THE 1985

CANADIAN EMISSIONS INVENTORY

OF COMMON AIR CONTAMINANTS

Inventory Management Division
Management & Emergencies Branch
Conservation & Protection
Environment Canada

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EXECUTIVE SUMMARY

Environment Canada has undertaken the task to inventory emissions on a national basis since the early seventies. Since that time, the inventory process has been continually modified to minimize the error involved in the estimation process, and to complement other environmental studies. The results of the 1985 national emissions inventory are presented in this report, as well as a description of the general methodologies employed, the computerized data handling system and the additional information assembled for modelling activities. The inventory represents anthropogenic sources of emissions from point and area sources:

-industrial sources
-fuel combustion in stationary sources
-fuel combustion in mobile (transportation) sources
-waste incineration (including wood waste incineration), and
-miscellaneous sources.

All point sources emitting at minimum 100 metric tonnes per year, of any of the parameters inventoried (i.e., total particulate matter (TPM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), total hydrocarbon (THC), and volatile organic compounds (VOC)) are included in this inventory. The inventory is based on 1985 data and statistics, and has been resolved to 127 kilometer by 127 kilometer grids covering the ten provinces and two territories for long range transport of air pollutants modeling requirements.

A summary of the atmospheric emissions from Canadian sources in 1985 is presented in Table 1 and Figure 1. An overview of national emissions is presented by pollutant in the following paragraphs.

TABLE 1

Summary of Emissions by Province
(Metric Tonnes per Year)

	Alta	B.C.	Man.	N.B.	Nfld.	NWT	N.S.	Ont.	P.E.I.	Que.	Sask.	Yukon	National
Total Particulate Matter													
Industrial	138,707	210,573	33,006	51,270	101,318	454	46,657	97,540	195	154,320	69,378	6,742	910,160
Stationary Fuel Combustion	44,410	58,268	9,268	24,234	15,536	2,273	15,206	84,235	6,533	77,564	39,421	0	376,998
Transportation	15,186	15,338	5,704	2,282	2,127	759	3,682	40,812	441	16,117	7,923	171	110,533
Incineration	1,827	22,342	181	785	100	6	379	5,407	36	6,590	449	0	38,102
Miscellaneous	18,593	107,054	5,814	11,781	4,110	341	6,222	54,714	913	55,250	8,806	93	273,691
Total	**218,723**	**413,575**	**53,973**	**90,352**	**123,191**	**3,824**	**72,146**	**282,708**	**8,168**	**309,841**	**125,977**	**7,006**	**1,709,484**
Sulphur Dioxide													
Industrial	446,621	75,548	459,720	20,341	2,778	0	11,889	977,978	0	569,318	8,378	341	2,572,912
Stationary Fuel Combustion	87,411	17,348	6,375	115,560	38,349	1,427	155,161	429,986	1,345	90,349	73,781	0	1,017,091
Transportation	4,548	11,980	3,026	1,771	2,234	311	3,361	31,632	340	32,314	3,361	30	94,858
Incineration	115	305	43	39	20	3	36	402	5	734	46	0	1,748
Miscellaneous													
Total	**538,695**	**105,131**	**469,040**	**137,711**	**43,381**	**1,741**	**170,447**	**1,439,938**	**1,690**	**692,715**	**85,566**	**371**	**3,686,485**

TABLE 1 (Cont'd)

Summary of Emissions by Province
(Metric Tonnes per Year)

	Alta	B.C.	Man.	N.B.	Nfld.	NWT	N.S.	Ont.	P.E.I.	Que.	Sask.	Yukon	National
Nitrogen Oxides													
Industrial	26,243	10,693	572	2,647	1,320	0	1,585	38,154	0	6,860	857	0	88,931
Stationary Fuel Combustion	222,404	45,238	7,622	13,489	8,953	3,732	27,618	168,155	618	34,246	61,316	0	593,391
Transportation	197,060	195,783	76,147	29,053	24,502	10,284	47,914	376,344	5,312	192,759	95,617	2,126	1,252,901
Incineration	471	2,263	146	170	68	10	136	2,160	19	1,851	156	0	7,450
Miscellaneous	1,055	9,033	202	928	295	22	404	317	48	4,160	355	0	16,819
Total	**447,233**	**263,010**	**84,689**	**46,287**	**35,138**	**14,048**	**77,657**	**585,130**	**5,997**	**239,876**	**158,301**	**2,126**	**1,959,492**
Carbon Monoxide													
Industrial	28,986	75,292	1,138	5,556	0	0	448	455,793	0	198,797	8,844	0	774,849
Stationary Fuel Combustion	86,751	492,945	14,375	32,676	51,592	8,782	35,493	212,054	26,303	237,391	65,972	0	1,264,334
Transportation	1,079,518	1,015,811	401,498	187,454	128,456	22,893	235,427	2,341,057	34,686	1,159,360	544,175	13,282	7,163,617
Incineration	19,357	274,005	1,199	8,945	757	8	3,739	39,060	313	77,800	4,248	0	429,441
Miscellaneous	61,988	518,774	12,790	53,160	17,091	1,292	23,654	194,756	2,932	241,155	20,872	42	1,148,506
Total	**1,276,600**	**2,376,827**	**481,000**	**287,791**	**197,896**	**32,975**	**298,756**	**3,242,720**	**64,234**	**1,914,503**	**644,121**	**13,324**	**10,780,747**

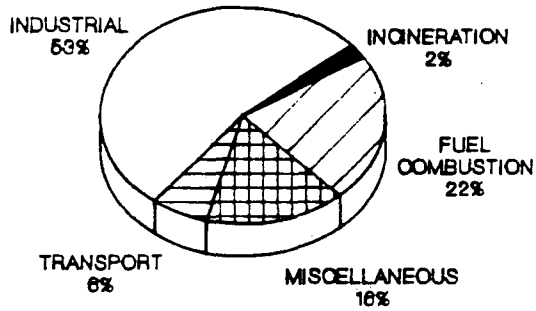
TABLE 1 (Cont'd)

Summary of Emissions by Province
(Metric Tonnes per Year)

	Alta	B.C.	Man.	N.B.	Nfld.	NWT	N.S.	Ont.	P.E.I.	Que.	Sask.	Yukon	National
Total Hydrocarbons													
Industrial	177,212	139,462	1,712	5,731	70	351	20,304	131,455	5	59,906	41,723	0	577,931
Stationary Fuel Combustion	44,480	63,385	3,034	5,524	9,075	1,658	5,447	39,234	4,578	41,584	3,424	0	221,423
Transportation	127,428	141,989	51,941	25,209	19,653	2,903	33,117	330,870	4,587	160,044	62,642	1,625	962,008
Incineration	1,692	20,829	124	741	74	2	334	4,428	29	14,628	378	2	43,259
Miscellaneous	41,413	101,818	16,578	16,138	9,095	697	14,675	169,755	2,423	121,849	16,289	403	511,133
Total	**392,225**	**467,483**	**73,389**	**53,343**	**37,967**	**5,611**	**73,877**	**675,742**	**11,622**	**398,011**	**124,456**	**2,028**	**2,315,754**
Volatile Organic Compounds													
Industrial	63,256	16,818	1,599	2,842	49	193	4,426	114,172	5	50,727	4,196	0	258,283
Stationary Fuel Combustion	8,506	47,132	2,644	5,402	8,954	1,570	5,057	36,578	4,522	40,692	3,010	0	164,068
Transportation	115,420	128,542	47,029	22,782	17,815	2,650	29,988	298,939	4,148	144,624	56,806	1,471	870,215
Incineration	692	8,349	56	301	32	1	139	2,044	12	7,587	157	0	19,370
Miscellaneous	39,818	88,163	16,273	14,735	8,649	664	14,064	169,600	2,349	115,560	15,753	403	486,032
Total	**227,691**	**289,005**	**67,601**	**46,062**	**35,500**	**5,079**	**53,674**	**621,332**	**11,037**	**359,191**	**79,922**	**1,874**	**1,797,969**

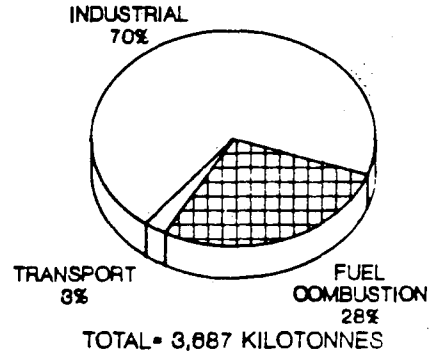
FIGURE 1
TOTAL CANADIAN EMISSIONS BY SOURCE CATEGORY FOR PARTICULATES, SO_2, NO_x, VOC, CO, THC 1985

PARTICULATES



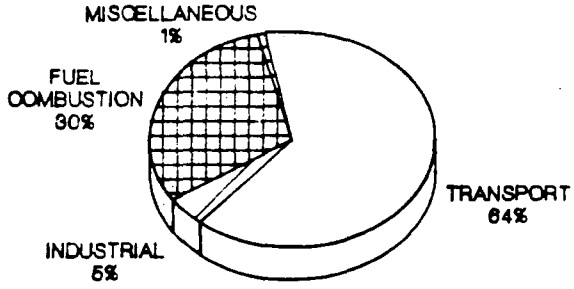
TOTAL= 1,709 KILOTONNES

SO2



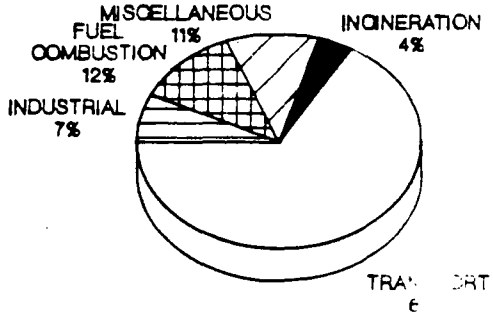
TOTAL= 3,687 KILOTONNES

NOX



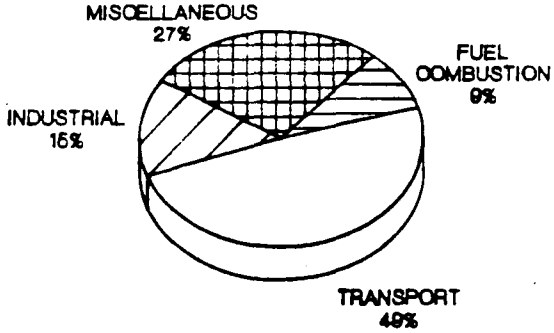
TOTAL= 1,959 KILOTONNES

CO



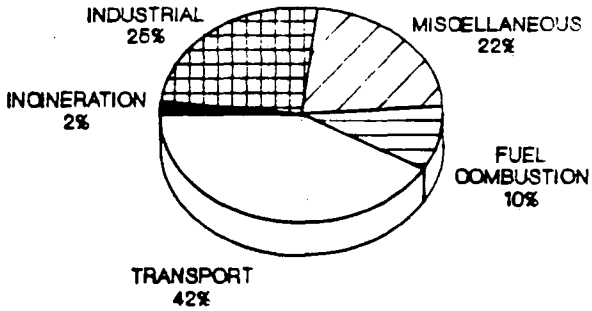
TOTAL= 10,781 KILOTONNES

VOC



TOTAL= 1,798 KILOTONNES

THC



TOTAL= 2,316 KILOTONNES

Total Particulate Matter

National emissions of total particulate matter totalled 1.7 million tonnes per year. Industrial sources collectively contributed 54 percent of the national total. Miscellaneous, fuel combustion, transportation and incineration sources accounted for 16, 22, 6 and 2 percent of total TPM emissions, respectively. A more detailed summary by sector is provided in Table 2.1.1. The major sources of particulate matter in Canada are mining and rock quarrying (10 percent), iron ore mining and beneficiation (8 percent), and power generation (8 percent). Most industrial sources as well as power generation plants employ control devices specifically designed for particulate emissions.

Sulphur Dioxide

Nationally, 3.7 million tonnes are estimated to have been released into the atmosphere in 1985. Of this total, industrial sources contributed 70 percent, fuel combustion 28 percent and transportation 3 percent. The industrial processes with significant sulphur dioxide emissions are primary nickel and copper smelting (44 percent), power generation (20 percent), and industrial fuel combustion (6 percent). The nickel and copper smelting sources generally are SO_2 controlled sources. This is also the case for some larger power plants.

Nitrogen Oxides

Emissions of nitrogen oxides totalled 2.0 million tonnes per year Canada-wide. Transportation sources collectively are the most significant source of NO_x (64 percent). Stationary fuel combustion accounts for 30 percent of the total NO_x emissions, while remaining sources contributed a mere 6 percent. The relative importance of the transportation sources is presented below:

1. gasoline powered vehicles (28 percent)
2. diesel powered vehicles (25 percent)
3. railroads (7 percent), and
4. marine, aircraft, and off-road sources (4 percent).

In newer gasoline powered vehicles, exhaust gas recycling systems moderate NO_x emissions, however, older gasoline powered vehicles, diesel powered vehicles, locomotives and other internal combustion engines are not controlled for NO_x emissions. The continuing increase in the number of transportation sources is also a factor in the relative importance of these sources.

Carbon Monoxide

Carbon monoxide is commonly generated as a byproduct of the inefficient combustion of the traditional fossil fuels and wood. The minor role that carbon monoxide plays in photochemical reactions to create haze and smog has been a great concern in many areas. In Canada, 10.8 million tonnes of CO were released into the atmosphere. As for nitrogen oxides, the largest contribution of CO is the agglomerative effect of transportation sources.

Total Hydrocarbons

Emissions of total hydrocarbons amounted to 2.3 million tonnes in 1985. Transportation sources at 42 percent were the most important followed by industrial processes and miscellaneous sources at 25 and 22 percent, respectively. The industrial contribution is in fact higher since the data reporting techniques group solvent use at industrial facilities and fuel marketing losses under the miscellaneous category. Automobiles were responsible for more than half of the releases from the transportation category.

Volatile Organic Compounds

The difference between total hydrocarbons and volatile organic compounds is that the latter excludes photochemically non-reactive organics such as methane, ethane and chloro-fluoro carbons (CFCs). A total of 1.8 million tonnes of VOCs were released or about 75 percent of THCs are photochemically reactive. The distribution of the emissions amongst the various economic categories is essentially the same as for THCs except for the industrial processes where 45 percent of THCs originate from coal mining operations. These releases are essentially all methane while solvents and volatile fuel fractions are mainly reactive organics hence the miscellaneous category contributes a larger proportion of VOCs than THCs. A more detailed analysis by sector is shown in Table 2.1.1. VOC emissions are not controlled to any large extent by add-on control devices but they are kept to a minimum by process optimizations and product formulations.

1 INTRODUCTION AND BACKGROUND

The primary objective of producing an emission inventory is the assessment of relative contribution of pollutants by various sources. The compilation of emissions for each known source allows comparisons by source type and region. Relative contributions are vital in assessing the magnitude of impacts due to a particular source type and in assessing the possible benefits that may be achieved through controls and reductions.

Historically, the inventory of emissions has been conducted since 1970, however the complexity has increased and a number of new sources have been incorporated. The inventory for 1985 is an update of the 1980 national emissions inventory with several enhancements. The method of compilation has remained essentially parallel to the 1980 emissions inventory. Collaboration with provinces has occurred to produce this inventory and to fulfil the requirements of provincial agencies within the national framework. Efforts to provide provincial data by provincial ministries are gratefully acknowledged. Modifications have also been driven by the efforts to exchange emissions information with U.S. E.P.A. The collaborative effort enables inter-boundary estimate and supports long-range modelling activities.

The pollutants inventoried also have been consolidated, and emission factors have been standardized whenever possible. These modifications facilitate more accurate, and uniform estimates of emissions on the North American continent.

1.1 OBJECTIVES

The objective of this emissions inventory is to provide accurate estimates of emissions to the atmosphere by source type with spatial and temporal distributions. The comparison of the contribution of various

sources also is important to efforts intended to maintain and improve ambient air quality. The source by source inventory allows the assessment of possible future impacts of increased industrial or area wide (automobiles, wood burning etc.) activities.

Another function of the emissions inventory is to augment the research activities in dispersion modelling. Sulphur dioxide and oxides of nitrogen are of particular interest with respect to acid rain issues. For modelling purposes, data elements such as stack height, stack diameter, exit velocity and temperature, as well as control devices and efficiencies were added to the inventory database. As indicated previously, activity levels have been included to define source activity by season, day of week and hour of the day.

1.2 SCOPE OF THE 1985 NATIONAL EMISSIONS INVENTORY

The 1985 National Emissions Inventory for Canada is a compilation of emissions in the ten provinces and the two territories. Annual emissions data have been obtained for the following pollutants:

1. particulate matter, (TPM)
2. sulphur dioxide, (SO_2)
3. nitrogen oxides, (NO_x)
4. carbon monoxide, (CO)
5. total hydrocarbons, (THC)
6. volatile organic compounds (VOC)
   (excludes methane and other non-reactive THC species)

Although not covered in this report, the following information has been assembled and is part of the emissions inventory which is supplied to the atmospheric modeling community. Volatile organic compound emissions have been speciated into 10 reactivity classes using EPA VOC species profiles (Shareef, 1988). Particulate matter has been further defined as fractions of calcium, magnesium, potassium, and sodium. Sulphate and ammonia emissions have been added because of their importance in atmospheric chemistry.

Detailed information regarding the activity level on a daily, weekly and seasonal basis has been compiled for each source type. These profiles provide a temporal resolution of 1 hour for each source classification; encompassing point, mobile, and other area sources. Spatially, the emissions were also dissaggregated on a 127 km by 127 km areas or grids for all of the Canadian territory.

1.3 IMPROVEMENTS

To increase compatibility and comparability with the inventory efforts of the E.P.A., NAPAP emission factors were used whenever Canadian sampling data were not available.

As in the previous 1980 canadian emissions inventory, a collaborative effort with the U.S. E.P.A. has resulted in the development of an updated North American inventory. All facets of the inventory were considered, and several improvements were incorporated in the 1985 Emissions Inventory.

Areas of improvement were motivated by acid rain issues, tropospheric ozone concerns, dispersion modelling efforts and timely concern for toxic organic reactivity classes. Stack parameters were added to enhance dispersion modelling efforts, as well as process and control information. Measures to ensure greater precision also were of prime concern. These involved increased level of detail, standardization of methodologies and improvements to the data handling system. This additional information is provided on a source by source basis.

The identification of source type is provided in both Source Classification Code (SCC) and Standard Industrial Code (SIC) for ease of retrieval (Appendix B). In areas where Canadian source data existed, these data have been employed in the inventory. A complete list of source sectors inventoried is provided in Appendix B.

1.4 REPORT ORGANIZATION

The structure of this Emissions Inventory Report has been revised since 1980. The underlying concept in its design is to address the needs of a diverse audience. The report begins with a summary of findings and continues to increasing detail and additional subject matter.

The results of the 1985 emissions inventory are outlined in the Executive Summary. These data are presented and interpreted in greater detail in Section 2. The methodologies employed in the compilation of emissions are summarized by major category in Section 3. A description of the enhancements made to the 1985 inventory especially in support of modelling activities is provided in Section 4. Section 5 details the database system maintained for the emissions inventory, and provides potential users with the file and data structures to make use of data existing in the Residual Discharge Inventory System (RDIS).

Section 6 of the report is intended to provide an insight to envisioned future activities and improvements.

Supplementary information that is provided include a glossary and various detailed listings of information in the three appendices.

2 OVERVIEW OF THE 1985 EMISSIONS INVENTORY RESULTS

The results of the 1985 National Emissions Inventory are summarized in this section. An overview of national emissions is presented, followed by a summary of each province providing more detailed information.

The 1985 National Emissions Inventory estimates the emissions for approximately 80 different source categories. For ease of presentation, these are agglomerated into about 30 source types. The provincial ministries of the environment contribute source information for their respective province and these data are verified and completed wherever possible. Whenever the latest base year is not available the 1980 values were used.

In particular, extensive information regarding point sources were compiled by the Provincial Ministries. Their collective effort has resulted in greater detail and accuracy in the 1985 Emissions Inventory. The emissions from point sources represent the greatest fraction of the total SO_2 emissions inventoried, and hence provincial cooperation has reduced estimate errors significantly.

2.1 NATIONAL SUMMARY

Total emissions are summarized by source type in Table 2.1.1. The national total emissions are addressed in the following order: sulphur dioxide, nitrogen oxides, total hydrocarbons, volatile organic compounds (VOCs), carbon monoxide and particulate matter.

Sulphur Dioxide

Nationally, 3,686 thousand tonnes of sulphur dioxide were emitted into the atmosphere by Canadian sources. The largest driving force in SO_2 reductions has been the increased use of control devices for industrial sources as stipulated by more stringent legislation.

TABLE 2.1.1

Summary of National Emissions - Canada

Category/Sector	TPM	SO_2	NOx	CO	THC	VOC
			(Metric Tones per Year)			
Industrial						
Iron Ore	103,019	116,657				
Iron & Steel	15,647					
Aluminium	18,950	22,802				
Copper & Nickel	20,394	1,625,673				
Lead & Zinc	4,329	123,057				
Gold		9,937				
Crude Oil		30,003			27,309	15,020
Refineries	8,833	73,959	15,379	61,662	66,940	40,164
Gas Plants		265,573				
Coal Production					261,540	
Petrochemicals					126,815	107,793
Plastics					48,619	48,619
Kraft Pulping			18,188		14,515	14,515
Tar Sands		162,425	15,975			
Asbestos	4,170					
Mining & Quarrying	201,164					
Coal Industry	165,467					
Carbon Black				117,211		
Chemical Pulping	115,010	60,182		33,088		
Sawmills	39,363					
Other	213,814	82,644	39,389	83,881	32,193	32,172
Subtotal	**910,160**	**2,572,912**	**88,931**	**774,849**	**577,931**	**258,283**
Fuel Combustion						
Stationary						
Refineries	5,119	43,679	16,796	53,345	1,917	671
Gas Plants	1,054		158,723	25,852	49,616	6,301
Other Industrial	107,859	176,680	102,690	481,404	50,973	42,617
Commercial	2,710	23,592	25,898	6,958	2,076	1,331
Residential	4,565	31,664	37,493	16,446	5,269	2,662
Fuelwood	155,919	3,746	3,899	624,212	108,025	107,866
Power Plants						
Utilities	98,882	735,939	235,061	52,900	2,624	1,928
Other	890	1,792	12,831	3,218	923	692
Subtotal	**376,998**	**1,017,091**	**593,391**	**1,264,334**	**221,423**	**164,068**

TABLE 2.1.1 - (Cont'd)

Summary of National Emissions - Canada

Category/Sector	TPM	SO_2	NOx	CO	THC	VOC
			(Metric Tones per Year)			
Transportation						
Gasoline						
Cars	43,256	10,622	392,077	4,015,545	523,039	470,735
L-D Trucks	9,740	3,996	123,251	1,416,139	213,067	191,778
H-D Trucks	2,549	750	25,019	335,208	32,428	29,185
Motorcycles	249	32	968	14,841	4,851	4,366
Diesel						
L-D Trucks	1,265	1,794	4,351	3,426	1,457	1,393
H-D Trucks	18,984	19,600	260,677	100,348	35,992	34,408
Other	20,487	14,867	230,304	69,559	24,446	23,370
Other						
Railroads	6,523	7,181	137,839	48,265	10,652	10,183
Marine	3,927	33,361	16,747	84,898	30,589	27,922
Aircraft	1,064	1,733	33,499	116,550	11,413	10,158
Off-road Gas	2,489	921	28,169	958,838	73,381	66,043
Tire Wear					673	673
Subtotal	110,533	94,858	1,252,901	7,163,617	962,008	870,215
Incineration						
Wood Waste	32,925	301	2,993	389,118	32,925	13,170
Other	5,177	1,447	4,457	40,323	10,334	6,200
Subtotal	38,102	1,748	7,450	429,441	43,259	19,370
Miscellaneous						
Fuel Marketing					108,771	108,771
Structural Fires					6,262	6,262
Pesticide Applic.	9,543					
Slash Burning	219,614		16,819	1,134,496	105,910	80,809
Other	44,534			14,010		
Solvent Use						
Dry Cleaning					48,259	48,259
Surface Coatings					122,167	122,167
General Use					119,764	119,764
Subtotal	273,691		16,819	1,148,506	511,133	486,032
National Total	1,709,484	3,686,485	1,959,492	10,780,747	2,315,754	1,797,969

Of the total sulphur dioxide emissions in Canada approximately 70 percent were associated with industrial and manufacturing processes. The relative source contributions are depicted for each pollutant on a national basis in Figure 1. Non-ferrous smelting is the major contributor followed by thermal power generation.

The extensive industrial activity in Ontario is reflected in the emission estimates with the highest SO_2 contribution arising from industrial activity in this province. In other provinces with less industrial activity, the sulphur dioxide emissions from fuel combustion predominate (e.g. New Brunswick) as illustrated in Figures 2.2.1 to 2.2.11.

Little seasonal variation in sulphur dioxide levels occurs throughout the year (Table 2.1.2). This is consistent with the nature of manufacturing processes that account for the largest contribution of SO_2 emissions.

Nitrogen Oxides

Emissions of nitrogen oxides emissions are primarily associated with the combustion of fossil fuels. The smaller sources such as home heating generally are not controlled. As such, NO_x emissions are directly linked to human activity. Automobiles have required control devices that decrease NO_x emissions since the implementation of motor vehicle regulations in the early 1970s. Despite the decreased emissions per vehicle, NO_x emissions have essentially remained constant, reflecting the increase in the number of vehicles.

TABLE 2.1.2

Seasonal Distribution of Emissions (Percent)

	Winter	Spring	Summer	Fall
TPM	21	29	29	21
SO_2	26	25	25	24
NOx	25	25	25	25
CO	23	25	29	23
THC	24	25	27	24
VOC	24	25	27	24

Nitrogen oxide emissions have experienced a steady rise since the first inventory of NO_x emissions in 1970 (Environment Canada, 1986). In 1985 a total of 1,963 thousand tonnes were estimated to be emitted into the atmosphere (Table 1).

Transportation represented the largest contribution of NO_x emissions on a national basis. NO_x emissions from transportation sources accounted for 64 percent of total NO_x emissions by anthropogenic sources (Figure 1). In provinces with less industrial activity, transportation sources become increasingly more important and can amount to 90 percent of all NO_x emissions (Manitoba). Therefore, areas with highest NOx emission densities are in most cases major urban centres except in the Atlantic provinces where thermal power generation was more significant. Also, NO_x emissions from Ontario and Alberta account for over half of the National total (1,032 thousand tonnes combined).

While sources such as power generation and residential fuel combustion vary seasonally, the relative magnitude of the transportation sources masks the seasonal variation of NO_x emissions (Table 2.1.2).

