



3.2 TIER II and TIER III – Ontario and Toronto Emission Sources

Unlike the US emissions, the Ontario and Toronto emissions (Figure 3-10 and Figure 3-11) were developed from a greater variety of approaches. A high resolution GIS based emission database system, previously developed for the City of Toronto (Golder, 2006) and known as AirTool, was used as the basis for assembling emissions data for Tier II and Tier III. The ArcGIS based AirTool holds the spatially allocated emissions over Ontario and the City of Toronto. Using the AirTool the emission changes that occur during the day, week and season reflecting the timing of different human/natural activities, are calculated. The emissions were created based on fine resolution data provided by the City of Toronto and subsequently extrapolated for other urban areas (i.e., London, Hamilton, Peel Region, etc) within Tier II.

The Tier II and III emission inventory data were expanded beyond Tier I with the addition of the following categories of emission sources:

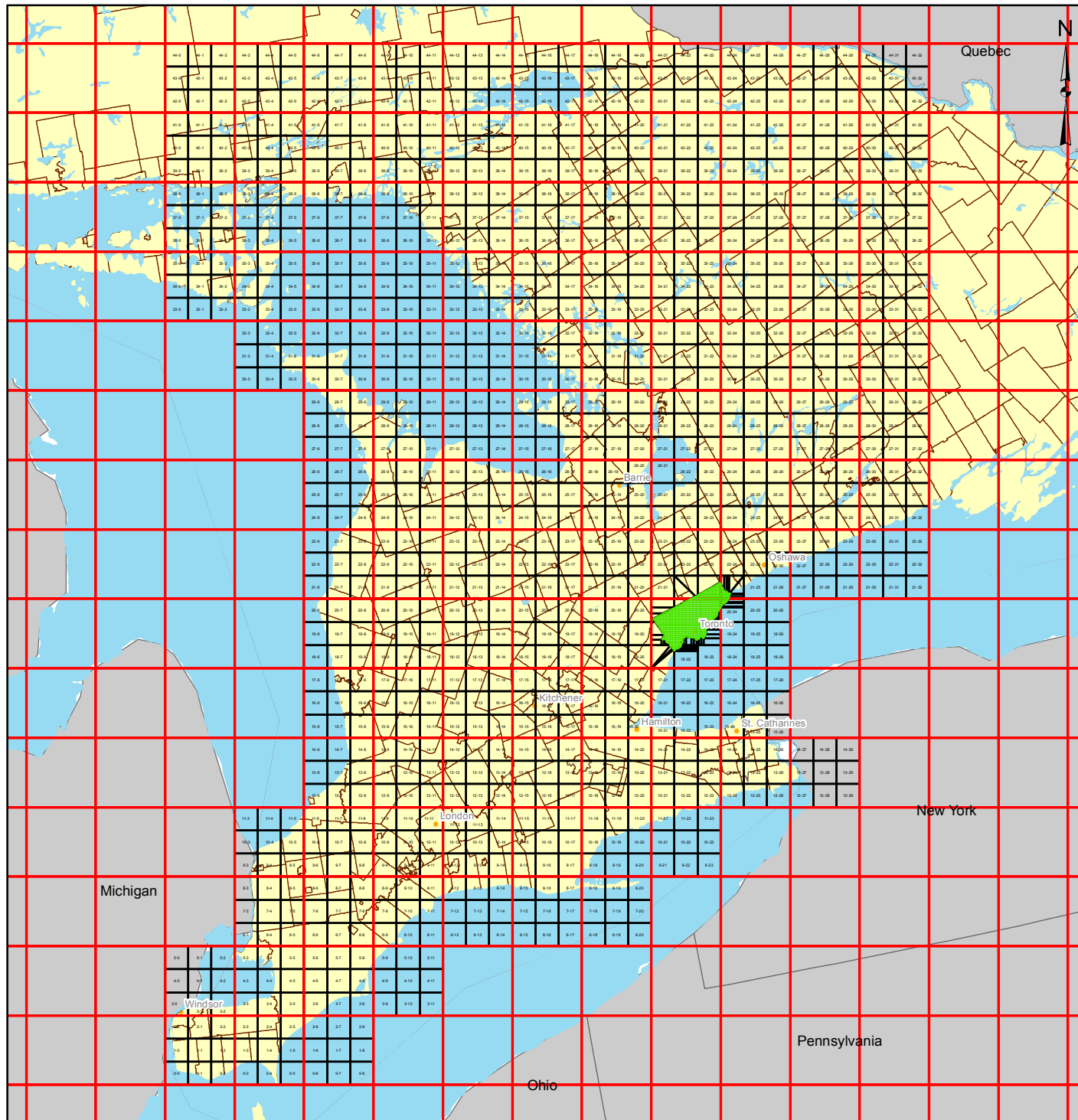
1. Industrial Points (NPRI stacks);
2. Industrial (NPRI plus below threshold reporting);
3. Commercial and Residential (commercial and residential natural gas usage, autobody shops, dry cleaners, commercial solvents, other residential heating sources);
4. Mobile (on-road vehicles);
5. Non-road (airport, marine, rail, lawn mowers, agricultural vehicles); and
6. Biogenic and Agricultural.

