Developing a National Emissions Inventory for Mexico Phase II: Northern States Emissions Inventory

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ABSTRACT

The first comprehensive national emissions inventory for the country of Mexico is currently under development. The Mexico National Emissions Inventory (NEI) project, which began in 2001, is being conducted in three phases over three years. Phase I covered program planning and organization, and development of the Inventory Preparation Plan. Phase II, which is the subject of this paper, includes the development of the inventory for the six northern Mexican states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas. Future work in Phase III will result in an emissions inventory for the remaining Mexican states. The Mexico NEI includes emissions estimates for seven pollutants (VOC, CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, and NH_3) generated by point, area, natural, and on- and off-road mobile sources.

This paper focuses on the point and area source emissions inventory status. Point source inventory development includes obtaining data from two important sources: the DATGEN database and the Cédula de Operación (COA) annual reports. These data are maintained for federal and state jurisdiction point sources. Current activities include identifying all COAs, ensuring their quality, and compiling them into one comprehensive database for the northern Mexican states. Area source data are being collected to estimate emissions from 35 difference source categories. The development of the area source inventory depends heavily on data obtained from the Secretaría de Energía (SENER) and Petróleos Mexicanos (PEMEX), as well as many other industry organizations, and the Instituto Nacional de Estadística, Geográfica e Informática (INEGI). On-going data collection efforts will ensure completion of the Phase II Northern States Emissions Inventory by July 2003.

INTRODUCTION

The Western Governors' Association (WGA), the United States Environmental Protection Agency (U.S. EPA), the North American Commission for Environmental Cooperation (NACEC), and Mexico's Secretariat of the Environment and Natural Resources/National Institute of Ecology (SEMARNAT/INE) are sponsoring the Mexico NEI project. The Mexico NEI is being conducted in three phases: Phase I covered program planning and organization[1]. Phase II, to be completed by July 1, 2003, includes the development of the inventory for the six northern Mexican states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas. Phase III, to be completed by October 1, 2004, will result in an emissions inventory that encompasses the entire country of Mexico.

An important aspect of the Mexico NEI is that it will have many uses, and users. The most significant uses of the Mexico NEI include the following:

- To provide baseline emission estimates used in understanding significant pollutants and sources contributing to air pollution in Mexico for the base year, and to examine trends in the future;
- To provide a tool to reformulate or confirm current air quality policies and regulations in Mexico[2];
- To assist Mexico and the United States in assessing the effect of trans-boundary pollutant transport; and
- To participate in achieving tri-national goals among Canada, the United States and Mexico in the development of compatible and comparable emission inventories.

Advisors and Participants

A Technical Advisory Committee (TAC) meets regularly to review progress, evaluate data and methodologies, determine how results will be disseminated, and address many other technical and regulatory issues that are encountered with an effort of this type. The TAC comprises representatives from government, industry, academia, and environmental organizations located in both Mexico and the United States. The TAC contributes to technical content of the project, while the Binational Advisory Committee (BAC) oversees administrative and policy issues. The BAC comprises representatives from the project sponsors: WGA, U.S. EPA, NACEC, and SEMARNAT/INE.

Participation of independent experts and consultants located in Mexico continue to be important for the development of the Mexico NEI. The experts and consultants work with Mexican government agencies to identify activity, land use and other types of data needed to estimate emissions from all source types. Also, they participate in TAC meetings, and generally provide the link between the U.S. government and consultants, and their counterparts in Mexico.

Inventory Scope and Characteristics

Figure 1 shows the domain of the Mexico NEI, and depicts the geographic areas included in the Phase II inventory (six northern states) and in the Phase III inventory (the remaining 26 states, including the Federal District). The Mexico NEI includes emissions estimates for seven pollutants (VOC, CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, and NH_3) generated by point, area, natural, and on- and off-road mobile sources during the base year of 1999. The on-road mobile emissions inventory is discussed in a companion paper[3]. Development of the natural and non-road mobile inventories is in a very preliminary stage at this time. The status of the point and area source emissions inventory is the main focus of this paper, including an evaluation of emission inventory data that has been collected to date.