Total Hydrocarbons

Total hydrocarbon (THC) emissions occur from evaporative losses (fugitive emissions) and as exhaust gases from the incomplete combustion of fossil fuels. Evaporative losses associated with fuel storage have decreased with the increased use of floating roof storage tanks in the petroleum industry. Other evaporative losses in the marketing of petroleum are directly related to the amount of fuel sold. THC emissions from transportation sources are influenced by the engine efficiency, the fuel type, and the ambient temperature.

The primary concerns with THC emissions include the carcinogenic characteristics of some species (benzene), the hormonal effects on plants (ethylene) and the catalytic role that several species play in photochemical reactions within the atmosphere. Efficient control devices are presently not available for THC. The evaporative losses can be minimized with better containment and leakage control. Emissions from transportation sources have been reduced by higher operating standards, catalytic converters and vehicle inspection and maintenance programs.

It was estimated that 2,316 thousand tonnes of THC were emitted in 1985. Relative source contributions are presented as pie charts in Figure 1. Nationally, transportation sources contributed 42 percent, followed by 25 percent due to industrial sources (which excludes general solvent evaporation). Ontario and British Columbia combined accounted for half of the National total.

The low boiling points of many hydrocarbon species render THC emissions particularly temperature dependent. Seasonal increases occur with warmer temperatures but are off-set by increased heating in winter months. These effects are evident in the seasonal profiles compiled in Table 2.1.2. THC emissions in the summer months are slightly higher (~4%) compared with emissions in the winter.

Volatile Organic Compounds

Volatile Organic Compounds (VOC) comprise hydrocarbon species that can react in the atmosphere and contribute to tropospheric ozone formation and to a lesser extent to acidic precipitation. As such, VOCs represent a subset of THC and exclude photochemically nonreactive compounds such as methane and ethane. The emission sources are identical to the sources discussed for THC except for coal mines which emit only methane.

For 1985, it was estimated that 1,798 thousand tonnes were emitted into the Canadian atmosphere. VOCs represent 77 percent of the THC emissions in Canada. As for the THC emissions, the greatest contribution is associated with transportation sources. The provinces with the greatest VOC emissions are Ontario and British Columbia.

Temporal patterns display an increase with higher temperatures and with increased heating in winter months (Table 2.1.2). This is consistent with evaporative losses associated with petroleum storage tanks under higher ambient temperatures.

Carbon Monoxide

Carbon monoxide emissions are produced as a reaction product in the incomplete combustion of petroleum, wood and coal. The numerous sources of CO are generally small individual sources (e.g., woodstoves, oil furnaces, boilers, etc.) which are unfeasible to control. Control devices on larger point sources have achieved decreases in those sectors since 1970. With the implementation of regulations requiring oxidation catalysts on automobiles reductions in CO emissions also have occurred in this sector.

A total of 10,781 thousand tonnes of CO are estimated to have been released from anthropogenic sources (Table 2.1.1). The transportation sources accounted for 66 percent of CO emissions on a National basis (Figure 1). Despite the increases in the number of automobiles, the emissions estimate for 1985 remained virtually unchanged since 1980. This reflects the effective control of CO by oxidation converters on new automobiles since 1978. Highest contributions of CO originated in Ontario and British Columbia while most urbanized areas in Canada show high CO emission densities.

The seasonal profile of CO emissions is presented in Table 2.1.2. Seasonal variation in National CO levels does appear to exist and is expected to be related to the activity level in the transportation sectors and wood waste burning.

Particulate Matter

A wide range of sources is associated with emissions of particulate matter. Many industrial processes, stationary fuel combustion, as well as sources that fall into the category of miscellaneous sources such as slash burning and structural fires; generate particulate emissions. Particulate emissions are comparatively easy to control in most industrial sources. Area sources of particulate emissions such as slash burning are virtually impossible to control.

Nationally, 1,709 thousand tonnes of particulate matter were emitted from Canadian sources. Particulate matter emissions display the most distinct seasonal pattern (Table 2.1.2) with low values during winter months where ground cover and precipitation decrease TPM levels.

2.2 EMISSIONS BY PROVINCE

Emissions are presented on a provincial basis in this section. Relative sector contributions are presented in the form of pie charts for each province in Figures 2.2.1 to 2.2.11. Further detail is given by source type in Appendix A. The provinces are discussed in alphabetical order in the subsections that follow.

Alberta

Annual emissions in Alberta are compared with other provinces and national totals in Table 1. The unusual feature of the data is the high NO_x emission total for Alberta, the second highest provincial estimate in Canada. Remaining pollutant levels are comparable with other western provinces.

Relative sector contributions for Alberta are summarized in Figure 2.2.1 and Appendix A (A-1,2). Industrial contributions of particulate emissions and sulphur dioxide were 63 percent and 83 percent, respectively, representing the sectors of largest contribution.

The salient feature is the NO_x emissions distribution where transportation sources were of lower significance (44%) in comparison with other western provinces (British Columbia: 74%, Saskatchewan: 61%, Manitoba: 90%). Fuel combustion accounted for 50 percent of all NO_x emissions in Alberta.

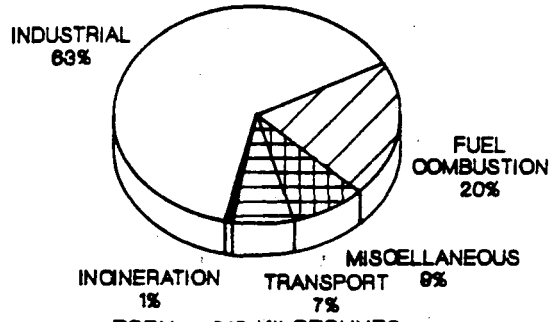
Transportation sources accounted for the largest fraction of total VOC and CO emissions, consistent with other western provinces. Total hydrocarbon emissions were largely attributed to industrial sources, in particular, emissions associated with the petroleum industry.

British Columbia

Examining the provincial estimates of Figure 2.2.2 and Appendix A (A-3,4), high CO, THC and particulate emissions characterize British Columbia. Particulate emissions in British Columbia totalled 414 thousand tonnes per year. Particulate and sulphur dioxide emissions resulted largely from industrial sources. While the largest fractions of NO_x, CO and THC emissions resulted from transportation sources (Figure 2.2.2), miscellaneous sources also accounted for a substantial fraction of total emissions. The combustion of large amounts of wood waste at industrial facilities augmented considerably the emissions for certain contaminants relative to other provinces.

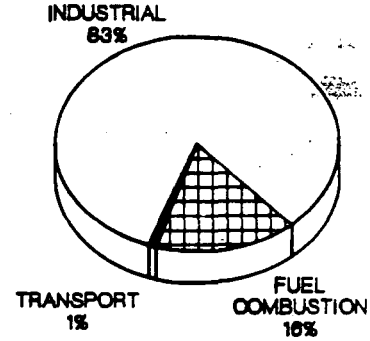
FIGURE 2.2.1
ALBERTA
Provincial Emissions by Source Category (1985)

PARTICULATES



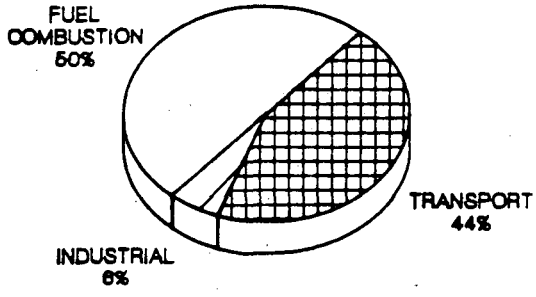
TOTAL = 219 KILOTONNES

SO2



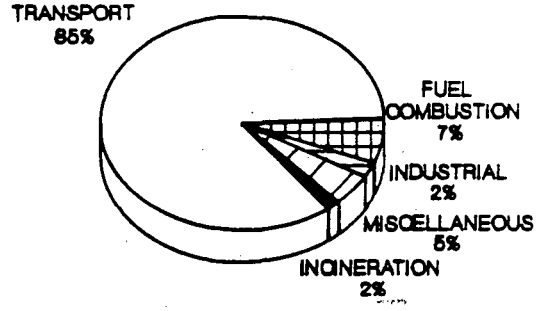
TOTAL = 539 KILOTONNES

NOX



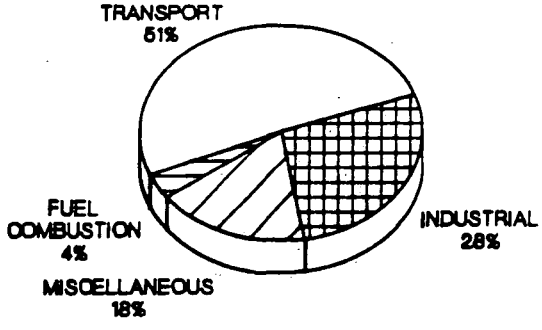
TOTAL = 447 KILOTONNES

CO



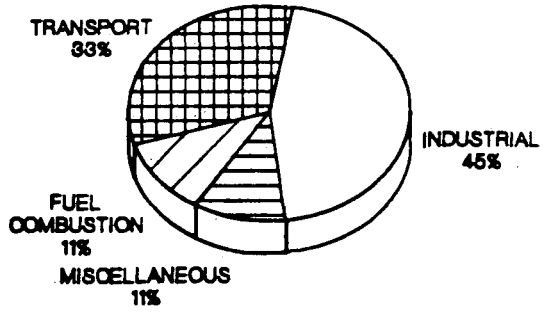
TOTAL = 1277 KILOTONNES

VOC



TOTAL = 228 KILOTONNES

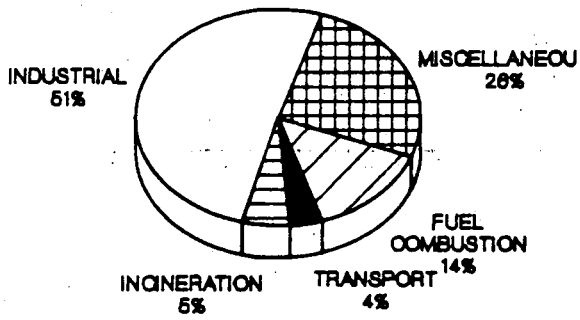
THC



TOTAL = 392 KILOTONNES

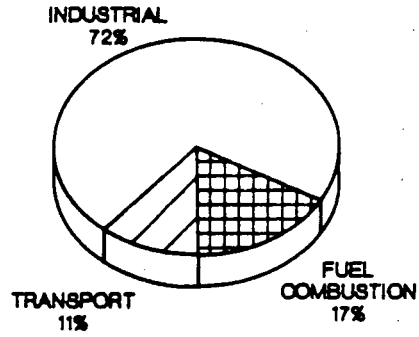
FIGURE 2.2.2
BRITISH COLUMBIA
Provincial Emissions by Source Category (1985)

PARTICULATES



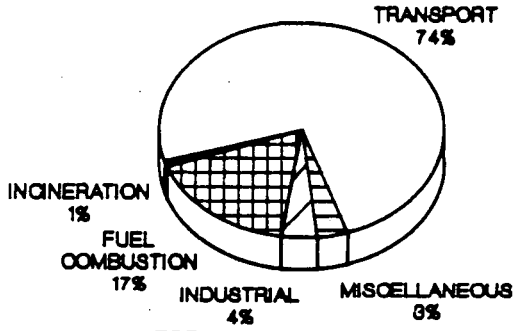
TOTAL = 414 KILOTONNES

SO2



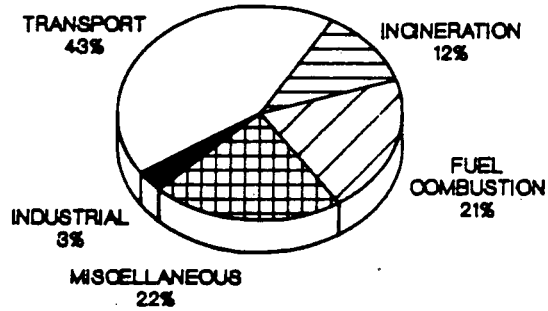
TOTAL = 105 KILOTONNES

NOX



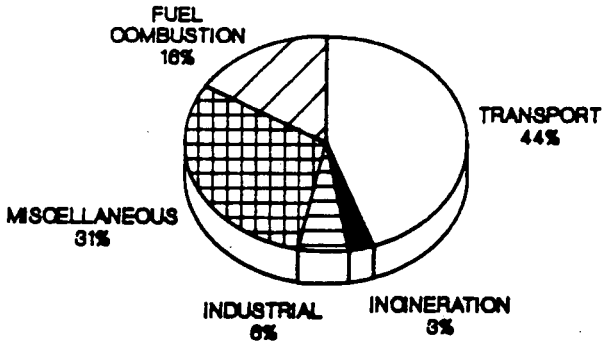
TOTAL = 263 KILOTONNES

CO



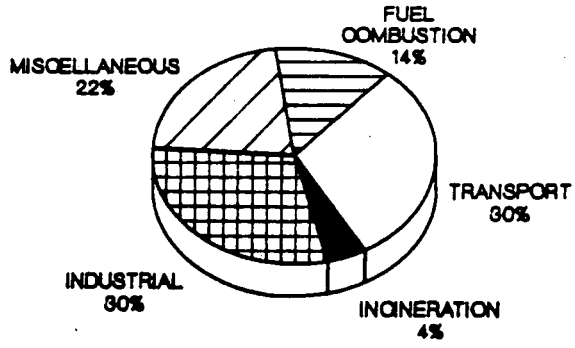
TOTAL = 2377 KILOTONNES

VOC



TOTAL = 289 KILOTONNES

THC



TOTAL = 467 KILOTONNES

Manitoba

Emissions by sector are presented in Figure 2.2.3 and Appendix A (A-5,6). Sources of specific pollutants are distinctly different from other provinces. The largely rural nature of the province is reflected in the emission totals. This province is characterized by the predominant effects of transportation related sources. NO_x, VOC, CO and THC emissions (Figure 2.2.3) are all dominated by transportation sources. Another noteworthy feature is the effect of mining and smelting industries (copper, nickel, and zinc) on provincial SO_2 and particulate levels (Table A-3).

New Brunswick

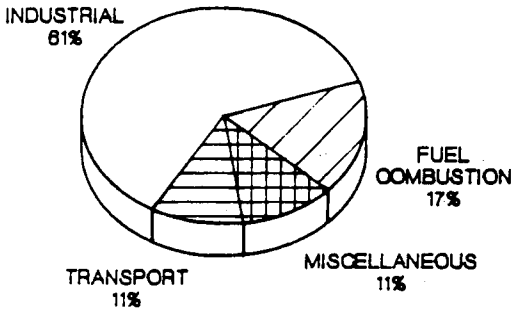
In New Brunwsick, fuel combustion from stationary sources generates the largest contribution of sulphur dioxide (Figure 2.2.4, Appendix A (A-7,8)). In particular, power generation is a significant source of SO_2 emissions to the atmosphere. Sources of particulate matter are generally more diffuse, with some contribution from mining and quarrying, coal production and miscellaneous industrial sources, and also power plants and residential wood combustion. For the remaining pollutants (CO, NO_x, THC, VOC) the relative importance of sources in New Brunswick are consistent with national totals.

Newfoundland

In Newfoundland the greatest contribution of particulate matter to the atmosphere is from the iron ore industry. Approximately 88 thousand tonnes of particulate matter are emitted by this sector (Figure 2.2.5, Appendix A (A-9,10). Emissions of sulphur dioxide are largely due to power generation and industrial fuel combustion. For the remaining pollutants (CO, NO_x, THC and VOC) transportation sources are the predominant sources and emissions from stationary fuel combustion are secondary.

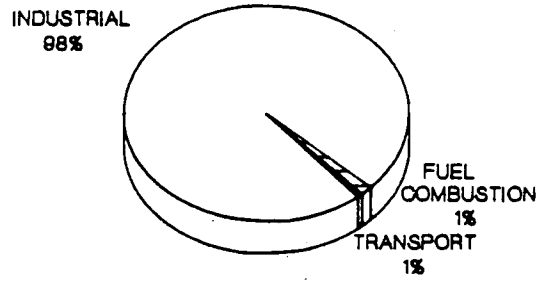
FIGURE 2.2.3
MANITOBA
Provincial Emissions by Source Category (1985)

PARTICULATES



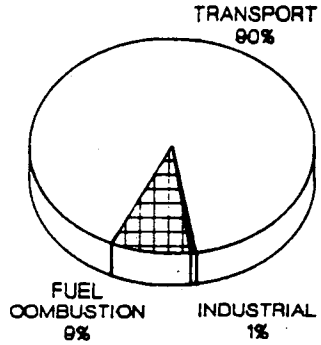
TOTAL = 54 KILOTONNES

SO2



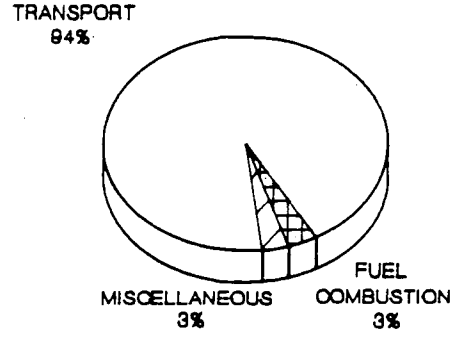
TOTAL = 469 KILOTONNES

NOX



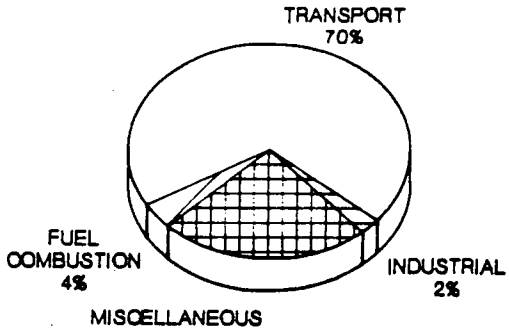
TOTAL = 85 KILOTONNES

CO



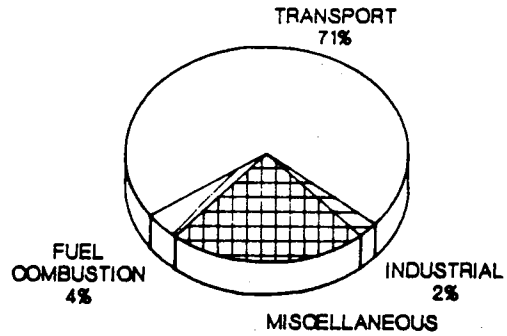
TOTAL = 431 KILOTONNES

VOC



TOTAL = 88 KILOTONNES

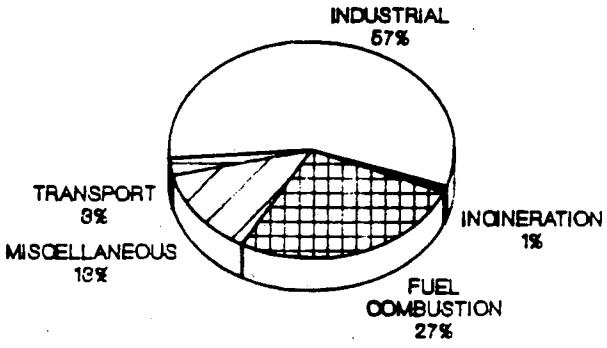
THC



TOTAL = 73 KILOTONNES

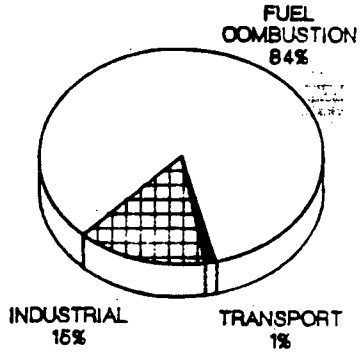
FIGURE 2.2.4
NEW BRUNSWICK
Provincial Emissions by Source Category (1985)

PARTICULATES



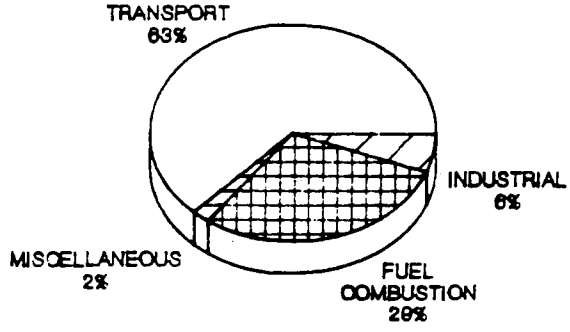
TOTAL = 90 KILOTONNES

SO2



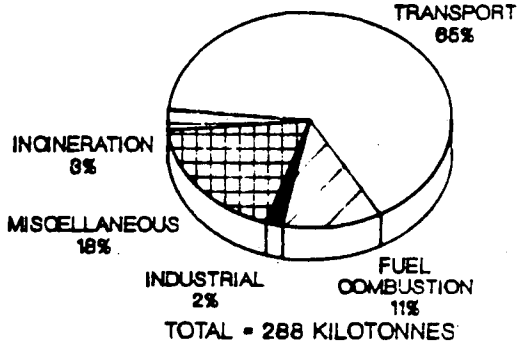
TOTAL = 138 KILOTONNES

NOX



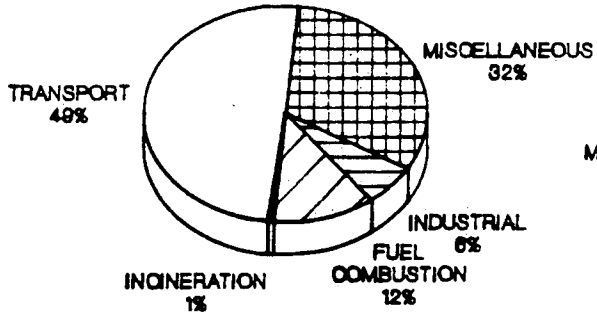
TOTAL = 46 KILOTONNES

CO



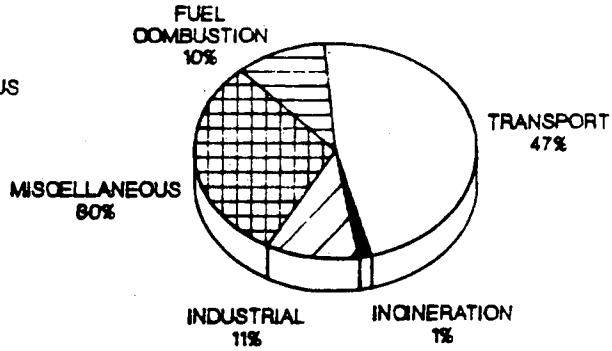
TOTAL = 288 KILOTONNES

VOC



TOTAL = 46 KILOTONNES

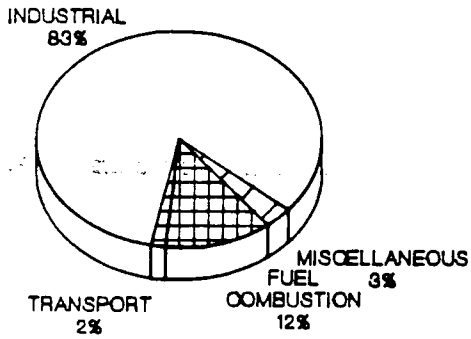
THC



TOTAL = 53 KILOTONNES

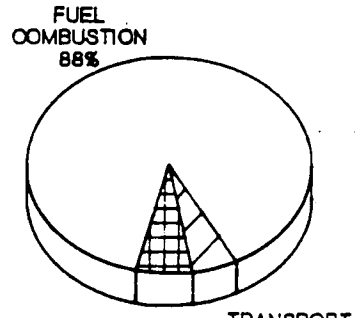
FIGURE 2.2.5
NEWFOUNDLAND
Provincial Emissions by Source Category (1985)

PARTICULATES



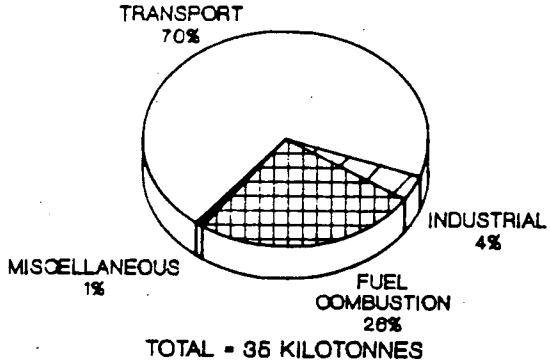
TOTAL = 123 KILOTONNES

SO2



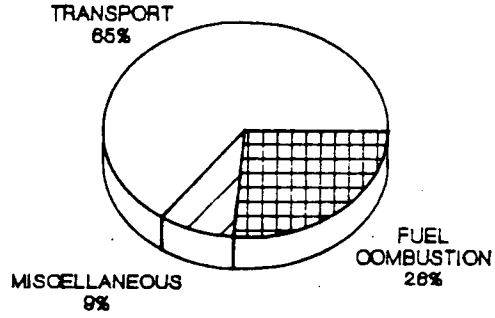
TOTAL = 43 KILOTONNES

NOX



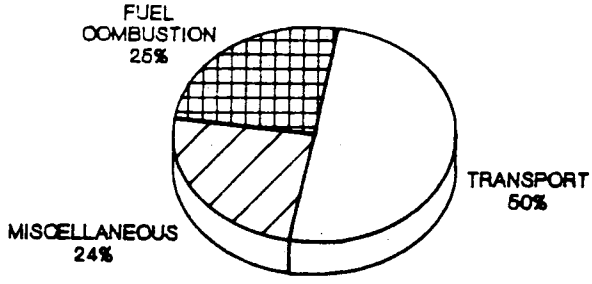
TOTAL = 35 KILOTONNES

CO



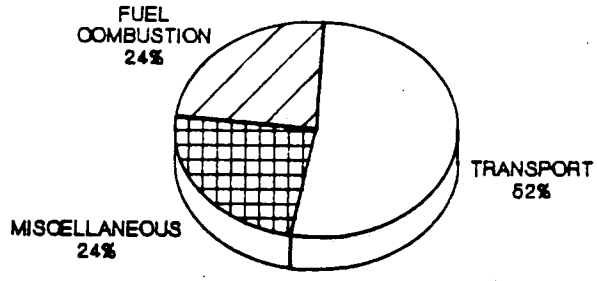
TOTAL = 198 KILOTONNES

VOC



TOTAL = 36 KILOTONNES

THC



TOTAL = 38 KILOTONNES

Nova Scotia

Consistent with other Atlantic provinces, highest particulate emissions in Nova Scotia are associated with industrial sources (Figure 2.2.6, Appendix A (A-13,14). Mining and quarrying activities along with iron ore handling, produce the greatest TPM emissions in Nova Scotia. Sulphur dioxide emissions are largely produced by power generation at the provincial basis. Oxides of nitrogen, carbon monoxide as well as the organic constituents inventoried (THC, VOC) were traffic related consistent with adjacent provinces.

