Developing a National Emissions Inventory for Mexico
Phase I: Planning

Paula Fields and Marty Wolf
Eastern Research Group, Inc.
8950 Cal Center Drive, Suite 260
Sacramento, California 95826
paula.fields@erg.com

Rich Halvey
Western Governors' Association
1515 Cleveland Place, Suite 200
Denver, Colorado 80202
rhalvey@westgov.org

William Kuykendal
U.S. Environmental Protection Agency
Emission Factor and Inventory Group (D205-01)
Research Triangle Park, North Carolina 27711
kuykendal.bill@epa.gov

ABSTRACT

The Western Governors' Association (WGA) and the United States Environmental Protection Agency (U.S. EPA) have been working with Mexico's Secretariat of the Environmental and Natural Resources/National Institute of Ecology (SEMARNAT/INE) to improve INE's air emissions inventory program since 1996. Until 2001, the program focused on capacity building for emissions inventory professionals in Mexico. In 2001, the project shifted to focus on implementation, including development of a national emissions inventory (NEI) for Mexico to support a tri-national inventory program with the United States and Canada, and to provide information to Regional Planning Organizations (RPOs) for regional haze compliance and planning. The program gained new partners such as the North American Commission for Environmental Cooperation (NACEC).

This work is being conducted in three phases over the next 3 years. Phase I covers planning and organization, as well as the development of an Inventory Preparation Plan (IPP) and initial data collection. Details of the IPP, which are the subject of this paper, include the inventory characteristics (e.g., base year, pollutants, source categories, methodologies, etc.), but also address the unique issues facing this type of effort in Mexico. In particular, the Mexico NEI IPP addresses administrative and regulatory issues pertaining to confidentiality of emissions data, technical issues pertaining to how point and area sources are defined and inventoried, and the use of existing inventories and their uncertainty. Future work in Phase II will result in an inventory covering Mexico's border states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. Phase III is to conclude with an emissions inventory for the remaining 24 Mexican states.

INTRODUCTION

The Mexico NEI will be the first national emissions inventory for the country of Mexico. The Mexico NEI project is sponsored by the WGA with funding from the U.S. EPA and the NACEC. The Mexico NEI is being developed using a three-phase methodology that covers multiple years:

- Phase I includes initial planning, development of the IPP, establishment of the Technical Advisory Committee (TAC), and compiling existing Mexico inventories and data;
- Phase II will include development of national fuel and solvents balances and compilation of an emissions inventory for the six northern states; and
- Phase III will include development of a projections methodology for future years' modeling efforts, and ultimately the development of the NEI for Mexico.

The development of the Mexico NEI will follow the framework described in the IPP. The IPP generally conforms with U.S. EPA guidance pertaining to inventory development for air quality planning[1], 1999), with some important distinctions. For example, administrative and regulatory issues pertaining to confidentiality of emissions data from point sources are discussed in detail. Complete resolution and agreement on handling these on a national and international level are still needed. Certain technical issues are especially important to address in a national methodology, including the definition of "point" versus "area" source, and how hydrocarbons are defined and inventoried. Also, the ability to use existing municipality- and regional-level inventories as building blocks for a national inventory is important. The IPP addresses the equally important assessment of the quality and uncertainties of these existing inventories. The draft IPP is currently undergoing extensive review, comment, revision, and improvement, in order to receive full support by all entities involved in this important endeavor. Also, it is expected that the IPP will be revised in the future as the inventory effort transitions from a U.S./Mexico border focus (during the first year of the project) to a national focus (second and third year of the project).

Inventory Objectives and End Uses

The major entities associated with the Mexico NEI are as follows:

- INE – Development of the Mexico NEI will allow INE to conduct national-level analyses of air emissions from all sources (i.e., point, area, and mobile) affecting air quality and public health in Mexico.
- U.S. EPA – The Mexico NEI will assist U.S. EPA in assessing the effect of trans-boundary pollutant transport between the United States and Mexico.
- RPOs – The RPOs, such as the Western Regional Air Partnership (WRAP) and the Central States Regional Air Planning Association (CenRAP), were established to examine regional haze and visibility issues and develop strategies to address them. The Mexico NEI will provide air quality planners with more comprehensive emissions information for Mexico than is currently available for modeling purposes.
- NACEC – The Mexico NEI supports NACEC's goals of tri-national (i.e., Canada, U.S., and Mexico) emissions inventory development and compatibility/comparability between inventories from the three countries.

Unfortunately, some of the objectives and end uses identified by the various entities and stakeholders cannot be fully accomplished during the initial development of the Mexico NEI for several reasons. For example, certain objectives/end uses may conflict with each other, or resources may be insufficient to accomplish the goals. However, the development of the Mexico NEI is viewed as an iterative process with Phases I-III representing the first of many steps. Some of the objectives/ end uses that cannot be addressed in this initial effort may be addressed in the future. Based upon the various objectives identified by the stakeholders, and the overall goal to develop a national inventory, the main objectives of the Mexico NEI can be stated as follows:

1) Development of a first-time national Mexico inventory using the highest quality Mexico-specific data available.

2) Reporting of 1999 annual emissions on the state-level and municipality-level, where possible.
3) Development of data and methods for improving the spatial and temporal resolution of the Mexico NEI in the future.