As mentioned above, emission processing is required to convert an annual emission inventory or an activity dataset into a format required for model ready data input by an air quality model. The ArcGIS Air Quality Tool (AirTool) was used in processing the annual emission inventory or activity into CALPUFF model ready emission files. AirTool is a Microsoft.NET based emissions processor, developed by Golder, to convert the emission inventory data into an air quality model ready format through spatial allocation. AirTool supports area-source, mobile-source, biogenic-source and point-source emissions processing, including the temporal allocation of emissions over a 24-hour/7-day week disaggregated time frame. A refined version of AirTool was implemented to process emissions for the City of Toronto and Ontario to take advantage of the high quality emissions and spatial data available for this study.

The AirTool emissions pre-processor is best suited for use with high-quality spatial datasets in conjunction with a detailed emissions inventory. Ultimately, the spatial datasets are used to populate each grid cell with an appropriate amount of emissions. The method in which the emission inventory is spatially disaggregated is dependent on the type of spatial data available. Each of the above six main emission inventory categories are discussed below.

Emission sources vary spatially and temporally. To accurately reflect the time-varying changes in emissions, temporal profiles based on Source Classification Codes (SCCs) were used to develop time dependent release rates (SCCs were used to classify different types of anthropogenic emission activities).

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LEGEND

- Tier 3 (2km) Grid
- Tier 2 (12km) Grid
- Tier 1 (36km) Grid

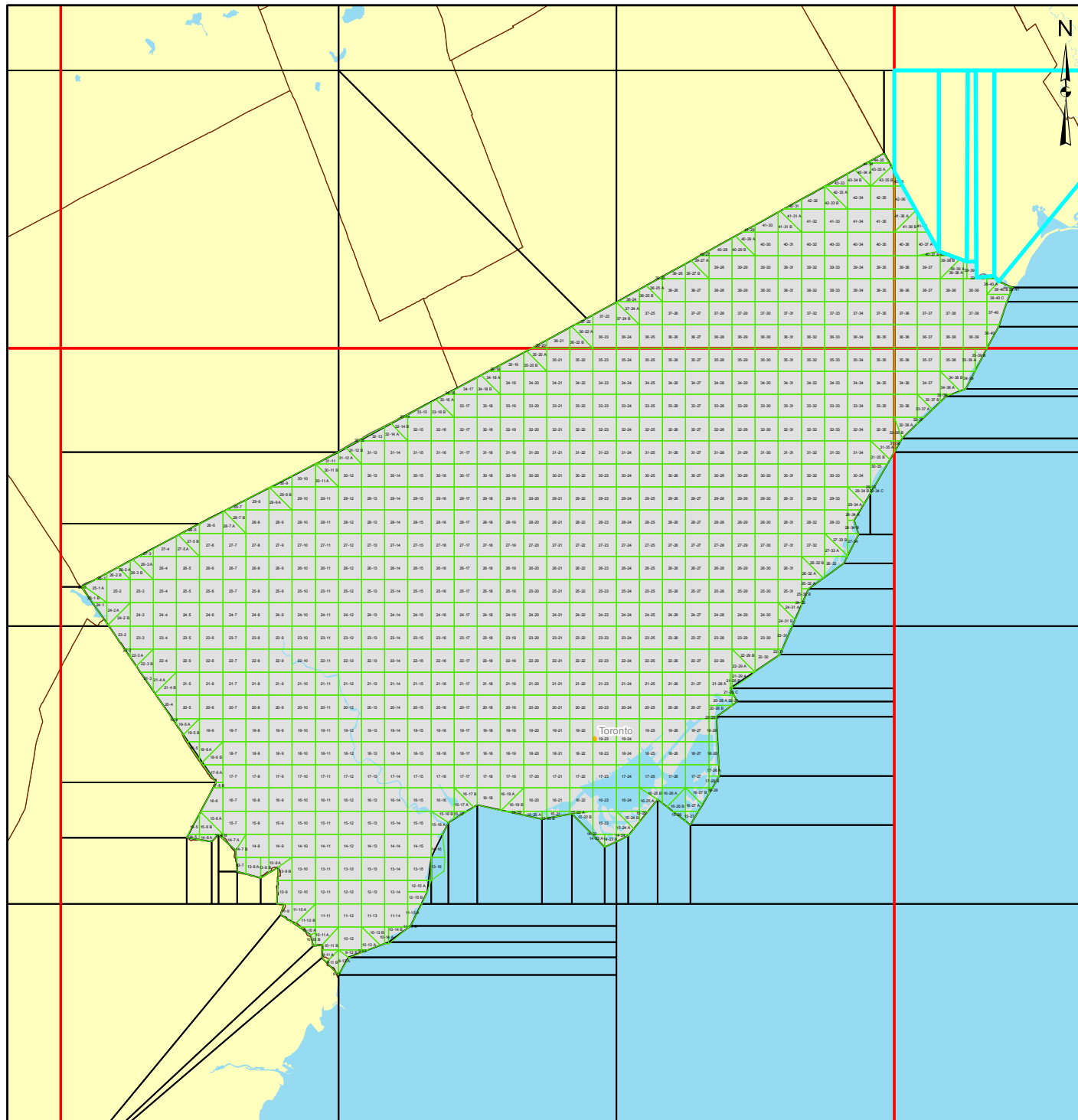


REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2006.4
 Produced by Golder Associates Ltd under licence from
 Ontario Ministry of Natural Resources, © Queens Printer 2008
 Projection: LCC Datum: NAD 83 Coordinate System: Ontario MNR Lambert



PROJECT	TORONTO AIRSHED MODELLING		
TITLE	GRIDDED TIER II COMPUTATIONAL DOMAIN		
 Golder Associates Mississauga, Ontario	PROJECT NO. 08-1112-0148	SCALE AS SHOWN	REV. 0.0