POINT SOURCES INVENTORY STATUS

For purposes of the Mexico NEI, point sources are defined as federal and state jurisdiction point sources[1]. The approach used to develop point source emissions estimates is based on existing emissions information from two main sources: the DATGEN database; and annual operating reports called the Cédula de Operación (COA). Data from these sources will be quality assured (QA'd); other significant sources not accounted for in these data sets would be identified and their emissions estimated; and, all emissions will be combined into one data set representing emissions from all federal and state jurisdiction point sources. Data collection and QA activities are currently underway, but some initial results can be reported.

DATGEN Emissions Data

In practical terms, DATGEN is a collection of spreadsheets representing the point source emissions inventories of federal facilities operating in the cities/areas where air quality plans have been developed. DATGEN includes federal point source emissions for five cities/areas located in Mexico/U.S. border states:

- Monterrey Metropolitan Area (state of Nuevo León, for 1995);
- Ciudad (Cd.) Juárez Area (state of Chihuahua, for 1996);
- La Laguna Area (partially located in the state of Coahuila, for 2001);
- Mexicali Area (state of Baja California, for 1996); and
- Tijuana Area (state of Baja California, for 1998).

DATGEN contains emission estimates for combustion sources, only (i.e., process and industrial fugitive emissions are not accounted for) in these areas. Also, DATGEN contains emission factors, production rates, control efficiency, and location for some sources/facilities.

Figures 2 and 3 illustrate the emissions contained in DATGEN for particulate matter (PM) and NO_x emissions. (Note that the PM data in Figure 2 may represent total suspended particulate (TSP) for one area, and PM_{10} for another area; on-going detailed quality assurance will resolve these discrepancies.) These figures illustrate that the majority of emissions of these pollutants are generated by a small percentage of the facilities. For example, Figure 2 shows that in Mexicali approximately 4% of the facilities emit more than 100 megagrams (Mg) per year of PM, and their emissions comprise approximately 87% of the total PM emitted. Figure 3 shows that in Monterrey, approximately 24% of the facilities emit greater than 10 Mg per year of NO_x, and their emissions comprise approximately 99% of the total NO_x emitted.

Quality Assurance

The entire DATGEN database was reviewed to identify estimates out of range (e.g., excessive emissions, supersonic stack flow, etc.), and to check for duplicate records. Out-of-range values were corrected, if possible, or eliminated from the database if the values could not be verified. Duplicate records were eliminated from the database.

In order to focus efforts and obtain the highest quality data possible for the most significant emitters, it was decided to reduce the number of facilities to be considered from DATGEN in the point source database. Facilities emitting greater than 10 Mg/year of any given pollutant (i.e., 25% or less of the DATGEN facilities, depending on the pollutant) were considered for further point source inventory development. Approximately 10-15% of these facilities are receiving a detailed QA check including

verification of emission factors, calculation, and control efficiencies, and checks for reasonableness of the other types of data contained in the records for that facility (e.g., local coordinates, etc.).

Cédula de Operación (COA) Emissions Data

All federal and state jurisdiction point sources are required to obtain an air permit and monitor their emissions according to the Mexican Official Standards (Normas Oficiales Mexicanas, or NOMs). These sources must submit an annual updated emissions inventory as part of their COA; however, a large number of facilities do not comply, or submit incomplete or incorrect information. Regardless, the COAs are useful to identify point sources located in the remainder of the country (i.e., not included in the DATGEN data), including state jurisdiction point sources. COAs collect the following types of information germane to Mexico NEI development:

1) General Information (e.g., facility name, CMAP code, municipality, address)
2) Emission Releases (e.g., Mg per year of criteria pollutants, carbon dioxide)
3) Raw Materials (e.g., CAS number, chemical name, usage in Mg/year)
4) Products (i.e., product name and production level)
5) Fuel Usage (i.e., type of fuel, yearly usage)
6) Energy Consumption (i.e., yearly consumption of electricity)
7) Equipment (e.g., type, hours of operation, capacity, fuel type and consumption)
8) Stack Parameters (i.e., type, size, gas velocity, temperature)
9) Pollutants (e.g., applicable standard, allowable and actual emissions, monitoring method)

