

The background features a large, faint watermark of the United States Environmental Protection Agency (EPA) logo. The logo is circular, with the words "UNITED STATES ENVIRONMENTAL PROTECTION AGENCY" around the perimeter. In the center is a stylized flower with three leaves and a sun-like shape above it.

How TRI Data are Used by Academics and Other Researchers

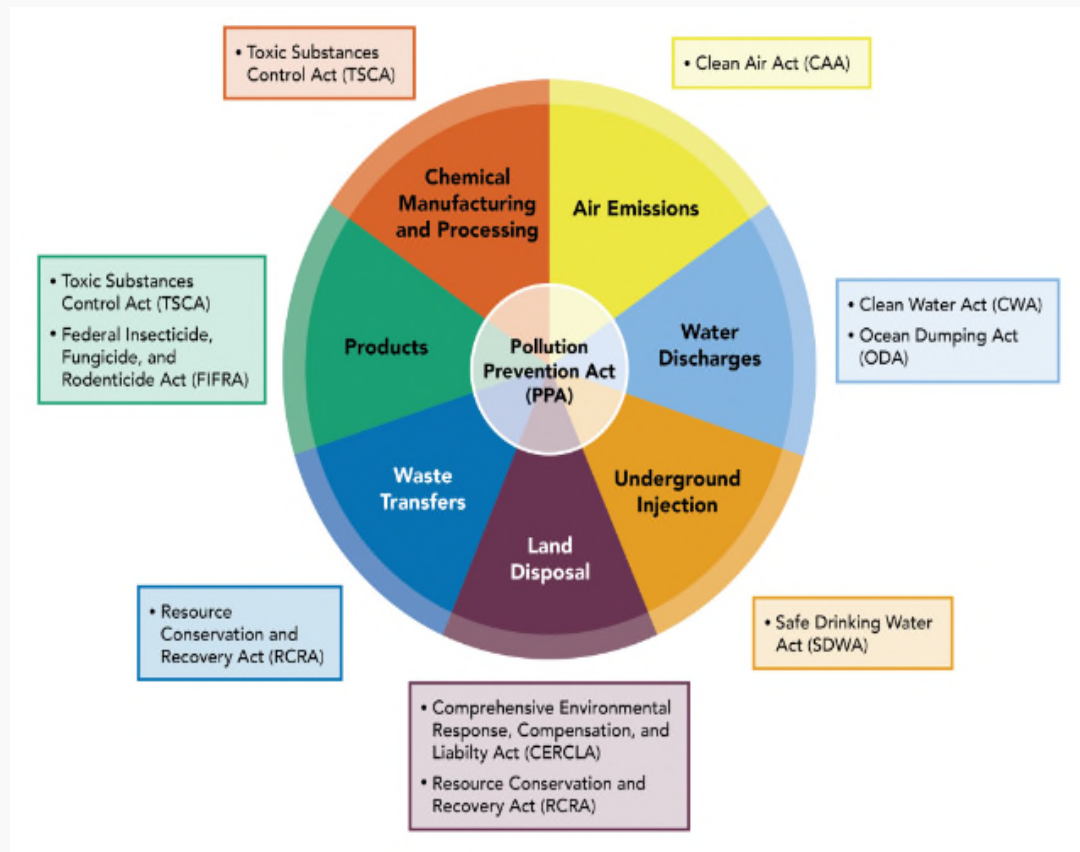
Sandra Gaona, MS
United States Environmental Protection Agency
Toxics Release Inventory Program

