



Exposing Canada's Chemical Valley

An Investigation of Cumulative Air Pollution
Emissions in the Sarnia, Ontario Area

ecojustice

EXPOSING CANADA'S CHEMICAL VALLEY

An Investigation of Cumulative Air Pollution
Emissions in the Sarnia, Ontario Area

October 2007

An Ecojustice Report

by Elaine MacDonald, Ecojustice
and Sarah Rang, Environmental Economics

On behalf of the Aamjiwnaang Health and Environment Committee
and the Occupation Health Clinic for Ontario Workers, Sarnia Chapter

ACKNOWLEDGMENTS

Ecojustice Canada wishes to thank Sharilyn Johnson and the Aamjiwnaang Health and Environment Committee for their assistance in the production of this report. We also wish to thank James Brophy and Margaret Keith of the Occupation Health Clinic for Ontario Workers Sarnia (OHCOW) for their assistance with the research and review of the draft report. Special thanks to Ada Lockridge and Ron Plain. Ada you are an inspiration to us all, and a force to be reckoned with. Ron you are one damn fine activist and thanks for letting us use your photographs. The authors also wish to thank Jode Roberts, Sophie Kohn and Justin Duncan of Ecojustice.

Ecojustice wishes to thanks the EJLB Foundation for its generous support.

Design and layout Nadene Rehnby, www.handsonpublications.com



TORONTO OFFICE

30 St. Patrick Street, Suite 900
Toronto, Ontario M5T 3A3
t: 416.368.7533 | f: 416.363.2746
e: ontario@ecojustice.ca

Contents

Executive Summary	5
Goals of this Report.....	7
Description of Land and People	8
Community Health Concerns	8
Data Sources	10
How Much Air Pollution is Released in the Sarnia Area?	11
Description of Industrial Facilities	11
Total Amount of Air Pollution.....	11
Top Air Polluters.....	12
US Sources of Air Pollution	14
Mercury	15
Dioxins and Furans	16
Types of Air Pollutants	17
Criteria Air Contaminants (CACs)	17
Toxic Air Pollutants	19
Health Based Approach.....	20
Greenhouse Gases.....	22
Pollution Prevention	23
Time Trends.....	23
Air Pollution in the Future	24
Conclusions	25
Recommendations	26
References.....	28
Appendix: Methodology	29

List of Tables

Table 1:	NPRI Facilities in the Sarnia Area with the Largest Combined Air Releases	13
Table 2:	US TRI Facilities Near the Sarnia Area with the Largest Air Releases.....	14
Table 3:	Canadian NPRI and US TRI Facilities in the Sarnia Area with the Largest Air Emissions of Mercury and its Compounds.....	15
Table 4:	Canadian NPRI and US TRI Sarnia Area Facilities with the Largest Air Emissions of Dioxins and Furans	16
Table 5:	Summary of all Types of Air Pollution from Sarnia NPRI Facilities.....	17
Table 6:	Top Five Sarnia Area Facilities with the Largest Air Releases of Sulphur Dioxide	17
Table 7:	Sarnia Area Facilities with the Largest Air Releases of Volatile Organic Compounds	18
Table 8:	Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Suspected Respiratory Toxicants.....	20
Table 9:	Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Known or Suspected Reproductive and Developmental Toxicants.....	20
Table 10:	Top Eight Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Known or Suspected Endocrine Disrupters	21
Table 11:	Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Toxic Under the <i>Canadian Environmental Protection Act</i>	21
Table 12:	Emissions of All Greenhouse Gases (Carbon Dioxide Equivalents) from Sarnia Area Facilities	22
Table 13:	Trends in Air releases in the Sarnia Area from 2002 to 2005.....	24
Table A1:	Industrial Facilities within 25 Kilometres of the Approximate Centrepont (Hwy 40 south of Christopher Road at Aamjiwnaang) that Report to NPRI.....	30
Table A2:	Anticipated Changes in Releases of Chemicals from Facilities in the Sarnia Area from 2006 to 2009	31



Executive Summary

Residents of Sarnia and the Aamjiwnaang First Nation face a grave air pollution problem. There are 62 large industrial facilities in this border region, quite literally in their backyards. Approximately 40 per cent of Canada's chemical industry is clustered near Sarnia in an area known as "Chemical Valley." Located at the southernmost tip of Lake Huron on the border between Ontario and Michigan, the area has become one of the most polluted hotspots in Canada.

The United States and Canadian governments both have central public registries that track the quantities of chemicals released into the environment each year: Canada's National Pollutant Release Inventory (NPRI) and the U.S. Toxic Release Inventory (TRI). This report is the first-ever cumulative analysis of air pollution data from these two registries and the Canadian Greenhouse Gas Reporting Program.

On the Canadian side there are 46 facilities listed under the NPRI within 25 kilometres of the Sarnia area. In 2005, these facilities emitted more than 131 million kilograms of

NPRI air pollutants. Although these facilities represent only 2 per cent of Ontario's NPRI-listed facilities, they contribute 16 per cent of Ontario's NPRI air pollution – almost as much as the entire Province of New Brunswick's NPRI releases.

The total amount of greenhouse gases emitted from Sarnia facilities in 2005 was 16.5 million tonnes of carbon dioxide equivalents. This represents more than one fifth of Ontario's total industrial greenhouse gas emissions and more than the Province of British Columbia.

What is particularly striking about the air pollution in the Sarnia area is the amount of toxic pollutants released. In 2005, the NPRI facilities in the Sarnia area emitted 5.7 million kilograms of "Toxic Air Pollutants," including numerous chemicals associated with reproductive and developmental disorders and cancer among humans. These toxic air emissions are more than the NPRI releases from the entire provinces of Manitoba, New Brunswick or Saskatchewan and greater than any other community in Ontario.

There are 62 large industrial facilities quite literally in the backyards of Sarnia and the Aamjiwnaang First Nation. In the above photo of Sarnia, Aamjiwnaang can be seen on the distant right.

This report highlights strategies to reduce emissions, such as aggressive pollution prevention efforts, increased enforcement of existing laws, and enactment of tougher regulatory standards.

Sarnia is home to three of the top 10 air polluters in Ontario from 2005: Ontario Power Generation's Lambton Generating Station, ranked number three, Imperial Oil's Sarnia Refinery ranked number six and Shell Canada's Sarnia Manufacturing Centre, ranked number 10. It also has eight additional facilities that released over 1 million kilograms of combined air releases: Suncor Energy Products Sarnia Refinery, Cabot Canada plant, NOVA Chemicals Corunna Site, Fibrex Installations Sarnia Plant, Transalta Energy Sarnia Regional Cogeneration Plant, Terra International Canada Terra Nitrogen Plant, and Lanxess East Plant.



In addition, just across the border, but still within 25 kilometres of the Sarnia area, there are 16 American facilities listed under the TRI. The total air pollution released from these facilities in 2005 was 1.9 million kilograms. Notable among these facilities is Intertape Polymer Group that emitted huge amounts of toluene, a known reproductive and developmental

toxin. Intertape's emissions of toluene dwarf any Canadian facility and are number two in North America. There are also two large coal fired power plants, Detroit Edison Belle River and St. Clair River that emitted large quantities of mercury.

It is the cumulative impact of emissions from these 62 facilities on both sides of the border that has made the Sarnia area Ontario's worst air pollution hotspot.

The toll these emissions are taking is dramatic and there is growing evidence that the health of the residents of Sarnia and the Aamjiwnaang First Nation and the local environment has been severely compromised. Thus, there is an obvious need to take precautionary steps to reduce the amount of air pollution in the airshed. There is also an urgent need to commence proper analysis and monitoring of human health and environmental impacts.

This report highlights some of the strategies that could be used to reduce emissions, such as aggressive pollution prevention efforts, increased enforcement of existing laws, and enactment of tougher regulatory standards. It also recommends that no additional sources be added to the airshed and calls on the federal, provincial and local governments and First Nations to work together to take the necessary steps to improve and protect the health of the community.



Goals of this Report

This report describes the nature of the air pollution from industrial facilities facing the people of the Aamjiwnaang First Nation and the City of Sarnia. It uses data from the federal National Pollutant Release Inventory (NPRI), the US Toxic Release Inventory (TRI) and the federal greenhouse gas-reporting program to document the release of air pollutants from industrial sources during the period from 2002 to 2005.

The report discusses three different types of air pollution:

- Criteria air contaminants associated with acid rain, smog, respiratory and cardiovascular diseases and premature death;

- Toxic pollutants associated with environmental contamination, cancer and reproductive and developmental disorders among humans; and
- Greenhouse gases associated with climate change.

The report asks three questions:

1. How much pollution is being released into the air from industrial sources in the Sarnia area?
2. How does Sarnia compare to other communities in Ontario?
3. What can be done to reduce air pollution?

How much pollution is being released into the air from industrial sources in the Sarnia area? What can be done to reduce it?

Description of Land and People

The City of Sarnia, Ontario is situated at the south end of Lake Huron on the east side of the St. Clair River in Lambton County. Lambton County is comprised of 11 municipalities, including Sarnia, as well as three First Nations. With a population of approximately 71,000, the City of Sarnia accounts for about 56 per cent of Lambton County's total population.

The Aamjiwnaang First Nation abuts the south end of Sarnia, Ontario. The reserve is 120 kilometres northeast of Detroit and Windsor and 300 kilometres west of Toronto. The Aamjiwnaang reserve is home to about 850 people. Some members live off reserve in surrounding communities. About one quarter of the band members are children.