An ambitious effort is currently underway to identify, obtain, and review all existing COAs for the six northern states. Adding to the complexity of the process are the facts that the COAs are in hard-copy format (i.e., not submitted electronically), reside in several locations depending on jurisdiction, and are for various years. Also, whether or not the COAs undergo QA and subsequent submittal to SEMARNAT for compilation into the national COA database depends on the resources available at the local level. The responsibility of and methods for handling COA data are as follows:

- SEMARNAT Headquarters (HQ) compiles the COAs submitted by the SEMARNAT Delegations for sources under federal jurisdiction. SEMARNAT HQ performs QA (some are eliminated if required data are missing) and compiles the COAs into a database. The COA database for year 2000 is the most current and complete database available.
- SEMARNAT Delegations, located in each state, collect the COAs submitted by the facilities under federal jurisdiction located in their state, perform QA, and submit them to SEMARNAT HQ. Each year facilities should submit their COAs by April, and the Delegations submit the COAs to Headquarters by the end of May. If facilities are late, then COAs are held by the Delegations. (They may or may not be submitted to Headquarters.)
- State Environmental Agencies (SEAs) collect COAs for facilities under state jurisdiction. However, many SEAs do not have the resources to adequately QA and compile the COAs. As a result, some states simply collect and store the hard-copy COAs, while other states enter the COAs in the spreadsheets or databases (e.g., Baja California and Chihuahua). Generally, the SEAs store the COAs locally. However, the SEAs may submit them to SEMARNAT HQ for compilation at the national level (e.g., Tamaulipas), although this is not a requirement.

To date, COAs for over 600 facilities under federal jurisdiction have been obtained from SEMARNAT for use in the Mexico NEI. COAs are still being collected from the SEAs, and efforts are underway to convert all of the state COAs into electronic format so that eventually all COAs can be compiled into a single point source database for the Mexico NEI.

Quality Assurance

The initial QA step is to make a comparison of the federal COA facilities (obtained from both SEMARNAT HQ and Delegations) with DATGEN facilities in order to ascertain the level of overlap between the two sets of data. Duplicate facilities will be eliminated. During initial QA review of the COAs collected to date, several errors have been found. Some of the most common include reporting of solvent-containing materials but no reporting of VOC emissions; incorrect emission factors; and, not all applicable pollutants are reported for some combustion equipment. Also, it has been observed that emissions reported from monitoring are usually much greater than emissions estimated with emission factors for the same type of equipment, fuel, and combustion processes. A thorough QA procedure will be implemented on 10-15% of the COAs from facilities above the 10 Mg/year threshold after all COAs have been compiled into electronic format.

AREA SOURCES INVENTORY STATUS

As described in a previous paper[1], the Mexico NEI area sources are defined as all stationary sources, excluding point sources under federal and state jurisdiction. Also, area sources include nonroad mobile sources such as construction equipment, commercial marine vessels, and agricultural equipment. More than 35 different area source categories will be included in the Mexico NEI.

An area source matrix describing activity data and emission factors needed to estimate emissions for these area source categories was previously prepared[1]. A modified version of this area source matrix is provided in Table 1. Because of the focus of this paper is on data collection, Table 1 was modified to summarize the current status of area source activity data collection efforts. As shown in Table 1, data collection for area source categories is in various stages of completion – a few categories are complete, a few are still in the starting phase, and many have some initial data that need further clarification or detail. Some key data collection results are presented in detail below.

Fuel Balance

One of the key components in the development of the Mexico NEI area source emissions inventory is development of the national fuel balance. The fuel balance provides a detailed accounting of fuel within Mexico (including production, usage, imports, and exports) for all commercially available fuels (i.e., gasoline, fuel oil, diesel, LPG, natural gas, other petroleum-based fuels, coal, and coke). Depending upon data availability, non-commercially available fuels (i.e., wood, biomass, and other waste-derived fuels) are also included in the national fuel balance.

The results of the fuel balance will be used to establish an "upper-end" estimate of area source fuel combustion emissions. In order to prevent the double-counting of fuel combustion in the area and point source categories, any fuel quantities specifically identified during the development of industrial point source emissions will be subtracted from the national fuel balance prior to calculation of area source fuel combustion emissions. Likewise, care is taken to not double-count the fuel quantities used in the estimation of multiple area source categories (e.g., locomotives, commercial marine vessels, and aircraft).