National Pollutant Release Inventory Data Users Workshop
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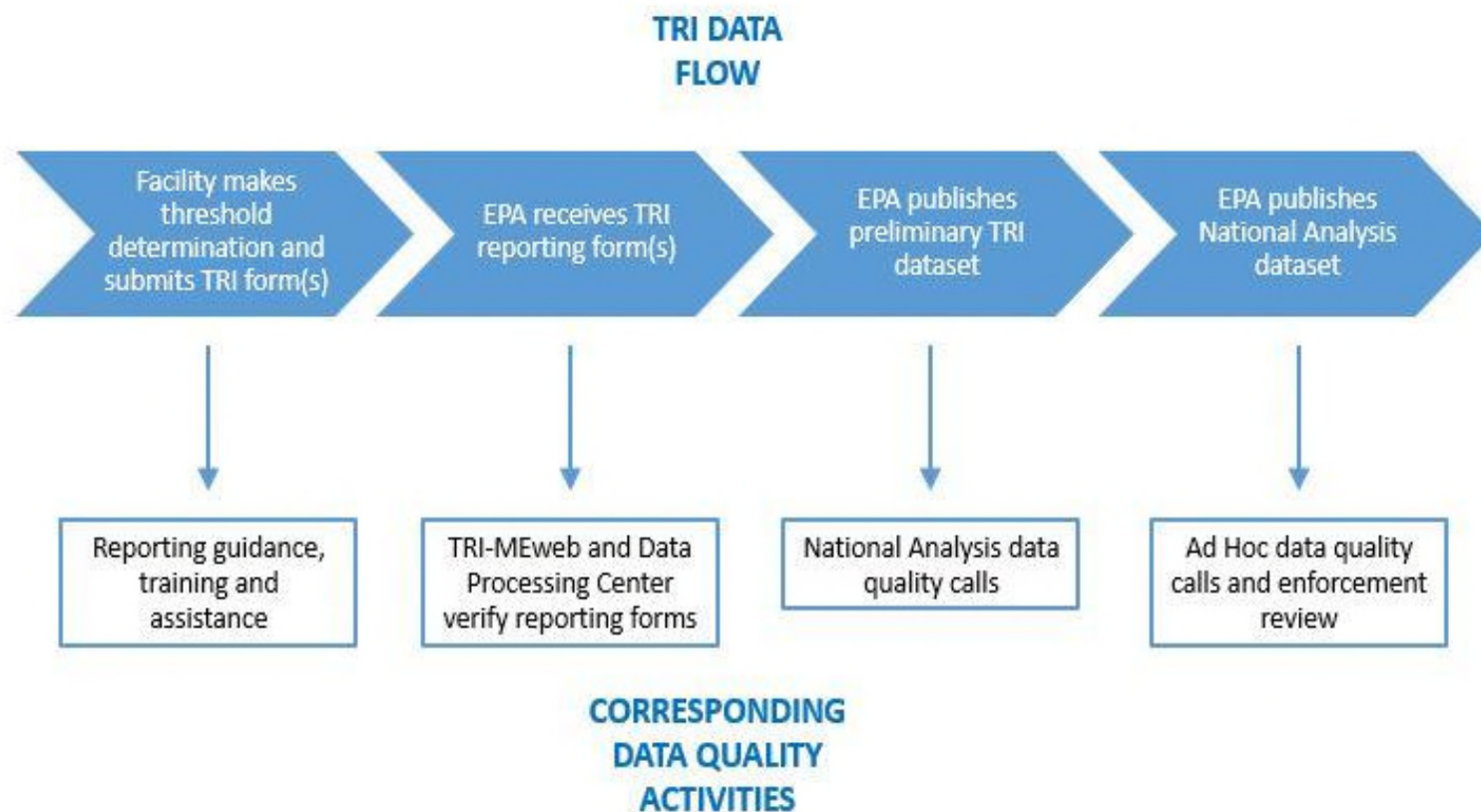
About TRI

- Annual – more frequent reporting than many other EPA programs
- Multimedia – only multimedia EPA dataset
- Beyond releases – pollution prevention (P2) and waste management information
- Complement - TRI data help to complete the picture





Robust data quality program





TRI Data Uses

Who uses the data?

Citizen/
Community

Government

Academic

Industry

Media

Advocacy

For what purposes?

- Track environmental performance of facilities
- Estimate potential chemical risks
- Encourage pollution prevention

Leading to increased awareness, understanding of impact, and improved decision making.



Past/Current Efforts to Facilitate Data Use

TRI University Challenge

- Expose students to TRI information
- Create a “force multiplier” for TRI
- Garner diverse portfolio of innovative projects using TRI data

Pollution Prevention


- Characterize industry sectors
- Identify and promote successes
- Encourage adoption of best practices and safer alternatives

International

- Facilitate integration of multi-PRTR system data
- Assess progress towards global sustainable goals



Types of Research Using TRI Data

- Community Engagement/Education 
- Human Health 
- Pollution Prevention 
- International PRTR Comparability 