Ontario

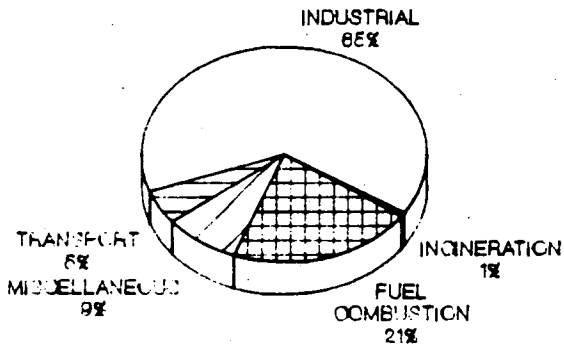
The urban/rural nature of southern and northern Ontario respectively, is evident in the comparison with other provinces (Figure 2.2.7, Appendix A (A-15,16). This is most apparent in the sources of particulate emissions for this province. Miscellaneous sources such as fuel wood burning and slash burning are all significant sources of TPM in Ontario. Sulphur dioxide emissions are largely associated with industrial processes such as iron ore and non-ferrous metals production. Another significant source of SO_2 sources is the production of power using fossil fuels. Emissions of the NO_x, CO and organic compounds (THC and VOC) are primarily generated by transportation sources.

Prince Edward Island

Unlike New Brunswick and Newfoundland, the predominant source of particulate matter in Prince Edward Island is residential fuelwood combustion (Figure 2.2.8, Appendix A (A-17,18). Sulphur dioxide emissions are largely attributed to commercial and residential fuel combustion for heating purposes; while it is noteworthy to indicate that stationary fuel combustion is the primary SO_2 source in all Atlantic provinces. Sources of NO_x, CO, THC and VOC are transportation related, and are consistent with national values.

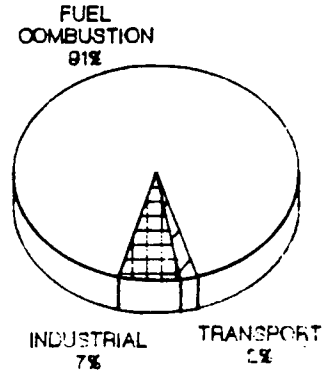
FIGURE 2.2.6
NOVA SCOTIA
Provincial Emissions by Source Category (1985)

PARTICULATES



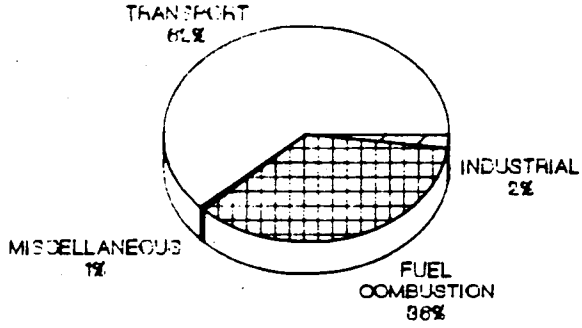
TOTAL = 78 KILOTONNES

SO2



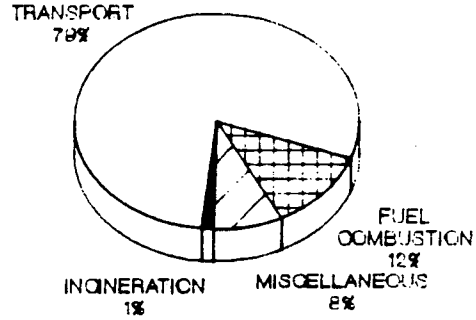
TOTAL = 170 KILOTONNES

NOX



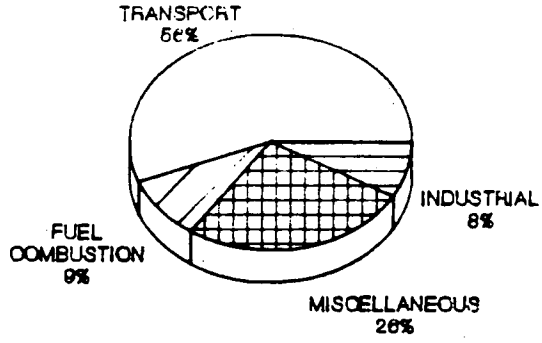
TOTAL = 78 KILOTONNES

CO



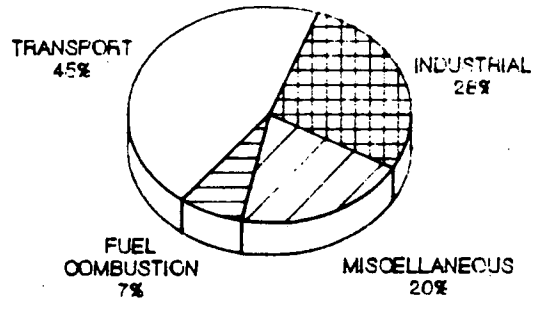
TOTAL = 299 KILOTONNES

VOC



TOTAL = 54 KILOTONNES

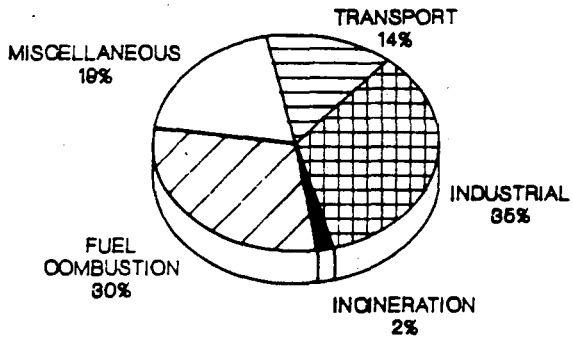
THC



TOTAL = 74 KILOTONNES

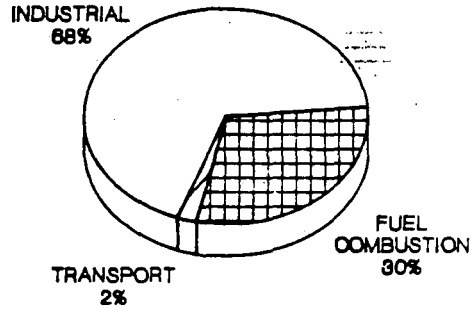
FIGURE 2.2.7
ONTARIO
Provincial Emissions by Source Category (1985)

PARTICULATES



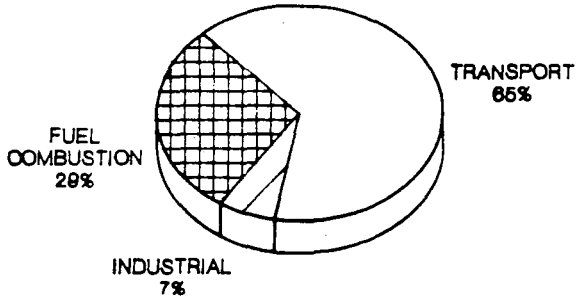
TOTAL = 283 KILOTONNES

SO2



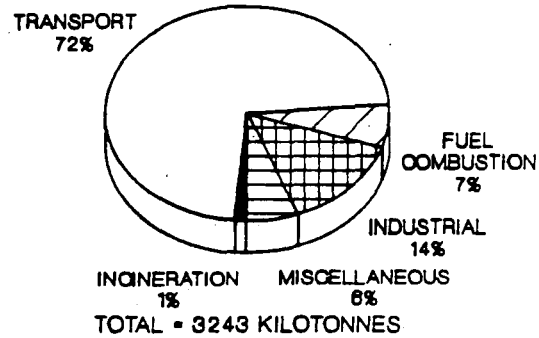
TOTAL = 1140 KILOTONNES

NOX



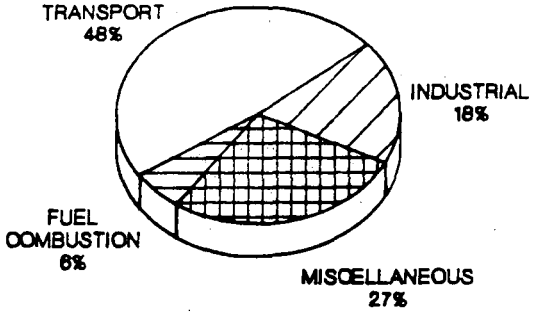
TOTAL = 585 KILOTONNES

CO



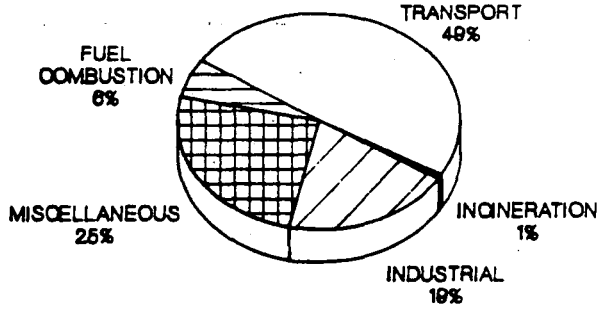
TOTAL = 3243 KILOTONNES

VOC



TOTAL = 621 KILOTONNES

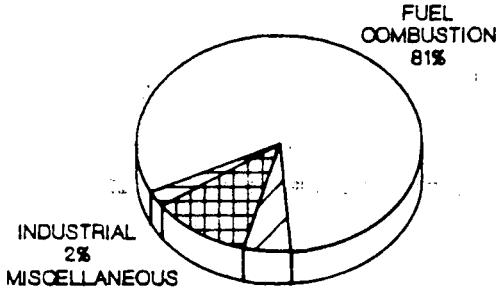
THC



TOTAL = 676 KILOTONNES

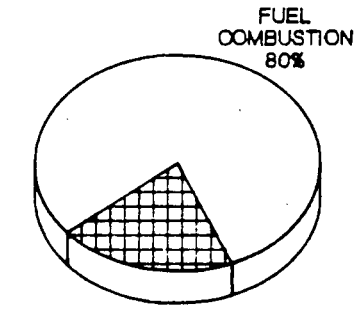
FIGURE 2.2.8
PRINCE EDWARD ISLAND
Provincial Emissions by Source Category (1985)

PARTICULATES



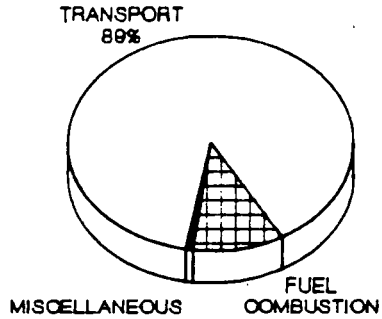
TOTAL = 8 KILOTONNES

SO2



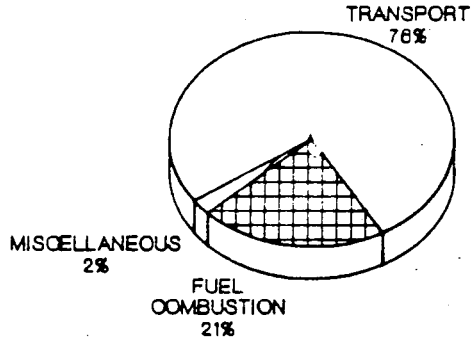
TOTAL = 2 KILOTONNES

NOX



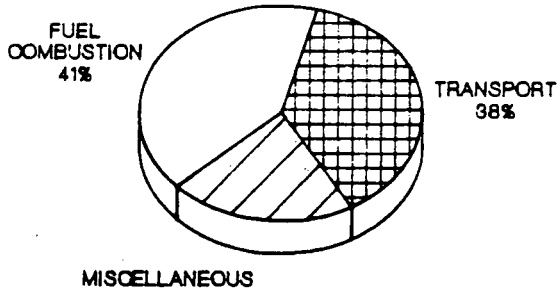
TOTAL = 6 KILOTONNES

CO



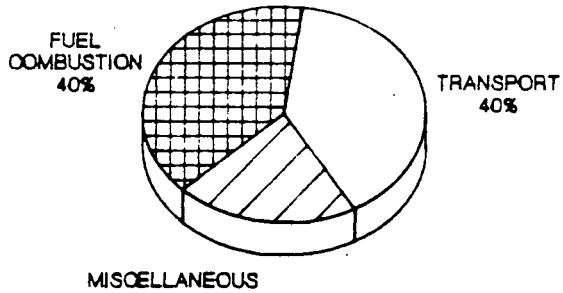
TOTAL = 64 KILOTONNES

VOC



TOTAL = 11 KILOTONNES

THC



TOTAL = 12 KILOTONNES

Quebec

Sources in Quebec and Ontario are quite similar with the exception of the extensive mining and quarrying activities that are an intergral part of the Quebec economy and the thermal power generating facilities in Ontario. Major sources of particulate matter are mining and quarrying, fuelwood combustion and slash burning (Figure 2.2.9, Appendix A (A-19,20). Sulphur dioxide emissions are associated with industrial sources (82%), in particular copper smelting. Another significant source of SO_2 is industrial fuel combustion. Emissions of NO_x and CO are largely traffic related (80% and 61%, respectively) with gasoline cars ranking highest. Major sources of THC and VOC include transportation (gasoline powered cars) and solvent use.

Saskatchewan

The relative importance of particulate sources in Saskatchewan is similar to the remaining western provinces (Figure 2.2.10, Appendix A (A-21,22). Industrial sources account for 55% of provincial particulate emissions, and chemical pulping is a very significant sector. Emissions of sulphur dioxide are largely associated with stationary fuel combustion (particularly power generation). Sources of CO, NO_x, THC and VOC are predominantly transportation related. Diesel powered vehicles and off-road uses of gasoline are more important in Saskatchewan than in other provinces.

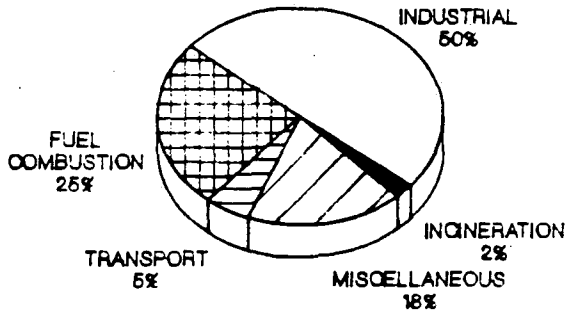
Yukon and Northwest Territories

The number of sources in the Territories is relatively few and hence the emission results are presented collectively in Figure 2.2.11, yet separately in Appendix A (A-11,12; A-23,24). Largely, industrial sources contribute to ambient particulate emissions in the territories. Of

greatest significance are the particulate emissions from mining and quarrying activities. Sulphur dioxide emissions generally are associated with industrial fuel combustion. Transportation sources contribute greatest to NO_x, CO, THC and VOC emissions. Of highest significance are emissions from gasoline cars and light duty trucks, and heavy-duty diesel powered trucks.

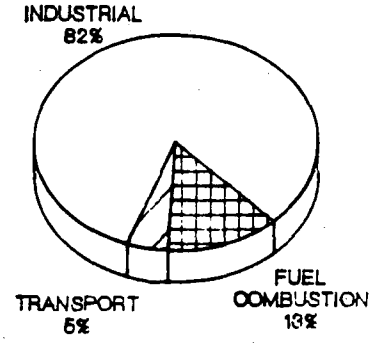
FIGURE 2.2.9
QUEBEC
Provincial Emissions by Source Category (1985)

PARTICULATES



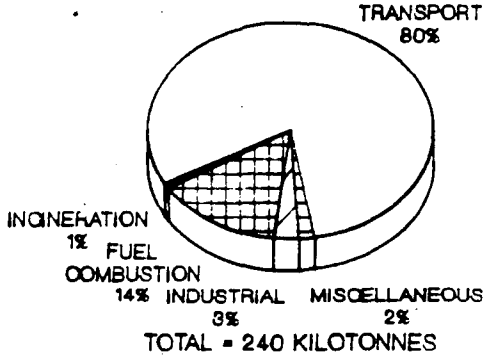
TOTAL = 310 KILOTONNES

SO2



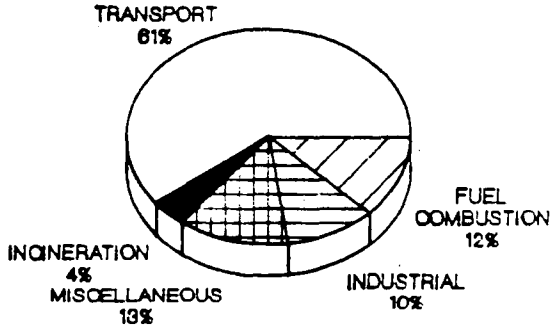
TOTAL = 693 KILOTONNES

NOX



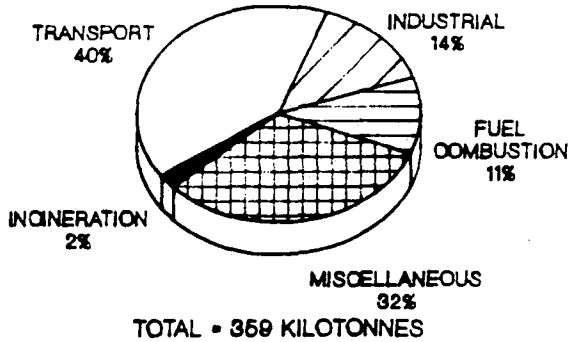
TOTAL = 240 KILOTONNES

CO



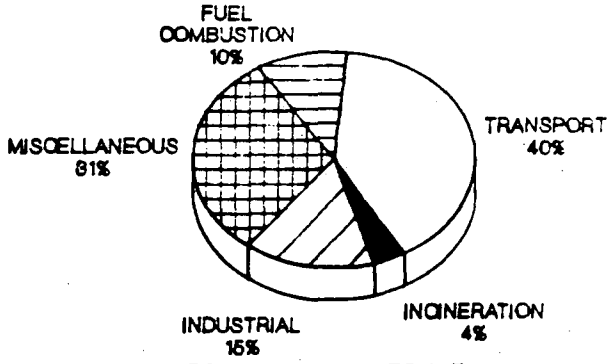
TOTAL = 1915 KILOTONNES

VOC



TOTAL = 359 KILOTONNES

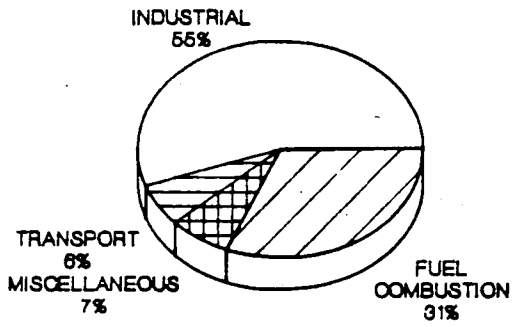
THC



TOTAL = 398 KILOTONNES

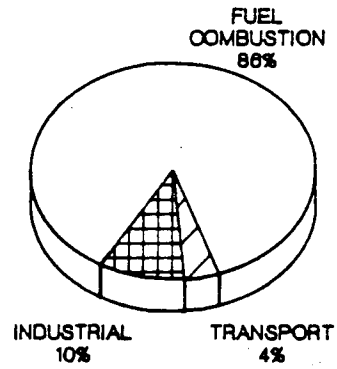
FIGURE 2.2.10
SASKATCHEWAN
Provincial Emissions by Source Category (1985)

PARTICULATES



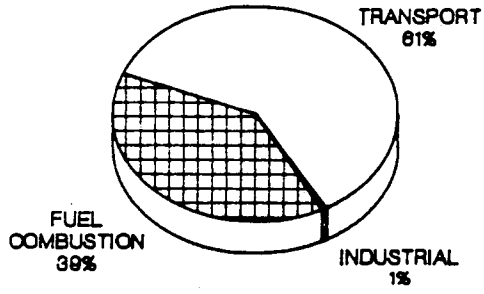
TOTAL = 126 KILOTONNES

SO2



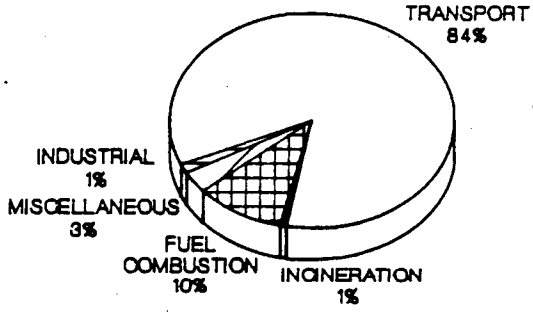
TOTAL = 86 KILOTONNES

NOX



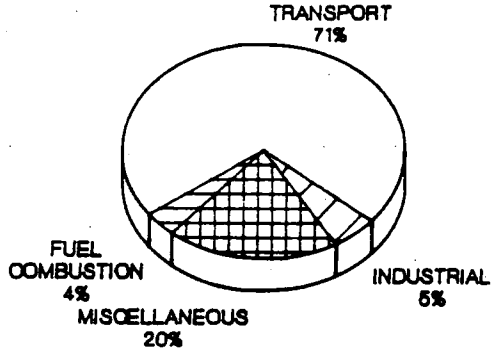
TOTAL = 158 KILOTONNES

CO



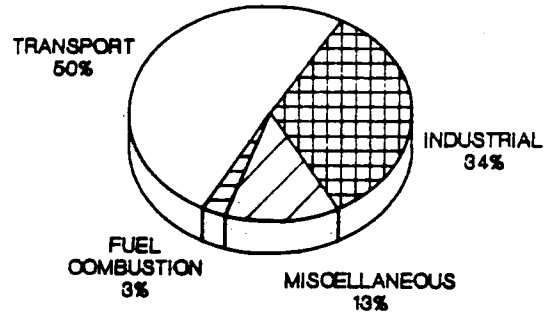
TOTAL = 644 KILOTONNES

VOC



TOTAL = 80 KILOTONNES

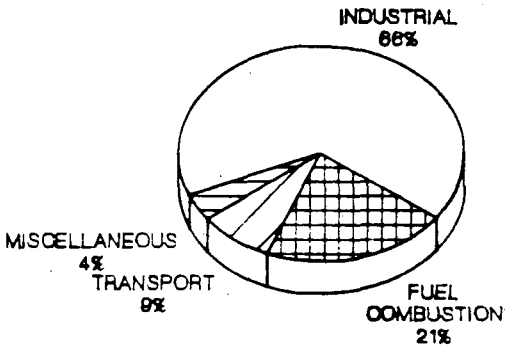
THC



TOTAL = 124 KILOTONNES

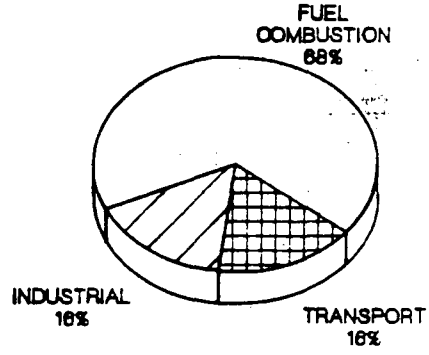
FIGURE 2.2.11
YUKON AND NORTHWEST TERRITORIES
Provincial Emissions by Source Category (1985)

PARTICULATES



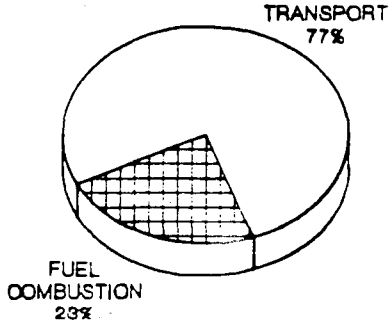
TOTAL = 11 KILOTONNES

SO2



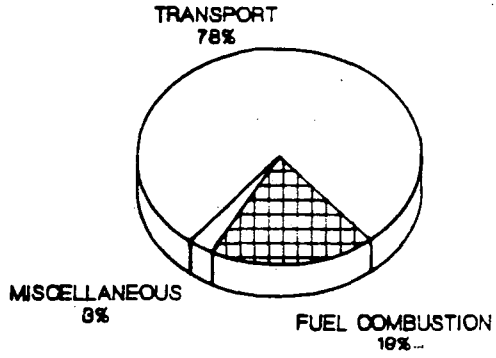
TOTAL = 2 KILOTONNES

NOX



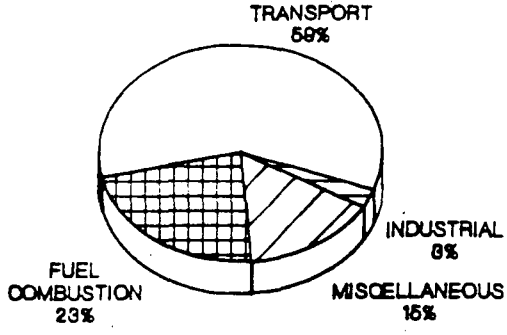
TOTAL = 16 KILOTONNES

CO



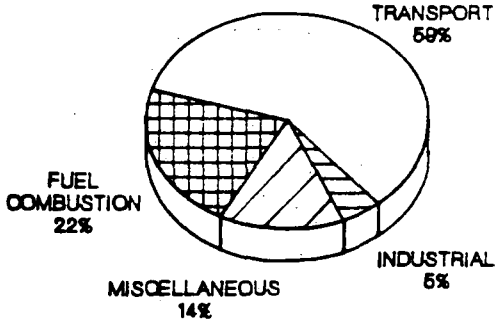
TOTAL = 46 KILOTONNES

VOC



TOTAL = 7 KILOTONNES

THC



TOTAL = 8 KILOTONNES

3 COMPILATION OF EMISSIONS

The process of acquiring and calculating emissions from each source type is described in this section. In Section 3.1, a general overview of the methodology used in an emissions inventory is presented. Emissions from similar sources often are estimated using parallel methods. Therefore, similar sources are discussed collectively, in Sections 3.2.1 to 3.2.5.

3.1 CALCULATION OF EMISSIONS

Basically, the calculation of emissions from a source requires information regarding:

1. process discharge quantities and characteristics,
2. activity levels and variations in activity level,
3. control technologies employed and their efficiencies,
4. physical characteristics influencing the discharge.

The actual annual discharge from a source is generally not available, and hence is estimated by relating the activity level to the emissions generated by this activity per unit activity (emission rate). The annual emissions can be obtained by adjusting direct measurement of the source to an annual value (i.e. stack testing) or indirectly by a process input or product. An example of a process input is the amount of fuel expended per unit time to generate a known quantity (capacity) of power at a thermal power generation process. An example of a process product is the amount of energy produced. This value that relates the activity to the discharge is known as the base quantity. The base quantity is then used to estimate the actual discharge by applying an emission factor. The general method of estimating the actual discharge is summarized below:

Discharge = base quantity x emission rate.