Although the fuel balance is not yet complete, some preliminary information is available. Up to this point, the two prime data sources for the fuel balance were the Secretaría de Energía (SENER) and Petróleos Mexicanos (PEMEX). SENER provided national-level energy balances, as well as usage data for coal and coke that are used by narrow sectors of industry[4]. In addition, SENER provided fuel-specific profiles including detailed information regarding fuel production, consumption, and distribution[5-8]. PEMEX provided fuel sales statistics for natural gas, LPG, and petroleum-based fuels (i.e., gasoline, diesel, fuel oil, etc.) [9]. Natural gas sales statistics are currently only available at the

regional level. LPG sales statistics were provided at the distribution plant level (488 plants throughout the county), while petroleum-based fuel sales statistics were provided at the bulk terminal level (81 terminals throughout the county). Regional 1999 sales data for some selected petroleum-based fuels are presented in Table 2. Regional sales data for natural gas and LPG are not shown because of differences in the definition of geographic sales regions.

Ideally, municipality-level sales and use statistics will be used in the Mexico NEI. However, presently there is a lack of data available for assigning regional data from PEMEX (i.e., at the regional, distribution plant, and bulk terminal level) to individual municipalities. Unfortunately, PEMEX's recordkeeping jurisdiction does not extend beyond distribution plants or bulk terminals. Research into a source of fueling station-level (i.e., municipality-level) sales data continues.

Solvents Balance

In addition to the national fuels balance described above, a national solvents balance was also planned in order to develop a conservative estimate of area source solvent emissions. However, a national solvents balance has not proven feasible because of data scarcity, as well as the difficulty in identifying relevant industry associations and government agencies that can provide sales or use statistics. Unlike the fuel balance where most of fuel-related statistics were maintained by PEMEX and SENER, solvent statistics are spread out over a larger number of industry associations and government agencies (some of which have not yet been identified). As a result, only limited amounts of solvent-related data has been collected so far.

One key industry association that has provided valuable data is the Asociación Nacional de Fabricantes de Pinturas y Tintas (ANAFAPYT) which is the industry association for paint and ink manufacturers. ANAFAPYT provided national 1999 sales data representing 90 percent of the market (including imports) which are shown in Table 3. ANAFAPYT also provided some limited VOC content information (i.e., 450 grams VOC/liter of paint for solvent-based architectural coatings). However, ANAFAPYT was unable to provide more detailed sales or usage data at the state- or municipality-level. As a result, surrogates will be used to disaggregate the national-level data to a finer level of resolution. For example, architectural surface coatings will be disaggregated to the municipality level based upon municipality population. Other types of coatings will be disaggregated based upon applicable industrial sector indicators.

CONCLUSIONS

The Mexico National Emissions Inventory is a first-of-its-kind emissions inventory for Mexico. To date, the only regional inventories developed for Mexico were for purposes of air quality planning in specific areas (e.g., Mexicali, Ciudad Juárez, Tijuana, Monterrey, and La Laguna area). The Mexico NEI will provide a comprehensive estimate (i.e., all source types in all states) of criteria air pollutant emissions for the entire country. The inventory for the six border states will be complete by July 2003, so the data collection efforts and emission calculation efforts are currently underway.

The point source emissions inventory is heavily dependent on data compiled by SEMARNAT, including the DATGEN database and the annual operating reports (COAs). These data are currently being collected, QA'd, and compiled into one database for the Mexico NEI. Early results of the QA efforts indicate some out-of-range values and duplicate records; incorrect emission factors; and, some facilities reporting the use of solvents but no emissions of VOCs. To help focus the QA efforts, only sources know to emit more than 10 Mg/year (total emissions) will be included in the point sources database, and only 10-15% of those sources will receive a detailed QA. The smaller (<10 Mg/year) sources will be incorporated into the area sources inventory.