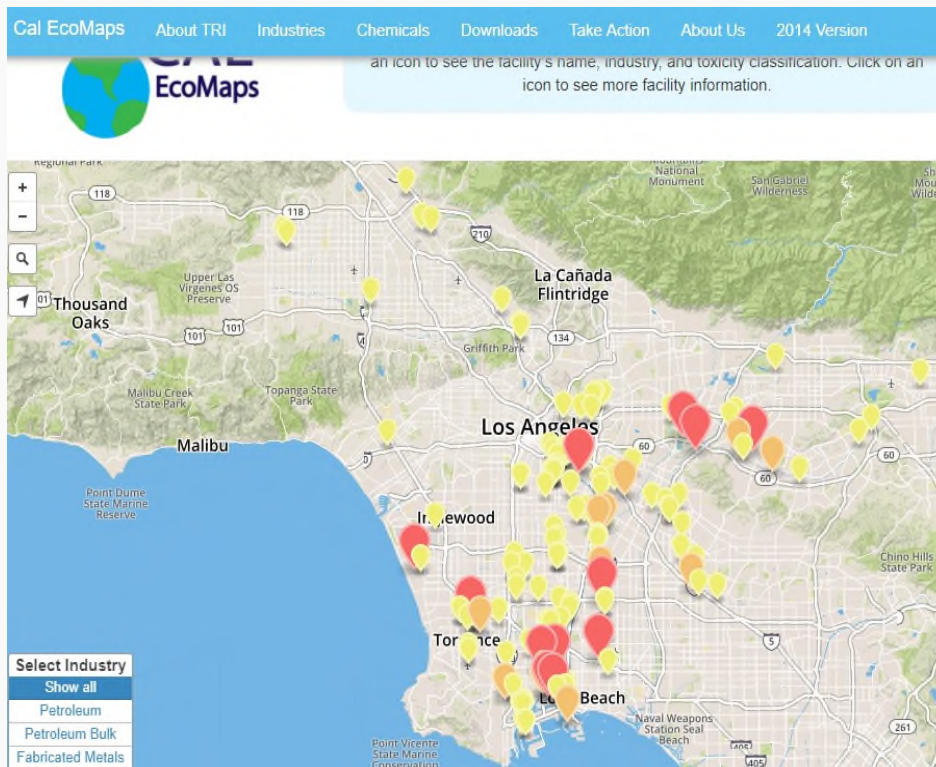


Disclaimer

The TRI data uses referenced in the projects and materials discussed in the slides that follow are provided as examples. Mention of these projects and materials does not constitute an EPA endorsement of their use, or of the individuals, groups, and organizations who developed them or their conclusions.



Facility-level Information for a City



University of California, Los Angeles

- Developed the **Cal EcoMaps** interactive website to **highlight TRI reporting facilities in the Los Angeles Basin**.
- Profiled facilities from the petroleum, fabricated metals, primary metals, and chemicals sectors.
- Information includes total toxic releases per facility, releases per \$1000 of revenue, percent of waste treated through preferred management practices, and an estimate of associated cancer risks.



Understanding Stakeholder Impacts



State University of New York at Plattsburgh

- Created **“Toxic Release!”**, an **eco-educational simulation game that demonstrates the various dynamics between stakeholders** that are impacted by industrial chemical releases.
- Purpose is to make the invisible dynamics associated with toxic releases more tangible.
- Players assume the roles of industry professionals, community members concerned with environmental and human health, and government regulators.
- These stakeholders then use computer models founded upon TRI data, role play, and environmental problem-solving frameworks to manage a toxic release scenario.



Asthma Incidence Study - City

GEORGE WARREN
BROWN
SCHOOL
of Social Work

Place, Pollution, and Health: Environmental and Social Predictors of Asthma Hospitalization in the St. Louis Region

Rebecca Gernes, MPH & MSW Candidate ('14)

Background

The St. Louis region has a number of industrial operations and an extensive network of interstate and roads, all of which contribute to air pollution and public health outcomes, including asthma.

- Regionally, 140 facilities report air emissions with effects on respiratory health to the Toxic Release Inventory (TRI).
- 81% of regional commuters drive alone to work, logging over 70 million miles per day.

Regional disparities in exposure to pollutants in combination with access to care contribute to poor outcomes for vulnerable groups, such as elevated emergency room visits for asthma in the region. A number of public data sources are available to examine potential relationships between regional air pollution, social demographics, and health outcomes.