The Lambton County area features a large petrochemical and chemical complex that represents approximately 40 per cent of Canada's chemical industry. These chemical plants, refineries and manufacturing plants have earned Sarnia the nickname "Chemical Valley." There are 62 large industrial facilities within 25 kilometres of Aamjiwnaang and south Sarnia. About half of these known sources of air pollution are within 5 kilometres of Aamjiwnaang and south Sarnia. Other sources of air pollution in the area include the significant exhaust output from cars and trucks travelling the area's numerous highways. Trucks are often idling for hours as their drivers wait in line to cross the nearby Canada-US border.

The Sarnia area features a large petrochemical and chemical complex that produces approximately 40 per cent of Canada's chemicals. These chemical plants, refineries and manufacturing plants have earned it the nickname "Chemical Valley."



Community Health Concerns

At present, regulatory standards designed to protect the public from exposure to toxic air pollutants do not account for the possible additive or synergistic effects of exposure to mixtures or multiple pollutants. Standards in Ontario set limits for each individual pollutant. However, an individual is not typically exposed to only one pollutant at a time. In fact people living in the Sarnia and Aamjiwnaang area are exposed to many different pollutants from multiple sources. The health impacts from consistent exposure to these mixtures of pollutants are largely unknown, but experts believe there are three possible forms of interaction. The effects could be less than additive, additive or synergistic (Carpenter et al., 2002).

The release of massive amounts of air pollutants into the airshed results in an obvious burden on the health of local residents as well as the environment. In the Sarnia area, the population that has become most profoundly impacted is the Aamjiwnaang First Nation. Their reserve is situated near the south end of Sarnia in close proximity to most of the facilities creating the pollution.

In 2006, The Aamjiwnaang Environment Committee interviewed Aamjiwnaang band members about pollution in the area. Members of the reserve identified releases of chemicals and incidents such as spills as their primary concerns. In addition, these chemicals and related incidents have significant impacts on their cultural life, including hunting, fishing, medicine gathering and ceremonial activities. Health impacts included asthma, reproductive effects, learning disabilities and cancer. The most common reported impact was fear. People on the reserve feared the outdoors, the warning sirens, and unreported incidences (Ron Plain, CEC presentation, November 2006).

The survey indicated that reserve members had no confidence in the abilities of their provincial, federal or international authorities to police and protect band members from pollution concerns. The federal status of the reserve means that provincial legislation does not apply to their band. Federal legislation tends to be limited in its capacity to protect each and every small community group within its scope from industrial pollutants.

The Aamjiwnaang Environment Committee asked band members to elaborate on their health concerns. The results showed that of the band members surveyed, many had respiratory problems. About 40 per cent of band members surveyed required an inhaler. Asthma is common on the reserve – about 17 per cent of adults surveyed have asthma, as well as about 22 per cent of children surveyed. The Lambton County children's asthma rate sits at 8.2 per cent. (Health survey based on 411 people in Aamjiwnaang Health Survey and Body Mapping 2004-2005).

Other health effects reported by those surveyed were:

- 26 per cent of adults surveyed experience high blood pressure;
- 26 per cent of adults and 9 per cent of children under 16 experience severe and chronic headaches;
- 23 per cent of children age 5 to 16 struggle with learning and behavioural problems;
- 13 per cent of children age 5 to 16 struggle with attention deficit hyperactivity disorder;
- 16 per cent of adults experience skin rashes (including eczema and psoriasis), with children particularly affected at 27 per cent;
- 39 per cent of women surveyed have experienced a miscarriage or stillbirth;
- 5 per cent of those surveyed experience thyroid problems; and
- 9 to 11 per cent of those surveyed experience kidney problems.

The most common concerns of visitors to the reserve surveyed (79 visitors) were:

- the offputting smell – 44 per cent;
- trouble breathing, coughing, asthma worsening – 32 per cent; and
- headache – 14 per cent.

Members of the reserve have also noticed a decrease in the number of boys being born as compared to girls. An assessment of the sex ratios in the reserve revealed that the significant ongoing decrease in the proportion of male live births began in the early 1990s and continued on through 2003 (the end of the study period). There are several potential factors that may be contributing to the imbalance in the sex ratio, such as the communities close proximity to a large aggregation of petrochemical industry. Further assessment was recommended (Mackenzie et al. 2005).

There is also evidence of the health impacts from air pollution in the City of Sarnia. A recent study found that hospital admission rates are significantly higher in Sarnia than in the cities of Windsor and London, Ontario (Fung et al., 2007), particularly with respect to respiratory and cardiovascular illnesses. Similarly, The Ontario Medical Association (OMA) estimated that as a result of air pollution, Sarnia-Lambton incurred 100 deaths per year, 270 hospital admissions, 920 emergency visits and 471,700 minor illness days at a cost of over \$14 million dollars (OMA, 2005). Sarnia-Lambton was one of the communities found to be most heavily impacted by air pollution among the communities assessed by the OMA.

Another study found elevated hospitalization levels for cerebral palsy in several Great Lakes communities, one of which was Sarnia. These findings may be an indicator of community exposure to methyl mercury by the consumption of contaminated fish from local waters (Gilbertson, 2004). Asbestos, a once commonly-used chemical in the Sarnia-Lambton area, is also a contributing factor. As a result, Sarnia is experiencing one of the world's worst asbestos-related disease outbreaks. Workers in the Sarnia-Lambton area are commonly

Health impacts reported by Aamjiwnaang band members included asthma, reproductive effects, learning disabilities and cancer. The most common reported impact was fear – the outdoors, the warning sirens, and unreported incidences.

A recent study found that hospital admission rates are significantly higher in Sarnia than in the cities of Windsor and London, Ontario (Fung et al., 2007), particularly with respect to respiratory and cardiovascular illnesses.



diagnosed with asbestos-related diseases such as mesothelioma and asbestosis in record numbers (Brophy, Keith and Schieman, 2007).

An earlier study by Health Canada examined health data from the late 1980s and early 1990s and found many examples of elevated rates of death, disease and hospitalization among Lambton County area residents along the St. Clair River. For example, male death rates from all causes were 5 per cent higher than in the rest of the province. Deaths due to disorders of the central nervous system (such as multiple sclerosis) and deaths due to respiratory infections and diseases of the arteries, arterioles and capillaries (such as atherosclerosis) were particularly high as compared to the rest of Ontario. The study also found elevated levels of general hospitalization compared to the rest of Ontario for males and females of all ages. The most elevated rates of hospitalization were seen in the young. Hospitalization rates were 30 per cent higher for males and 28 per cent higher for females between birth and 24 years old. Some cancers rates were also elevated – in particular, Hodgkin's disease amongst males was 80 per cent higher than the rest of Ontario and leukemia incidents amongst women between the ages of 25 and 44 was more than double the Ontario rate (Health Canada, 2000).

Data Sources

This report is mainly based on data from the federal NPRI program, as it is the only public source of air releases from industrial facilities across Canada. It is important to understand that NPRI data reflect releases and transfers of about 330 chemicals from larger industrial facilities. In general, facilities are required to

report to NPRI if they manufacture, process or otherwise use more than 10 tonnes of more of a substance on the NPRI list. In 2005, there were about 330 chemicals on the NPRI list, including various toxics and criteria air contaminants. There are specific reporting requirements for certain chemicals such as mercury and dioxins/furans.

Some general limitations to NPRI data:

- It does not cover all sources, only those meeting certain thresholds;
- It does not include emissions from area sources such as gas stations and dry cleaners;
- It does not cover emissions from mobile sources such as cars and trucks or from natural sources such as forest fires;
- It is self-reported by facilities and a variety of different methods can be used to estimate emissions; and
- It does not cover all chemicals known to be of concern (does not include many pesticides, for example).

For some pollutants, such as particulates, mobile and natural sources can be significant contributors to total amounts. For other pollutants, such as sulphur dioxide, industrial sources are the main contributors to total amounts. Other sources of information, including monitoring data, emission inventories and modeling data on emissions may cover a greater number of sources or be otherwise wider in scope than the NPRI data.

This report is based on data from the 46 NPRI and 16 TRI facilities that are located within 25 kilometres of the reserve. For more information on data sources and methodology please see the Appendix.



How Much Air Pollution is Released in the Sarnia Area?

Description of Industrial Facilities

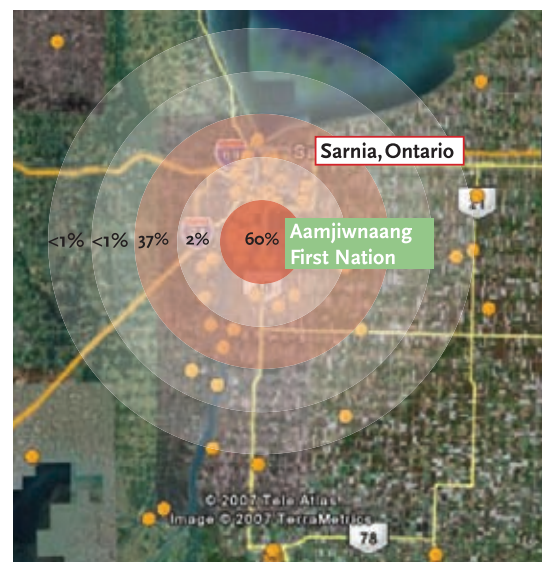
There are a large number of industrial facilities within 25 kilometres of the reserve: 62 facilities in total (see maps on following pages). On the Canadian side there are 46 NPRI facilities, and 16 TRI facilities on the US side of the river. This concentration of facilities has given Sarnia the nickname “Chemical Valley.” This area is one of the most heavily industrialized in Canada, accounting for more than 40 per cent of Canada’s total chemical industry (Fung et al., 2007). Refineries and chemical plants owned by Dow, Nova, Bayer, Imperial Oil, Suncor and Shell exist within 5 kilometres of the reserve. Many of these facilities operate continuously, 24 hours a day, seven days a week.