The area sources inventory includes 35 different source categories. Data collection is still underway for most of these categories. A key element of this inventory includes the development of a national fuels balance that provides a detailed accounting of commercially available fuel production and use within Mexico, including production usage, imports, and exports. The fuel balance, based entirely on data provided by SENER and PEMEX, is nearly complete. Results show that national sales of Magna and Premium gasoline are 27,160,793 and 2,478,263 m^3/year, respectively. Efforts continue to determine methods and data for distributing regional fuel sales and use statistics to the municipality level. A similar national solvents balance was envisioned to provide information needed to estimate VOC emissions from use of paints, coatings, and thinners. Although national sales data have been obtained from ANAFAPYT (see Table 3), state- or municipality-level data are not available. Efforts continue to determine methods and data to spatially disaggregate the national solvent sales data.

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Figure 1. Mexico NEI domain to be completed in Phases II and III.

Figure 2. Percentage of facilities in DATGEN contributing more than 10 Mg/year and more than 100 Mg/year of particulate matter emissions.

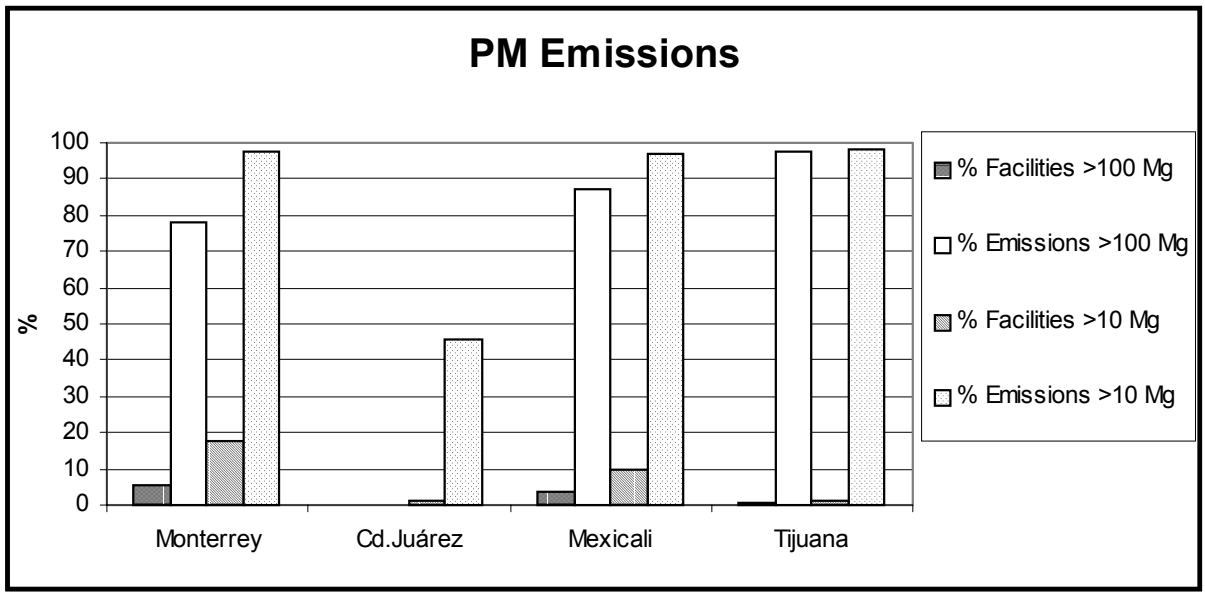

Figure 3. Percentage of facilities in DATGEN contributing more than 10 Mg/year and more than 100 Mg/year of nitrogen Oxide emissions.