Research Aims

- Determine strength of association between toxic point sources reported to TRI and asthma hospitalization outcomes at the ZIP code level.
- Examine toxic air releases alongside socio-demographic and asthma indicators to identify disparities in exposure to air pollution and asthma outcomes.

Methods

This TRI University Challenge Project uses publicly available data to examine spatial and environmental predictors of asthma in eight counties in the St. Louis Region.

Figure 3. Study Area
Locations and air releases (in lb) for facilities reporting respiratory health-related air releases to TRI in all ZIP codes in the eight county region were mapped for the year 2010. Toxic source emissions were compared to the 2005 National Air Toxic Assessment (NATA).

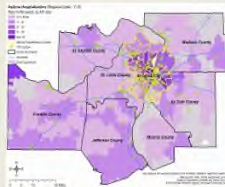


Figure 3. Asthma Hospitalization Cluster, 2010. Asthma hospitalizations are significantly clustered in ZIP codes in St. Louis City, north St. Louis County, and western Madison, Warren, and St. Clair Counties (Moran's $I=0.36$, $p<0.001$).



Figure 3. Asthma Hospitalization Cluster, TRI Facilities, and Percent African American. Asthma hospitalizations were positively associated with majority African American ZIP codes ($R=0.91$, $p<0.001$).

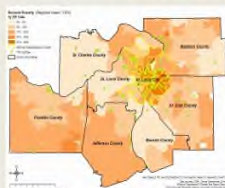


Figure 4. Asthma Hospitalization Cluster, TRI Facilities, and Percent Below Federal Poverty Level, 2010. Asthma hospitalizations were positively associated with ZIP codes with higher poverty ($R=0.87$, $p<0.001$).



Figure 5. Asthma Hospitalization Cluster, TRI Facilities and Air Releases. Asthma hospitalization clustered ZIP codes were closer on average to TRI facilities, but had lower average TRI releases. This may show the facilities reporting the highest respiratory-related air releases.

Table 1. Descriptive Statistics

Variable	Region Mean (SD)	Within-Cluster Mean (SD)	Within-Cluster Standard Deviation
Asthma Hospitalizations	21.0	2.0	22.8**
Below Federal Poverty Level (%)	21.6	3.4	40.7**
African American (%)	6.9	0.8	8.2**
Below Federal Poverty Level (%)	14.1	0.1	22.8**
Median household income (\$)	32,766	63,618	40,360**
Air Releases (lb)	21,726	26,765	17,407
Distance to Air Release from ZIP code (miles/km)	21,645	29,264	3,588**
Distance to Interstate from ZIP (miles/km)	21,200	28,722	3,642**

Table 2. Moran's Coefficients

Variable	Moran's I
Asthma Hospitalizations	0.598 (3.0E-11)**
Below Federal Poverty Level (%)	0.187 (2.0E-7)**
Distance to Interstate from ZIP	0.082 (1.9E-4)**

The population within the asthma hospitalization cluster differed significantly from the population outside the cluster on social and environmental indicators. ZIP codes inside the cluster have higher percentages of African Americans, higher percent poverty and unemployment, lower median household income, and are closer on average to TRI facilities and highways than ZIP codes outside the cluster.

Discussion

This analysis supports previous findings of higher asthma hospitalization rates in socially disadvantaged areas. On average, ZIP codes with the highest asthma hospitalization rates are located closer to TRI facilities and highways. This information can help focus community efforts to reduce asthma hospitalizations.

Key limitations to this study include:

- Exposure Assessment:** TRI provides information on pounds released, and cannot be used to determine toxicity or exposure related to inhalation of releases. Additionally, social demographics and exposures may vary within ZIP codes.
- Summary Measures:** TRI does not provide cumulative effects of releases or potential combinations of released chemicals (secondary sources).
- Modeling of Air Releases:** This analysis does not account for prevailing winds or potential dispersion of TRI releases.

According to NATA, mobile and secondary sources accounted for over 70% of respiratory risk in the region in 2005 (Fig. 6.), while point sources accounted for only 2% of risk. TRI air releases also decreased 41% from 2005 to 2010 (Fig. 7).

Future research should examine mobile sources of pollution such as highways, as well as potential contributors to secondary pollution to determine potential risks to respiratory health. Analysis of health and socio-demographic data at smaller geographic levels could provide more detailed information on exposure and risk estimates within ZIP codes.