	DESIGN JMC 24 Mar. 2011	FIGURE: 3-10	
	GIS JMC 24 Mar. 2011		
	CHECK AC 24 Mar. 2011		
REVIEW AC 24 Mar. 2011			



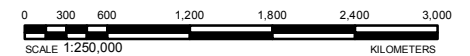
LEGEND

- Tier 3 (2km) Grid
- Tier 2 (12km) Grid
- Tier 1 (36km) Grid



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2006.4
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PROJECT	TORONTO AIRSHED MODELLING		
TITLE	GRIDDED TIER III COMPUTATIONAL DOMAIN		
<p>Golder Associates Mississauga, Ontario</p>	PROJECT NO. 08-1112-0148	SCALE AS SHOWN	REV. 0.0
	DESIGN JMC 24 Mar. 2011	FIGURE: 3-11	
	GIS JMC 24 Mar. 2011		
	CHECK AC 24 Mar. 2011		
REVIEW AC 24 Mar. 2011			



SOUTH RIVERDALE - LESLIEVILLE - BEACHES AIRSHED MODELLING STUDY

An SCC identifies the monthly, weekly and diurnal temporal profiles (i.e., change in the level of activity per time of day, day of week and month of year) such that hourly emissions can be estimated from annual emissions. The annual emissions were converted into hourly emissions using the following three steps:

- allocate the emissions to the monthly profile;
- allocate the emissions to the weekly profile; and
- allocate the emissions to the diurnal profile.

For Industrial, Residential and Mobile source emissions, temporal allocation files were obtained from the U.S. EPA Technology Transfer Network Clearinghouse (EMCH) for Inventories and Emission Factors and applied to the emissions inventory data of Tier II and Tier III.

3.2.1 Industrial Sources

Industrial sources include emissions reported to NPRI (Inventory) from large industrial operations in existence in 2006. Industrial sources are modelled as either point sources or area sources. Any stationary source that usually releases emissions through stacks at elevated heights for which individual source records are maintained and reported to the Inventory and for which annual emissions exceed a specified cut-off level are included. The cut-off level, in tonnes of emissions, varies from province to province. Point sources are the only sources that have specific latitude and longitude information as well as stack height, top of stack diameter and related parameters, such as exit velocity and temperature, provided.