In the event that control technology is employed to reduce emissions and hence the emission rate; the rate of reduction (the efficiency also is applied to acquire the effective emission rate:

Discharge = base quantity x uncontrolled emission rate x efficiency

The discharge can be defined in greater detail both temporally and spatially. Further information on the activity level as a function of time, allows the calculation of the discharge at a certain time, accounting for seasonal, day of week and diurnal variations in the activity level. Within the 1985 Emissions Inventory, the temporal resolution is achieved by attributing the total annual discharge to:

1. monthly activity fractions (totalling one for all months)
2. day of week activity fractions (totalling one from Monday to Sunday)
3. hourly activity fractions (totalling one for 24 hours)

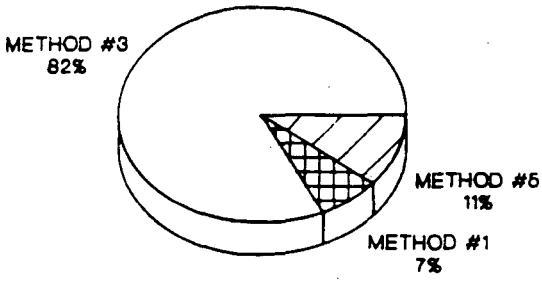
These factors may be applied to an annual discharge estimate successively, to obtain discharge quantities of the desired temporal resolution.

The spatial resolution of point sources is usually to the nearest kilometre, and is based on the spherical coordinate system. For sources, that are not stationary or cannot be defined in terms of these coordinates other means of attributing the total emissions to a geographical location are necessary. Proration factors derived from surrogate variables are used to apportion emissions to geographical locations (or grids) as outlined in Table 3.1.1. The proration factors are generally based on the most appropriate and available statistic. Statistics Canada compiles a variety of such statistics through the census process and survey protocols. If necessary, information on industrial processes are solicited directly.

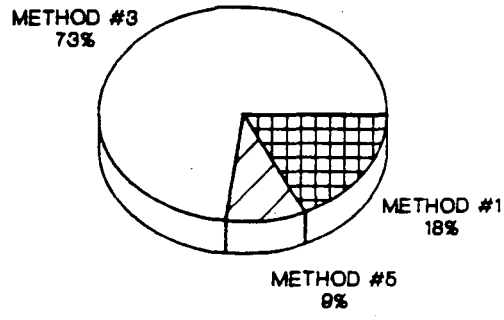
The methods of estimation used in this inventory and their relative frequency of use have been summarized for each major sector in Figure 3.1.1. It is readily apparent that the majority of the emission estimates are based on emission calculations employing standard NAPAP emission factors (NAPAP, 1987).

FIGURE 3.1.1
EMISSION CALCULATION METHODS

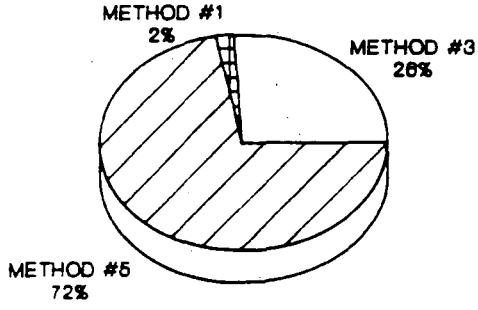
PARTICULATES



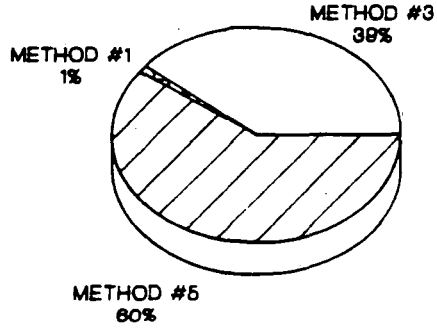
SO2



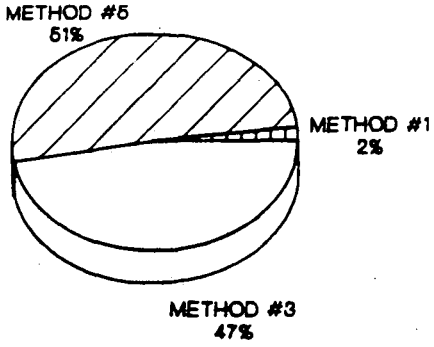
NOX



CO



VOC



THC

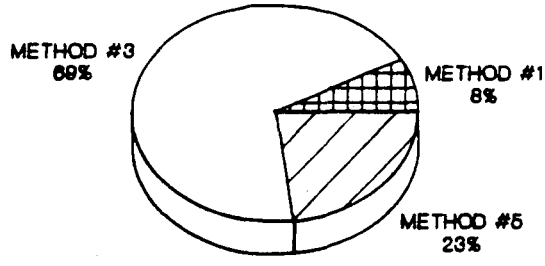


FIGURE 3.1.1 (Cont'd)
Emission Calculation Methods

Key to Pie Charts on Previous Page:

Method #1 Emissions based on source testing or other emission measurements.

Method #2 Emissions based on material balance using engineering expertise and knowledge.

Method #3 Emissions based on computer calculation employing standard emission factors (NAPAP, 1987).

Method #4 Educated guess.

Method #5 Emissions calculated using emission factors other than NAPAP, 1987.

TABLE 3.1.1

Area Source Proration Parameters

Area Source	Proration Parameter
Industrial	
Coal industry	Mining labour force
Sand and gravel processing	Population
Iron ore mining and beneficiation	Mining labour force
Asphalt production	Population
Stone processing	Population
Grain handling	Agricultural labour force
Grain milling	Milling capacity
Ferrous foundries	Industrial labour force
Crude oil production	Distribution network
Mining and rock quarrying	Mining labour force
Concrete batching	Population
Fuel Combustion (stationary sources)	
Residential	Residential dwelling units - gas
	Residential dwelling units - oil
Residential (fuelwood)	Residential dwelling units - total
Commercial	Commercial labour force
Industrial	Industrial labour force
Utilities	Population
Transportation	
Highway gasoline powered vehicles	Population
Off-highway use of gasoline	Population
Diesel powered vehicles	Population
Tire wear	Population
Aircraft	Landing/takeoff cycles
Railroads	Population
Marine	Calls in port/population

Table 3.1.1 - (Cont'd)

Area Source Proration Parameters

Area Source	Proration Parameter
Incineration	
Commercial and industrial	Population
Wigwam burners	Forestry land area
Miscellaneous	
Slash burning	Forestry land area
Structural fires	Residential dwelling units
Fertilizer application	Acres of farmland
Dry cleaning	Population
Gasoline and diesel marketing	Population
Application of surface coating	Population
Cigarette smoking	Population
Pesticide application	Acres of farmland

3.2 METHODS OF EMISSIONS CALCULATION BY SOURCE CATEGORY

Five categories of sources are defined for reporting purposes, namely:

- industrial processes
- stationary fuel combustion
- mobile fuel combustion
- solid waste incineration
- miscellaneous

The calculation of the main source categories are described in the following subsections.

3.2.1 Industrial Processes

The category of industrial processes encompasses most point sources emitting 100 tonnes per year or more of the parameters inventoried. Smaller sources are included as area sources. This broad category can be further subdivided into:

- ferrous industries
- non-ferrous smelters
- mining and mineral processing
- wood and paper industry
- fossil fuel production
- chemical industries, and
- other manufacturing industries.

Data regarding industrial processes represent the largest part of the emissions database, and hence are of utmost importance to the inventory process. The majority of this information was provided by the Provincial Ministries. A complete listing of reports for provincial data inputs is presented separately in the references, Section 7. Other sources of information are specifically referenced in the appropriate subsections.

Ferrous Industries

Ferrous industries refer to all processes from the initial mining of iron ore to the manufacture of finished ferro-alloy products. Specifically the following sectors are included in this subcategory:

- iron ore mining and beneficiation
- ferrous foundries
- iron and steel production, and
- ferro-alloys production.

Direct emissions information, activity levels and control device data were provided by the Provincial Ministries. Additional industry background data was obtained from the "Canadian Minerals Yearbook - 1986" published by Energy, Mines and Resources; Cajka, C.J., 1986; McInnis, R., 1986. When environmental release data were not available for a ferrous operation, emissions were estimated using production figures obtained from various sources (the Canadian Foundry Association, the Industrial Programs Branch of Environment Canada; Statistics Canada; and Energy, Mines and Resources) in conjunction with EPA emission factors or emission rates developed specifically for each site (Environment Canada, 1988). Control efficiencies were assumed to be the same as in the 1980 emissions inventory unless specifically reported by the provincial ministries.

Non-Ferrous Smelting

The smelting of metals other than iron fall within this subcategory. The sectors that have been addressed in the context of the 1985 Emissions Inventory are:

- gold roasting
- aluminum production
- lead/zinc production
- copper/nickel production, and
- pyrrhotite roasting.

While direct emissions data were given preference, (e.g. SO_2) most frequently such information was only available for SO_2 (Provincial Agencies). In these instances, production information was obtained (as for ferrous industries) and emissions were estimated using mass balances for SO_2 and other data obtained from internal studies (Environment Canada(a); Environment Canada(b); Schultz International Limited, 1981 and 1982; Leroux, 1983) and other federal departments (Environment Canada, 1986; McCutcheon, 1986; Telewiak, 1986; Bokovay, 1986(a); Bigauskas, 1986(a); Gauvin, 1986; Law-West, 1986; The Northern Miner, 1985-1986). For nickel and copper smelting, site specific process information was used in conjunction with emission factors.

Mining and Mineral Processing

Mining and mineral processing include all remaining mining activities as well as the processing of these varied materials. The type of emissions associated with these activities range from actual process emissions, to storage-related emissions (i.e., emissions associate with the movement and storage of raw materials such as limestone and products such as lime). This subcategory consists of the following sectors:

- mining and rock quarrying
- sand and gravel processing
- asbestos production
- lime manufacturing
- potash processing
- stone processing
- silica processing
- salt production
- gypsum processing, and
- nepheline syenite processing.

Limited stack testing data were available from provincial agencies and such measurements were only used for the following sectors (eg. potash processing, asbestos production). Less specific information on the emission sources for the remaining activities examined in this grouping were available which also were less spatially defined in comparison with other point sources. Hence, no direct emissions data were available. Emissions from these processes were estimated from production figures. Such information was obtained from Energy Mines and Resources, the Canadian Mineral Yearbook, and Statistics Canada (Stonehouse, 1986(a); 1986(b); 1986(c); 1986(d); Statistics Canada 1986(a); 1986(c); 1986(d); 1986(e); Barry, 1986; Boucher, 1986(a); 1986(b); Prud'Homme, 1986; Vagt, 1986. The emission rates were obtained from US Environmental Protection Agency (Stockton, 1987) unless specific Canadian data were available (Environment Canada (b)).

Wood and Paper Industry

The processing of wood derived products are included in this subcategory. The sectors that are compiled in this inventory are:

- sulphite pulping
- sawmills
- sulphate (Kraft) pulping, and
- plywood and veneer manufacture

For pulping plants, provincial agencies provided site specific information for these processes whenever possible. Little information was available for the remaining sectors in this grouping. The main reasons for the lack of direct emissions testing data are the smaller size of the plants and the assumption that the emissions are relatively low. Hence emission estimates were calculated using the standard U.S. EPA emission factors (Stockton, 1987) in conjunction with the most appropriate, available statistics that related to

production levels. British Columbia has compiled good data on all the above forestry sectors since it is a major component of the provincial economy and as a result the emission estimates are judged considerably more accurate.

Shipment figures for the logging industry and the products generated, were obtained on a provincial basis from Statistics Canada; 1985(b); 1985(f); 1985(g) and were used in the estimation of sawmill activity, pulpwood manufacturing, and plywood and veneer manufacturing. For sulphate and sulphite pulping, production figures were obtained as part of data provided by the provincial agencies.

Fossil Fuel Production

This subcategory includes the processing of oil, natural gas, and coal for the production of various fuels.

Relevant industries addressed were:

- crude oil production
- natural gas processing
- coal industry
- petroleum refining
- tar sands operations, and
- metallurgical coke production

In addition to SO_2, particulate matter, NO_x emissions from the refinement and processing of fossil fuels and a vast range of organic constituents are released as well. In the 1980 emissions inventory, organic emissions were only reported collectively as total hydrocarbons (THC), volatile organic compounds (VOC) were added in this update because of their importance to tropospheric ozone.

Crude oil production includes the emissions from the extraction, marine handling, storage tank losses and the transfer operations associated with the production process for crude oil only, as well as sour oil batteries. Stack testing data were available from provincial files for major sources. These data were employed whenever possible. Otherwise, crude oil production figures from Statistics Canada, 1980(h) were used in the estimation of emissions. For emissions associated with marine handling and transfer operations, such information is generally not available and emissions were estimated using import quantities obtained from Statistics Canada, 1980(i); 1980(j). Emissions from evaporative losses from storage were estimated on a plant by plant basis using standard US EPA emission factors inconjunction with PACE data (Grant, 1985).

Plant-specific information for the natural gas industry was obtained directly from Alberta Environment; other reports such as from the Energy Resource Conservation Board (ERCB) (Energy Resources conservation Board, 1980; 1984) were also used as a reference. Data regarding emission estimates, the amounts of raw gas processed, fuel gas employed within the process, flaring operations, and sulphur recovery operations were obtained; otherwise, statistics regarding production, and/or plant capacities from Statistics Canada, 1980(h) were used to estimate emissions in conjunction with U.S. EPA emission factors (Stockton, 1987).

Tar sands operations are a unique sector to fossil fuel production in Canada, hence emissions data were obtained from Alberta and other Canadian studies such as: (Shultz International Limited, 1982; Alberta Environment, 1986; Alberta Environment, 1987).

In the production of coal for use as a combustion fuel, emissions from coal cleaning, mining and transportation were considered. Emissions from these sources are not readily measured, and hence were estimated using quantities of coal mined (Aylsworth, 1986) and internal coal handling and transportation statistics (Environment Canada, (c); (d)).

The emissions from the production of coke for subsequent use in the metallurgical industry were supplied by provincial ministries or were in most cases estimated from annual production quantities compiled by Energy, Mines & Resources (Aylsworth, 1986) and data developed by Environment Canada (Choquette, 1974) and US EPA (Stockton, 1987).

Chemical Industry

The various industries involved in the production of specific chemicals for both industrial and commercial use, are included in this subcategory. Specifically it includes the production of:

- phosphoric acid
- nitric acid
- phosphate fertilizers
- phosphate rock processing
- petrochemicals
- sulphuric acid
- nitrate fertilizers
- elemental phosphorous
- ammonium sulphate, and
- carbon black

Process statistics and actual emissions information were available for certain pollutants from the provincial agencies especially for larger plants, and these data were used in conjunction with US EPA emission factors to calculate annual emissions for all pollutants of concern. For plants where such information was not available, in particular; sulphuric acid and nitric acid production; production quantities were obtained from Energy, Mines and Resources, or internal surveys (Boucher, 1986; Environment Canada(e)). As in the estimation of emissions from other sectors, U.S. EPA emission factors (U.S. EPA, 1977; Stockton, 1987) were employed.

Other Manufacturing

Manufacturing industries that have not been included in previous subgroupings are collectively addressed in the subcategory of other manufacturing. Sectors relevant to Canadian industry are:

- abrasives industry
- concrete batching
- glass manufacturing
- clay products
- cement production
- asphalt production
- pigments production
- bakeries
- grain handling and milling
- plastics fabrication, and
- magnesium production

Few direct measurements of emissions existed for these various manufacturing industries with the exception of cement and concrete batching plants where some provincial data were supplied. Alternatively, production figures or plant capacities were used to estimate annual emissions. For most sectors, these data were obtained from Statistics Canada publications: (Statistics Canada, 1985(k); 1985(l); 1985(m); 1985(n); 1985(o); 1985(p); 1985(q); 1985(r); 1985(t). Another source of values was Energy, Mines and Resources (Bokovay, 1986; Prud'Homme, 1986; Stonehouse, 1986). Production figures used to estimate emissions from the production of pigments were obtained from CPI (Corpus Information Services Ltd.).

Control efficiencies were estimated based on the process and control device type. Standard U.S. EPA(a); 1973; Stockton, 1987; and Environment Canada(e) emission factors were used in the calculations.

3.2.2 Fuel Combustion at Stationary Sources

The combustion of fossil fuels from sources other than transportation sources are addressed in this grouping.

Specifically, stationary combustion sources comprise:

- electric power generation
- residential fuel combustion
- commercial fuel combustion
- industrial fuel combustion, and
- fuel wood combustion

Aside from larger electric power plants, these sources are generally uncontrolled. Direct measurement of emissions is impractical and therefore emissions were estimated indirectly by fuel consumption figures. Some values are submitted regularly to Environment Canada (Ontario Hydro, 1986; Gillis, 1987) for electric power generation. Emissions data for the utilities was provided by the provincial ministries (Boucher, 1980) and internal surveys (Environment Canada (c)). For the other sources such as residential fuel combustion, commercial and industrial fuel combustion and fuel wood combustion; fuel consumption data were obtained on a provincial basis from Statistics Canada, (Statistics Canada(b); (s)) and emission factors were obtained from U.S. EPA and Environment Canada (U.S. EPA, 1977; Stockton, 1987; Roch et Associes) were apportioned to each area using appropriate proration statistics.

Information on fuel characteristics such as sulphur content, were obtained for each region (RTM Engineering Ltd.) and were employed in conjunction with U.S. EPA emission factors.

3.2.3 Transportation

Generally, transportation sources include all emissions associated with mobile sources powered by internal combustion engines. The emissions associated with mobile sources encompass exhaust/evaporative emissions and tire wear. The types of mobile sources included in this category are grouped as follows:

- gasoline-powered motor vehicles
- diesel-powered vehicles
- railroads
- marine vessels
- aircraft
- off-road use of gasoline, and
- tire wear

The estimation of emissions for mobile sources is complicated by several factors; individual activity levels are generally unknown, the location of the mobile sources are not fixed geographically, and operating/control conditions are not known for individual sources.

For vehicular sources, the number of vehicles of each type was obtained from licence registration figures compiled by Statistics Canada, 1985(u). The activity levels were estimated assuming an average number of vehicle - miles travelled per year per vehicle type. Operational variables affecting emissions from vehicles such as the use of catalytic control devices, climatic differences etc.(Environment Canada,(d)), were incorporated into the calculation of emissions using a computerized system developed by the U.S. EPA known as 'MOBILE 3'.

This method of estimation was employed for all gasoline-powered vehicles (i.e., automobiles, light-duty trucks, heavy-duty trucks, and motorcycles), and diesel-powered vehicles (i.e., automobiles, light-duty trucks and heavy-duty trucks). Tire wear was calculated using the same statistics and was based on total vehicle miles travelled. The emissions were calculated using the findings in a published study (Cadle, 1978).

For railroads, off-road uses of gasoline (agricultural equipment, power tools etc.) as well as off-road uses of diesel fuel (construction and other heavy-duty equipment) fuel sales for such purposes were used to estimate emissions. The fuel quantities obtained from Statistics Canada, 1980(s); 1980(z) used in conjunction with U.S. EPA (1977) emission factors.

Emissions from larger marine sources (steam ships and motorships) entail both fuel combustion for electrical power generation during dockage, as well as fuel combustion for steam generation or motor power. The level of activity was estimated using the recorded number of calls in port for each port available from Statistics Canada, 1985(v); 1985(w). An average layover in port of 1.66 days was assumed (National Harbours Board) and U.S. EPA (1977) emission factors were applied.

Information on smaller marine crafts (power boats and other pleasure crafts) was limited to the number of boats owned. These data are recorded by Statistics Canada, 1985(x) as part of a sample survey taken each year. U.S. EPA emission factors were applied with an assumed average activity level of 50 hours per year (Environment Canada(d)) and an average horsepower of 9.1 (Environment Canada(d)) in the calculation of emissions.

In the calculation of emissions from aircrafts, inflight emissions as well as emissions from landing, taxiing, takeoff and climbout were considered. Transport Canada, (a); (b) provided information on the number of landing and takeoff (LTO) cycles for each airport by aircraft type. These figures were used with U.S. EPA (1977) emission factors to estimate emissions from such procedures at airports. For inflight emissions, flight times obtained from Transport Canada (a); Statistics Canada, 1985 (y); were used to estimate emissions. These were combined with information on engine type and EPA (1977) emission factors for cruising conditions.

3.2.4 Solid Waste Incineration

The sectors addressed in solid waste incineration are:

- municipal incineration
- industrial and commercial incineration
- sewage sludge incineration, and
- wigwam burners

Because most solid waste incinerators are relatively small, uncontrolled sources that are geographically dispersed; stack measurements of emissions are not made. Other statistics relating to the activity level also are not available in most cases. The exceptions are larger municipal incinerators and sewage sludge incinerators. Municipalities and provincial agencies compile annual throughput data. These figures obtained from provincial ministries were used in conjunction with U.S. EPA emission factors to estimate emissions from these two sectors.

With the aforementioned lack of information, emissions from industrial and commercial incineration were calculated indirectly by relating the emissions from this sector to municipal incineration applying a ratio developed by the U.S. EPA. A ratio of 9 tonnes of industrial and commercial incineration to 16.6 tonnes of municipal waste was used and it was assumed that 75% of the waste was treated in multiple chamber type incinerators while the remaining incinerators were of the controlled air type (Environment Canada(f)). The emission factors were taken from (US EPA, 1977).

Emissions from the burning of waste wood also were derived indirectly. Production figures for the logging industry were available from Statistics Canada, 1885(aa) and these values were used with the assumption of a percentage waste to estimate the amount of waste wood burned. Emission factors developed for previous emissions studies (Environment Canada, 1986) were used in the calculations.

3.2.5 Miscellaneous Sources

A variety of other sources of pollutants have been grouped together as miscellaneous sources. All of these source emissions were estimated on an area source basis. The sectors that were addressed in the 1985 Emissions Inventory are:

- fertilizer application
- pesticide manufacturing and application
- gasoline and diesel marketing
- dry cleaning
- application of surface coatings
- structural fires
- cigarette smoking
- general solvent use, and
- slash burning

For all product use and application sectors, some statistics on product sales are available from Statistics Canada, 1985(p); 1985(s); 1985(bb); 1985(cc). Census statistics were used for sector activities that were based on population (Statistics Canada, 1985(dd) (i.e. cigarette smoking, dry cleaning). In addition to solvent sales figures from Statistics Canada, it was assumed that domestic solvent use resulted in 100% emissions due to evaporative losses, and that commercial and industrial recovery of spent solvents was about _____ (Environment Canada (e)).

Structural fires and slash burning were based on historical average values obtained for data available at Statistics Canada (Statistics Canada, 1980(aa); Public Works).

4 ENHANCEMENTS TO THE 1985 INVENTORY (Kosteltz, 1989)

The 1985 inventory requirements were identical as for 1980; however missing data, uncertainties, and erroneous data were to be eliminated or reduced to the extent possible. Three basic elements were identified that would ensure greater precision and integrity of the inventory. These were:

1) the availability of detailed information on emitting sources;
2) the standardization of methodologies; and
3) the availability of an improved data handling system.

By taking the analysis down to the individual building blocks of the inventory, the following specific improvements were necessary. For point sources, the geographic location, stack parameters, the number and type of unit operations and processes, pollution control equipment, and the base quantities (production/consumption rates) had to be updated and improved. Although a straight forward survey could yield such information, the task was not simple since there existed no legal requirement for industry or the Canadian provinces to provide these data to Environment Canada. The use of emission factors that would be in line with those used by EPA, where appropriate, was required. Given that emission factors are generally available at the process level, the proper identification of the processes was essential. Methods for spatially disaggregating area source estimates to grid squares were also weak and had to be improved. Moreover hourly resolved emission estimates were essentially based on typical activity profiles since no other statistics were available.

In order to compile a more complete and accurate inventory, the project was broken down into a number of tasks, namely:

- Direct provincial input
- Standardization of data codes
- Use of NAPAP emission factors
- Review of source sectors
- DBMS improvements

A brief description of the activities that were undertaken for each of these tasks is given in the following sections.

Direct Provincial Input

The most reliable method for obtaining the required background data on major point sources was to acquire it directly from industry. Provincial authorities were known to have some of the required information as a result of their permit programs. Discussions were held with them and a mutual interest for having good provincial inventories was identified. A working group on emission inventories was established under the Federal/Provincial Advisory Committee on Air Quality (FPACAQ). The data requirements were outlined and the provincial ministries initiated a data collection program where required. They then submitted the data to Environment Canada following the data collection program which ran through 1987 and 1988. These datasets covered most major sources of sulphur dioxide and nitrogen oxides and, to a lesser extent, those emitting particulate matter. The coverage on hydrocarbon emissions was generally poor.

The provincial permit data was judged to be an excellent source of information on background data such as: type of processes; stacks; rated capacities; and geographic locations. Annual operating statistics were available on occasion but industry contacts were generally made for obtaining such data. Results from stack sampling surveys were obtained and compiled, where available, either through industry performance and

compliance tests or from provincial audits. Such data were used in preference to standard emission factors. At Environment Canada, this information was then used to update the existing 1980 point source file to the 1985 base year.

Standard methodologies on SO_2 and NOx were prepared to be used as a guide in compiling the inventory. Input forms for data maintenance were created and submitted to the provinces to streamline the transfer of data to the federal inventory system. These were only used by the provinces that did not have a computerized data handling system and proved to be the real weak link in the overall process. Considerable effort was required to convert the provincial data into a format suitable for input into the national system.

Standardization of Data Codes

Source Classification Codes (SCC). The most important modification to the 1985 inventory was the adaptation of the SCC codes. In previous Canadian inventories, the SCC coding was not used within the data handling system to any large extent. On account of this, for bilateral acid rain studies the integration of the Canadian data within the U.S. NAPAP inventory proved difficult. The advantages of being able to link emission factors automatically at the SCC level were recognized and this modification was made to the Canadian inventory structure.

SCC codes for the existing processes within the Canadian inventory were reviewed. The use of SCC codes assigned to non-identified processes was necessary for several industrial sectors; however this would limit the effectiveness of this objective and could negatively impact on the accuracy of the emission estimates. With cooperation from Alliance Technologies, additional codes were developed to accommodate unique

Canadian processes. Only processes in the point sources files were identified since EPA had no SCC codes that were applicable to area sources. Advantages of having similar codes for area sources quickly became apparent; therefore EPA and Environment Canada jointly developed a set of codes through Alliance Technologies.

To simplify the data exchange and integration process, Environment Canada adopted several other coding practices used by EPA (AEROS). Control equipment codes and emission estimated method codes are two examples. Although these codes are not as crucial as the SCCs, they were useful in classifying some of the information that otherwise might have been lost or misrepresented.

Use of NAPAP Emission Factors

To increase the compatibility of the U.S. and Canadian emission estimates on similar sources, the published NAPAP emission factors on criteria pollutants were used whenever no Canadian data were available. These factors were utilized nearly exclusively for area sources and to some extent on point sources. They were also used for calculating all non-methane VOCs since only total hydrocarbon emissions were established by Environment Canada.

Using NAPAP emission factors also improved the resolution of the data in some sectors. For the 1980 inventory, the lack of statistics often necessitated the use of average emission factors by plant and contaminant which presumably took into account emissions from several processes. Such data were always highly suspect.