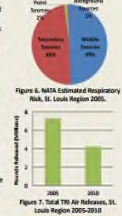


Figure 6. NATA Estimated Respiratory Risk, St. Louis Region 2005.

Transdisciplinary Aspects

Mapping and analyzing TRI with health and socio-demographic trends is a replicable approach requiring the use and application of publicly accessible environmental and health data. The project is transdisciplinary in its data sources, analysis, and implications for policy and programs addressing community health.

Results will be shared with community educators, researchers, and policy makers in the region, including Metro East Community Air Project, Missouri Department of Health and Senior Services, Illinois Department of Public Health, East West Gateway Council of Governments, Illinois State Asthma Partnership, US Environmental Protection Agency, Washington University in St. Louis, and the University of Illinois.

Acknowledgements

Many thanks to Amy Furek of the Metro East Community Air Project, Nancy Anderson of the Illinois Department of Public Health, Whitney Coffey and Andrew Hunter of the Missouri Department of Health and Senior Services, Kara Kasper of the Environmental Protection Agency, Bill Wilson of Washington University, and Aaron Hipp and Darrell Hubson of the Brown School for their guidance and assistance with this project.

Rebecca Gernes [rjgernes@wustl.edu]

Note: The work presented here was done for the purposes of a course and is not my thesis or dissertation.

Washington University, St. Louis

- Created maps and conducted liner regressions to analyze 2010 TRI data, sociodemographic variables, and hospitalizations for asthma.
- Determined the strength of association between toxic point sources reported to TRI and asthma hospitalization outcomes at the ZIP code level.
- Examined toxic air releases alongside socio-demographic and asthma indicators to identify disparities in exposure to air pollution and asthma outcomes.



Human Health Data Mashup – County



Indiana University-Bloomington

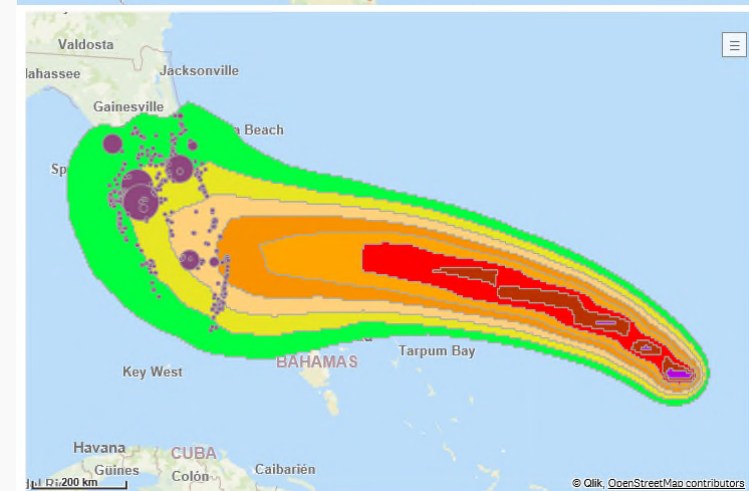
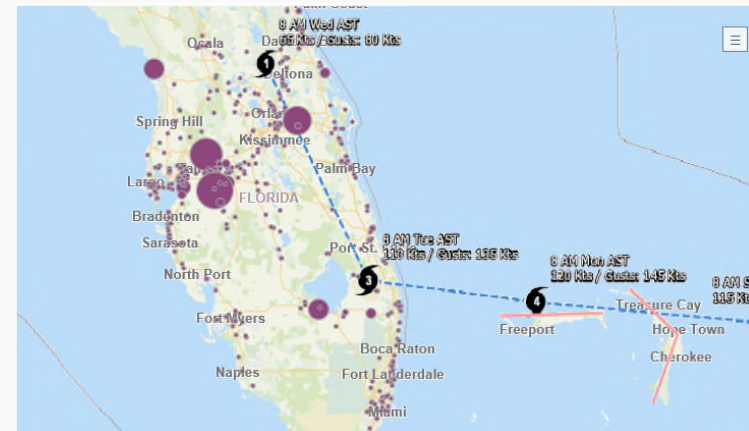
- **Merged TRI data with data from the CDC and the Area Health Resource File.**
- Publicly available dataset as Excel, STATA, and SAS files.
- Dataset is useful to broadly explore releases of chemicals from TRI facilities alongside socio-demographic and health data at the county level.
- Created codebook/data dictionary to help other researchers.