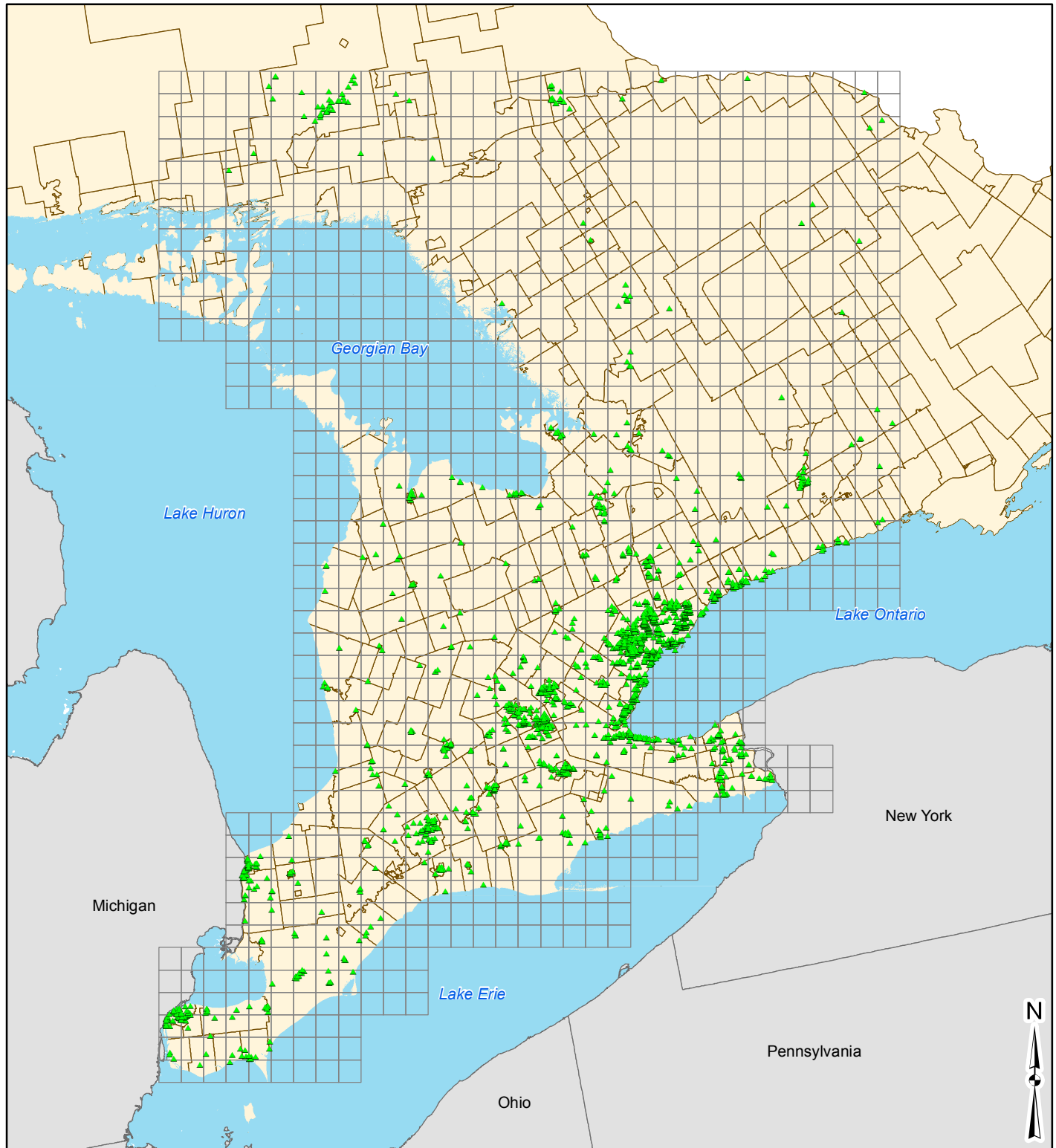
Some industrial activities emit contaminants in amounts which are below their applicable reporting thresholds and are not reported to public inventories but for the purposes of this study, need to be quantitatively addressed and included. These below threshold emissions were back calculated based on reported data from NPRI and using industry specific emission factors.