Emission factors for road vehicles were standardized as well since the Mobile 3 model was used. The emission rates for Canadian vehicles are different than in the U.S. since national statistics and conditions were used but no major inconsistency should result at the border. The emission factors generated from Mobile 3 runs are expected to reflect the situation in Canada since the following input variables were modified:

- City/highway speeds
- Vehicle miles traveled
- Ambient temperatures
- Impact of I/M
- Impact of anti-tampering
- Hot/cold starts with and w/o catalysts

Review of Source Sectors

Four separate studies were made to improve upon the emission estimates for specific sectors and the results were incorporated into the 1985 inventory; the sectors examined were:

- Petroleum refineries
- Petrochemical industries
- Fuel combustion
- Residential fuelwood

In conjunction with the Petroleum Association for the Conservation of the Environment (PACE), the emissions of all five common contaminants from petroleum refineries were established (Grant). Although a similar study for the year 1978 was used for the 1980 assessment, the changes that occurred within this industry in the early eighties warranted a further analysis.

Recognizing that the emissions from the petrochemical manufacturing industries caused concern in the 1980 inventory, a thorough analysis of the available surveys on the industry was made (Edwards). As suspected, the emissions were shown to have been over estimated by about 60 percent for 1980. The study also reported the data by SCC for each plant site.

Emissions from stationary fuel combustion are very important and comprise several sectors within the inventory. With the exception of power plants, the emissions from industrial, residential and commercial applications are reported as area source emissions and therefore the geographical resolution could be improved. Plant specific fuel consumptions requested from the provinces were obtained to various degrees; unfortunately the coverage was not sufficient for incorporation into the point source file. Also sulphur dioxide emission estimates for these sectors are dependent on good fuel sulphur analyses. A study was undertaken to compile all such statistics on a regional basis as reported by refineries (RTM). The results were used for the 1985 inventory.

A study undertaken by Environment Canada's regional office in the province of Quebec was used to update emission estimates on residential fuelwood (Roche). Information on combustion equipment and quantities of wood burned were lacking in the past. This study included a survey for the province and actual statistics were produced which were then applied nationally.

DBMS Improvements

The National Emissions Inventory System (NEIS) operating under the Mark IV file management system was used for handling the 1980 inventory requirements. Several limitations were noted with the NEIS and a new system was developed for the 1985 inventory. This system was designed with the following objectives in mind:

- To provide interactive access to the end user
- To facilitate data maintenance functions
- To integrate temporal data
- To integrate chemical speciation data
- To improve data retrieval capabilities
- To add quality control capabilities

This system allowed the management of all inventory related data and was used for the electronic transfer of provincial files were possible. It was also used for some quality control checks. Unfortunately the data gathering activity for the 1985 inventory was initiated before the system was fully developed and some of the planned features were not available. Once the system objectives can be fully implemented, this DBMS should simplify the overall task and place more confidence on the reported data. An overview of the system is given in the next section.

5 THE NATIONAL EMISSION INVENTORY DATABASE SYSTEM

The database system developed for the National Emission inventory is known as the Residual Discharge Inventory System, or RDIS. The system encompasses several main functions:

1. Maintenance of data,
2. Reporting of emissions and background data, and
3. Generation of output files for modelling needs.

The RDIS system contains point sources and area sources (including mobile sources). This universality is achieved by the underlying concept of a standard classification code and a corresponding emission estimate. Where emissions are not known, an emission factor is used and refers to the release rate of a specific contaminant due to some activity divided by the level of activity.

The software chosen to support the system is dBase IV. Within the dBase IV programming environment, custom reports, sorting and graphical representations are easily produced by a novice to the system. The reporting system has been summarized in an unpublished Environment Canada Document titled "RDIS User Documentation".

The RDIS structure is hierarchical in nature. More precisely, it is a system that maximizes functions for file structures with one to many relationships.

The RDIS system is comprised of five primary files and three support files:

1) Plant file
2) Process file
3) Stack device file
4) Contaminant file
5) Component file

These files have been developed in context of the DBMS system called dBase IV, a proprietary product of Ashton-Tate. Both point and area sources have been handled in parallel fashion. A general description of the one to many file relationships is provided in Figure 5.1.1. The system is updated as required using editing screens. For quality control purposes, a history of each change and operator also is stored in a computer file. Hence, any change, the person responsible for the change, and the reason for the change can be traced.

An overview of the main files and some of the fields follows. The objective is to provide an understanding of the information that may be accessed as well as the level of detail that is available. The file interrelationships are depicted in Figure 5.1.2. Specific data elements maintained in the system are given in Appendix C, key fields used for accessing the data are denoted by asterisks.

FIGURE 5.1.1

Basic Design of the RDIS Database System

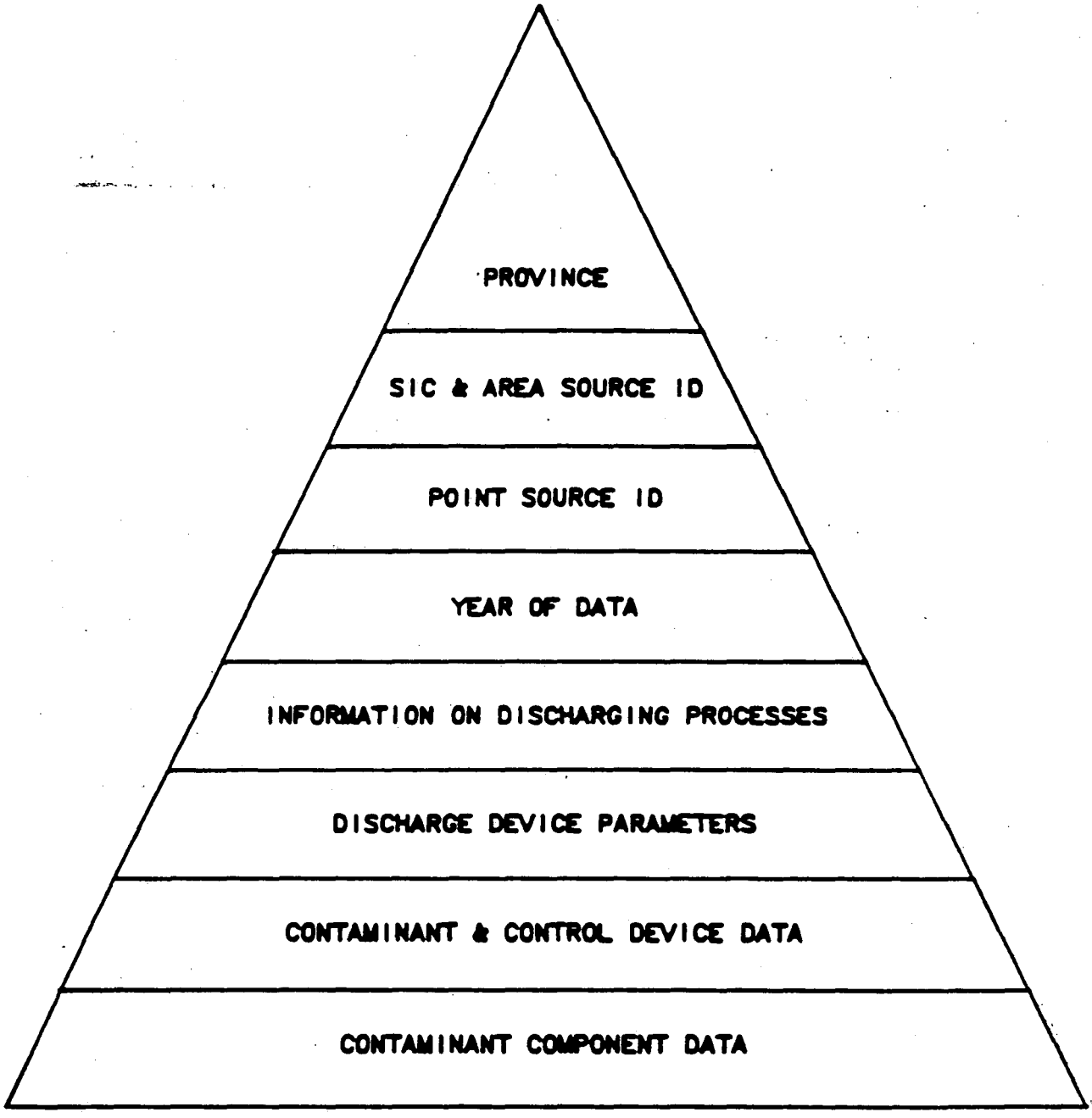
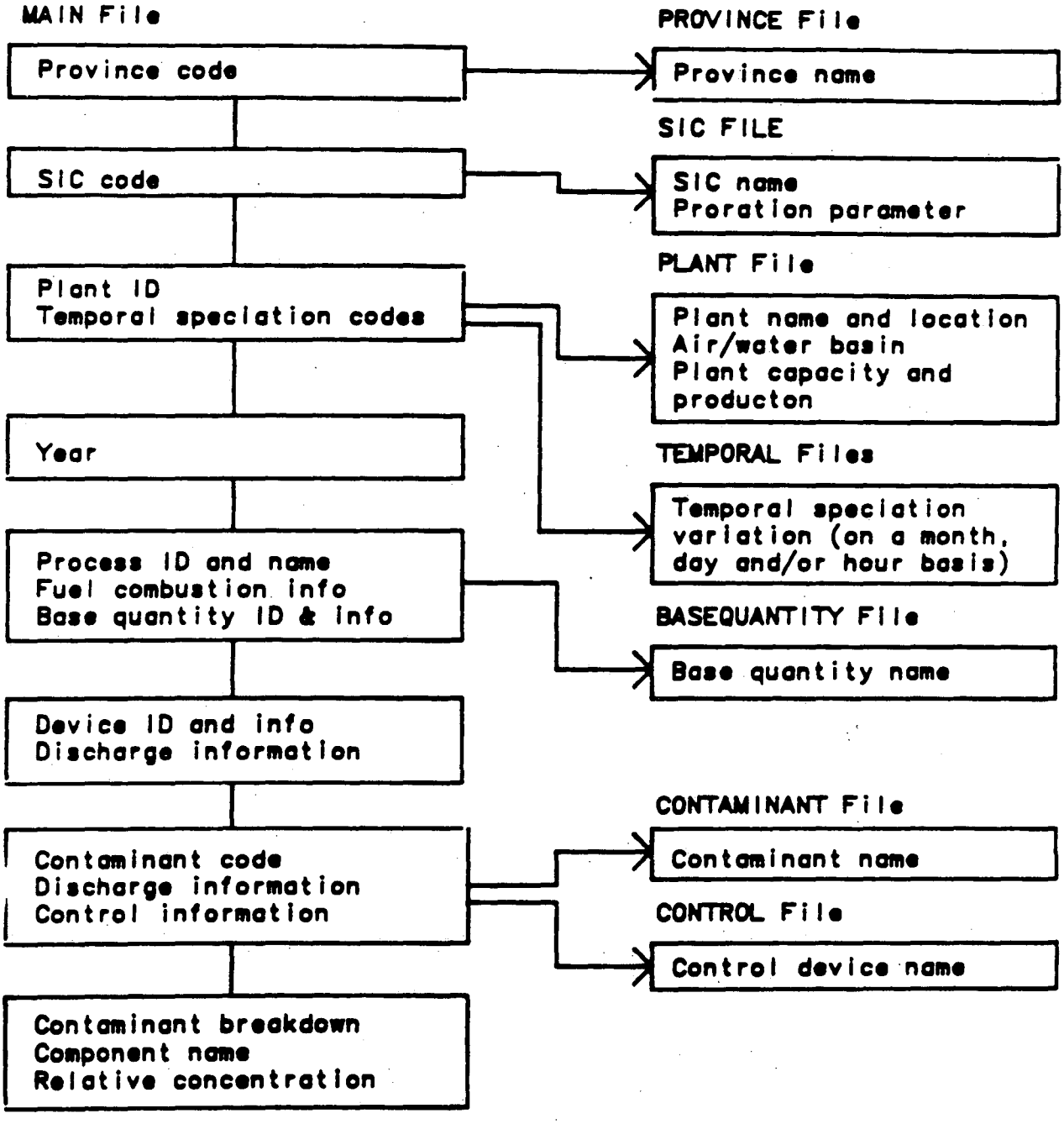


FIGURE 5.1.2
RDIS File Interactions



The "plant.dfb" file is the primary file and coordinates the logical movement between the specific data files. It contains production and capacity of each plant on an annual basis, as well as the plant-specific codes to orchestrate the retrieval of all information corresponding to a specific plant. The codes that link the production field to the temporal variations by month, day of week, and hour of day are contained in this file. A plant contained in "plant.dbf" may have several associated processes. Hence one "plant.dbf" record may have many corresponding records in "process.dbf".

The "process.dbf" file contains detailed information on each process within the plant. Aside from the base quantity used for emission estimation, the file contains information on the control devices and characteristics of the fuel employed by the process.

The operating and physical characteristics of each point source are located in the "device.dbf" file. Information of particular interest to modelling activities, such as the stack height, stack diameter, exit velocity and exit temperature is included in this file.

The remaining two system files address the pollutant discharged by the source. The contaminant file ("contam.dbf") contains information regarding the compound class measured (e.g. NO_x) whereas the component file ("compon.dbf") contains information regarding the specific compound (e.g. NO_2). The "contam.dbf" file contains data derived by using one of the following methods:

a) direct measurement (e.g. stack test)
b) emission estimate employing EPA AP-42 Emission factors
c) emission estimate based on Emission factors derived from actual tests
d) emission estimate based on engineering judgement.

The method used is stored in the "COMPMETH" field of file "contam.dbf". The efficiency of the primary (and possibly secondary) control device(s) also is provided.

The purpose of the "compon.dbf" files is to provide further speciation within a compound group. The fraction of the specific component within a compound group is given in the "FRACTION" field. The species fraction is generally based on the U.S. EPA Air Emissions Species Manual (1988). The species fraction are also based on the following studies for toxic pollutants and particulates:

- Toxic Air Pollutants Emission Factors, Information Storage and Retrieval Systems; and

- U.S. Source Composition Library

There are also three files that characterize the activity level of the source to a maximum resolution of one hour. The desired resolution for a specific dispersion model can be obtained by consecutive application of the temporal profiles beginning with YEAR. For example, a long term model would only require seasonal variation, and hence only the YEAR profile would be required. For short term models, the YEAR profile would be applied, followed by WEEKDATA, then DAYDATA. The activity levels contained in these files total to a 100 percent for each profile.

A brief description of each field in the five primary files as well as the three temporal variation files is presented in Appendix C.

6 FUTURE ENHANCEMENTS

The initiatives undertaken in the 1985 Emissions Inventory to improve accuracy will continue to be the focus of future improvements. Several aspects have been identified for further study. Generally, future enhancements will strive to improve methodology for specific sectors, standarize the provinical contributions to the national inventory, and streamline the database system for ease of use.

Current methodologies for estimating emissions will be reviewed and standardized through the ad-hoc working group on emission inventories. Shortcomings in the available information will be assessed, as well as the emission factors that were employed. The development of emission factors that improve the accuracy of the estimation process with repect to actual emissions, will be investigated for specific sectors. The sectors that have been identified as requiring additional study include:

- petroleum refineries
- fuel marketing
- highway vehicles
- boilers (conventional and other fuels)
- solvent use

Recent changes in the petroleum industry warrant further examination. New technologies and processes along with regional differences in climate and crude oil composition will be considered in the formulation of plant specific emission factors and other evaporative losses associated with the petroleum/chemical industries. Accounting for variables with a significant effect on resultant emissions, should greatly reduce the error of estimation associated with this sector. In particular, the VOC and NO_x emission factors will be reviewed.

The methodologies employed in the estimation of vehicular emissions will be addressed prior to the next inventory. Due to the great variablility in climate and fuel composition, province-specific emission factors will be considered. Another aspect that warrants review is the evaporative losses that occur during vehicle operation. Concerns regarding the underestimation of VOC emissions from the EPA model, MOBILE 3, also will be investigated and the newer Mobile 4 model will be introduced.

In the 1985 National Emissions Inventory, information on industrial boilers and boilers fueled by alternative fuels such as wood waste was scarce. Source specific information on Canadian industrial boilers, and boilers that employ non-traditional fuel will be sought. Other aspects that will recieve attention are NO_X emission testing data, demographic resolution and operating conditions (especially pertaining to NO_X emissions).

Due to the ever increasing detail and volume of the data contained within the Residual Discharge Information System, database improvements will be sought to streamline file structures and optimize database functions.

Information supplied by the provincial ministries is vital in the compilation of a national emissions inventory, and this is a complex and fastideous task. Efforts will be made to minimize the work effort expended by the provincial agencies, and to assure uniformity accross the provinces. Several aspects of the data handling will be addressed, including Provincial manuals outlining specific methods of emission calculation.

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8 GLOSSARY OF TERMS

Acid Deposition Precursor - A material such as SO_2 or NOx which is transformed to become a component of acidic deposition.

Acid Rain - Sulfuric, nitric, organic, or other acids that acidify rain water.

Acidic Deposition - The transfer of acidic or acidifying materials from the atmosphere by dry and wet deposition to the earth.

ADOM - Acid Deposition and Oxidants Model used by the Atmospheric Environment Service to study the transport and deposition of air pollutants.

Area Sources - Activities or numerous smaller sources for which source and emission information are maintained in the inventory on an aggregate or collective basis rather than for each source. For some sectors, combined point and area source emissions constitute the total emissions.

Base Quantity - Is an activity level or rate indicating the amount of fuel consumed, quantity of product manufactured in an industrial process, or some comparative measure.

Category - A combined group of economic sectors to a major category (e.g., industry, transportation) which, for emission inventory purposes, permits an identification of the contribution from broadly related activities to be made.

Common Pollutant - Pollutants historically regarded as being the most significant air pollutants and are known as the criteria pollutants at U.S. EPA (Particulates, SO_2, NOx, THC, CO).

Dry Deposition - Removal of trace gases and particles from the atmosphere through interactions with various surfaces except water.

Emission Factor - An estimate or statistical average of the rate at which a contaminant is released to the atmosphere as a result of some activity, such as combustion or industrial production, divided by the level of that activity. The emission factor, therefore, relates the average quantity of each contaminant emitted to an appropriate base quantity. It is usually expressed as the weight of contaminant divided by a unit weight, volume, distance or duration of the associated activity that emits the pollutant (e.g., kg of SO_2 emitted per tonne of coal combusted). Factors are usually obtained from data of varying degrees of accuracy and may be presented for either uncontrolled sources or facilities having air pollution control devices in place.

EPA - Environmental Protection Agency in the United States which is their equivalent to Environment Canada.

Eulerian - A method for modelling fluid processes which relies on a framework of fixed coordinates. These models track the activity at a specific location. ADOM is a model of this type.

Fugitive Emissions - Air pollution deriving from human activities that do not emanate from a particular point, such as an exhaust pipe or stack. Roadway dust and VOC from refinery valves are examples.

Grid - Identifies a geographical area for reporting area source emissions. Grid squares of 127 km x 127 km and 20 km x 20 km are used for reporting Canadian emission data.

Mobile Source - A segment of the area source classification representing transportation sources such as vehicles, aircraft and railroads.

Nitrogen Oxides - Consist of nitrous oxide (NO) and nitrogen dioxide (NO_2) and are reported as NO_2.

Particulates - Or total particulate matter (TPM) is any aerosol that is released to the atmosphere in either solid or liquid form. The upper size limit is generally regarded to be about 75 microns in aerodynamic equivalent diameter.

Point Source - Any stationary source that usually releases emissions through stacks at elevated heights for which individual source records are maintained in the inventory and for which annual emissions exceed a specified cut-off level. Although there is no uniform designated cut-off level, sources with emissions that generally exceed 100 metric tons (tonnes) per year of any one of the 5 common pollutants generally are included in inventories. Similarly, emission points that release greater than approximately 500 tonnes per year are regarded as major point sources.

Proration - Reporting emission data for sources and/or geographical areas for which no base quantities are available by relating the source to some other parameter such as population.

SCC - Standard Classification Code established by U.S. EPA for estimating emissions at the industrial process level.

Sector - A grouping of similar industries (or other entities) that have common activities within the economy and/or the classification of establishments by type of activity in which the establishment is engaged (e.g., petroleum refining, aluminum production). In many instances, a Standard Industrial Classification (SIC) code is used to describe a sector/industry for purposes of facilitating the collection and assimilation of data relating to the establishment when maintained on a Database Management System.

SIC - Standard Industrial Classification Code is a classification system determined by Statistics Canada for reporting survey data on various manufacturing activities in Canada.

Source - Any structure, facility, equipment of operation (or combination thereof), located on a property, which is owned, controlled or operated by one or more persons. In many instances, a Source Classification Codes (SCC) is used which specifically identifies the source or operational process and defines the units of activity level. Emissions may be calculated by multiplying the emission factor for each SCC and the activity level.

Spatial Resolution - The reporting of emission data by geographic locations.

Speciation - Is the determination and reporting of specific elements or compounds that constitute pollutants such as; Particulates, Nitrogen Oxides and Volatile Organic Compounds.

Sulphur Dioxide - Refers to gaseous sulphur dioxide (SO_2) for which national and provincial air quality objectives and regulations have been promulgated. In some cases, emissions may contain small amounts of sulphur trioxide (SO_3) and sulphurous and sulphuric acid vapour but particulate or aerosol sulphate is excluded from emission totals.

Surrogate - A parameter that is used to substitute for a variable for which no values are available.

Temporal Factor - An estimated or measured fraction that gives a monthly, day of week, or hourly portion of an annual emission value.

THC - Total Hydrocarbons include all volatile organic compounds that are released to the atmosphere.

VOC - Volatile Organic Compounds also known as Reactive Organic Gases (ROG) or Non-Methane Volatile Organic Compounds (N-MVOC) refer only to photochemically reactive hydrocarbons and therefore exclude compounds such as methane, ethane and several chlorinated organics.

APPENDIX A

Summary of Emissions by Province

ALBERTA

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron Ore						
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil		30,003			19,151	10,533
Refineries	1,549	2,634	2,664	109	8,837	5,302
Gas Plants		240,280				
Coal Production					93,970	
Petrochemicals					52,225	44,391
Plastics					2,547	2,547
Kraft Pulping			750		219	219
Tar Sands		162,425	15,975			
Asbestos						
Mining & Quarrying	17,345					
Coal Industry	78,681					
Carbon Black						
Chemical Pulping	3,791	2,227		3,833		
Sawmills	5,336					
Other	32,005	9,052	6,854	25,044	263	263
Subtotal	**138,707**	**446,621**	**26,243**	**28,986**	**177,212**	**63,256**
FUEL COMBUSTION :						
STATIONARY						
Refineries	710	4,934	411	2,980	50	18
Gas Plants	979		131,480	24,121	39,885	5,065
Other Industrial	293	1,000	10,936	2,709	440	213
Commercial	216	257	4,534	904	357	236
Residential	992	762	6,920	5,257	1,324	789
Fuelwood	2,233	54	67	8,932	1,544	1,542
POWER PLANTS						
Utilities	38,962	80,314	67,810	41,775	857	626
Other	25	90	246	73	23	17
Subtotal	**44,410**	**87,411**	**222,404**	**86,751**	**44,480**	**8,506**

ALBERTA

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	3,648	642	45,187	449,546	59,393	53,454
L-D Trucks	936	291	15,246	167,983	25,256	22,730
H-D Trucks	413	79	3,212	55,371	5,360	4,824
Motorcycles	30	3	101	1,460	480	432
DIESEL						
L-D Trucks	84	102	506	313	125	120
H-D Trucks	2,685	911	31,700	12,636	4,528	4,329
Other	4,876	1,575	50,454	16,066	5,905	5,645
Railroads	1,694	480	35,802	12,536	2,767	2,645
Marine		7	16	8,205	2,791	2,512
Aircraft	155	249	4,753	17,615	1,923	1,711
Off-road Gas	665	209	10,083	337,787	18,820	16,938
Tire Wear					80	80
Subtotal	**15,186**	**4,548**	**197,060**	**1,079,518**	**127,428**	**115,420**
INCINERATION :						
Wood Waste	1,617	15	147	19,107	1,617	647
Other	210	100	324	250	75	45
Subtotal	**1,827**	**115**	**471**	**19,357**	**1,692**	**692**
MISCELLANEOUS :						
Fuel Marketing					12,927	12,927
Structural Fires					707	707
Pesticides	1,749					
Slash Burning	11,692		1,055	60,400	6,730	5,135
Solvent Use						
Dry Cleaning					4,201	4,201
Surface Coatings					6,977	6,977
General Use					9,871	9,871
Other	5,152			1,588		
Subtotal	**18,593**		**1,055**	**61,988**	**41,413**	**39,818**
PROVINCIAL TOTAL	**218,723**	**538,695**	**447,233**	**1,276,600**	**392,225**	**227,691**

BRITISH COLUMBIA

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
INDUSTRIAL :						
Iron Ore						
Iron & Steel						
Aluminium	4,404	3,844		47,555		
Copper & Nickel						
Lead & Zinc	2,033	16,980				
Gold						
Crude Oil					713	392
Refineries	717	13,815	1,887	16,413	10,430	6,258
Gas Plants		20,590				
Coal Production					117,870	
Petrochemicals					1,875	1,594
Plastics					2,607	2,607
Kraft Pulping			6,710		5,540	5,540
Tar Sands						
Asbestos	139					
Mining & Quarrying	63,284					
Coal Industry	71,239					
Carbon Black						
Chemical Pulping	27,356	16,676				
Sawmills	9,951					
Other	31,450	3,643	2,096	11,324	427	427
Subtotal	**210,573**	**75,548**	**10,693**	**75,292**	**139,462**	**16,818**
FUEL COMBUSTION :						
STATIONARY						
Refineries	586	672	277	684	29	10
Gas Plants	75		9,878	1,731	9,730	1,236
Other Industrial	51,279	12,361	25,145	465,730	48,878	41,468
Commercial	203	1,705	2,711	529	187	123
Residential	284	2,084	3,392	1,071	376	205
Fuelwood	5,547	133	166	22,204	3,843	3,837
POWER PLANTS						
Utilities	113	102	1,657	368	148	108
Other	181	291	2,012	628	194	146
Subtotal	**58,268**	**17,348**	**45,238**	**492,945**	**63,385**	**47,132**