Severe Weather Mapping

EPA

- **Overlays TRI facility location and release data with NOAA National Weather Service GIS data for current hurricanes.**
- TRI data summaries about release quantities and types of releases **aid in understanding potential impacts of imminent storms.**
- Could be expanded to other types of severe weather (e.g., flooding, fires).

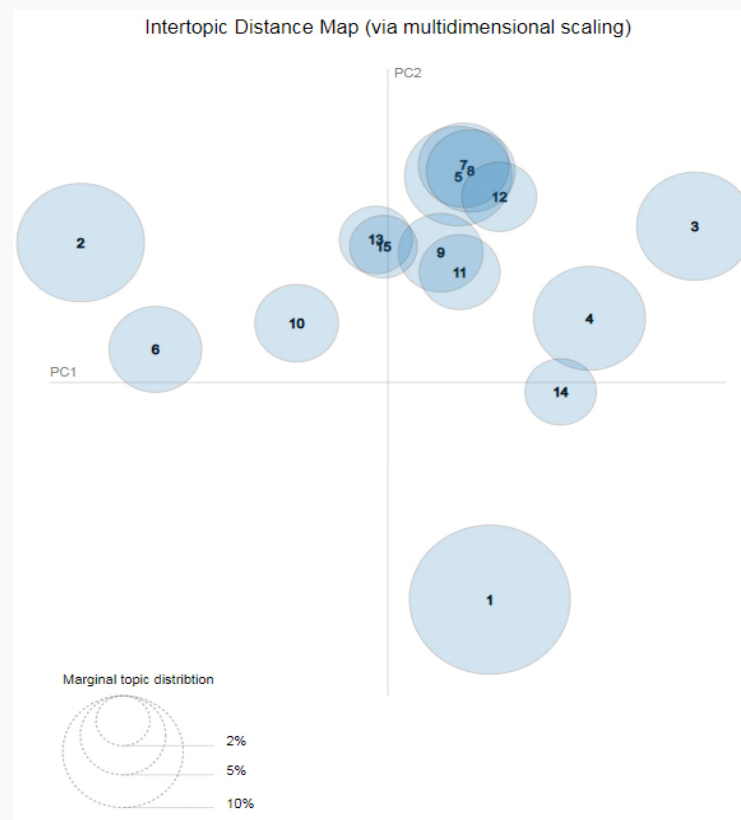




Analysis of TRI P2 Text using Machine Learning

EPA

- Exploring use of **natural language processing (NLP) algorithms to cluster P2-related free text reported on TRI forms.**
- Text relates to source reduction actions or barriers to P2.
- Objective is to identify more efficient analytical methods to learn about and shed light on best practices.
- Through use of bins, NLP can organize P2 texts in a more digestible way.