The major industrial sources within Tier II and Tier III domains are illustrated in Figure 3-12. Stack emissions information for point sources were obtained from the NPRI 2006 database. A total of 2104 industrial sources were identified within the Tier II and Tier III domains and were provided in electronic form to the City. The distribution of industrial sources between Tier I and II are presented in Table 3-3.

Table 3-3: Distribution of Industrial Sources in 2006 within TIER II and Tier III domains.

Domain	Number	Percentage of Modelled NPRI Sources
Tier II	1,770	84%
Tier III	334	16%
Total	2,104	100%

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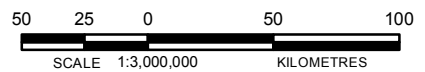


LEGEND

- ▲ NPRI Reporting Facility
- Tier 2 Cell
- Waterbody
- Municipal Boundary

REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
 NPRI Locations - NPRI
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 Projection: Lambert Conformal Conic Datum: NAD 83 Coordinate System: US EPA LCC



PROJECT				TORONTO AIRSHED MODELLING			
TITLE				NPRI INDUSTRIAL SOURCES IN TIER II			
PROJECT NO. 08-112-0148		SCALE AS SHOWN		REV.			
DESIGN	PRM	16 Nov. 2009					
GIS	PP	24 Mar. 2011					
CHECK	BCo	24 Mar. 2011					
REVIEW	AC	24 Mar. 2011					



FIGURE: 3-12



In consultation with the City, who undertook discussions with the Ministry of Environment, the reported sources for 2006 within the SRLB receptor area, that were known to be no longer operating, were removed from the data set. For point sources, the Inventory provides individual emission data for each source including SCC number, location (latitude/longitude) and exit stack characteristics (temperature, velocity, and diameter). For non-point NPRI emission sources, the emissions were attributed to the domain cell that contained the source. The number of point and non-point emissions for Tier II and Tier III are shown in Table 3-4.

3.2.1.1 *Below threshold reporting for NPRI Sources*

Special attention was given to industrial sources that could release PAC contaminants. Environment Canada has assigned specific reporting thresholds to various contaminants above which a facility is required to report emissions. These thresholds are not all based on a quantity of emissions released (i.e., tonnes/yr) but also on a Manufactured, Processed or Otherwise (MPO) used basis. Over 340 contaminants are listed under NPRI which include the 30 PACs studied here. Some facilities in Ontario release PAC emissions but because they are below the reporting threshold, the facilities do not have an obligation to report such emissions to the NPRI.

Where emission releases are below the reporting threshold, emission estimates are developed based on the level of an activity such as the amount of material consumed or product produced over a period of time (e.g., tonnes of raw product per hour). The activity level is multiplied by an appropriate emission factor to estimate the rate of emissions released into the atmosphere from a specific activity. By estimating the activity level and using an appropriate emission factor, an estimate of the non-reported (or below threshold) emissions can be realized. Applicable emission factors were obtained with the aid of the US EPA web-based Factor Information Retrieval (FIRE) Data System (i.e., webFIRE). FIRE is a database management system containing EPA's recommended emission estimation factors for criteria and hazardous air pollutants. FIRE includes information about industries and their emitting processes, the chemicals emitted, and the emission factors themselves. FIRE allows easy access to criteria and hazardous air pollutant emission factors obtained from the Compilation of Air Pollutant Emission Factors (AP 42), Locating and Estimating (L&E) documents, and the original AIRS documentation of emission factors as in the AFSEF and XATEF documents of the USEPA.

The following procedure was applied to Ontario (Tier II) and Toronto (Tier III) emission estimates.

1. NPRI reporting facilities has a SCC assigned based on the type of operation they carry out.
2. webFIRE was used as the source of emissions factors for the SCC of interest.
3. NPRI reported emissions were compared to webFIRE emission factors.
4. Where emissions were reported, and corresponding emission factors existed - an activity level was derived (emission factor/ reported emissions) .
5. Activity levels were used to calculate emissions for facilities where webFIRE PAC emission factors existed, but emissions were not reported for the industry of interest.
6. Below threshold emissions were added to the industry profile and the Tier II or Tier III inventory.

The above simple approach was applied to Tier II and III sources to provide an estimate of potential emissions from existing facilities. These emissions have been combined and summarised as shown in Table 3-4.