BRITISH COLUMBIA

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION:						
GASOLINE						
Cars	4,156	1,117	51,475	512,102	67,657	60,891
L-D Trucks	1,519	722	24,742	272,610	40,986	36,887
H-D Trucks	589	171	4,585	79,023	7,650	6,885
Motorcycles	51	7	173	2,511	826	743
DIESEL						
L-D Trucks	136	453	822	507	202	193
H-D Trucks	3,863	3,599	45,609	18,180	6,516	6,229
Other	3,447	3,536	44,022	13,149	4,056	3,878
Railroads	843	1,051	17,809	6,236	1,376	1,315
Marine	385	1,022	1,193	14,249	5,251	4,803
Aircraft	130	181	3,133	21,156	1,585	1,411
Off-road Gas	219	71	2,220	76,088	5,781	5,203
Tire Wear					103	103
Subtotal	**15,338**	**11,930**	**195,783**	**1,015,811**	**141,989**	**128,542**
INCINERATION :						
Wood Waste	20,742	189	1,886	245,132	20,742	8,297
Other	1,600	116	377	28,873	87	52
Subtotal	**22,342**	**305**	**2,263**	**274,005**	**20,829**	**8,349**
MISCELLANEOUS :						
Fuel Marketing					12,350	12,350
Structural Fires					746	746
Pesticides	499					
Slash Burning	100,094		9,033	517,073	57,615	43,960
Solvent Use						
Dry Cleaning					5,129	5,129
Surface Coatings					13,975	13,975
General Use					12,003	12,003
Other	6,461			1,701		
Subtotal	**107,054**		**9,033**	**518,774**	**101,818**	**88,163**
PROVINCIAL TOTAL	**413,575**	**105,131**	**263,010**	**2,376,827**	**467,483**	**289,005**

MANITOBA

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron ore						
Iron & Steel						
Aluminium						
Copper & Nickel	4,592	378,877				
Lead & Zinc	1,624	79,903				
Gold						
Crude Oil					251	138
Refineries						
Gas Plants						
Coal Production						
Petrochemicals						
Plastics					1,155	1,155
Kraft Pulping			229		179	179
Tar Sands						
Asbestos						
Mining & Quarrying	8,033					
Coal Industry						
Carbon Black						
Chemical Pulping	1,402	282		877		
Sawmills	446					
Other	16,909	658	343	261	127	127
Subtotal	**33,006**	**459,720**	**572**	**1,138**	**1,712**	**1,599**
FUEL COMBUSTION :						
STATIONARY						
Refineries						
Gas Plants						
Other Industrial	3,458	2,172	2,168	574	57	31
Commercial	313	307	1,290	1,849	414	240
Residential	77	306	1,375	290	121	69
Fuelwood	2,794	67	84	11,185	1,935	1,932
POWER PLANTS						
Utilities	2,544	3,380	1,781	191	419	306
Other	82	142	924	286	88	66
Subtotal	**9,268**	**6,375**	**7,622**	**14,375**	**3,034**	**2,644**

MANITOBA

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	1,451	578	17,974	178,813	23,624	21,262
L-D Trucks	504	355	8,213	90,488	13,605	12,245
H-D Trucks	196	84	1,522	26,230	2,539	2,285
Motorcycles	11	2	40	581	191	172
DIESEL						
L-D Trucks	45	42	273	168	67	64
H-D Trucks	1,298	334	15,325	6,109	2,189	2,093
Other	1,100	243	10,307	3,359	1,368	1,308
Railroads	862	1,172	18,215	6,378	1,408	1,346
Marine	1	11	13	4,279	1,456	1,311
Aircraft	50	91	1,833	3,009	348	310
Off-road Gas	186	114	2,432	82,084	5,111	4,600
Tire Wear					35	35
Subtotal	**5,704**	**3,026**	**76,147**	**401,498**	**51,941**	**47,029**
INCINERATION :						
Wood Waste	92	1	8	1,093	92	37
Other	89	42	138	106	32	19
Subtotal	**181**	**43**	**146**	**1,199**	**124**	**56**
MISCELLANEOUS :						
Fuel Marketing					4,558	4,558
Structural Fires					581	581
Pesticides	1,031					
Slash Burning	2,236		202	11,550	1,287	982
Solvent Use						
Dry Cleaning					1,903	1,903
Surface Coatings					3,802	3,802
General Use					4,447	4,447
Other	2,547			1,240		
Subtotal	**5,814**		**202**	**12,790**	**16,578**	**16,273**
PROVINCIAL TOTAL	**53,973**	**469,164**	**84,689**	**431,000**	**73,389**	**67,601**

NEW BRUNSWICK

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron Ore		424				
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc	462	16,814				
Gold						
Crude Oil					830	457
Refineries	172	1,546	51	7	2,115	1,269
Gas Plants						
Coal Production					1,670	
Petrochemicals						
Plastics					474	474
Kraft Pulping			2,596		564	564
Tar Sands						
Asbestos						
Mining & Quarrying	9,624					
Coal Industry	1,829					
Carbon Black						
Chemical Pulping	25,814	1,557		5,549		
Sawmills	2,722					
Other	10,647				78	78
Subtotal	**51,270**	**20,341**	**2,647**	**5,556**	**5,731**	**2,842**
FUEL COMBUSTION :						
STATIONARY						
Refineries	178	2,085	1,254	237	5	2
Gas Plants						
Other Industrial	1,336	15,263	2,624	284	59	46
Commercial	176	2,298	631	106	20	13
Residential	146	1,729	815	226	104	33
Fuelwood	7,597	182	227	30,411	5,263	5,255
POWER PLANTS						
Utilities	14,800	93,991	7,929	1,410	73	53
Other	1	12	9	2		
Subtotal	**24,234**	**115,560**	**13,489**	**32,676**	**5,524**	**5,402**

NEW BRUNSWICK

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	737	226	9,749	96,988	12,814	11,533
L-D Trucks	277	141	4,511	49,701	7,472	6,725
H-D Trucks	107	33	836	14,407	1,395	1,256
Motorcycles	8	1	26	372	122	110
DIESEL						
L-D Trucks	25	95	150	93	37	35
H-D Trucks	704	756	8,315	3,315	1,188	1,136
Other	357	404	4,470	1,276	412	394
Railroads	12	18	266	93	21	20
Marine	14	69	51	1,538	537	486
Aircraft	11	12	191	3,371	325	289
Off-road Gas	30	16	488	16,300	867	780
Tire Wear					19	19
Subtotal	**2,282**	**1,771**	**29,053**	**187,454**	**25,209**	**22,782**
INCINERATION :						
Wood Waste	717	7	65	8,470	717	287
Other	68	32	105	475	24	14
Subtotal	**785**	**39**	**170**	**8,945**	**741**	**301**
MISCELLANEOUS :						
Fuel Marketing					3,213	3,213
Structural Fires					197	197
Pesticides	209					
Slash Burning	10,281		928	53,108	5,918	4,515
Solvent Use						
Dry Cleaning					1,275	1,275
Surface Coatings					2,534	2,534
General Use					3,001	3,001
Other	1,291			52		
Subtotal	**11,781**		**928**	**53,160**	**16,138**	**14,735**
PROVINCIAL TOTAL	**90,352**	**137,711**	**46,287**	**287,791**	**53,343**	**46,062**

NEWFOUNDLAND

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron Ore	88,306	2				
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil						
Refineries						
Gas Plants						
Coal Production						
Petrochemicals						
Plastics					31	31
Kraft Pulping						
Tar Sands						
Asbestos	3,996					
Mining & Quarrying	1,905					
Coal Industry						
Carbon Black						
Chemical Pulping		2,741				
Sawmills	130					
Other	6,981	35	1,320		39	18
Subtotal	**101,318**	**2,778**	**1,320**		**70**	**49**
FUEL COMBUSTION :						
STATIONARY						
Refineries						
Gas Plants						
Other Industrial	1,017	13,451	2,354	224	54	42
Commercial	99	1,344	413	77	12	8
Residential	70	754	467	158	69	22
Fuelwood	12,581	302	374	50,370	8,718	8,705
POWER PLANTS						
Utilities	1,631	22,267	3,808	284	74	66
Other	138	231	1,537	479	148	111
Subtotal	**15,536**	**38,349**	**8,953**	**51,592**	**9,075**	**8,954**

NEWFOUNDLAND

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	477	146	5,904	58,734	7,760	6,984
L-D Trucks	175	95	2,849	31,393	4,720	4,248
H-D Trucks	79	26	615	10,605	1,027	924
Motorcycles	6	1	22	319	105	95
DIESEL						
L-D Trucks	16	60	95	58	23	22
H-D Trucks	445	477	5,252	2,093	750	717
Other	456	577	6,257	1,769	489	467
Railroads	43	61	907	318	70	67
Marine	266	705	813	3,515	1,474	1,380
Aircraft	38	67	1,316	1,578	195	174
Off-road Gas	126	19	472	18,074	3,028	2,725
Tire Wear					12	12
Subtotal	**2,127**	**2,234**	**24,502**	**128,456**	**19,653**	**17,815**
INCINERATION :						
Wood Waste	60	1	5	709	60	24
Other	40	19	63	48	14	8
Subtotal	**100**	**20**	**68**	**757**	**74**	**32**
MISCELLANEOUS :						
Fuel Marketing					1,853	1,853
Structural Fires					83	83
Pesticides	42					
Slash Burning	3,268		295	16,884	1,881	1,435
Solvent Use						
Dry Cleaning					1,028	1,028
Surface Coatings					1,817	1,817
General Use					2,433	2,433
Other	800			207		
Subtotal	**4,110**		**295**	**17,091**	**9,095**	**8,649**
PROVINCIAL TOTAL	**123,191**	**43,381**	**35,138**	**197,896**	**37,967**	**35,499**

NORTHWEST TERRITORY

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron Ore						
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil					351	193
Refineries						
Gas Plants						
Coal Production						
Petrochemicals						
Plastics						
Kraft Pulping						
Tar Sands						
Asbestos						
Mining & Quarrying						
Coal Industry						
Carbon Black						
Chemical Pulping						
Sawmills						
Other	454					
Subtotal	**454**				**351**	**193**
FUEL COMBUSTION :						
STATIONARY						
Refineries						
Gas Plants						
Other Industrial	5	81	72	18	2	1
Commercial	55	706	312	61	9	6
Residential	7	64	109	24	10	5
Fuelwood	1,918	46	57	7,680	1,330	1,328
POWER PLANTS						
Utilities						
Other	288	530	3,182	999	307	230
Subtotal	**2,273**	**1,427**	**3,732**	**8,782**	**1,658**	**1,570**

NORTHWEST TERRITORY

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	25	1	314	3,122	413	372
L-D Trucks	31	1	512	5,646	849	764
H-D Trucks	13		99	1,709	165	149
Motorcycles	1		2	32	11	10
DIESEL						
L-D Trucks	3	2	17	11	4	4
H-D Trucks	89	17	1,050	418	150	143
Other	506	201	6,765	1,959	552	528
Railroads	7	3	140	49	11	11
Marine	4	12	13	12	9	9
Aircraft	57	73	1,148	2,441	339	302
Off-road Gas	14	1	224	7,494	399	359
Tire Wear					1	1
Subtotal	**750**	**311**	**10,284**	**22,893**	**2,903**	**2,650**
INCINERATION :						
Wood Waste						
Other	6	3	10	8	2	1
Subtotal	**6**	**3**	**10**	**8**	**2**	**1**
MISCELLANEOUS :						
Fuel Marketing					119	
Structural Fires					18	119
Pesticides						18
Slash Burning	242		22	1,251	139	
Solvent Use						106
Dry Cleaning					90	
Surface Coatings					122	90
General Use					209	122
Other	99			41		209
Subtotal	**341**		**22**	**1,292**	**697**	**664**
PROVINCIAL TOTAL	**3,824**	**1,741**	**14,048**	**32,975**	**5,611**	**5,079**

NOVA SCOTIA

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
INDUSTRIAL :						
Iron Ore	7,608					
Iron & Steel	1,692					
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil					1,192	656
Refineries	3,489	9,177	1,177	153	5,323	3,194
Gas Plants						
Coal Production					13,210	
Petrochemicals					14	12
Plastics					320	320
Kraft Pulping			242		123	123
Tar Sands						
Asbestos						
Mining & Quarrying	14,239					
Coal Industry	8,444					
Carbon Black						
Chemical Pulping	1,017	2,389		288		
Sawmills	681					
Other	9,487	323	166	2	122	122
Subtotal	**46,657**	**11,889**	**1,585**	**443**	**20,304**	**4,426**
FUEL COMBUSTION :						
STATIONARY						
Refineries	1,134	6,258	1,144	149	9	3
Gas Plants						
Other Industrial	1,788	9,660	1,786	275	36	28
Commercial	312	4,104	1,155	204	36	24
Residential	635	5,056	1,591	2,584	626	301
Fuelwood	6,673	160	199	26,710	4,622	4,615
POWER PLANTS						
Utilities	4,658	129,898	21,676	5,551	112	82
Other	6	25	67	20	6	5
Subtotal	**15,206**	**155,161**	**27,618**	**35,493**	**5,447**	**5,057**

NOVA SCOTIA

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	1,036	317	12,836	127,701	16,871	15,184
L-D Trucks	345	186	5,617	61,886	9,304	8,374
H-D Trucks	134	44	1,041	17,939	1,737	1,563
Motorcycles	12	2	41	590	194	175
DIESEL						
L-D Trucks	31	118	187	115	46	44
H-D Trucks	1,023	1,099	12,084	4,817	1,726	1,650
Other	741	868	9,675	2,697	822	786
Railroads	205	290	4,324	1,514	334	319
Marine	86	356	293	2,544	954	876
Aircraft	33	66	1,389	1,137	129	115
Off-road Gas	36	15	427	14,487	975	878
Tire Wear					25	25
Subtotal	**3,682**	**3,361**	**47,914**	**235,427**	**33,117**	**29,988**
INCINERATION :						
Wood Waste	309	3	28	3,656	309	124
Other	70	33	108	83	25	15
Subtotal	**379**	**36**	**136**	**3,739**	**334**	**139**
MISCELLANEOUS :						
Fuel Marketing					3,688	3,688
Structural Fires					225	225
Pesticides	77					
Slash Burning	4,479		404	23,140	2,578	1,967
Solvent Use						
Dry Cleaning					1,563	1,563
Surface Coatings					2,962	2,962
General Use					3,659	3,659
Other	1,666			514		
Subtotal	**6,222**		**404**	**23,654**	**14,675**	**14,064**
PROVINCIAL TOTAL	**72,146**	**170,447**	**77,657**	**298,756**	**73,877**	**53,674**

ONTARIO

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
INDUSTRIAL :						
Iron ore	2,486	115,890		47,518		
Iron & Steel	6,723			201,516		
Aluminium	50					
Copper & Nickel	8,318	769,006				
Lead & Zinc	186	4,272				
Gold		9,937				
Crude Oil					42	23
Refineries	2,251	38,429	9,043	44,980	25,690	15,414
Gas Plants						
Coal Production						
Petrochemicals					46,588	39,600
Plastics					28,766	28,766
Kraft Pulping			3,287		6,200	6,200
Tar Sands						
Asbestos						
Mining & Quarrying	51,523					
Coal Industry						
Carbon Black				117,211		
Chemical Pulping	20,799	16,066		11,761		
Sawmills	217					
Other	4,987	24,378	25,824	32,807	24,169	24,169
Subtotal	**97,540**	**977,978**	**38,154**	**455,793**	**131,455**	**114,172**
FUEL COMBUSTION :						
STATIONARY						
Refineries	1,282	21,271	8,687	360	1,763	617
Gas Plants			446		1	
Other Industrial	25,441	58,722	36,437	6,799	863	452
Commercial	547	4,124	9,660	1,952	688	454
Residential	991	7,980	13,887	3,059	1,324	675
Fuelwood	49,045	1,179	1,465	196,355	33,981	33,931
POWER PLANTS						
Utilities	6,913	336,707	94,600	3,314	605	442
Other	16	3	2,973	216	9	7
Subtotal	**84,235**	**429,986**	**168,155**	**212,055**	**39,234**	**36,577**

ONTARIO

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
TRANSPORTATION :						
GASOLINE						
Cars	23,427	5,809	145,839	1,565,841	199,392	179,453
L-D Trucks	4,429	1,433	36,751	463,079	69,796	62,816
H-D Trucks	293	95	7,469	32,723	3,152	2,837
Motorcycles	56	9	309	5,315	1,718	1,546
DIESEL						
L-D Trucks	788	595	1,477	1,653	750	717
H-D Trucks	4,429	9,294	88,827	31,847	11,442	10,938
Other	3,696	4,166	43,676	12,565	4,375	4,183
Railroads	1,521	2,241	32,144	11,255	2,483	2,374
Marine	1,270	7,327	5,678	34,899	12,269	11,145
Aircraft	310	511	10,110	37,845	3,759	3,346
Off-road Gas	593	151	4,064	144,035	21,500	19,350
Tire Wear					234	234
Subtotal	**40,812**	**31,631**	**376,344**	**2,341,057**	**330,870**	**298,939**
INCINERATION :						
Wood Waste	3,064	28	279	36,209	3,064	1,226
Other	2,343	374	1,881	2,851	1,364	818
Subtotal	**5,407**	**402**	**2,160**	**39,060**	**4,428**	**2,044**
MISCELLANEOUS :						
Fuel Marketing					41,552	41,552
Structural Fires					2,119	2,119
Pesticides	2,622					
Slash Burning	36,753		317	189,863	655	500
Solvent Use						
Dry Cleaning					19,300	19,300
Surface Coatings					54,329	54,329
General Use					51,800	51,800
Other	15,339			4,893		
Subtotal	**54,714**		**317**	**194,756**	**169,755**	**169,600**
PROVINCIAL TOTAL	**282,708**	**1,439,997**	**585,130**	**3,242,721**	**675,742**	**621,332**

PRINCE EDWARD ISLAND

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
INDUSTRIAL :						
Iron Ore						
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil						
Refineries						
Gas Plants						
Coal Production						
Petrochemicals						
Plastics						
Kraft Pulping						
Tar Sands						
Asbestos						
Mining & Quarrying						
Coal Industry						
Carbon Black						
Chemical Pulping						
Sawmills	23					
Other	172				5	5
Subtotal	**195**				**5**	**5**
FUEL COMBUSTION :						
STATIONARY						
Refineries						
Gas Plants						
Other Industrial	10	132	36	6	1	
Commercial	64	437	112	330	64	1
Residential	30	332	210	57	28	36
Fuelwood	6,470	156	193	25,903	4,483	8
POWER PLANTS						4,476
Utilities	9	287	67	7	2	
Other						1
Subtotal	**6,583**	**1,345**	**618**	**26,303**	**4,578**	**4,522**

PRINCE EDWARD ISLAND

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION						
GASOLINE						
Cars	154	47	1,912	19,018	2,513	2,262
L-D Trucks	46	25	743	8,187	1,231	1,108
H-D Trucks	22	7	172	2,962	287	258
Motorcycles	1		5	67	22	20
DIESEL						
L-D Trucks	4	16	25	15	6	6
H-D Trucks	118	127	1,398	557	200	191
Other	69	66	695	219	84	80
Railroads	5	7	108	38	8	8
Marine	13	35	40	36	26	26
Aircraft	3	6	114	259	27	24
Off-road Gas	6	4	100	3,328	179	161
Tire Wear					4	4
Subtotal	**441**	**340**	**5,312**	**34,686**	**4,587**	**4,148**
INCINERATION :						
Wood Waste	25		2	300	25	10
Other	11	5	17	13	4	2
Subtotal	**36**	**5**	**19**	**313**	**29**	**12**
MISCELLANEOUS :						
Fuel Marketing					576	576
Structural Fires					62	62
Pesticides	108					
Slash Burning	542		48	2,798	312	238
Solvent Use						
Dry Cleaning					226	226
Surface Coatings					718	718
General Use					529	529
Other	263			134		
Subtotal	**913**		**48**	**2,932**	**2,423**	**2,349**
PROVINCIAL TOTAL	**8,168**	**1,690**	**5,997**	**64,234**	**11,622**	**11,037**

QUEBEC

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
INDUSTRIAL :						
Iron Ore	4,619					
Iron & Steel	7,232			6,593		
Aluminium	14,496	18,958		175,825		
Copper & Nickel	7,484	477,790				
Lead & Zinc	24	5,088				
Gold						
Crude Oil					1,237	680
Refineries	293	6,336	360		11,763	7,058
Gas Plants						
Coal Production						
Petrochemicals					26,113	22,196
Plastics					12,519	12,519
Kraft Pulping			3,768		1,563	1,563
Tar Sands						
Asbestos	35					
Mining & Quarrying	26,517					
Coal Industry						
Carbon Black						
Chemical Pulping	13,163	17,701		8,779		
Sawmills	19,007					
Other	61,450	43,445	2,732	7,600	6,711	6,711
Subtotal	**154,320**	**569,318**	**6,860**	**198,797**	**59,906**	**50,727**
FUEL COMBUSTION :						
STATIONARY						
Refineries	810	8,459	4,432	26	57	20
Gas Plants						
Other Industrial	17,330	60,009	16,914	3,677	466	272
Commercial	674	8,223	3,941	716	201	133
Residential	932	11,833	6,519	1,598	763	262
Fuelwood	57,679	1,386	966	230,924	39,963	39,905
POWER PLANTS						
Utilities						
Other	139	439	1,474	450	134	101
Subtotal	**77,564**	**90,349**	**34,246**	**237,391**	**41,584**	**40,692**

QUEBEC

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	7,028	1,302	87,056	866,078	114,423	102,981
L-D Trucks	729	239	11,866	130,737	19,656	17,690
H-D Trucks	374	75	2,910	50,153	4,855	4,370
Motorcycles	68	6	229	3,315	1,091	982
DIESEL						
L-D Trucks	65	250	394	243	97	93
H-D Trucks	2,300	2,469	27,162	10,827	3,880	3,709
Other	2,423	2,626	29,093	8,165	2,845	2,720
Railroads	847	1,200	17,904	6,269	1,384	1,323
Marine	1,888	23,808	8,628	11,114	4,289	3,994
Aircraft	183	306	6,041	20,293	2,075	1,847
Off-road Gas	212	33	1,476	52,166	5,327	4,794
Tire Wear					122	122
Subtotal	**16,117**	**32,314**	**192,759**	**1,159,360**	**160,044**	**144,624**
INCINERATION :						
Wood Waste	5,950	54	541	70,312	5,950	2,380
Other	640	680	1,310	7,488	8,678	5,207
Subtotal	**6,590**	**734**	**1,851**	**77,800**	**14,628**	**7,587**
MISCELLANEOUS :						
Fuel Marketing					23,272	23,272
Structural Fires					1,252	1,252
Pesticides	721					
Slash Burning	46,098		4,160	238,134	26,534	20,245
Solvent Use						
Dry Cleaning					11,699	11,699
Surface Coatings					31,603	31,603
General Use					27,489	27,489
Other	8,431			3,021		
Subtotal	**55,250**		**4,160**	**241,155**	**121,849**	**115,560**
PROVINCIAL TOTAL	**309,841**	**692,715**	**239,876**	**1,914,503**	**398,011**	**359,191**

SASKATCHEWAN

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron ore						
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil					3,542	1,948
Refineries	362	2,022	197		2,782	1,669
Gas Plants		4,703				
Coal Production					34,820	
Petrochemicals						
Plastics					200	200
Kraft Pulping			606		127	127
Tar Sands						
Asbestos						
Mining & Quarrying	2,011					
Coal Industry	5,274					
Carbon Black						
Chemical Pulping	21,668	543		2,001		
Sawmills	850					
Other	39,213	1,110	54	6,843	252	252
Subtotal	**69,378**	**8,378**	**857**	**8,844**	**41,723**	**4,196**
FUEL COMBUSTION :						
STATIONARY						
Refineries	419		591	48,909	4	1
Gas Plants			16,919			
Other Industrial	5,902	3,828	4,218	1,108	117	63
Commercial	51	86	1,139	230	88	58
Residential	401	764	2,208	2,122	524	293
Fuelwood	3,382	81	101	13,538	2,343	2,340
POWER PLANTS						
Utilities	29,252	68,993	35,733		334	244
Other	14	29	407	65	14	11
Subtotal	**39,421**	**73,781**	**61,316**	**65,972**	**3,424**	**3,010**

SASKATCHEWAN

CATEGORY / SECTOR	TMP	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	1,096	437	13,575	135,055	17,843	16,059
L-D Trucks	719	507	11,716	129,090	19,409	17,468
H-D Trucks	317	136	2,464	42,466	4,111	3,700
Motorcycles	5	1	18	256	84	76
DIESEL						
L-D Trucks	65	59	389	240	96	92
H-D Trucks	1,935	499	22,851	9,109	3,265	3,121
Other	2,816	605	24,890	8,335	3,538	3,382
Railroads	484	658	10,220	3,579	790	755
Marine		9	9	4,507	1,533	1,380
Aircraft	87	162	3,342	5,907	631	562
Off-road Gas	399	288	6,143	205,631	11,305	10,175
Tire Wear					37	37
Subtotal	**7,923**	**3,361**	**95,617**	**544,175**	**62,642**	**56,806**
INCINERATION :						
Wood Waste	349	3	32	4,130	349	140
Other	100	43	124	128	29	17
Subtotal	**449**	**46**	**156**	**4,258**	**378**	**157**
MISCELLANEOUS :						
Fuel Marketing					4,475	4,475
Structural Fires					252	252
Pesticides	2,485					
Slash Burning	3,929		355	20,295	2,261	1,725
Solvent Use						
Dry Cleaning					1,805	1,805
Surface Coatings					3,267	3,267
General Use					4,229	4,229
Other	2,392			577		
Subtotal	**8,806**		**355**	**20,872**	**16,289**	**15,753**
PROVINCIAL TOTAL	**125,977**	**85,566**	**158,301**	**644,121**	**124,456**	**79,922**

YUKON

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
		(Metric Tonnes per Year)				
INDUSTRIAL :						
Iron Ore		341				
Iron & Steel						
Aluminium						
Copper & Nickel						
Lead & Zinc						
Gold						
Crude Oil						
Refineries						
Gas Plants						
Coal Production						
Petrochemicals						
Plastics						
Kraft Pulping						
Tar Sands						
Asbestos						
Mining & Quarryi	6,683					
Coal Industry						
Carbon Black						
Chemical Pulping						
Sawmills						
Other	59					
Subtotal	**6,742**	**341**				
FUEL COMBUSTION :	(included under NWT)					
STATIONARY						
Refineries						
Gas Plants						
Other Industrial						
Commercial						
Residential						
Fuelwood						
POWER PLANTS						
Utilities						
Other						
Subtotal						

YUKON

CATEGORY / SECTOR	TPM	SO2	NOx	CO	THC	VOC
			(Metric Tonnes per Year)			
TRANSPORTATION :						
GASOLINE						
Cars	21		256	2,547	336	302
L-D Trucks	30	1	485	5,339	803	723
H-D Trucks	12		94	1,620	150	135
Motorcycles			2	23	7	6
DIESEL						
L-D Trucks	3	2	16	10	4	4
H-D Trucks	95	18	1,104	440	158	151
Other						
Railroads						
Marine						
Aircraft	7	9	129	1,939	77	69
Off-road Gas	3		40	1,364	89	80
Tire Wear					1	1
Subtotal	**171**	**30**	**2,126**	**13,282**	**1,625**	**1,471**
INCINERATION :						
Wood Waste						
Other						
Subtotal						
MISCELLANEOUS :						
Fuel Marketing					188	188
Structural Fires					20	20
Pesticides						
Slash Burning						
Solvent Use						
Dry Cleaning					40	40
Surface Coatings					61	61
General Use					94	94
Other	93			42		
Subtotal	**93**			**42**	**403**	**403**
PROVINCIAL TOTAL	**7,006**	**371**	**2,126**	**13,324**	**2,028**	**1,874**