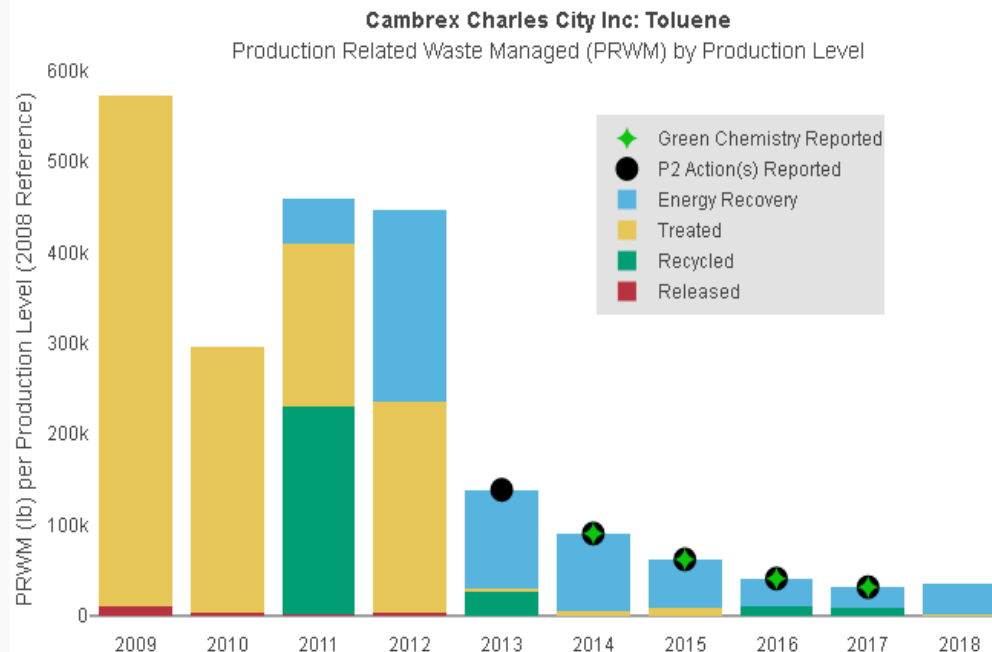


Pollution Prevention Performance Index

EPA

- Exploring development of an **enhanced methodology (P3 Index) for identifying and assessing sustained pollution prevention results.**
- Potential to promote replication of effective strategies.
- Metric considers various factors - potential risk, toxicity of chemicals, value of reported free text, production level changes.

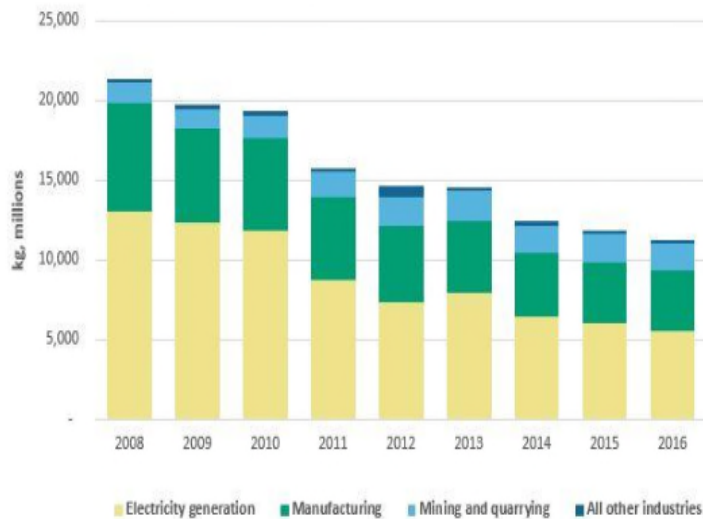
Example Success Story Identified Using Metric





International PRTR Comparability and Sustainable Development Goals

Releases by Industry (kg): 7 PRTRs, 14 pollutants



OECD

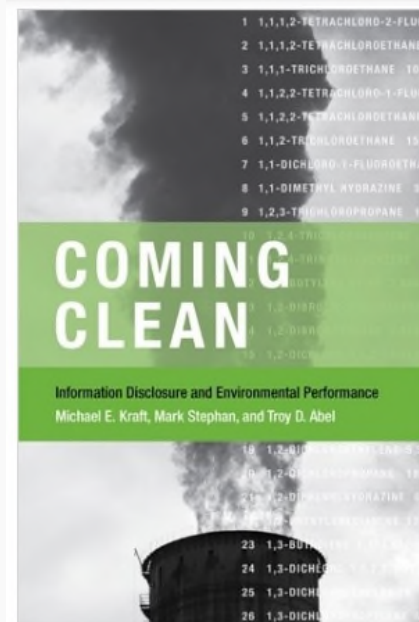
- Global analyses of PRTR data underway to **integrate data from multiple PRTRs, document methods, and recommend indicators to help in tracking progress toward selected SDGs.**
- Initial analysis of 14 pollutants from 7 PRTRs
- Project applies and demonstrates the utility of PRTR data to inform progress towards meeting SDG Target 12.4.



Research on the Effectiveness of the TRI to reduce or prevent pollution

Researchers have looked at the TRI program as a subject unto itself to investigate the impact of information disclosure as a means to achieve environmental policy outcomes.

- “The impact of pollution prevention on toxic environmental releases from US manufacturing facilities”
Environmental Science & Technology, 49(21), 12951-12957.





Conclusions

- The data that industry provides to the TRI Program doesn't just go into a black box never to be seen again... far from it!
- TRI data has been used to inform and educate communities, assess human health, and evaluate the effectiveness of information disclosure.
- TRI data are an incredibly valuable resource to a broad array of stakeholders – it's useful to facilities, doctors, parents, economists, teachers, and everyone in between.



Contact Information

Sandra Gaona, MS

Senior Analyst

United States Environmental Protection Agency (EPA)

Toxics Release Inventory (TRI) Program

gaona.sandra@epa.gov