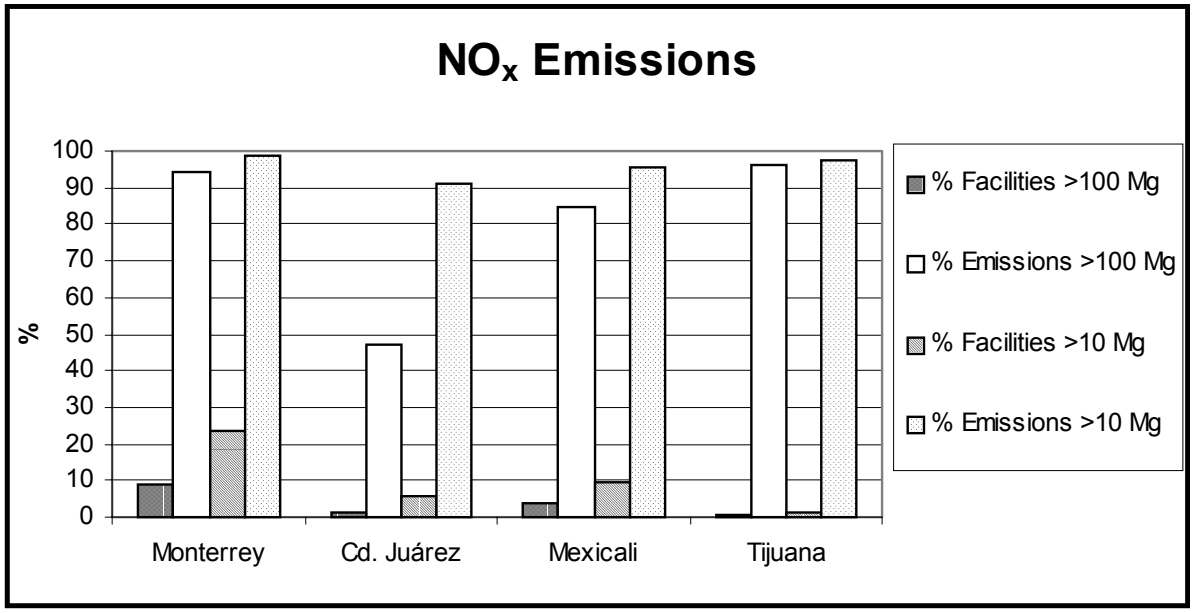

Table 1. Mexico NEI area source matrix – status of data collection.

CATEGORY NAME	Activity Data Needed	Status
Fuel Combustion – Commercial Fuels[a]	Fuel usage	Energy balances, bulk terminal and distribution plant sales data, and fuel specifications obtained from SENER and PEMEX. Currently attempting to obtain sales data for individual fueling stations to improve spatial allocation.
Fuel Combustion – Non-Commercial Fuels[b]	Fuel usage	One study obtained with limited survey information. Continuing to search for other studies.
Locomotives	Railroad fuel usage; number of yard locomotives	Railroad fuel usage and total number of locomotives obtained from SCT. Currently attempting to identify the municipality-level location of railroads and the number of line and yard locomotives.
Commercial Marine Vessels	Commercial marine fuel usage	Commercial marine fuel usage obtained from SCT and IMT. Currently attempting to identify appropriate basis for spatial allocation.
Aircraft	Landing and takeoff data	Landing and takeoff data obtained from SCT and IMT for largest airports. Currently attempting to locate data for other airports and identify aircraft/engine types used.
Other Non-Road Mobile Equipment	Equipment population	NONROAD-Mexico currently under development.
Border Crossings	Vehicle counts, wait times	Border crossing statistics obtained from BTS. Border wait times obtained from U.S. Customs.
Bus/Truck Terminals	Vehicle counts, wait times	Currently attempting to identify appropriate federal/state/local agency to talk with regarding this category.
Consumer Solvent Use	Solvent usage	Currently attempting to obtain sales/usage data from CANIPEC
Architectural Surface Coating	Solvent usage	National sales/usage data and VOC content obtained from ANAFAPYT. Detailed spatial allocation information unavailable; will allocate based on population.
Autobody Refinishing	Solvent usage	National sales/usage data obtained from ANAFAPYT. VOC content not provided. Detailed spatial allocation information unavailable; will allocate based on sector indicators.
Industrial Surface Coating	Solvent usage	National sales/usage data obtained from ANAFAPYT. VOC content not provided. Detailed spatial allocation information unavailable; will allocate based on sector indicators.
Degreasing	Solvent usage	No data obtained yet. Initial meeting with CANACINTRA on 10/15/02.
Dry Cleaning	Solvent usage	Preliminary usage data obtained from CANALAVA. More detailed information to be received shortly.
Graphic Arts	Solvent usage	Sales/use data should be available from ANAFAPYT, but no data provided yet. Follow-up data requests are continuing.
Traffic Markings	Solvent usage	National sales/use data obtained from ANAFAPYT. VOC content not provided. Detailed spatial allocation information unavailable; still assessing basis of allocation.
Asphalt Application	Asphalt Usage	Asphalt production/sales data provided by PEMEX. Detailed spatial allocation information unavailable; still assessing basis of allocation.