Large amounts of air pollutants are also released from the Lambton Generating Station, owned by Ontario Power Generation, which is about 15 kilometres south of the reserve.

Total Amount of Air Pollution

The total amount of air pollution released from NPRI industrial sources within 25 kilometres of the Aamjiwnaang First Nation’s community in 2005 is 131,992 metric tonnes. This includes criteria air contaminants (without volatile organic compounds) associated with smog and toxic contaminants, but does not include greenhouse gases. About 60 per cent of the total emissions are released within 5 kilometres of the reserve – in 2005, 80,254 tonnes of air pollutants were released in this zone.

About 60 per cent of the total emissions are released within 5 kilometres of the reserve.



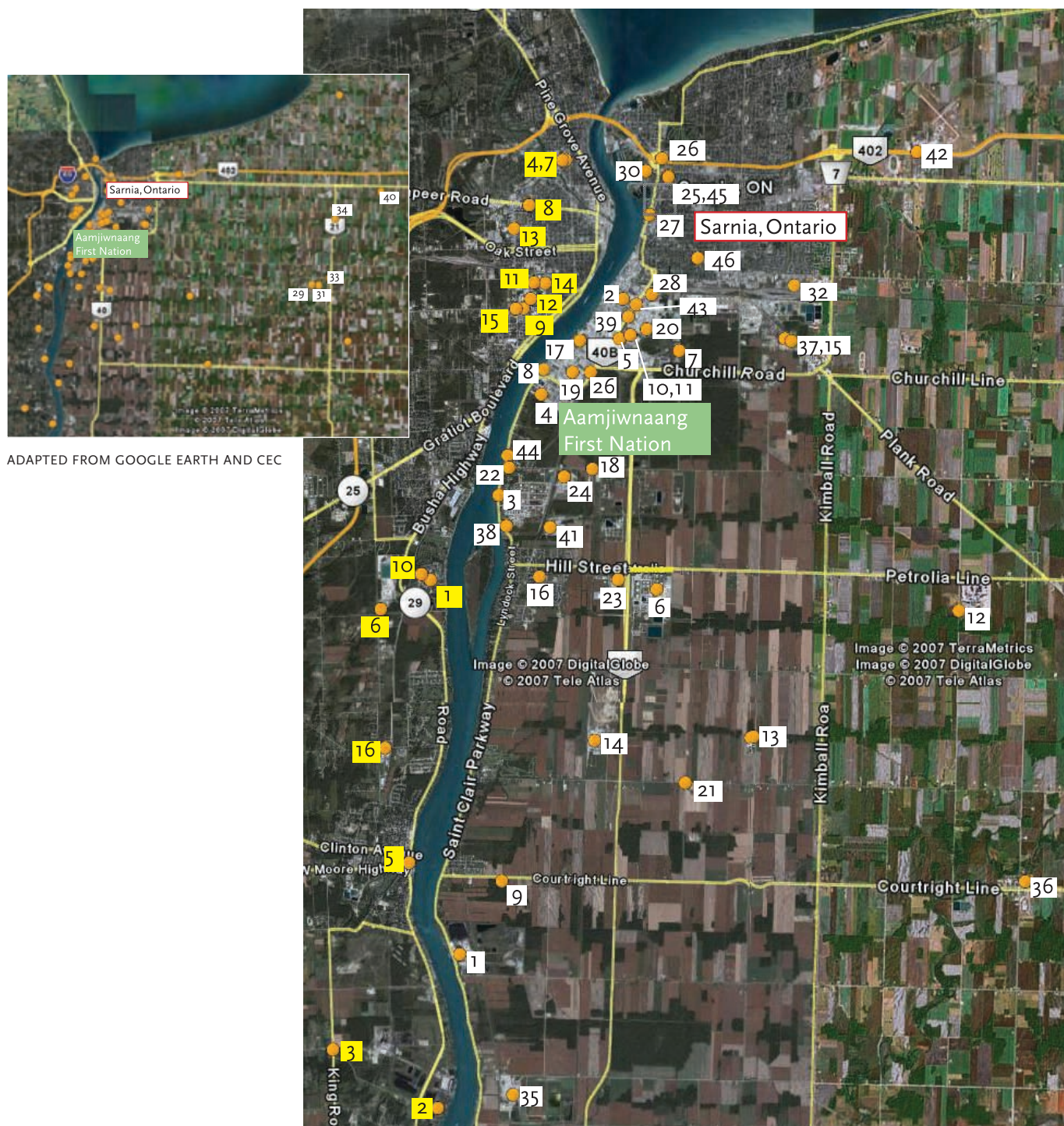
Top Air Polluters

Table 1 ranks the air pollution from NPRI facilities in the Sarnia area.

The maps show the locations of the facilities according to ranking.

In 2005, several facilities released large amounts of pollutants into the air in the Sarnia area. Ontario Power Generation's Lambton Generating Station was ranked number one for the greatest amount of air releases, followed by

Imperial Oil Sarnia Refinery Plant at number two and Shell Canada Sarnia Manufacturing Centre at number three. These air releases include criteria air contaminants (without volatile organic compounds) and toxic contaminants. Table 1 ranks the air pollution from NPRI facilities in the Sarnia area. The maps show the locations of the facilities according to ranking (US TRI facilities in yellow).



ADAPTED FROM GOOGLE EARTH AND CEC

Table 1: NPRI Facilities in the Sarnia Area with the Largest Combined Air Releases					
Sarnia rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Air pollutants released in 2005 (kilograms)	Ontario rank
1	Lambton Generating Station	Ontario Power Generation	15	46,246,992	3
2	Sarnia Refinery Plant	Imperial Oil	3	31,818,167	6
3	Sarnia Manufacturing Centre	Shell Canada	4	14,079,525	10
4	Sarnia Refinery	Suncor Energy Products Inc.	3	10,214,295	15
5	Cabot Canada Ltd.	Cabot Canada	2	9,967,068	16
6	NOVA Chemicals (Canada) Ltd. – Corunna Site	NOVA Chemicals	4	7,259,661	22
7	Sarnia Plant	Fibrex Insulations	2	2,381,537	38
8	Sarnia Regional Cogeneration Plant	Transalta Energy	5	1,947,491	48
9	Terra Nitrogen	Terra International Canada Inc.	13	1,568,361	49
10	Lanxess East	Lanxess Inc.	7	1,065,100	61
11	Sarnia Chemical Plant	Imperial Oil	2	809,448	73
12	Lambton Facility	Clean Harbours Limited	10	748,730	76
13	Tecumseh Gas Storage	Enbridge Gas Distribution Inc.	9	681,420	79
14	Moore Site	NOVA Chemicals	8	600,391	86
15	Sarnia Fractionation Plant	BP Canada	4	503,202	98
16	NOVA Chemicals Corp-St. Clair River Site	NOVA Chemicals	5	429,897	114
17	NOVA Chemicals (Canada) Ltd. Sarnia Site	NOVA Chemicals	3	359,026	134
18	Sarnia Plant	Basell Canada	2	233,108	183
19	Dow Chemical Canada Inc. – Sarnia	Dow Chemical Canada Inc.	2	150,790	225
20	Sarnia PVC Plant	Royal Polymers	2	129,200	248
21	Seckerton Compressor Station	Enbridge Gas Distribution Inc.	9	125,550	245
22	Lasalle Landfill	Waste Management of Canada	4	106,618	270
23	Sarnia Enerflex	Woodbridge Foam	4	89,870	*
24	Sarnia IPA Plant	Shell Chemicals Canada	2	85,386	299
25	Sarnia Cogen	Imperial Oil	7	83,159	306
26	Lanxess West	Lanxess Inc.	2	68,071	339
27	Dow A compressor station	Union Gas	5	58,000	373
28	Water Pollution Control Centre	City Of Sarnia	3	47,856	*
29	Petrolia Steel Drums	Vulcan Containers	22	34,699	479
30	Sarnia Grain Terminal	Cargill Limited	7	30,313	511
31	Henry Company Canada-Petrolia	Henry Company Canada	22	22,536	577
32	Sarnia Terminal	Enbridge Pipelines	5	18,233	>600
33	Waterville TG- Waterville TG Petrolia	Waterville TG	23	17,830	>600
34	Wyoming Feed	New Life Mills	24	2,624	>600
35	Courtright	Agrium Advanced Technologies	13	2,354	>600
36	Brigden Facility	Orford Cooperative	16	1,408	>600
37	Kel-Gor Limited	Kel-Gor	4	1,129	>600
38	Ethyl Canada Inc. Corunna Site	Ethyl Canada Inc.	4	774	>600
39	H. C. Starck Canada	Bayer Inc.	2	766	>600
40	Sarnia, Plant No. 63	Canada Building Materials	4	562	>600
41	St. Clair River Site – Modified Polymers	Canada Commercial Services	4	546	>600
42	UBE Automotive Sarnia Plant Inc.	UBE Automotive	10	345	>600
43	Sarnia Terminal	Imperial Oil	3	57	>600
44	Sarnia Terminal	Shell Canada	4	5	>600
45	City of Sarnia – Sarnia Police Services	City of Sarnia	7	0	-
46	City of Sarnia – Public Works Department	City of Sarnia	4	0	-
Total for Sarnia				131,992,100	
Total for Ontario				836,061,754	
Sarnia as per cent of Ontario				15.8 per cent	
*Reports only VOCs or VOCs and particulates and so not ranked.					