APPENDIX B

List of Sources by SIC and SCC Codes

RDIS SIC and SCC code listing 04/28/89

SOURCE	SIC	CATEGORY	SCC
AREA	02190	Animal Waste - Cattle Excrement	66100
	02190	Animal Waste - Pig Excrement	66200
	02190	Animal Waste - Sheep Excrement	66300
	02220	Pesticide Application	65000
	02290	Fertilizer Application	64000
	02290	Fertilizer Application - Ammonia Distributors	64100
	02390	Agriculture - Land Tilling	43100
	02390	Agriculture - Wind Erosion of Crop	43200
	02391	Agriculture - Fugitive Tilling Emissions	43200
	04111	Solid Waste Incineration - Wood Waste Disposal	32100
	04120	Slash Burning	33100
	05120	Forest Fires	47100
	06170	Iron Ore Mining and Beneficiation - Mining	15401
	06170	Iron Ore Mining and Beneficiation - Crushing and Grinding	15402
	06170	Iron Ore Mining and Beneficiation - Pelletizing	15403
	06301	Coal Industry - Coal Mining	53200
	06301	Coal Industry - Coal Handling	53210
	06301	Coal Industry - Overburden Removal Fugitive	53220
	06302	Coal Industry - Coal Transportation	53300
	07111	Natural Gas Processing - Natural Gas Processing	52210
	07112	Natural Gas Processing - Heaters Boilers In-Plant	52220
	07112	Natural Gas Processing - Compressor Turbine Non-Plant	52230
	07112	Natural Gas Processing - Compressor Engine Non-Plant	52240
	07112	Natural Gas Processing - Compressors In-Plant	52245
	07113	Crude Oil Production - Evaporation	52110
	07113	Crude Oil Production - Evaporation from Ships	52120
	08110	Stone Processing - Crushed Stone - Primary Crushing	53611
	08110	Stone Processing - Crushed Stone - Secondary Crushing	53612
	08110	Stone Processing - Crushed Stone - Screening	53614
	08110	Stone Processing - Crushed Stone - Secondary Crushing	53615
	08111	Stone Processing - Pulverized Stone - Primary Crushing	53621
	08111	Stone Processing - Pulverized Stone - Secondary Crushing	53622
	08111	Stone Processing - Pulverized Stone - Recrush/Screens	53623
	08111	Stone Processing - Pulverized Stone - Fines Mills	53624
	08111	Stone Processing - Pulverized Stone - Screening Conveying	53625
	08111	Stone Processing - Pulverized Stone - Storage Pile Losses	53626
	08111	Stone Processing - Pulverized Stone - Secondary Crushing	53627
	08111	Stone Processing - Recrushing	53628
	08210	Sand and Gravel Processing	53500
	09290	Mining and Rock Quarrying - Open Pit Mining	53410
	09290	Mining and Rock Quarrying - Overburden Removal Fugitive	53420
	09290	Mining and Rock Quarrying - Under Ground Mining	53430
	09290	Mining and Rock Quarrying - Concentrate Dryers	53440
	09290	Mining and Rock Quarrying - Concentrate Transport	53450
	09291	Tailing Piles Erosion	46100
	10720	Bakeries	51000
	12220	Cigarette Smoking	81000
	15111	Tire Wear - 4 wheeled	26100
	15111	Tire Wear - 8 wheeled	26200

AREA	25120	Wood Industry - Sawmill Production	57100
	25200	Wood Industry - Plywood and Veneer Production	57200
	25201	Wood Industry - Pulpboard Production	57300
	25210	Wood Industry - Hardwood Production	57400
	29111	Ferrous Foundries - Induction Furnace (Hot Melt)	85100
	29111	Ferrous Foundries - Cupola Furnace (Hot Melt)	85200
	29111	Ferrous Foundries - Electric Arc Furnace	85300
	29111	Ferrous Foundries - Rotary Oil Furnace (Hot Melt)	85400
	35111	Clay Products Manufacture - Clay Production - Dryer	53110
	35111	Clay Products Manufacture - Clay Production - Storage	53120
	35510	Concrete Batching	55100
	35510	Concrete Batching - Fugitive (Material Handling)	55200
	35990	Stone Processing - Building Stone - Cutting	53631
	36101	Petroleum Refining-Process Storage Tank Losses	XXXXX
	36991	Asphalt Production - Asphalt Drying	54100
	36991	Asphalt Production - Asphalt Fugitive	54200
	37312	Plastics Fabrication	56000
	40110	Construction Sites - Residential Construction	45100
	40210	Construction Sites - Non-Residential Construction	45200
	41190	Construction Sites - Heavy Construction	45500
	41210	Construction Sites - Bridges, Tunnels, Roads	45400
	41220	Construction Sites - Water, Sewer, Utility	45300
	42751	Application of Surface Coating - Trade, Sales Use	77000
	42751	Application of Surface Coating - Industrial Use	78200
	44910	Landfill Sites	44000
	45110	Off-Highway Mobile Source - Jet Aircraft	23110
	45110	Off-Highway Mobile Source - Turboprop Aircraft	23120
	45110	Off-Highway Mobile Source - Piston Engine Aircraft	23130
	45110	Off-Highway Mobile Source - Helicopters	23140
	45110	Off-Highway Mobile Source - Small Piston Aircraft	23150
	45110	Off-Highway Mobile Source - Jet Aircraft Inflight	23210
	45110	Off-Highway Mobile Source - Piston Engine Inflight	23230
	45110	Off-Highway Mobile Source - Piston Transport Inflight	23230
	45110	Off-Highway Mobile Source - Helicopter Inflight	23240
	45110	Off-Highway Mobile Source - Local Aircraft Inflight	23250
	45310	Off-Highway Mobile Source - Diesel Oil - Railroads	24110
	45400	Off-Highway Mobile Source - Motorships Dockside	25110
	45400	Off-Highway Mobile Source - Steampship Dockside	25120
	45400	Off-Highway Mobile Source - Motorships Underway	25210
	45400	Off-Highway Mobile Source - Steamships Underway	25220
	45400	Off-Highway Mobile Source - Gasoline Outboards	25310
	45600	Gasoline Powered Motor Vehicles - Light Duty Trucks	21100
	45601	Gasoline Powered Motor Vehicles - Heavy Duty Trucks	21200
	45602	Diesel Powered Engines - Light Duty Vehicles	21300
	45602	Diesel Powered Engines - Heavy Duty Vehicles	21400
	45602	Diesel Powered Engines - Agriculture Diesel Vehicles	22210
	45602	Diesel Powered Engines - Construction Vehicles	22220
	45602	Diesel Powered Engines - Mining Diesel Vehicles	22230
	45602	Diesel Powered Engines - Manufacturing Diesel Vehicles	22240
	45602	Diesel Powered Engines - Forestry Diesel Vehicles	22250
	45602	Diesel Powered Engines - Public Administration Diesel	22260
	45602	Diesel Powered Engines - Pipelines Diesel Vehicles	22270
	45610	Dust from Unpaved Roads - Trucks Treated Gravel Roads	42120

AREA	45610	Dust from Unpaved Roads - Trucks Untreated Gravel Roads	42220
	45610	Dust from Unpaved Roads - Trucks Earth Roads	42320
	45890	Gasoline Powered Motor Vehicles - Automobiles	21000
	45891	Gasoline Powered Motor Vehicles - Motorcycles	21150
	45892	Gasoline Powered Motor Vehicles - Snowmobiles	22140
	45893	Dust from Unpaved Roads - Vehicles Treated Gravel Roads	42110
	45893	Dust from Unpaved Roads - Vehicles Untreated Gravel Road	42210
	45893	Dust from Unpaved Roads - Vehicles Earth Roads	42310
	45894	Non-Highway Use of Gasoline	22100
	45911	Dust from Paved Roads - Vehicles Paved Roads	41110
	45911	Dust from Paved Roads - Trucks Paved Roads	41120
	47110	Grain Handling - Milling - Terminal Elevator - Shipping	61110
	47110	Grain Handling - Milling - Terminal Elevator - Transfer	61120
	47110	Grain Handling - Milling - Terminal Elevator - Cleaning	61130
	47110	Grain Handling - Milling - Terminal Elevator - Cleaning	61130
	47110	Grain Handling - Milling - Terminal Elevator - Drying	61140
	47110	Grain Handling - Milling - Terminal Elevator - Drying	61140
	47110	Grain Handling - Milling - Terminal Elevator - Headhouse	61150
	47110	Grain Handling - Milling - Terminal Elevator - Headhouse	61150
	47110	Grain Handling - Milling - Terminal Elevator - Tripper	61160
	47111	Grain Handling - Milling - Priminal Elevator - Shipping	61410
	47111	Grain Handling - Milling - Priminal Elevator - Transfer	61420
	47111	Grain Handling - Milling - Priminal Elevator - Headhouse	61430
	47112	Grain Handling - Milling - Transfer Elevator - Shipping	61210
	47112	Grain Handling - Milling - Transfer Elevator - Transfer	61220
	47112	Grain Handling - Milling - Transfer Elevator - Headhouse	61230
	47112	Grain Handling - Milling - Transfer Elevator - Headhouse	61230
	47112	Grain Handling - Milling - Transfer Elevator - Tripper	61240
	47113	Grain Handling - Milling - Process Elevator - Receiving	61310
	47113	Grain Handling - Milling - Process Elevator - Preclean	61320
	47113	Grain Handling - Milling - Process Elevator - Cleaning	61330
	47113	Grain Handling - Milling - Process Elevator - Millhouse	61340
	49110	Fuel Comb - Stationary Source Electric Power - Gas	14100
	49110	Fuel Comb - Stationary Source Electric Power - Heavy Oil	14200
	49110	Fuel Comb - Stationary Source Electric Power - Light Oil	14300
	49110	Fuel Comb - Stationary Source Electric Power - Heavy Oil	14300
	49110	Fuel Comb - Stationary Source Electric Power - Misc.	14400
	49110	Fuel Comb - Stationary Source Electric Power - Diesel	14500
	49992	Solid Waste Incineration - Multiple Chamber	31300
	49992	Solid Waste Incineration - Controlled Air	31500
	51111	Diesel and Gasoline Marketing - Refinery Storage Transfer	27110
	51111	Diesel and Gasoline Marketing - Filling Vehicle Tank	27111
	51111	Diesel and Gasoline Marketing - Station Storage Transfer	27130
	51111	Diesel and Gasoline Marketing - Vapor Loss at Stations	27140
	51111	Diesel and Gasoline Marketing - Transfer to Cars	27150
	51111	Diesel and Gasoline Marketing - Spillage at Station	27160
	51112	Diesel and Gasoline Marketing - Diesel Evaporation	27120
	56221	Fuel Comb - Stationary Source - Residential Natural Gas	11100
	56221	Fuel Comb - Stationary Source - Residential Liquid Petrol	11200
	56221	Fuel Comb - Stationary Source - Residential Kerosene	11300
	56221	Fuel Comb - Stationary Source - Residential Coal	11400
	56221	Fuel Comb - Stationary Source - Residential Light Oil	11510
	56221	Fuel Comb - Stationary Source - Residential Residual Oil	11520
	56222	Fuel Comb - Stationary Source - Commercial Natural Gas	12100

AREA	56222	Fuel Comb - Stationary Source - Commercial Liquid Petrol		12200
	56222	Fuel Comb - Stationary Source - Commercial Kerosene		12300
	56222	Fuel Comb - Stationary Source - Commercial Coal		12400
	56222	Fuel Comb - Stationary Source - Commercial Distillate Oil		12510
	56222	Fuel Comb - Stationary Source - Commercial Residual Oil		12520
	56223	Fuel Comb - Stationary Source - Industrial Natural Gas		13100
	56223	Fuel Comb - Stationary Source - Industrial Liquid Petrol		13200
	56223	Fuel Comb - Stationary Source - Industrial Kerosene		13300
	56223	Fuel Comb - Stationary Source - Industrial Coal		13400
	56223	Fuel Comb - Stationary Source - Industrial Distillate Oil		13510
	56223	Fuel Comb - Stationary Source - Industrial Residual Oil		13520
	56224	Fuel Comb - Stationary Source - Conventional Wodd Stove		11610
	56224	Fuel Comb - Stationary Source - Slow Combustion Stove		11620
	56224	Fuel Comb - Stationary Source - Fireplace		11630
	56224	Fuel Comb - Stationary Source - Wood Furnace		11640
	65321	General Solvent Use		70000
	82240	Structural Fires		47200
	97211	Dry Cleaning		71000
POINT	06110	Gold Production	Roaster	30301301
	06171	I and S Iron Sintering	Windbox-Sintering	30300813
	06171	Pyrrhotite Roasting	Fluid Bed Roaster	305XXXXX
	06173	I and O Mining-Sintering	Windbox	30300813
	06173	I and O Mining-Sintering	Discharge	30300814
	06173	I and O Mining-Sintering	Fugitive (Material Handling)	30300823
	06210	Asbestos Production	Dry Rock Storage	30503110
	06210	Asbestos Production	Tailings	30503111
	06210	Asbestos Milling	Crushing	30503201
	06210	Asbestos Production	Crushing	30503201
	06210	Asbestos Production	Crushing/Grinding	30503201
	06210	Asbestos Milling	Drying	30503202
	06210	Asbestos Production	Dryer	30503202
	06210	Asbestos Production	Dryers-Fluid Bed	30503202
	06210	Asbestos Production	Dryers-Rotary	30503202
	06210	Asbestos Production	Dryers-Vertical	30503202
	06210	Asbestos Production	Product Dryers	30503202
	06210	Asbestos Milling	Recrushing	30503203
	06210	Asbestos Production	Crushing/Grinding	30503203
	06210	Asbestos Milling	Screening	30503204
	06210	Asbestos Production	Screening/Handling	30503204
	06210	Asbestos Milling	Fiberizing	30503205
	06210	Asbestos Milling	Bagging	30503206
	06210	Asbestos Production	Screening/Handling	30503206
	06210	Asbestos Milling	Other Not Classified	30503299
	06210	Asbestos Production	Heater (Heavy Oil)	30590002
	06240	Potash Processing	Compactor	30502201
	06240	Potash Processing	Ozark Heaters	30502201
	06240	Potash Processing	Product Dryer	30502201
	06240	Potash processing	Screening/Handling	30502299
	06240	Potash Processing	Storage/Loading	30502299
	06250	Salt Production	Brine/Vacuum Salt	30502101
	06250	Salt Production	Rock Salt Mining	30502101
	06290	Phosphate Rock Processing	Phosphate Rock Dry	30501901
	06290	Phosphate Rock Processing	Grinding Phosphate	30501902

POINT	06290	Phosphate Rock Processing	Transfer/Storage	30501903
	06290	Phosphate Rock Processing	Pelletizing	30501999
	06290	Phosphate Rock Processing	Closed Storage Piles	30510206
	06292	Nephleline Syenite Processing	Primary Crushing	30502001
	06292	Nephleline Syenite Processing	2nd Crushing	30502002
	06292	Nephleline Syenite Processing	Recrushing	30502004
	06292	Nephleline Syenite Processing	Fines Mill	30502005
	06292	Nephleline Syenite Processing	Handling	30502006
	06292	Nephleline Syenite Processing	Storage Pile Losses	30502007
	06300	Coal Cleaning	Coal Cleaning	30501001
	06300	Coal Cleaning	Coal Dryers	30501001
	06300	Coal Cleaning	Fluidized Bed Dryer	30501001
	06300	Coal Cleaning	Moving Grate Dryer	30501006
	07110	Natural Gas Processing	Incinerator	31000201
	07110	Natural Gas Processing	Incinerator - SWS	31000201
	07110	Natural Gas Processing	Incinerator - Tail	31000201
	07110	Natural Gas Processing	Sour Gas Stripping	31000202
	07110	Natural Gas Processing	Flare	31000205
	07110	Natural Gas Processing	Flare Stack	31000205
	07110	Natural Gas Processing	Flaring	31000205
	07110	Natural Gas Processing	Storage Tanks	40781604
	07111	Natural Gas Processing	Lean Oil Reboiler	10200401
	07111	Natural Gas Processing	ROF Reboiler	10200401
	07111	Natural Gas Processing	Auxiliary Boiler	10200601
	07111	Natural Gas Processing	Boiler	10200601
	07111	Natural Gas Processing	Crude Stabilizer Reboiler	10200601
	07111	Natural Gas Processing	Fuel Combustion Boilers/Heaters	10200601
	07111	Natural Gas Processing	Main Stream Boiler	10200601
	07111	Natural Gas Processing	Napanee Boiler	10200601
	07111	Natural Gas Processing	Power Boiler	10200601
	07111	Natural Gas Processing	Reaction Boiler	10200601
	07111	Natural Gas Processing	Start Up Boiler	10200601
	07111	Natural Gas Processing	Steam Boiler	10200601
	07111	Natural Gas Processing	Utility Boilers	10200601
	07111	Natural Gas Processing	Amine Reboiler	10200602
	07111	Natural Gas Processing	Glycol Reboiler	10200602
	07111	Natural Gas Processing	Hot H20 Boiler	10200602
	07111	Natural Gas Processing	LOF Reboiler	10200602
	07111	Natural Gas Processing	Reboiler	10200602
	07111	Natural Gas Processing	Regeneration Reboiler	10200602
	07111	Natural Gas Processing	Stabilizer Reboiler	10200602
	07111	Natural Gas Processing	Fuel Combustion (Cogeneration)	10200604
	07111	Natural Gas Processing	Fuel Gas Boiler Etc.	10200701
	07111	Natural Gas Processing	TEG Reboiler	102XXXXX
	07111	Natural Gas Processing	Plant Heater	10500106
	07111	Natural Gas Processing	Winter Heater	10500106
	07111	Natural Gas Processing	FG Heater	30600105
	07111	Natural Gas Processing	LPG Gas Heater	30600107
	07111	Natural Gas Processing	Amine Reclaimer	31000201
	07111	Natural Gas Processing	Reclaimer	31000201
	07111	Natural Gas Processing	Compressors	31000203
	07111	Natural Gas Processing	Compressors 6SW-2S S	31000203
	07111	Natural Gas Processing	Compressors Sour	31000203
	07111	Natural Gas Processing	Compressors SS	31000203

POINT	07111	Natural Gas Processing	Compressors Sweet	31000203
	07111	Natural Gas Processing	Debutanizer	31000299
	07111	Natural Gas Processing	Total 30 Line and Well HT	31000299
	07111	Natural Gas Processing	HO Heater	31000402
	07111	Natural Gas Processing	Hot Oil Heater	31000402
	07111	Natural Gas Processing	Lean Oil Heater	31000402
	07111	Natural Gas Processing	Main Oil Heater	31000402
	07111	Natural Gas Processing	Oil Heater	31000402
	07111	Natural Gas Processing	Oil Still Heater	31000402
	07111	Natural Gas Processing	Air Preheater	31000404
	07111	Natural Gas Processing	CHF Heater	31000404
	07111	Natural Gas Processing	Converter Heater	31000404
	07111	Natural Gas Processing	Direct Heater	31000404
	07111	Natural Gas Processing	Glycol Bath Water Heater	31000404
	07111	Natural Gas Processing	Glycol Heater	31000404
	07111	Natural Gas Processing	Heater	31000404
	07111	Natural Gas Processing	Heaters/Boilers	31000404
	07111	Natural Gas Processing	Line Heater	31000404
	07111	Natural Gas Processing	Process Heater	31000404
	07111	Natural Gas Processing	Reclaimer Heater	31000404
	07111	Natural Gas Processing	Regeneration Gas Heater	31000404
	07111	Natural Gas Processing	Regeneration Gas HTR-Vi	31000404
	07111	Natural Gas Processing	Regeneration Heater	31000404
	07111	Natural Gas Processing	Regeneration Steam Heater	31000404
	07111	Natural Gas Processing	Reheater	31000404
	07111	Natural Gas Processing	Salt Bath Heater	31000404
	07111	Natural Gas Processing	Stab. Feed Heater	31000404
	07111	Natural Gas Processing	Steam Super Heater	31000404
	07111	Natural Gas Processing	Still Heater	31000404
	07111	Natural Gas Processing	Utility Heater	31000404
	07111	Natural Gas Processing	Steam Generator	31000414
	07111	Natural Gas Processing	Steam Unit Heater	31000414
	07111	Natural Gas Processing	Acid Gas Heater	31000415
	07120	Tar Sands Operation	Hydrocarbon Flare	30600904
	07120	Tar Sands Operation	Coker Burner Co Boiler	30601201
	07120	Tar Sands Operation	Flare Stack H2S	306XXXXX
	07120	Tar Sands Operation	H2S Flare	306XXXXX
	07120	Tar Sands Operation	Powerplant	306XXXXX
	07120	Tar Sands Operation	Storage Losses	306XXXXX
	07120	Tar Sands Operation	Sulphur Plant	306XXXXX
	07120	Tar Sands Operation	Sulphur Plant Co Boiler	306XXXXX
	07120	Tar Sands Operation	Utility Boiler Heater	306XXXXX
	08211	Silica Processing	Recrushing/Screening	30500204
	08211	Silica Procesing	Storage Pile Loss.	30500207
	08211	Silica Processing	Primary Crushing	30502001
	08211	Silica Processing	2nd Crushing/Screens	30502002
	08211	Silica Processing	Recrushing/Screens	30502004
	08211	Silica Processing	Screens/Handling	30502006
	08211	Silica Processing	Open Storage	30502007
	08211	Silica Processing	Dryers	30502012
	08211	Silica Processing	Fine Mill	30505005
	09290	Mining and Rock Quarrying	Pelletizing	30501008
	09290	Mining and Rock Quarrying	Primary Crushing	30502001
	09290	Mining and Rock Quarrying	Crushing and Grinding	30502002

POINT	09290	Mining and Rock Quarrying	Open Pit Mining	30504001
	09290	Mining and Rock Quarrying	Underground Mining	30504010
	27108	Thermo Mechanical Pulping		XXXXXXXX
	27109	Neutral Sulphite Semi-Chemical Pulping		30700300
	27110	Sulphate (Kraft) Pulping	Smelt Dissolving Tank	30700105
	27110	Sulphate (Kraft) Pulping	Lime Kiln	30700106
	27110	Sulphate (Kraft) Pulping	Recovery Boiler	30700110
	27110	Sulphate (Kraft) Pulping	Power Boiler	30700199
	27111	Sulphite Pulping	Digester Discharge (Basic)	30700203
	27111	Sulphite Pulping	Digester Discharge (Acid)	30700212
	27111	Sulphite Pulping	Heat Recovery Boiler	30700221
	27111	Sulphite Pulping	Misc. (Acid Sulp)	30700231
	27111	Sulphite Pulping	Misc. (Bisulph)	30700231
	27111	Sulphite Pulping	Misc. (Knotters, Washers)	30700234
	27111	Sulphite Pulping	Absorption Tower	30700304
	27111	Sulphite Pulping	Absorption Tower (Bisul)	30700304
	27111	Sulphite Pulping	Absorption Tower-Bign	30700304
	27111	Sulphite Pulping	SSL Combustion	30700304
	27111	Sulphite Pulping	SSL Combustion (Bilsul)	30700304
	29110	Ferroalloys Manufactures	Sizing Packaging	30300610
	29110	Ferroalloys Manufactures	Dryers/Furnace	30300611
	29110	Ferroalloys Manufactures	Raw Material Dryer	30300611
	29110	Ferroalloys Manufactures	Materials Handling	30300613
	29110	Ferroalloys Manufactures	Materials Handling	30300614
	29110	Ferroalloys Manufactures	Other Not Classified	30300699
	29110	Ferroalloys Manufactures	Furnace Smelting	30300701
	29110	Ferroalloys Manufactures	Agglomeration	30300799
	29191	Iron Ore Smelting	Blast Furnaces	30300801
	29191	Iron Ore Smelting	Ilmenite Roasting	30300801
	29191	Iron Ore Smelting	Blast Furnaces	30300802
	29191	Iron Ore Smelting	Bleeder Stacks (Fugitive)	30300802
	29191	Iron Ore Smelting	Materials Handling	30300812
	29191	Iron Ore Smelting	Concentrate Cooling	30300817
	29191	Iron Ore Smelting	Misc. (Process Emissions)	30300819
	29191	Iron Ore Smelting	Cast House	30300825
	29191	Iron Ore Smelting	Coal Drying	30501001
	29192	Iron and Steel Production	Open Hearth Furnace	30300901
	29192	Iron and Steel Production	Charging	30300906
	29192	Iron and Steel Production	Tapping	30300907
	29192	Iron and Steel Production	Basic 02 Furnace	30300913
	29192	Iron and Steel Production	Charging BOF	30300916
	29192	Iron and Steel Production	Charging/Tapping	30300916
	29192	Iron and Steel Production	Charging/Tapping	30300917
	29192	Iron and Steel Production	Tapping BOF	30300917
	29192	Iron and Steel Production	Charging OHF	30300918
	29192	Iron and Steel Production	Tapping OHF	30300919
	29192	Iron and Steel Production	Material Handling	30300923
	29192	Iron and Steel Production	Material Handling BOF	30300923
	29192	Iron and Steel Production	Material Handling OHF	30300923
	29192	Iron and Steel Production	Fugitive BOF	30388801
	29192	Iron and Steel Production	Fugitive OHF	30388801
	29193	Coke Ovens	Charging	30300302
	29193	Coke Ovens	Pushing	30300303
	29193	Coke Ovens	Quenching	30300304