Table 1. Mexico NEI area source matrix – status of data collection (continued).

CATEGORY NAME	Activity Data Needed	Status
Gasoline Distribution	Fuel distribution statistics	Energy balances, bulk terminal sales data, and fuel specifications obtained from PEMEX. Currently attempting to obtain sales data for individual fueling stations to improve spatial allocation.
LPG Distribution	LPG distribution statistics	Energy balances, distribution plant sales data, and fuel specifications obtained from PEMEX. Currently attempting to obtain sales data for individual fueling stations to improve spatial allocation. Emission factor information also obtained from Mexico City LPG study.
Bakeries	Population	Currently attempting to identify industry association to determine Mexico-specific characteristics.
Brick Manufacturing	Fired brick quantities	Identified relevant technical study. Currently attempting to contact construction association to obtain more information on brick usage.
Construction Activities	Construction acreage or value	Limited construction license information obtained from SCAE CD-ROMs. Currently attempting to contact construction association to obtain more complete information.
Charbroiling/Street Vendors	Number of charbroilers, amount of meat cooked	Currently attempting to identify appropriate federal/state/local agency to talk with regarding this category.
Pesticide Application	Pesticide usage, applied acreage, application method, pesticide characteristics	National-level pesticide use obtained from AMIFAC. Currently attempting to obtain more detailed information regarding pesticide characteristics and application methods.
Beef Cattle Feedlots	Annual throughput, average stay	State-level livestock populations obtained from SIACON database. Some municipality-level livestock population information available on SCAE CD-ROMs. Have requested information regarding feedlot quantities and location from SAGARPA.
Agricultural Burning	Acreage burned, fuel loadings	State-level agricultural acreage obtained from SIACON database. Some municipality-level agricultural acreage information available on SCAE CD-ROMs. Requested complete municipality-level information from SAGARPA. Currently trying to identify agricultural burning practice information.
Fertilizer Application	Fertilizer usage, nitrogen content	State-level agricultural acreage obtained from SIACON database. Some municipality-level agricultural acreage information available on SCAE CD-ROMs. Requested complete municipality-level information from SAGARPA. Currently trying to identify appropriate fertilizer industry group.
Animal Waste	Livestock population	State-level livestock populations obtained from SIACON database. Some municipality-level livestock population information available on SCAE CD-ROMs. Requested complete municipality-level information from SAGARPA.
Agricultural Tilling	Acreage tilled, number of yearly operations, silt content	State-level agricultural acreage obtained from SIACON database. Some municipality-level agricultural acreage information available on SCAE CD-ROMs. Requested complete municipality-level information from SAGARPA. Currently trying to identify tilling practice information.
Open Burning – Waste	Quantity of waste burned	Currently trying to identify appropriate federal/state/local agency for this category.

Table 1. Mexico NEI area source matrix – status of data collection (continued).

CATEGORY NAME	Activity Data Needed	Status
Wastewater Treatment	Quantity of wastewater treated	Some wastewater treatment information identified on SCAE CD-ROMs. Currently trying to identify appropriate federal/state agency for this category.
Wildfires	Acreage burned	Wildfire acreages obtained from SCAE CD-ROMs. Fuel loading information may be available from 2000 National Forest Inventory requested for biogenic emissions.
Structure Fires	Number of fires	Some structural fire information identified on SCAE CD-ROMs.
Paved Road Dust	VKT, silt loading, vehicle characteristics	Total VKT currently being estimated as part of motor vehicle estimates. Currently implementing methodology to determine paved/unpaved split.
Unpaved Road Dust	VKT, silt content, vehicle characteristics	Total VKT currently being estimated as part of motor vehicle estimates. Currently implementing methodology to determine paved/unpaved split.
Wind Erosion	Disturbed acreage, soil characteristics, meteorological data	State-level agricultural acreage obtained from SIACON database. Some municipality-level agricultural acreage information available on SCAE CD-ROMs. Requested complete municipality-level information from SAGARPA. Currently trying to identify soil characteristic data. Meteorological data obtained as part of biogenic emissions.
Domestic Ammonia Emissions	Population	Censo XII (2000) statistics obtained from INEGI

[a] Commercial fuels include fuel oil (distillate and residual), natural gas, LPG, kerosene, coal, etc.
[b] Non-commercial fuels include residential wood/biomass and waste-derived fuels.