US Sources of Air Pollution

Approximately two times more toxic air pollutants are being released into the Sarnia area from Canadian NPRI sources as compared to US TRI sources.

The Aamjiwnaang First Nation and Sarnia also receive air pollutants from US TRI facilities across the St. Clair River. There are 16 TRI facilities within 25 kilometres of the reserve. These include two large coal fired power plants owned by Detroit Edison and many other manufacturing plants. The total air pollution released from these 16 TRI facilities in 2005 was 1,900,805 kilograms or 1,900 tonnes (4,190,557 lbs or 2,095 tons).

It should be noted that some chemicals and industrial sectors are reported to TRI but not reported to NPRI and vice versa. To make TRI and NPRI data comparable, we need to compare only those chemicals and sectors that are reported in both countries. This allows apples-to-apples comparison between TRI and NPRI data.

Taking into account only those chemicals and sectors that match between TRI and NPRI, the total amount of air pollution from TRI sources is approximately 2 million kilograms. By way of

the same process of matching chemicals and sectors, the NPRI total air pollution amount is approximately 5 million kilograms. Therefore, approximately two times more toxic air pollutants are being released into the Sarnia area from Canadian NPRI sources as compared to US TRI sources. Although the amount of US emissions is less than that of Canadian sources, US sources are still a significant contributor to Sarnia's overall airshed.

However, for some specific chemicals, US facilities release larger amounts than Canadian sources. Huge amounts of toluene, a respiratory, developmental and reproductive toxicant, is released to the air from one TRI facility, Intertape Polymer Group in Marysville (directly across the river from the reserve). In 2005, this facility released 896,749 kilograms of toluene. The amount of toluene from this one facility is more than ten times the toluene released from all NPRI facilities affecting the Sarnia area. In fact, Intertape emitted more than double the amount of the top emitting NPRI facility in Canada. The amounts of toluene released are so large that Intertape is ranked number two in North America for releases of toluene (only behind another Intertape facility).

Table 2: US TRI Facilities Near the Sarnia Area with the Largest Air Releases

Rank	Name of US TRI facility	Air pollutants released in 2005 (kilograms)
1	Intertape Polymer Group	902,273
2	Detroit Edison Co St. Clair Power Plant	671,011
3	Detroit Edison Co Belle River Power Plant	134,574
4	E. B. Eddy Paper Inc.	95,819
5	Cargill Salt Saint Clair	57,559
6	Huntsman International Llc	26,669
7	Acheson Colloids Co.	7,166
8	Mueller Brass Co.	5,563
9	Takata Petri Inc.	92
10	Mueller Impacts Co.	39
11	Lear Corp.	32
12	Wirtz Manufacturing Co. Inc. Plant 2	6
13	Wirtz Manufacturing Co. Inc. Plant 1	2
14	Auto Anodics Inc.	0
15	Blue Water Automotive Systems Inc. Port Huron Plant	0
16	Collins & Aikman	0
Total for TRI facilities		1,900,805

In addition to the huge amounts of toluene from Intertape, emissions have also increased from 1998 to 2005. The 2005 amount is the largest amount released during this time period. The 2005 amount represents a 55 per cent increase in emissions from 2004, although it is reduced from 1998 amounts.

Mercury

Mercury and its compounds are developmental and reproductive toxicants, and considered to be legally toxic under the *Canadian Environmental Protection Act*. The releases of mercury are to be virtually eliminated under several agreements such as the Great Lakes Water Quality Agreement. Releases of mercury into the air can contribute to elevated levels of mercury in fish. Mercury is one of the contaminants that limit our consumption of Great Lakes fish. One study reports higher rates of hospitalization for cerebral palsy in the Great Lakes communities and suggests that this may be an indicator of community exposure to methyl mercury by the consumption of contaminated fish (Gilbertson, 2004). When

pregnant women eat fish contaminated with mercury, it can cross the placenta. Mercury readily accumulates in the brain of the developing child. Infants exposed to methylmercury (the most toxic form of mercury) can appear normal at birth but later show impairment of attention focus, fine motor function, language, drawing ability and memory (CEC, 2006).

Large amounts of mercury are released into the air in the Sarnia area; 390 kilograms were released in 2005. More mercury and mercury compounds are released into the air from TRI than NPRI facilities in the Sarnia area. Mercury is emitted from three TRI facilities: Detroit Edison Belle River (125 kilograms), Detroit Edison St. Clair (121 kilograms) and EB Eddy (4 kilograms). In 2005, a total of 259 kilograms of mercury was released from TRI facilities, about double the 130 kilograms released from NPRI facilities.

The two Detroit Edison power plants emitted relatively large amounts of mercury – enough to rank in the top 10 per cent of all 1,749 TRI facilities that released mercury to the air in 2005.

The mercury released from NPRI facilities in the Sarnia area is about 15 per cent of total Ontario NPRI mercury air emissions in 2005.

Large amounts of mercury are released into the air in the Sarnia area; 390 kilograms were released in 2005. The releases of mercury are to be virtually eliminated under several agreements such as the Great Lakes Water Quality Agreement.

Table 3: Canadian NPRI and US TRI Facilities in the Sarnia Area with the Largest Air Emissions of Mercury and its Compounds

Rank	Facility name	Amount of mercury and its compounds released in 2005 (kilograms)	Percentage of total emissions (%)
1	Detroit Edison Co., Belle River Power Plant	125.3	32
2	Detroit Edison Co., St. Clair Power Plant	120.6	31
3	Ontario Power Generation, Lambton Generating Station	67.44	17
4	Imperial Oil Sarnia Refinery Plant	33.74	9
5	Cabot Canada Ltd.	14.38	4
6	Clean Harbours Ltd., Lambton Facility	6.68	2
7	Imperial Oil, Sarnia Cogen	5.99	2
8	EB Eddy Paper Inc.	3.5	1
9	Shell Canada, Sarnia Manufacturing Centre	1.93	0
10	Imperial Oil, Sarnia Chemical Plant	0.38	0
Total TRI facilities		259.4	67
Total NPRI facilities		130.54	33
Total TRI and NPRI facilities		389.94	100

Dioxins and Furans

Dioxins and furans are legally considered toxic under the *Canadian Environmental Protection Act*.

Dioxins and furans are persistent, bioaccumulative and toxic compounds. Some members of the dioxin and furan family are carcinogens, suspected endocrine disruptors and suspected developmental and reproductive toxicants. Dioxins and furans are also legally considered toxic under the *Canadian Environmental Protection Act*.

More dioxin and furans are released into the air from NPRI than TRI facilities. The largest source of dioxins and furans in the Sarnia area is the coal fired power plant, Lambton Generating Station owned by Ontario Power Generation. This plant emits 85 per cent of the total dioxin and furans. There are some differences in reporting of dioxins and furans to TRI and NPRI. See Appendix for details.

Rank	Facility name	Amount of dioxins and furans (grams toxic equivalents)	Percentage of total emissions in Sarnia area (%)
1	Ontario Power Generation, Lambton Generating Station	0.183	85
2	Detroit Edison Belle River Power Plant	0.010	5
3	Detroit Edison St Clair Power Plant	0.008	4
4	EB Eddy Paper Inc.	0.007	3
5	Clean Harbours Lambton Facility	0.004	2
6	Royal Polymers	0.001	0
Total TRI facilities		0.026	12
Total NPRI facilities		0.188	88
Total TRI and NPRI facilities		0.214	100



The largest source of dioxins and furans in the Sarnia area is the coal fired power plant, Lambton Generating Station owned by Ontario Power Generation, which emits 85 per cent of the total dioxin and furans.

Types of Air Pollutants

This section describes three different types of air pollution:

- criteria air contaminants associated with acid rain, smog, respiratory and cardiovascular diseases and premature death;
- toxic pollutants associated with environmental contamination, cancer and reproductive and developmental disorders; and
- greenhouse gases associated with climate change.

The facilities in the Sarnia area are a significant source of the toxics, criteria air contaminants and greenhouses gases.

Table 5: Summary of all Types of Air Pollution from Sarnia NPRI Facilities		
Type of air pollutant	2005	Percentage of Ontario (%)
Toxic pollutants	5,669,073 kg	13.9
Criteria air contaminants	132,505,100 kg	15.2
Greenhouse gases (carbon dioxide equivalents)	16,494,169 tonnes	21.0
Note: Criteria air contaminants includes VOCs.		

Criteria Air Contaminants (CACs)

Criteria air contaminants include: sulphur dioxide, carbon monoxide, nitrogen oxides, total particulate matter, particulate matter equal to or less than 10 microns (PM₁₀), particulate matter equal to or less than 2.5 microns (PM_{2.5}) and volatile organic compounds.

The total amount of criteria air contaminants released into the air from Canadian Sarnia area facilities in 2005 was 132,505 tonnes. About 60 per cent of this total was released within 5 kilometres of the reserve.

In 2005, the amount of CACs released in the Sarnia area was about 15 per cent of total Ontario NPRI emissions of CACs. The Sarnia area emissions of CACs were only slightly less than the NPRI emissions of CACs for the entire province of New Brunswick (138,278 tonnes).

In the Sarnia area, most of the criteria air contaminants are releases of sulphur dioxide, a respiratory toxicant legally considered toxic under the *Canadian Environmental Protection Act*, which contributes to the formation of smog and acid rain. Several Sarnia facilities emit relatively large amounts of sulphur dioxide (Table 6). In fact the facilities in Sarnia account for 17 per cent of the total sulphur dioxide emitted in Ontario from NPRI facilities.

