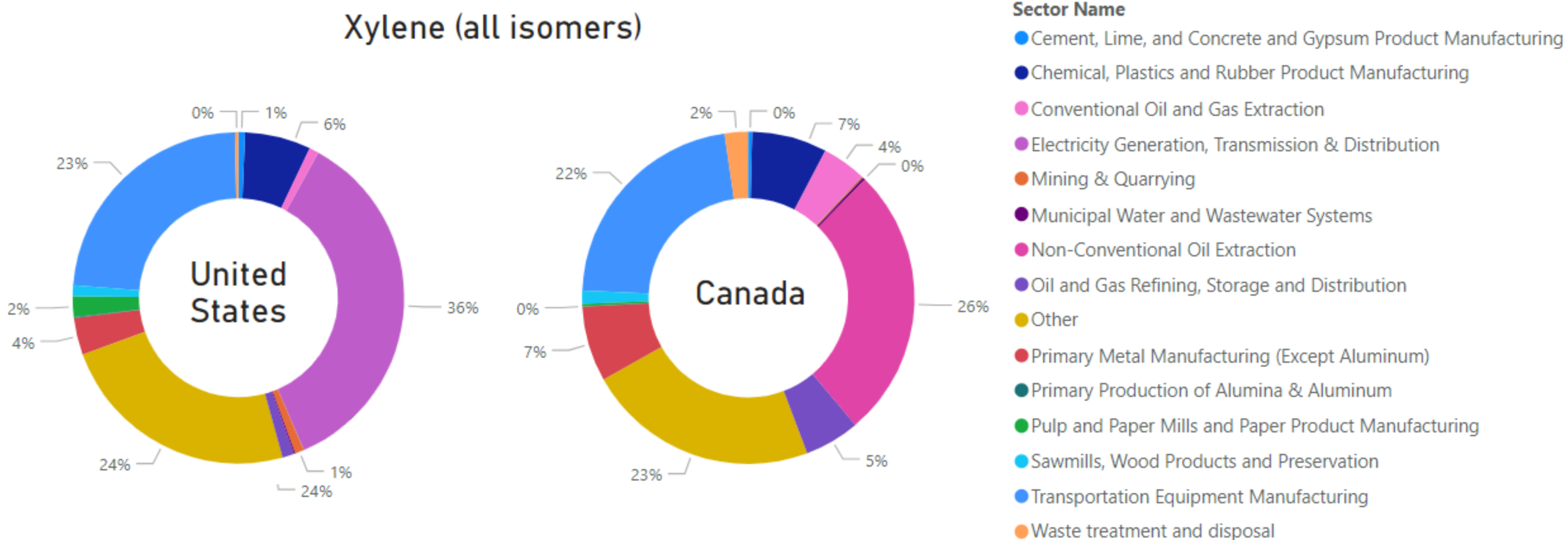
Indicator	Predicted	Reported
Facility releases	+7%	-6.5%
Number of facility reports	+8%	-1.7%
Stack releases	+111%	+3.7%
Number of stack reports	+22%	+26%



Challenges and uncertainties

- Differences between industrial activities in Canada and the US
 - Canadian oil sands facilities
- Differences in reporting requirements between NEI and NPRI

Xylene (all isomers)



Next steps

- Development of estimation methods, particularly for oil sands facilities
- Further refinement of listed species
- Further analysis of predicted vs. reported with a few years of reviewed data
- Evaluation of the impacts of the changes and further refinements as needed



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Thank you!

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