AMIFAC = Asociación Mexicana de la Industria Fitosanitaria, A.C.
ANAFAPYT = Asociación Nacional de Fabricantes de Pinturas y Tintas (National Association of Paint and Ink Manufacturers)
BTS = Bureau of Transportation Statistics
CANALAVA = Cámara Nacional de la Industria de Lavanderías (National Chamber of the Dry Cleaning Industry)
CANIPEC = Cámara Nacional de la Industria de Perfumeria y Cosmetica (National Chamber of the Perfume and Cosmetics Industry)
IMT = Instituto Mexicano del Transporte (Mexican Institute of Transportation)
INEGI = Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography, and Information)
PEMEX = Petrólos Mexicanos (Mexican national oil company)
SAGARPA = Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Secretariat of Agriculture, Livestock, Rural Development, Fisheries, and Food)
SCAE = Sistema para la Consulta del Anuario Estadístico
SCT = Secretaría de Comunicaciones y Transportes (Secretariat of Communication and Transportation)
SENER = Secretaría de Energía
SIACON = Sistema de Información Agropecuaria de Consulta

Table 2. Total Mexico fuel sales for 1999 (m^3/year).

Fuel Type	Central[a]	North[b]	West[c]	South[d]	Valley of Mexico[e]	Total
Magna gasoline	5,975,682	6,106,639	5,563,848	3,286,118	6,228,506	27,160,793
Premium gasoline	486,798	528,695	696,534	253,027	513,209	2,478,263
Turbosina (Jet fuel)	246,437	204,890	914,878	607,514	1,236,745	3,210,464
Diesel	3,095,447	3,646,197	2,768,881	1,797,943	1,615,995	12,924,463
Combustóleo (Residual fuel oil)	2,482,514	4,360,098	10,117,452	5,382,228	4,770,023	27,112,314

[a] Includes the states of Guanajuato, Guerrero, Morelos, Puebla, Querétaro, and Tlaxcala and portions of the states of México, Michoacán, and Hidalgo.

[b] Includes the states of Aguascalientes, Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas.

[c] Includes the states of Baja California, Baja California Sur, Colima, Jalisco, Nayarit, Sinaloa, and Sonora and portions of the state of Michoacán.

[d] Includes the states of Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatán.

[e] Includes Distrito Federal and portions of the states of México and Hidalgo.

Table 3. Total Mexico paint/coating and solvent/thinner sales for 1999 (1000 liters).

Type	1999 Sales
ARCHITECTURAL PAINTS/COATINGS – TOTAL	**239,670**
Architectural – Water-based	175,320
Architectural – Solvent-based	57,200
Architectural – Other Commercial	7,150
SPECIAL USE PAINTS/COATINGS- TOTAL	**48,691**
Industrial Maintenance	12,600
Marine Maintenance	1,915
Traffic	4,900
Autobody Refinishing	24,675
Aerosol Spray Cans	4,601
INDUSTRIAL PAINTS/COATINGS - TOTAL	**90,825**
Motor Vehicles	33,480
Appliances	851
Wood Products	15,450
Metal Fabrication	5,200
Powdered	11,000
Metallic Rolls	9,392
Metallic Containers	4,652
Miscellaneous Industrial	10,800
ALL PAINTS/COATINGS – TOTAL	**379,186**
ALL SOLVENTS/THINNERS - TOTAL	**66,780**
PAINTS/COATINGS, SOLVENTS/THINNERS – TOTAL	**445,966**

KEY WORDS

Mexico
Emissions inventory
Fuel balance
Point sources
Area sources