About 60 per cent of the 132,505 tonnes of criteria air contaminants was released into the air within 5 kilometres of the Aamjiwnaang reserve.

Table 6: Top Five Sarnia Area Facilities with the Largest Air Releases of Sulphur Dioxide					
Rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Sulphur dioxide released in 2005 (kilograms)	Percentage of sulphur dioxide emissions in Sarnia area (%)
1	Lambton Generating Station	Ontario Power Generation	15	29,343,100	38
2	Sarnia Refinery Plant	Imperial Oil	3	26,117,484	34
3	Sarnia Manufacturing Centre	Shell Canada	4	11,401,200	15
4	Cabot Canada Ltd.	Cabot Canada	2	6,347,776	8
5	NOVA Chemicals (Canada) Ltd. – Corunna Site	NOVA Chemicals	4	3,834,343	5
Total for five facilities				77,043,903	
Total for all Sarnia area facilities				80,422,240	
Total for all Ontario facilities				478,714,750	
Sarnia as percentage of Ontario					16.8

Because VOCs tend to evaporate into the air, they are a major building block in the creation of smog.



Volatile Organic Compounds

Volatile organic compounds (VOCs) are a group of chemicals that share one property: they evaporate or volatilize easily into the air. There are many examples of VOCs, such as benzene, styrene and toluene. Because VOCs tend to evaporate into the air, they are a major building block in the creation of smog. Many VOCs are considered respiratory toxicants,

and some VOC chemicals are carcinogens, reproductive and developmental toxicants and endocrine disruptors. VOCs are reported as a recognized group to NPRI, and not reported as a recognized group to TRI.

In 2005, facilities in the Sarnia area released large amounts of VOCs – 6,055,864 kilograms. Of this total, over 60 per cent of VOCs were released within 5 kilometres of the reserve.

Table 7: Sarnia Area Facilities with the Largest Air Releases of Volatile Organic Compounds

Rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Volatile organic compounds released in 2005 (kilograms)	Per cent of Sarnia total (%)
1	Lanxess East	Lanxess Inc.	7	1,362,500	23
2	Sarnia Refinery Plant	Imperial Oil	3	906,062	15
3	Sarnia Manufacturing Centre	Shell Canada	4	636,800	11
4	Sarnia Refinery	Suncor Energy Products Inc.	3	417,522	7
5	Sarnia Chemical Plant	Imperial Oil	2	347,269	6
6	Sarnia Plant	Basell Canada	2	272,310	5
7	NOVA Chemicals (Canada) Ltd. – Corunna Site	NOVA Chemicals	4	262,931	4
8	Sarnia Fractionation Plant	BP Canada	4	244,975	4
9	NOVA Chemicals Corp – St. Clair River Site	NOVA Chemicals	5	237,305	4
10	Sarnia Terminal	Enbridge Pipelines	5	212,642	4
Total for all Sarnia area facilities				6,055,864	100

Toxic Air Pollutants

This section discusses toxic air pollutants. Toxic air pollutants are defined in this report as substances reported under Part 1, 2 and 3 under NPRI. There were over 300 toxic air pollutants reported to NPRI in 2005. They are substances such as benzene, toluene, and metals such as mercury, lead and nickel. Toxic air pollutants do not include criteria air contaminants or greenhouse gases.

In 2005, the amount of toxic air pollutants released in the Sarnia area was 5,669,073 kilograms (12,498,166 lbs). This amount is about 14 per cent of Ontario's total toxic emissions for that year. The Sarnia area facilities emitted more toxic air pollutants than the entire province of Manitoba, or New Brunswick or Saskatchewan.

To help put Sarnia's toxic air pollutants into perspective, the city's emissions were compared with other communities in Ontario. The facilities in the Sarnia area emitted the largest amounts of toxic air pollutants compared to any other community in Ontario. The total emissions of toxic air pollutants from Sarnia facilities are larger than in Hamilton, Windsor, Sudbury, Toronto, Thunder Bay, Kitchener or Oshawa. This is based on NPRI

facility emissions of toxic air pollutants (those reported in Part 1, 2 and 3, see Appendix) within 25 kilometres of the city hall in each of these communities.

Sarnia is an example of a community with a number of facilities, each with relatively large individual emissions. When considered together, one can begin to appreciate the tremendous load of toxic contaminants spewed into this area. Sarnia has a large number of facilities within 25 kilometres of its city centre. It is the cumulative impact of all these facilities which results in Sarnia having the largest amount of toxic contaminants of any community in the entire province of Ontario.

This idea of cumulative emissions is only just beginning to be considered in mainstream environmental thinking. Traditionally, each facility was regulated without considering emissions from other facilities. The facility was assumed to exist in a pristine airshed for permitting processes. Now, we need to begin to work on processes that recognize the already degraded nature of some airsheds. The Sarnia airshed is an oversaturated airshed, already receiving air pollutants in large amounts from numerous sources.

Traditionally, each facility was regulated without considering emissions from other facilities – it was assumed to exist in a pristine airshed. We need to recognize that the Sarnia airshed is oversaturated, already receiving air pollutants in large amounts from numerous sources.



Health Based Approach

While the total amount of toxic contaminants seems much smaller than criteria air contaminants or greenhouse gases, toxic contaminants may have adverse health effects when emitted in low amounts. For this reason, we can look at air releases by identifying those

chemicals with known or suspected health effects. This approach provides another way to look at Sarnia area emissions from a health perspective.

This section analyzes air pollutants associated with four different types of health effects: known or suspected respiratory toxicants, developmental and reproductive

Table 8: Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Suspected Respiratory Toxicants

Sarnia Rank	Facility name	Company name	Distance from Aamjiwnaang centrepont (km)	Amount released in 2005 (kilograms)	Ontario rank
1	Lambton Generating Station	Ontario Power Generation	15	45,296,297	3
2	Sarnia Refinery Plant*	Imperial Oil	3	31,580,007	5
3	Sarnia Manufacturing Centre*	Shell Canada	4	13,952,712	10
4	Sarnia Refinery*	Suncor Energy Products Inc.	3	10,165,010	15
5	Cabot Canada Ltd.*	Cabot Canada	2	9,951,317	16
6	NOVA Chemicals – Corunna Site*	NOVA Chemicals (Canada) Ltd.	4	7,224,421	23
7	Sarnia Plant	Fibrex Insulations	2	2,378,767	38
8	Sarnia Regional Cogeneration Plant	Transalta Energy	6	1,586,984	45
9	Lanxess East	Lanxess Inc.	7	1,071,330	58
10	Terra Nitrogen	Terra International Canada Inc.	13	1,025,925	61
Total for all Sarnia area facilities				129,446,425	
Total for Ontario				814,518,130	
Sarnia as per cent of Ontario				15.9 per cent	
* denotes facilities that appear in top 10 facilities on all four health lists					

Table 9: Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Known or Suspected Reproductive and Developmental Toxicants

Sarnia rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Amount released in 2005 (kilograms)	Ontario rank
1	Sarnia Refinery	Suncor Energy Products Inc.	3	6,190,716	4
2	Lambton Generating Station	Ontario Power Generation	15	3,913,713	9
3	Sarnia Plant	Fibrex Insulations	2	2,721,151	15
4	Cabot Canada Ltd.	Cabot Canada	2	2,271,151	14
5	Sarnia Refinery Plant	Imperial Oil	3	954,037	26
6	Nova Chemicals – Corunna Site	Nova Chemicals (Canada) Ltd.	4	886,772	29
7	Terra Nitrogen	Terra International Canada Inc.	13	561,932	41
8	Sarnia Manufacturing Centre	Shell Canada	4	338,105	51
9	Sarnia Chemical Plant	Imperial Oil	2	210,969	66
10	Sarnia Regional Cogeneration Plant	Transalta Energy	6	204,751	71
Total for all Sarnia area facilities				18,949,965	
Total for Ontario				138,131,129	
Sarnia as per cent of Ontario				13.7 per cent	

toxicants, endocrine disrupters and chemicals considered legally toxic under the *Canadian Environmental Protection Act* (called CEPA toxics). For information on the source of these health lists please see the Appendix.

The Sarnia area has many facilities ranked in the top 15 in Ontario for releases of chemicals. Related health effects include suspected

respiratory toxicants (4 facilities), reproductive and developmental toxicants (4 facilities), endocrine disruptors (1 facility) and CEPA Toxics (4 facilities). There is considerable overlap among these lists, with five facilities appearing in the top 10 on all four health based lists (denoted in Table 8 with *).