POINT	29193	Coke Ovens	Fugitive Coal Handling	30300305
	29193	Coke Ovens	Crushing/Screening	30300310
	29193	Coke Ovens	Crushing/Screening	30300311
	29193	Coke Ovens	Fugitive Coke Handling	30300312
	29193	Coke Ovens	Coking Cycle	30300315
	29193	Coke Ovens	Fugitive Storage Pile	30300316
	29193	Coke Ovens	COG Consumption	30390004
	29195	Non Integ. Steel MKG Mills	Fuel Comb. Boilers	102XXXXX
	29195	Non Integ. Steel MKG Mills	Fuel Comb. Furnace	303009XX
	29196	Elect. Arc Furn. Shops (I&S)	Raw Mat. Handling	30300823
	29196	Elect. Arc Furn. Shops (I&S)	Charging and Tapping	30300906
	29196	Elect. Arc Furn. Shops (I&S)	Charging and Tapping	30300907
	29196	Elect. Arc Furn. Shops (I&S)	Electric Arc Furnaces	30300908
	29196	Elect. Arc Furn. Shops (I&S)	Fug. Elec. Arc Furnaces	30388801
	29197	Iron and Steel	Direct Reduction	30300904
	29198	Ancillary Operations (I&S)	Continuous Casting	30300922
	29198	Ancillary Operations (I&S)	Hand Scarfing	30300932
	29198	Ancillary Operations (I&S)	Machine Scarfing	30300932
	29198	Ancillary Operations (I&S)	Conditioning	30300933
	29198	Ancillary Operations (I&S)	Annealing	30300934
	29198	Ancillary Operations (I&S)	Cold Rolling	30300935
	29199	Ancillary Operations (I&S)	Iron Power	30300998
	29199	Ancillary Operations (I&S)	Ferrous Powders	30300999
	29510	Alumina from Bauxite	Bauxite Grinding	30300001
	29510	Alumina from Bauxite	Material Handling	30300001
	29510	Alumina from Bauxite	Alum. Hydro. Calcining	30300201
	29511	Aluminum from Alumina	Fugitive Reduction Cell	30300101
	29511	Aluminum from Alumina	Smelting	30300103
	29511	Aluminum from Alumina	Material Handling	30300104
	29511	Aluminum from Alumina	Anode Paste Production	30300105
	29511	Aluminum from Alumina	Fugitive Prebake	30300108
	29511	Aluminum from Alumina	Fugitive Anode Baking	30300111
	29512	Aluminum Fluoride		XXXXXXXX
	29590	Copper Smelting/Refining	Mult. Hearth Roaster	30300502
	29590	Copper Smelting/Refining	Reverb Furnace	30300503
	29590	Copper smelting/Refining	Reverbs (Hot/Wet)	30300503
	29590	Copper Smelting/Refining	Converters	30300504
	29590	Copper Smelting/Refining	TRB Converter	30300504
	29590	Copper Smelting/Refining	Copper Refining	30300505
	29590	Copper Smelting/Refining	Cu Ni Refining	30300505
	29590	Copper Smelting/Refining	Concentrate Dryer	30300506
	29590	Copper Smelting/Refining	Fluid Bed Roaster	30300509
	29590	Copper Smelting/Refining	Electrolysis	30300511
	29590	Copper Smelting/Refining	Flash Furnace	30300512
	29590	Copper Smelting/Refining	Fug. Roasting	30300513
	29590	Copper Smelting/Refining	Fug. Reverb	30300514
	29590	Copper Smelting/Refining	Fug. Converting	30300515
	29590	Copper Smelting/Refining	Anode Production	30300516
	29590	Copper Smelting/Refining	Casting Furnace	30300516
	29590	Copper Smelting/Refining	Concentrate Storage	30300599
	29590	Copper Smelting/Refining	Fug. Reactor	30300599
	29590	Copper Smelting/Refining	Raw Material Handling	30300599
	29590	Copper Smelting/Refining	Fug. Casting	30400239
	29592	Nickel Smelting/Refining	Blast Furnaces	30401001
	29592	Nickel Smelting/Refining	Concentrate Storage	30401008

POINT	29592	Nickel Smelting/Refining	Nickel Refining	30401010
	29592	Nickel Smelting/Refining	Converters	30401099
	29592	Nickel Smelting/Refining	Electric Furnaces	30401099
	29592	Nickel Smelting/Refining	Fluid Bed Roaster	30401099
	29592	Nickel Smelting/Refining	Fugitive Converting	30401099
	29592	Nickel Smelting/Refining	Fugitive Reverb	30401099
	29592	Nickel Smelting/Refining	Fugitive Roasting	30401099
	29592	Nickel Smelting/Refining	Mult. Hearth Roasters	30401099
	29592	Nickel Smelting/Refining	Reverbs	30401099
	29592	Nickel Smelting/Refining	Sinter Machines	30401099
	29592	Nickel Smelting/Refining	Raw Material Handling	30401099
	29594	Magnesium Production	Dolomite Calcine	30400699
	29594	Magnesium Production	Dolomite Ore Drying	30400699
	29990	Lead Smelting/Refining	Blast Furnace	30301002
	29990	Lead Smelting/Refining	Fug. Pelletizing	30301005
	29990	Lead Smelting/Refining	Fug. Material Handling	30301005
	29990	Lead Smelting/Refining	Feed Handling	30301013
	29990	Lead Smelting/Refining	Fug. Casting	30301023
	29990	Lead Smelting/Refining	Sinter Machine	30301025
	29990	Lead Smelting/Refining	Fug. Furnace	30400412
	29990	Lead Smelting/Refining	Fug. Smelting	30400413
	29992	Zinc Smelting/Refining	Fluid Bed Roasters	30303008
	29992	Zinc Smelting/Refining	Fug. Material Handling	30303009
	29992	Zinc Smelting/Refining	Casting Furnaces	30303011
	29992	Zinc Smelting/Refining	Fug. Casting	30303011
	29992	Zinc Smelting/Refining	Residue Dryer	30400807
	33990	Mfg. Carbon/Graphite Elect.	Coke Calcination	30402001
	35210	Cement Manufacture	Cement Prod.	30500606
	35210	Cement Manufacture	Cement Prod.-Dry	30500606
	35210	Cement Manufacture	Kiln	30500606
	35210	Cement Manufacture	Rotary Kiln	30500606
	35210	Cement Manufacture	Material Handling	30500607
	35210	Cement Manufacture	Primary Crushing (Dry)	30500609
	35210	Cement Manufacture	Misc. Sources	30500612
	35210	Cement Manufacture	Grinding	30500613
	35210	Cement Manufacture	Clinker Cooling	30500614
	35210	Cement Manufacture	Clinker Storage	30500615
	35210	Cement Manufacture	Clinker Grinding (Dry)	30500617
	35210	Cement Manufacture	Packaging/Loading	30500619
	35210	Cement Manufacture	Cement Prod.-Wet	30500706
	35210	Cement Manufacture	Clinker Grinding (Wet)	30500717
	35210	Cement Manufacture	Cement Storage Silos	30510202
	35220	Glass Manufacture	Glass Containers	30501402
	35620	Glass Manufacture	Flat Glass	30501403
	35620	Glass Manufacture	Blown Glass	30501404
	35620	Glass Manufacture	Material Handling	30501410
	35711	Abrasives-Silicon Carbide	Furnaces Sic	30500401
	35711	Abrasives-Silicon Carbide	Sic Furnace	30500401
	35711	Abrasives-Silicon Carbide	SLC Furnace	30500403
	35711	Abrasives-Silicon Carbide	Materials Handling	30500405
	35711	Abrasives-Silicon Carbide	Sizing/Packaging	30500405
	35712	Abrasives-Aluminum Oxides	Furnaces	30300201
	35712	Abrasives-Aluminum Oxides	Higgins Furnace	30300201
	35712	Abrasives-Aluminum Oxides	Materials Handling	30300201

POINT	35712	Abrasives-Aluminum Oxides	Sizing/Packaging	30300201
	35810	Lime Manufacturing	Crushing	30501601
	35810	Lime Manufacturing	Vertical Kiln	30501603
	35810	Lime Manufacturing	Rotary Kiln	30501604
	35810	Lime Manufacturing	Calcimatic Kiln	30501605
	35810	Lime Manufacturing	Fug. Emissions	30501607
	35810	Lime Manufacturing	Lime Hydrator	30501609
	35930	Gypsum Processing	Raw Material Drying	30501501
	35930	Gypsum Processing	Primary Grinding	30501502
	35930	Gypsum Processing	Conveying	30501504
	35930	Gypsum Processing	Stockpile Losses	30501508
	35930	Gypsum Processing	Calcining	30501512
	35930	Gypsum Processing	Board Drying	30501520
	36100	Petroleum Ref.-Fuel Combustion	Boilers - Oil	10200401
	36100	Petroleum Ref.-Fuel Combustion	Boilers - Gas	10200601
	36100	Petroleum Ref.-Fuel Combustion	Boilers - Gas/Oil	10200710
	36100	Petroleum Ref.-Fuel Combustion	Co Boilers - Gas/Oil	10201401
	36100	Petroleum Ref.-Fuel Combustion	Charge Heater - Gas	30600103
	36100	Petroleum Ref.-Fuel Combustion	Cooker Heater- Gas	30600103
	36100	Petroleum Ref.-Fuel Combustion	Crude Heater Oil)	30600103
	36100	Petroleum Ref.-Fuel Combustion	Heat. Blr. Incin.	30600103
	36100	Petroleum Ref.-Fuel Combustion	Heaters, Boilers - Oil	30600103
	36100	Petroleum Ref.-Fuel Combustion	Heaters - Oil	30600103
	36100	Petroleum Ref.-Fuel Combustion	Process Heater-Oil	30600103
	36100	Petroleum Ref.-Fuel Combustion	Blr. Heat. Incin.	30600104
	36100	Petroleum Ref.-Fuel Combustion	Heaters, Boilers - Gas	30600104
	36100	Petroleum Ref.-Fuel Combustion	Heaters - Gas	30600104
	36100	Petroleum Ref.-Fuel Combustion	Process Heater-Gas	30600104
	36100	Petroleum Ref.-Fuel Combustion	Natural Gas - Heaters	30600105
	36100	Petroleum Ref.-Fuel Combustion	Heaters - Coke	30600199
	36100	Petroleum Ref.-Fuel Combustion	Process-Cat. Cracking	30600201
	36100	Petroleum Ref.-Fuel Combustion	Vacuum Fctnatr-Gas	30600602
	36100	Petroleum Ref.-Fuel Combustion	Pitch and Coke	30601201
	36100	Petroleum Ref.-Fuel Combustion	Incinerator - Oil	30609912
	36100	Petroleum Ref.-Fuel Combustion	Incinerator - Gas	30609913
	36101	Petroleum Refining-Process	CO Boiler	10201402
	36101	Petroleum Refining-Process	CO Boiler SWS	10201402
	36101	Petroleum Refining-Process	Catalytic Cracker	30600201
	36101	Petroleum Refining-Process	Process-Cat. Cracker	30600201
	36101	Petroleum Refining-Process	Process-Cat. Crack.	30600201
	36101	Petroleum Refining-Process	Pumps - Without Control	30600803
	36101	Petroleum Refining-Process	Misc. HC Emissions	30600805
	36101	Petroleum Refining-Process	Flare	30600904
	36101	Petroleum Refining-Process	Incinerator-Asphalt	30601101
	36101	Petroleum Refining-Process	Petroleum Coking	30601201
	36101	Petroleum Refining-Process	Heater SWS-Incinerator	30609914
	36101	Petroleum Refining-Process	Incinerator	30609914
	36101	Petroleum Refining-Process	Incinerator-SWS	30609914
	36101	Petroleum Refining-Process	Incinerator-SWS Gas	30609914
	36101	Petroleum Refining-Process	Incinerator-SWS-TG	30609914
	36101	Petroleum Refining-Process	Incinerator-Tail Gas	30609914
	36101	Petroleum Refining-Process	Tail Gas Incinerator	30609914
	36990	Coke Ovens-Not-Steel Plants	Charging	30300302
	36990	Coke Ovens-Not-Steel Plants	Pushing	30300303

POINT	36990	Coke Ovens-Not-Steel Plants	Quenching	30300304
	36990	Coke Ovens-Not-Steel Plants	Fugitive Coke Handling	30300306
	36990	Coke Ovens-Not-Steel Plants	Fugitive Char. Handling	30300307
	36990	Coke Ovens-Not-Steel Plants	Crushing/Screening	30300310
	36990	Coke Ovens-Not-Steel Plants	Crushing/Screening	30300311
	36990	Coke Ovens-Not-Steel Plants	Fugitive Coke Handling	30300312
	36990	Coke Ovens-Not-Steel Plants	Fugitive Storage Pile	30300316
	36990	Coke Ovens-Not-Steel Plants	COG Consumption	30390004
	36990	Coke Ovens-Not-Steel Plants	Fugitive Coal Handling	30501008
	36990	Coke Ovens-Not-Steel Plants	Coking Cycle	30601401
	37110	Sodium Carbonate	Dryer (Gas Fired)	30102106
	37110	Sodium carbonate	Bleacher	30102113
	37110	Sodium Carbonate	Fugitive Losses	30102199
	37111	Carbon Black	Carbon Black Production	30100502
	37112	Elemental Phosphoros Prod.	Drying	30111201
	37112	Elemental Phosphoros Prod.	Electric Arc Furnace	30111202
	37112	Elemental Phosphoros Prod.	Fugitive	30111299
	37112	Elemental Phosphoros Prod.	Grinding/Smelting	30111299
	37113	Ammonium Sulphate	Centrifugal Drying	30113004
	37113	Ammonium Sulphate	Dryers (Fluid Bed)	30113005
	37113	Ammonium Sulphate	Storage (Fixed-Roof Breathing)	30187097
	37113	Ammonium Sulphate	Storage (Fixed-Roof Working)	30187098
	37114	Nitric Acid Production	Nitric Acid Production	301013XX
	37115	Ammonium Phosphate	Dryer	30103001
	37115	Ammonium Phosphate	Ammoniator-Granulator	30103002
	37115	Ammonium Phosphate	Fugitive Phosphate	30103004
	37115	Ammonium Phosphate	Material Handling	30103004
	37116	Single Superphosphate	Fugitive Phosphates	30102801
	37116	Single Superphosphate	Grinding/Drying	30102801
	37116	Single Superphosphate	Rock Unloading	30102803
	37116	Single Superphosphate	Rock Feeder System	30102804
	37116	Single Superphosphate	Mixer/Den	30102805
	37116	Single Superphosphate	Curing Building	30102806
	37116	Single Superphosphate	Bagging/Handling	30102807
	37116	Single Superphosphate	Mixing	30102820
	37116	Single Superphosphate	Den	30102821
	37116	Single Superphosphate	Curing	30102822
	37116	Single Superphosphate	Ammoniator/Granulator	30102823
	37116	Single Superphosphate	Dryer	30102824
	37116	Single Superphosphate	Cooler	30102825
	37117	Triple Superphosphate	Rock Unloading	30102903
	37117	Triple Superphosphate	Rock Feeder System	30102904
	37117	Triple Superphosphate	Mixer/Den/Curing	30102905
	37117	Triple Superphosphate	Granular: React/Dryer	30102906
	37117	Triple Superphosphate	Granular: Curing	30102907
	37117	Triple Superphosphate	Bagging/Handling	30102908
	37117	Triple Superphosphate	Mixing	30102920
	37117	Triple Superphosphate	Den	30102921
	37117	Triple Superphosphate	Curing	30102922
	37117	Triple Superphosphate	Ammoniator/Granulator	30102922
	37117	Triple Superphosphate	Dryer	30102924
	37117	Triple Superphosphate	Cooler	30102925
	37118	Phosphate Acid Prod.-Thermal	Absorber: General	30101702
	37118	Phosphate Acid Prod.-Thermal	Dehydration	30101702

POINT	37118	Phosphate Acid Prod.-Thermal	Thermal Acid Stack	30101702
	37118	Phosphate Acid Prod.-Thermal	Absorber W/Packed Tower	30101703
	37118	Phosphate Acid Prod.-Thermal	Absorber "/Scrubber	30101704
	37118	Phosphate Acid Prod.-Thermal	Absorber W/Glass Mist Elim.	30101705
	37118	Phosphate Acid Prod.-Thermal	Absorber W/Wire Mist Elimi.	30101706
	37118	Phosphate Acid Prod.-Thermal	Absorber W/High-Press Mist	30101707
	37118	Phosphate Acid Prod.-Thermal	W/ ESP	30101708
	37118	Phosphate Acid Prod.-Thermal	Phosphate Dryer	301017XX
	37118	Phosphate Acid Prod.-Thermal	Storage Tank-Breathing	30187007
	37118	Phosphate Acid Prod.-Thermal	Storage Tank-Working	30187008
	37119	Sulphuric Acid Production	Absorber/99.9% Conv.	30102301
	37119	Sulphuric Acid Production	Absorber/99.5% Conv.	30102304
	37119	Sulphuric Acid Production	Absorber/99.0% Conv.	30102306
	37119	Sulphuric Acid Production	Absorber/97.0% Conv.	30102310
	37119	Sulphuric Acid Production	Absorber/96.0% Conv.	30102312
	37119	Sulphuric Acid Production	Absorber/95.0% Conv.	30102314
	37119	Sulphuric Acid Production	Absorber/94.0% Conv.	30102316
	37119	Sulphuric Acid Production	Absorber/93.0% Conv.	30102318
	37119	Sulphuric Acid Production	Concentrator	30102319
	37119	Sulphuric Acid Production	Tank Car Unloading	30102320
	37119	Sulphuric Acid Production	Storage Tank Vents	30102321
	37119	Sulphuric Acid Production	Leads in Process Equip.	30102322
	37119	Sulphuric Acid Production	Absorber/98.0% Conv.	30102408
	37120	Methanol Production	Methanol Production	30125001
	37121	Ethylene Production	Ethylene Production	30119701
	37122	Phthalic Anhydride Prod.	Phthalic Anhydride Prod.	30101901
	37123	Propylene Prod.	Propylene Prod.	30119705
	37125	Polyvinyl Chloride Prod.	PVC Production	30101801
	37125	Polyvinyl Chloride Prod.	General	30101801
	37126	Ethylene Oxide Production	Ethylene Oxide Production	30117401
	37127	Butadiene Production	Butadiene Production	30115301
	37128	Benzene Production	Benzene Other Chemicals	30125801
	37128	Benzene Production	Benzene Production	30125801
	37128	Benzene Production	Benzene Storage-Breathing	40703601
	37128	Benzene Production	Benzene storage-Working	40703602
	37130	Ammonia Production	Feedstock Desulfurization	30100305
	37130	Ammonia Production	Primary Reformer-N'L	30100306
	37130	Ammonia Production	CO2 Regenerator	30100308
	37130	Ammonia Production	Condensate Stripper	30100309
	37130	Ammonia Production	Primary Reformer; Oil	30100807
	37131	Isobutylene Production	Isobutylene Production	30199998
	37132	Cyclohexane Production	Cyclohexane Production	30115701
	37134	Vinyl Chloride Production	Vinyl Chloride Production	30112540
	37135	Acetic acid production	Liquid Phase Oxidation Unit	30113205
	37136	Ketone Production		30109105
	37137	Pentaerythritol Production		XXXXXXXX
	37138	Methanol Production		30125002
	37139	Acethaldehyde Production	Secondary Oxidation	30112011
	37140	Vinyl Acetate	Purification Scrubber	30116702
	37140	Vinyl Acetate	CO_2 Recovery Unit	30116703
	37141	Red Phosphorus		30111201
	37142	Sodium Chlorate		XXXXXXXX
	37144	Sodium Nitrate		XXXXXXXX

POINT	37145	TNT		30101011
	37210	Butrate Fert.-Ammon. Nitrate	Neutralizer	30102704
	37210	Butrate Fert.-Ammon. Nitrate	Bulk Loading	30102709
	37210	Butrate Fert.-Ammon. Nitrate	Prilling Tower (High	30102712
	37210	Butrate Fert.-Ammon. Nitrate	Cooler (High)	30102714
	37210	Butrate Fert.-Ammon. Nitrate	Evap Concen. (High)	30102717
	37210	Butrate Fert.-Ammon. Nitrate	Evap Concen. (Low)	30102717
	37210	Butrate Fert.-Ammon. Nitrate	Prilling Towre (Low)	30102722
	37210	Butrate Fert.-Ammon. Nitrate	Cooler (Low)	30102724
	37210	Butrate Fert.-Ammon. Nitrate	Dryer (High)	30102725
	37210	Butrate Fert.-Ammon. Nitrate	Dryer (Low)	30102725
	37220	Nitrate Fertilizer-Urea	Cooler	30104002
	37220	Nitrate Fertilizer-Urea	Evap. Concentrator	30104002
	37220	Nitrate Fertilizer-Urea	Prilling Tower	30104003
	37220	Nitrate Fertilizer-Urea	Granulator	30104004
	37220	Nitrate Fertilizer-Urea	Bulk Loader	30104007
	37310	Polyethylene	Light-Duty Product	30101812
	37311	Polyethylene	Heavy-Duty Product	30101807
	37510	External Comb. Boilers	Heavy Oil	10200401
	37510	Titanium Dioxide Prod.	Calcining Rotary Kiln	30103501
	37510	Titanium Dioxide Prod.	Micronization	30103501
	37510	Titanium Dioxide Prod.	Slag Floatation	30103502
	37510	Titanium Dioxide Prod.	Titanium Slag Crushing	30103550
	49110	Electric Power Generation	Bituminous Coal - SS	10100204
	49110	Electric Power Generation	Boilers Coal - SS	10100224
	49110	Electric Power Generation	Subituminous Coal - SS	10100224
	49110	Electric Power Generation	Pulverized Coal: Dry	10100226
	49110	Electric Power Generation	Lignite-Pulverized	10100301
	49110	Electric Power Generation	Lignite Coal Boiler	10100306
	49110	Electric Power Generation	Heavy Oil, Bunker	10100401
	49110	Electric Power Generation	Boiler - Heavy Oil	10100405
	49110	Electric Power Generation	Boiler - Light Oil	10100504
	49110	Electric Power Generation	Boilers Natural Gas	10100602
	49110	Electric Power Generation	National Gas-Tangential	10100604
	49110	External Comb. Boilers-Ind.	Pulverized Coal - Dry	10200202
	49110	External Comb. Boilers-Ind.	Distillate Oil	10200501
	49110	External Comb. Boilers-Ind.	Coke	10200802
	49110	Electric Power Generation	Turbine-Light Oil	20100101
	49110	Electric Power Generation	Turbine Natural Gas	20100201
	49110	Electric Power Generation	Bruce Steam Plant	20101001
	49110	Electric Power Generation	Heavy H2O Flare	20101XXX
	49110	Electric Power Generation	Diesel Oil	20200102
	49110	Electric Power Generation	Crude Oil Turbine	20200501
	49110	Electric Power Generation	Coal Handling	30501008
	49110	Electric Power Generation	Storage Pile Losses	30501009
	49990	Municipal Incineration	Municipal Incineration	50100101
	49990	Municipal Incineration	Municipal Incineration	50100102
	49990	Municipal Incineration	Open Pit. Incineration	50100201
	49990	Municipal Incineration	Close Pit. Incineration	50100507
	49990	Municipal Incineration	Pit Incineration	50100512
	49991	Sewage Sludge Incineration	Fluidized Bed	50300506
	49991	Sewage Sludge Incineration	Multiple Hearth	50300506

APPENDIX C
RDIS Field Descriptions

plant.dbf

*PROVCODE	- Province code
*SIC	- Standard Industrial Classification code
*PLANTID	- Plant Identification Code
YEARCODE	- Year code to link YEAR file
WEEKCODE	- Week code to link WEEK file
DAYCODE	- Day code to link DAY file
*YEAR	- Year associated with discharge data
CAPACITY	- Plant capacity
PRODUCTION	- Plant production
PRODUNITS	- Plant capacity/production units

process.dbf

*PROVCODE	- Province code
*SIC	- Standard Industrial Classification code
*PLANTID	- Plant identification code

*YEAR	-	Year
PROCESSID	-	Process identification code
PROCESS NAME	-	Name of process
SCC	-	Source Classification Code
BASEQTYID	-	Base quantity identification code to BASEQUANTITY file
VALUE	-	Base quantity
BQ UNITS	-	Unit of the base quantity rate
PVAR1	-	Represents process variable 1.
P1UNITS	-	Units of process variable 1.
PVAR2	-	Represents process variable 2.
P2UNITS	-	Units of process variable 2.
FUELTYPE	-	Process fuel type
FUELQTY	-	Fuel quantity used by process
FUELUNITS	-	Units of the fuel quantity
SULFUR	-	Sulfur content of fuel in percent
ASH	-	Fuel ash content in percent
HEAT	-	Fuel heat content

devicl.dbf

*PROVCODE	- Province code
*SIC	- Standard Industrial Classification code
*PLANTID	- Plant identification code
*YEARD	- Year of device implementation/ commissioning
*PROCESSID	- Process identification code
*DEVICEID	- Device code
DEFHT	- Height of source in meters
DEVDIAM	- Diameter of source in meters
MV	- Exit velocity from source
VELUNITS	- Units of the exit velocity "MV"
MT	- Exit temperature from source in degrees celsius
MF	- Flow rate of the medium
FRUNITS3	- Flow rate units

contam.dbf

*PROVCODE	-	Province code
*SIC	-	Standard Industrial Classification code
*PLANTID	-	Plant identification code
*YEAR	-	Year
*DEVICEID	-	Device identification code
*CCODE	-	Contaminant code
ORIGIN	-	Origin of contaminant - fuel, cooling or process
UDISFACT	-	Uncontrolled discharge factor, i.e. uncontrolled emission rate
DISFACT	-	Controlled discharge factor, i.e. controlled emission rate.
DISUNITS	-	The units of the discharge factor - either controlled or uncontrolled
CNTL1	-	The primary control device
CNTL2	-	The secondary/supplement control device
CONRATE	-	Composite control rate
DISCHQTTY	-	Amount of liquid/solid waste discharged

DISCON	- Concentration of contaminant in discharge (liquid/solids)
DISCOUNITS	- Units of "DISCON"
COLMED	- Cooling medium
COLQTTYA	- Quantity of cooling medium used
COLUNITS	- Units of cooling medium quantity
RECRATE	- Recycling rate of collected contaminant
COMPMETH	- Computational method used
METH	- Computational method code
REASCH	- Reasons for changing the computational method
ERROR	- Percentage of error in emissions estimate
UPDATEBY	- Person responsible for the last update

compon.dbf

*PROVCODE	- Province identification code
*SIC	- Standard industrial classification code

*PLANTID	- Plant identification code
*YEAR	- Year
*PROCESSID	- Process identification code
*DEVICEID	- Device identification code
*CCODE	- Contaminant code
COMPID	- Component identification code
COMPNAME	- Name of component
FRACTION	- The fraction of the component within the contaminant associated specific to the process

yeardata.dbf

*YEARCODE	- Process specific code that links the monthly activity profile to the process
JANUARY ↓ DECEMBER	- Activity level for the month as a percent of annual activity occurring in the month
YEARDATA	- Plant specific code that links the monthly activity profile to the plant

weekdata.dbf

*WEEKCODE	- Process specific code that links the daily activity profile to the process
MONDAY ↓ SUNDAY	- Activity level for the day as a percent of the total activity for a week.
WEEKDATA	- Plant specific code that links the daily activity profile to the plant

daydata.dbf

*DAYCODE	- Process specific code that links the hourly activity profile to the process
HOUR01 ↓ HOUR24	- Percentage activity for 0000 hrs - 0100 hrs - 2300 hrs - 2400 hrs.
DAYDATA	- Plant specific code that links the hourly activity profile to the plant

* **Key Fields**