Table 10: Top Eight Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Known or Suspected Endocrine Disrupters

Sarnia Rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Amount released in 2005 (kilograms)	Ontario rank
1	Cabot Canada Ltd.	Cabot Canada	2	66,334	13
2	NOVA Chemicals – Sarnia Site	NOVA Chemicals (Canada) Ltd.	3	31,512	28
3	Sarnia Refinery	Suncor Energy Products Inc.	3	16,600	49
4	Sarnia Manufacturing Centre	Shell Canada	4	12,433	60
5	Sarnia Refinery Plant	Imperial Oil	3	9,899	73
6	Sarnia Chemical Plant	Imperial Oil	2	9,851	74
7	Dow Chemical Canada Inc. – Sarnia	Dow Chemical Canada Inc.	2	7,989	77
8	NOVA Chemicals – Corunna Site	NOVA Chemicals (Canada) Ltd.	4	6,319	87
Total for all Sarnia area facilities				166,817	
Total for Ontario				2,976,558	
Sarnia as percentage of Ontario				5.6 per cent	

Table 11: Top 10 Facilities in the Sarnia Area with the Largest Combined Air Releases of Chemicals Considered Toxic Under the *Canadian Environmental Protection Act*

Sarnia rank	Facility	Company	Distance from Aamjiwnaang centrepont (km)	Amount released in 2005 (kilograms)	Ontario rank
1	Lambton Generating Station	Ontario Power Generation	15	40,528,223	4
2	Sarnia Refinery Plant	Imperial Oil	3	30,162,730	5
3	Sarnia Manufacturing Centre	Shell Canada	4	13,303,810	8
4	Cabot Canada Ltd.	Cabot Canada	2	7,179,225	15
5	NOVA Chemicals – Corunna Site	NOVA Chemicals (Canada) Ltd.	4	6,293,242	21
6	Sarnia Refinery	Suncor Energy Products Inc.	3	3717873	28
7	Sarnia Regional Cogeneration Plant	Transalta Energy	5	1,382,233	36
8	Terra Nitrogen	Terra International Canada Inc.	13	976,715	46
9	Lambton Facility	Clean Harbours Limited	11	707,970	54
10	Tecumseh Gas Storage	Enbridge Gas Distribution Inc.	9	581,700	59
Total for all Sarnia area facilities				106,979,279	
Total for Ontario				653,784,585	
Sarnia as per cent of Ontario				16.4 per cent	



The industrial facilities in the Sarnia area emit more greenhouse gases than the industrial facilities in many provinces such as New Brunswick and British Columbia.

Greenhouse Gases

Many of the facilities in the Sarnia area also emit greenhouse gases. In fact, the total amount of greenhouse gases emitted in Sarnia area by industrial facilities in 2005 was 16,494,169 tonnes (carbon dioxide equivalents).

Sarnia emits more than one fifth (21 per cent) of Ontario's total greenhouse gas emissions from industrial facilities reporting to the

greenhouse gas program. The industrial facilities in the Sarnia area emit more greenhouse gases than the industrial facilities in many provinces such as New Brunswick (12,610,793 tonnes carbon dioxide equivalents) and British Columbia (12,443,950 tonnes carbon dioxide equivalents) (Pollutionwatch, 2007).

Greenhouse gas emissions from Sarnia area facilities increased 4 per cent from the previous year, 2004.

Table 12: Emissions of All Greenhouse Gases (Carbon Dioxide Equivalents) from Sarnia Area Facilities

Sarnia rank	Facility	Company	Amount released in 2005 (tonnes)	Ontario rank
1	Lambton Generating Station	Ontario Power Generation	8,738,072	2
2	Sarnia Refinery Plant	Imperial Oil	1,715,193	9
3	NOVA Chemicals – Corunna Site	NOVA Chemicals Corporation	1,487,810	11
4	Sarnia Regional Cogeneration Plant	TransAlta Energy Corporation	1,271,501	14
5	Sarnia Manufacturing Centre	Shell Canada Products	1,032,975	18
6	Sarnia Refinery	Suncor Energy Products Inc.	830,124	21
7	Terra International (Canada) Inc. – Courtright Plant	Terra International (Canada) Inc.	499,920	28
8	Sarnia Chemical Plant	Imperial Oil	244,384	42
9	Cabot Canada Limited	Cabot Canada Limited	231,735	46
10	Sarnia Fractionation Plant	BP Canada Energy Company	181,195	53
11	NOVA Chemicals – Sarnia Site	NOVA Chemicals Corporation	144,031	62
12	NOVA Chemicals – SCRS Site	NOVA Chemicals Corporation	71,198	79
13	Sarnia Cogen Plant	Imperial Oil	46,029	82
Total for all Sarnia area facilities			16,494,169	
Total for Ontario			78,399,997	
Sarnia as percentage of Ontario			21.0 per cent	

Source: Pollutionwatch.org, based on federal greenhouse gas reporting program.

Pollution Prevention

Pollution prevention is the use of processes, practices, materials, products, chemicals or energy that avoid or minimize the creation of pollutants and waste so as to reduce the overall risk to the environment and human health (Environment Canada, 2004).

The idea is to redesign products or processes so that they avoid the creation of pollutants in the first place. It is a different approach than pollution management, which seeks to reduce the pollution only after it has been created. An example of pollution prevention is changing from oil-based paint to water-based paints. Pollution management in this case would have installed equipment to reduce discharges of oil-based paints. Pollution prevention encourages the kinds of changes that lead to lower releases and transfers, lower production costs and increased efficiencies.

Facilities report which pollution prevention activity they have undertaken for a particular chemical in the reporting year. They can choose more than one activity for each chemical. The types of pollution prevention activities in NPRI are: material or feedstock substitution, product design or reformulation, equipment or process modification, spill and leak prevention, on site reuse, recycling or recovery, improved inventory management or purchasing techniques and good operating practices and training. For example, a facility might report installation of an alarm for benzene. A facility does not report how much benzene has been eliminated from the pollution prevention measure. So the pollution prevention reporting in NPRI is qualitative rather than quantitative.

In 2005, about half of the chemicals released and transferred and half of the facilities in the Sarnia area reported no pollution prevention activity at all. Even those chemicals and facilities reporting some pollution prevention activity, the most common types of actions were: good operating practices and training,

training related to pollution prevention and improved maintenance scheduling, record keeping and procedures.

No facility reported doing some of the upstream, tougher pollution prevention activities such as product design or reformulation, or substitution of materials. Only five facilities reported equipment or process modifications, often for only a single chemical. Actions such as improved storage, improved loading and unloading, installing overflow alarms, installing vapour recovery, improved drainage, better labelling were not reported by any Sarnia facility.

So pollution prevention does not seem to be a consideration for half of the Sarnia area facilities, and for those that *are* doing some activity, it is largely training and not process or product changes.

Actions such as improved storage, improved loading and unloading, installing overflow alarms, installing vapour recovery, improved drainage, better labelling were not reported by any Sarnia facility.

Time Trends

From 2002 to 2005, releases of combined air pollution have decreased in the Sarnia area by 9 per cent. This time trend reflects only those chemicals and facilities that have consistently reported in 2002 and 2005. This time period was chosen because criteria air contaminants were not reported before 2002. This 2002 to 2005 period indicates short-term trends in the Sarnia area. About half of the Sarnia facilities show decreases in combined air pollution while about half show increases.

Air releases of toxic pollutants from NPRI facilities in the Sarnia area have decreased by 50 per cent from 2002 to 2005. However, most of this decrease is driven by a few facilities, Lanxess West, which has decreased its releases by 2,165,917 kilograms (mainly of n-hexane and chloromethane) and Lambton Generating Station, which reported decreases of 1,008,255 kilograms (mainly hydrochloric acid).



Most changes in releases from 2004 to 2005 in the Sarnia facilities were due to production changes (39 per cent). Very little change was driven by pollution prevention (2 per cent).

N-Hexane, chloromethane and hydrochloric acid are considered suspected respiratory toxicants, and the latter two are also considered reproductive and developmental toxicants. During the 2002 to 2005 period, about half of the Sarnia facilities show decreases in toxic air pollution while about half show increases.

Some facilities and some chemicals are also showing increases over this time period. And some new facilities have started operating or reporting to the NPRI, giving us a glimpse of “new” air pollution amounts.

The lack of pollution prevention as a driving force is further demonstrated when we look at the reasons facilities report for their changes in releases from one year to another. Most changes in releases from 2004 to 2005 in the Sarnia facilities were due to production changes (39 per cent). Very little change was driven by pollution prevention (2 per cent).

Most of this decrease occurred from 2002 to 2003 with fewer reductions from 2004 to 2005.

Air Pollution in the Future

Sarnia facilities emitted large amounts of air pollutants in 2005. But what about the future? Are these releases expected to continue? As part of the process of reporting to NPRI, facilities are required to estimate their releases and transfers for the next three years. We looked at these anticipated releases to determine if facilities in the Sarnia area were anticipating no change, increases or decreases in air releases from 2006-2008. For more than half of the chemical releases, facilities did not anticipate any change in air releases from 2006-2008. For about a third of chemical releases, facilities anticipated increases. A decrease in chemical releases was anticipated for only 11 per cent of chemicals released in the Sarnia area. So, almost 90 per cent of chemical releases in the Sarnia area are expected to either show no improvement or else increase over the next three years.

Table 13: Trends in Air releases in the Sarnia Area from 2002 to 2005					
Air release	2002	2003	2004	2005	Cumulative amounts 2002 to 2005
	(kilograms)				
Combined	143,707,965	139,408,861	140,498,400	130,404,175	554,019,401
Toxics only	8,771,489	5,800,588	4,529,112	4,388,451	23,489,640
CACs only	144,017,369	141,166,490	141,609,048	130,523,653	546,542,253
Note: Based on only those facilities and chemicals consistently reported between 2002 and 2005.					



Conclusions

The people of Sarnia are surrounded by 62 large industrial facilities that emit a range of dangerous air pollutants. In 2005, the total air pollution emitted from the 46 NPRI facilities was 131,992 tonnes. To put this into perspective, the facilities in the Sarnia area emitted almost the same amount of air pollution as all the NPRI facilities in the entire province of New Brunswick (137, 191 tonnes).

These 46 NPRI facilities constitute only 2 per cent of Ontario's total NPRI facilities yet they contribute more than 16 per cent of Ontario's NPRI air pollution load.

Sarnia is home to many of the largest air polluting facilities in Ontario: Ontario Power Generation's Lambton Generating Station, ranked number three in Ontario, Imperial Oil's Sarnia Refinery ranked sixth, and Shell Canada's Sarnia Manufacturing Centre ranked tenth (combined air releases).

The total amount of greenhouse gases emitted from Sarnia facilities in 2005 was 16,494,169 tonnes (carbon dioxide equivalents). Sarnia facilities emit more than one fifth (21 per cent) of Ontario's total greenhouse gas emissions from industrial facilities reporting to the Greenhouse Gas Reporting Program.

Sarnia area facilities release vast amounts of toxic pollutants into the air. In 2005, the

NPRI facilities in the Sarnia area emitted 5,669,073 kilograms of toxic pollutants to the air. Toxic pollutants are defined in this report as pollutants reported to NPRI in Parts 1,2 and 3 (see Appendix). They do not include criteria air contaminants such as sulphur dioxide, oxides of nitrogen or particulate matter or greenhouse gases such as carbon dioxide.

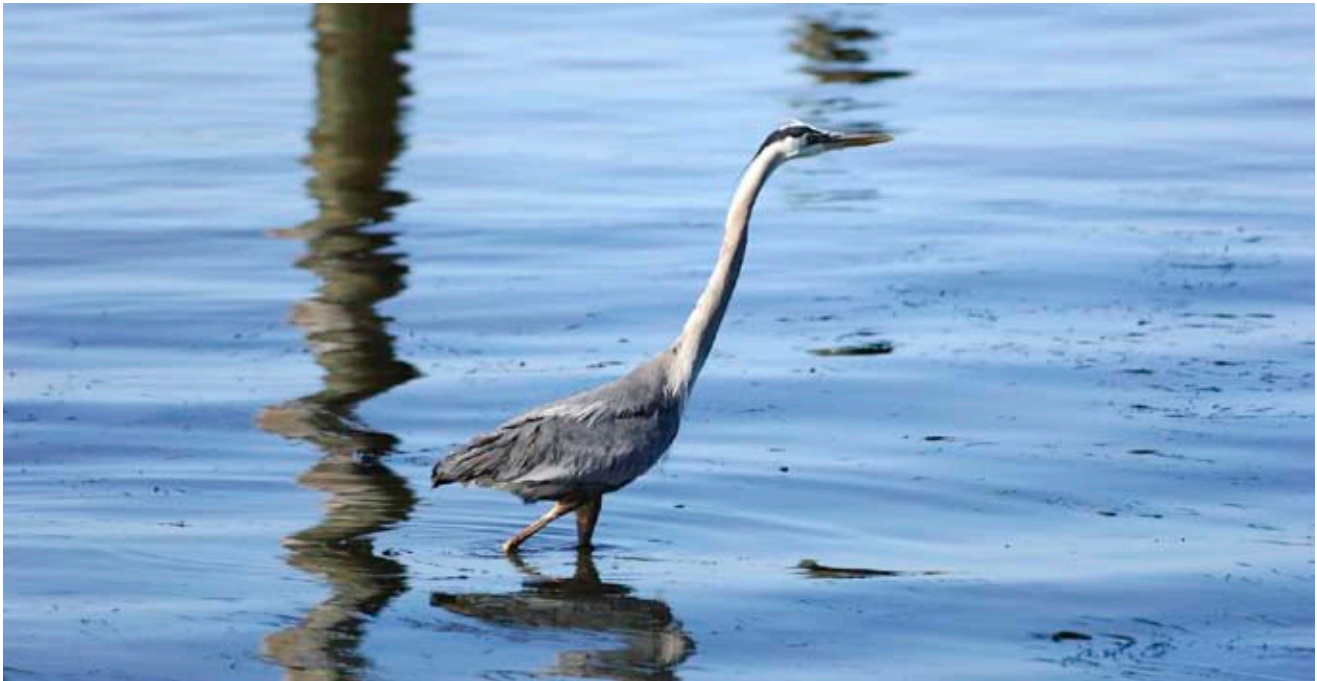
Sarnia area facilities emitted about 14 per cent of Ontario's total toxic pollutants from NPRI facilities – more than NPRI facilities emit in the entire province of Manitoba, or New Brunswick or Saskatchewan.

To put the total annual loadings of toxic air pollutants into perspective, Sarnia emissions were compared with other comparable communities in Ontario. The facilities in the Sarnia area emitted the largest amount of toxic air pollutants of any community in Ontario, more than Hamilton, Windsor, Sudbury, Toronto, Thunder Bay, Kitchener or Oshawa.

Health effects resulting from exposure to air pollutant emissions are being observed in both the people of the Sarnia area and the Aamjiwnaang First Nation.

The situation is unlikely to improve in the coming years without major reductions in the air pollutant emissions from industrial facilities in the area.

Facilities in the Sarnia area emitted the largest amount of toxic air pollutants of any community in Ontario, more than Hamilton, Windsor, Sudbury, Toronto, Thunder Bay, Kitchener or Oshawa.



Recommendations

Non-compliance should not be tolerated and enforcement measures should be taken immediately.

The facilities in the Sarnia area are emitting large amounts of toxic pollutants, the largest amounts of any community in Ontario. The health and environmental evidence is sufficient to warrant immediate action to reduce air pollution in the Sarnia area. The precautionary principle must be followed. The absence of scientific certainty regarding the causes of the observed health problems and the full effects of the air pollution in the Sarnia area should not be used as a reason to postpone action. Regulations requiring immediate reductions in industrial pollution emissions should be implemented without delay.

Governments should ensure that all facilities are in full compliance with all environmental laws and standards at all times. Non-compliance should not be tolerated and enforcement measures should be taken immediately.

At least two further studies are needed in order to ensure reductions are adequate and carried out in a manner that will ensure the greatest possible positive effect on the health of Aamjiwnaang and Sarnia area residents.

- A comprehensive assessment of the cumulative health and environmental impacts of the hundreds of air pollutants emitted from the Sarnia area facilities should be conducted. The study should also assess the additive and synergistic effects of the various air pollutants from the multiple sources. It should further explore the background air quality contributions from transboundary air pollution. Finally, the study must account for other routes of exposure to pollutants such as contaminated fish consumption, exposure to contaminated soil and occupational exposures.

- As the evidence of pollution-related health risks mounts, it has become apparent that a community-lead comprehensive health study is urgently needed. The study should determine who is impacted and where the impacted populations reside and the health problems facing those populations. The study should link the observed health effects to pollutants in the community.

The two studies should be used to target the most problematic pollutants for reductions with the ultimate goal of reducing the present threat to human health.

The relevant authorities must refrain from issuing any new authorizations or approvals for facilities (existing or new) in the Sarnia area that could increase pollutant loadings (individual or cumulative) or increase the community's exposure to pollutants.

Once deep reductions in air pollutant emissions have been put into place, the health of residents should be monitored on an ongoing basis. This will help to ensure that reductions are adequate such that residents in the Sarnia area no longer suffer from pollution-related health problems and concerns.

Although there are currently some air monitors in the Sarnia area, the network is inadequate, prone to breakdowns and full disclosure of

the monitoring results is not made accessible to the public. A comprehensive, reliable, long-term ambient air quality monitoring system near to the industrial facilities must be established in the Sarnia area with all results regularly reported to the public. The locations of all monitors should be based on a combination of community consultation and independent expert advice to target the areas with the highest level of pollutants and highest observed health impacts. The pollutants to be monitored should be chosen based on a complete review of the NPRI data and other reported industrial emissions, as well as through community consultation, preliminary comprehensive ambient air sampling and independent expert advice.

The governments of Canada, the United States, Ontario and the local First Nations must collaborate to ensure that improvements are made on both sides of the border that result in reduced air pollution loadings and pollution exposures in the Sarnia and Aamjiwnaang areas.

An independent watchdog chosen by the community should be appointed to oversee the above recommendations and ensure that they are fully implemented. Regular progress reports to the community will help to further hold all governments accountable.

The relevant authorities must refrain from issuing any new authorizations or approvals for facilities (existing or new) in the Sarnia area that could increase pollutant loadings (individual or cumulative) or increase the community's exposure to pollutants.

References

- Brophy, James, Margaret Keith and Jenny Schieman, 2007. Canada's Asbestos Legacy at Home and Abroad, *Int. Journal of Occupational Health*. 13:235-242.
- Carpenter DO, Arcaro K and Spink DC. 2002. Understanding the human health effects of chemical mixtures. *Enviro Health Perspectives*. 110 (Suppl 1): 25-42.
- Commission for Environmental Cooperation. May 2006. Toxic Chemicals and Children's Health in North America. A call for efforts to determine the sources, levels of exposure and risks that industrial chemicals pose to children's health. www.cec.org
- Environment Canada. 2004. Guide for reporting to the National Pollutant Release Inventory. 2003. Available at www.ec.gc.ca/pdb/npri
- Fung, Karen, Isaac Lunginaah, and Kevin M. Gorey. 2007. Impact of air pollution on hospital admissions in Southwestern Ontario, Canada: Generating hypotheses in sentinel high exposure places. *Environmental Health* 6:18-34. <http://www.ehjournal.net/content/6/1/18>
- Gilbertson, Michael. Male cerebral palsy hospitalization as a potential indicator of neurological effects of methylmercury exposure in Great Lakes Communities. *Environmental Research* 2004, 95(3):375-84
- Health Canada. 2000. St. Clair Area of Concern: Health Data and Statistics for the Population of Sarnia and Region (1986-1992). Great Lakes Health Effects Program. A Technical Report for the RAP Community.
- Mackenzie, Constanze, Ada Lockridge and Margaret Keith. 2005. Declining sex ratio in a First Nation Community. *Environmental Health Perspectives* 113 (10): 1295-1298
- Ontario Medical Association. 2005. The Illness Cost of Air Pollution.
- Pollutionwatch. 2007. Ranking of provinces for total greenhouse gases in 2005 in carbon dioxide equivalents. www.pollutionwatch.org
- Plain, Ron. 2006. How can PRTR data help the indigenous communities of North America. CEC Consultative Meeting. November 2006, San Diego, USA Available at http://www.cec.org/files/PDF/POLLUTANTS/PRTR/Ron-Plain_GreatLakes_en.pdf

Appendix: Methodology

About NPRI

This report uses 2005 NPRI data downloaded from the Environment Canada website. The NPRI data is constantly being revised and this report is based on the data version June 2007. NPRI data from the periods 1998 to 2004 was downloaded in 2006. For more information on NPRI, see www.ec.gc.ca/pdb/npri.

Combined air releases is the sum of criteria air contaminants and toxic contaminants minus volatile organic compounds (VOCs). VOCs are excluded from the combined air releases to avoid potential double counting that could occur when a compound such as benzene is reported as a toxic contaminant and then also reported as part of the group of VOCs. For the few facilities that reported only VOCs and no other chemicals, the VOC amount was considered the combined air release, as there is no potential for double counting. Only the total particulate matter (TPM) was included in the combined air releases and not the sub fractions particulate matter equal to or less than 10 microns (PM₁₀) or equal to or less than 2.5 microns (PM_{2.5}). For those few facilities that did not report total particulate matter but did report either PM₁₀ or PM_{2.5}, then this amount was included in the combined air releases.

About TRI

This report uses 2005 TRI data downloaded from the Environmental Protection Agency in June 2007. There are many similarities between TRI and NPRI and some important differences. For this report, TRI data is presented in two ways: first, the total amounts of air releases reported to TRI are presented. Then the report

presents the air releases from TRI data for only those chemicals and sectors that are common to both systems. This allows an apples to apples comparison of TRI and NPRI data. This matching eliminates some chemicals, such as ammonia, phosphorus, sulphur dioxide, particulates, carbon monoxide, and volatile organic compounds. It also eliminates reporting from NPRI oil and gas facilities. For more information on TRI, see www.epa.gov/tri.

Dioxins and Furans

There are differences in reporting of dioxins and furans between TRI and NPRI. TRI requires all facilities meeting a threshold of 0.1 grams to report, and to report the total amount of dioxins and furans in grams. NPRI specifies which types of facilities are required to report dioxins and furans, has no reporting threshold and requires the amount to be reported in grams toxic equivalents (g TEQ) not grams. To make the dioxin data from TRI and NPRI as comparable as possible for this analysis, the grams of dioxins reported by the four TRI facilities were converted into grams TEQ using the congener distribution reported by each facility. For example, EB Eddy reported 18.2 per cent of the total amount was congener number 1, which has a toxic equivalency factor of 0.01, resulting in a total amount of 0.000169 g TEQ of congener number 1 of dioxin (18.2 per cent of total 0.009269g*0.01). This procedure was repeated for each congener reported by a facility and then the total summed for a facility. It is recognized that the TRI threshold of 0.1 grams may exclude some facilities that report under NPRI rules. The TRI facility congener distribution reported is also assumed to be a good fit for air releases.

Table A1: Industrial Facilities within 25 Kilometres of the Approximate Centrepont (Hwy 40 south of Christopher Road at Aamjiwnaang) that Report to NPRI

NPRI facility	Company	Distance from Aamjiwnaang centrepont (km)
Sarnia Plant	Basell Canada	2
Lanxess West	Lanxess Inc.	2
Sarnia Plant	Fibrex Insulations	2
Dow Chemical Canada Inc. – Sarnia	Dow Chemical Canada Inc.	2
Sarnia Chemical Plant	Imperial Oil	2
Cabot Canada Ltd.	Cabot Canada	2
Sarnia IPA Plant	Shell Chemicals Canada	2
Sarnia PVC Plant	Royal Polymers	2
H. C. Starck Canada	Bayer Inc.	2
NOVA Chemicals – Sarnia Site	NOVA Chemicals (Canada) Ltd.	3
Sarnia Refinery	Suncor Energy Products Inc.	3
Sarnia Terminal	Imperial Oil	3
Sarnia Refinery Plant	Imperial Oil	3
Water Pollution Control Centre	City Of Sarnia	3
Sarnia Terminal	Shell Canada	4
Lasalle Landfill	Waste Management of Canada	4
St. Clair River Site – Modified Polymers	Canada Commercial Services L.P.	4
Sarnia, Plant No. 63	Canada Building Materials	4
Kel-Gor Limited	Kel-Gor	4
Sarnia Fractionation Plant	BP Canada	4
Sarnia Manufacturing Centre	Shell Canada	4
NOVA Chemicals – Corunna Site	NOVA Chemicals (Canada) Ltd.	4
Sarnia Enerflex	Woodbridge Foam	4
Ethyl Canada Inc. Corunna Site	Ethyl Canada Inc.	4
City Of Sarnia-Public Works Department	City Of Sarnia	4
Sarnia Regional Cogeneration Plant	Transalta Energy	5
Nova Chemicals – St. Clair River Site	Nova Chemicals Corp.	5
Sarnia Terminal	Enbridge Pipelines	5
Dow A Compressor Station	Union Gas	5
Sarnia Cogen	Imperial Oil	7
City Of Sarnia – Sarnia Police Services	City Of Sarnia	7
Sarnia Grain Terminal	Cargill Limited	7
Lanxess East	Lanxess Inc.	7
Moore Site	Nova Chemicals	8
Tecumseh Gas Storage	Enbridge Gas Distribution Inc.	9
Seckerton Compressor Station	Enbridge Gas Distribution Inc.	9
Lambton Facility	Clean Harbours Limited	10
UBE Automotive Sarnia Plant Inc.	UBE Automotive	10
Courtright	Agrium Advanced Technologies	13
Terra Nitrogen	Terra International Canada Inc.	13
Lambton Generating Station	Ontario Power Generation	15
Brigden Facility	Orford Cooperative	16
Petrolia Steel Drums	Vulcan Containers	22
Henry Company Canada – Petrolia	Henry Company Canada	22
Waterville TG – Waterville TG Petrolia	Waterville TG	23
Wyoming Feed	New Life Mills	24

Facility Identification

To identify facilities within 25 kilometers of the reserve, several methods were used:

1. Postal code: NPRI data were searching using the six postal codes for the Sarnia and surrounding areas: N7T (22 facilities), N7V (0 facilities), N7S (1 facility), N7X (0 facilities), N7W (1 facility) and NON (21 facilities). These facilities in NON were further reviewed to see if they fell within 25 kilometres of the reserve.
2. Communities: Facilities were identified using the community search feature at Environment Canada NPRI community portal site. Two communities, St. Clair (18 facilities) and Sarnia (21 facilities) were further reviewed to see if they fell within 25 kilometres of the reserve.
3. County: TRI facilities were identified for one County, St. Clair which borders the St. Clair river. Seventeen facilities located in St. Clair County reported to TRI in 2005. Of these three facilities were beyond the 25 kilometres limit (Algonac Cast Products, Sunsation Products Inc. and Detroit Edison Greenwood Energy Center)
4. Google Earth: The TRI and NPRI facilities have been mapped using Google Earth (www.cec.org). The

facilities within 25 kilometres of the reserve are identified. A few facilities did not appear on Google Earth, but were contained in the databases. The ruler function of Google Earth was used to measure the distance of the facility from the reserve. A midpoint of the reserve was used at Hwy. 40 and south of Christopher Road. Distances to the facility are best seen as estimates as many facilities cover large areas.

5. Greenhouse gas data: Searching the greenhouse gas data on Pollutionwatch (www.pollutionwatch.org) for postal code N yielded a new facility, Sarnia Regional Cogeneration Plant.

After cross-referencing lists, the final 2005 facility list included 46 NPRI facilities and 16 TRI facilities.

Health Lists

The health lists used in this report are derived from the US Environmental Defense web site, Scorecard at www.scorecard.com. The web site provides lists of chemicals considered known or suspected carcinogens, respiratory toxins, reproductive and developmental toxins, endocrine disruptors. Lists of chemicals considered CEPA toxic are derived from Environmental Defence and Canadian Environmental Law Association’s website, Pollutionwatch at www.pollutionwatch.org

Anticipated Releases

The anticipated releases for the NPRI facilities in the Sarnia area was downloaded from the Environment Canada web site. Only the first three years of anticipated releases (2006/2007/2008) were considered, as these are required to be reported. Environment Canada defines releases to include releases to air, water, spill and leaks to land (not landfill) and underground injection. A facility’s releases for each chemical were grouped into one of three categories: no change, increase or decreases. The analysis accounted for rounding in some fields. The total number of chemical reports in 2005 was 473.

Time Trends

In order to compare air releases over time, only those chemicals and facilities that are consistently reported from 2002 to 2005 are included. This means excluding chemicals that were added to NPRI reporting during this time period such as phosphorus and carbonyl sulphide. It also means excluding any facilities that did not report in 2002 and 2005. This excluded 12 facilities from the analysis. Because of these exclusions for chemicals and facilities, the amount of air releases used in the time trend analysis will be lower amounts than the 2005 air releases.

Table A2: Anticipated Changes in Releases of Chemicals from Facilities in the Sarnia Area from 2006 to 2009

Anticipated change in releases of chemicals from 2006 to 2009	Number of reports of chemical releases	Percentage of total reports
No change	274	57.9 per cent
Increase	149	31.5 per cent
Decrease	50	10.6 per cent
	473	



ecojustice.ca