Roles and Responsibilities

Because the Mexico NEI is a comprehensive first-time inventory that covers a large geographic area, there are many different entities involved in the inventory process. Without the important contributions of each of these entities it will be impossible to develop an inventory that successfully meets the majority of the inventory objectives and end uses. These entities include:

- INE – INE will be the primary owner of the inventory and will support and facilitate data collection efforts from other Mexican government agencies and industry, as appropriate. Also, INE will support the role of the WGA-sponsored intern working in their offices in Mexico City to assist the Mexico NEI effort.
- TAC – The TAC will provide technical oversight of the inventory development process. During Phases I and II, the TAC will consist of representatives from INE, WGA, U.S. EPA, RPOs, the 10 Mexico/U.S. border states, industry, academia, and environmental groups. Also, subcommittees will be formed to address specific technical issues. For Phase III, TAC membership will be revised to reflect the comprehensive nature of the final project.
- WGA – The WGA is responsible for coordinating this inventory project with other entities including INE, U.S. EPA, U.S. EPA regional offices, Western states, and relevant RPOs (e.g., WRAP and CenRAP).
- Mexico state/municipal agencies – Mexico state and local agencies will be a valuable resource in developing point source activity data for those sources that fall under state or local jurisdiction and in identifying data related to area source emissions in their state.
- Contractor team – The contractor team led by Eastern Research Group, Inc. (ERG) is responsible for all technical work under this contract. Other team members include: TransEngineering (for assistance with motor vehicle emissions); Acosta y Asociados (for assistance with industrial point source data collection); International Emissions Inventories (to facilitate communications with the various entities in the Mexico/U.S. border region); and Boadella English Services (for translation/interpretation services).

After the Mexico NEI has been completed, the inventory will be transferred from the contractor team to INE. It is expected that INE will periodically update the Mexico NEI to reflect future growth and controls, as well as improved methodologies and more detailed inventory-related data.

Existing Mexico-Related Emissions Inventories and Databases

Several metropolitan- and regional-scale inventories have been conducted in Mexico by various government agencies. These inventories, which are briefly described below, provide building blocks for the Mexico NEI:

- Mexico City – Comprehensive emissions inventories containing point source, area source, motor vehicle, and natural source emissions with base years of 1994, 1996, and 1998 have been developed for the Valley of Mexico.[2,3,4] A 2000 base year inventory is expected to be completed in 2002.
- Guadalajara – An initial 1995 base year inventory developed for the Guadalajara Air Quality Plan.[5]

- Monterrey – An initial 1995 base year inventory developed for the Monterrey Air Quality Plan.[6]
- Ciudad Juárez – An initial 1996 base year inventory developed for the Ciudad Juárez Air Quality Plan.[7]
- Toluca – An initial 1996 base year inventory developed for the Toluca Air Quality Plan[8].
- Mexicali – An initial 1996 base year inventory developed for the Mexicali Air Quality Plan[9].
- Tijuana – An initial 1998 base year inventory developed for the Tijuana Air Quality Plan.[10]
- Northwestern Mexico – A1996 base year inventory for the Western Regional Air Partnership (WRAP) covering the Mexican portion of the inventory domain (i.e., the northwestern Mexican states of Baja California Norte, Sonora, and Chihuahua).[11]
- BRAVO Modeling Inventory – A regional inventory developed for 10 Mexican states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, Sinaloa, Durango, Zacatecas, and San Luis Potosi).[12] This inventory was developed as part of the Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study, which examined visibility impairment at Big Bend National Park in west Texas, obtained from the Monterrey, Ciudad Juárez, Mexicali, and Tijuana Air Quality Plan inventories, as well as emissions from the three municipalities of Tula, Vito, and Apaxco detailed power plant emissions, and the Popocateptl volcano.
- National Mercury Inventory – A national mercury (Hg) inventory developed for Mexico including stationary sources of Hg (e.g., gold mining and refining, mercury mining and refining, medical waste incinerators, chlor-alkali plants, residential boilers, and copper smelters).[13]
- Arizona Air Toxics Inventories – An air toxics inventory, including particulate matter (PM) for Ambos Nogales (Nogales, Sonora and Nogales, Arizona).[14] Another air toxics inventory is currently underway in Agua Prieta, Sonora, and Douglas, Arizona.

In addition to these inventories, there are several other valuable sources of inventory-related data. The first source is the Sistema Nacional de Información de Fuentes Fijas (National Information System of Point Sources) (SNIFF) database, which is maintained by INE for industrial facilities. The SNIFF database was originally developed in 1984. In general, the SNIFF point sources are limited to combustion sources. It is estimated that there are between 4,000 and 5,000 point sources contained in SNIFF, of which approximately 1,215 are federal jurisdiction point sources. More recently, INE has developed the Registro de Emisiones y Transferencia de Contaminantes (Pollutant Releases and Transfers Register) (RETC or PRTR) database. The RETC database is intended to provide detailed information regarding the types, locations, and quantities of pollutants released by industrial facilities. This information is to be submitted annually by industrial facilities. It was expected that the RETC database would be more comprehensive than the SNIFF database; however, in practice, the RETC database is of limited value for obtaining emissions data because submittal of information is voluntary.

Other Mexico emission inventory information includes a geographical information system (GIS) database recently developed for Ciudad Juárez that includes information for various point sources (i.e., maquiladoras, asphalt plants, and cast metal foundries) and area sources (e.g., paved/unpaved roads, autobody refinishers, brick kilns, wood manufacturers, dry cleaners, tortilla factories, bakeries, and gasoline stations).[15] Other current WGA-sponsored Mexico emissions inventory tasks include the completion of the emissions inventory manual series, review and evaluation of the 1998 Mexico City inventory, an unregistered vehicle study, and development of the NONROAD-Mexico emission factor model.

CONFIDENTIALITY AND INFORMATION MANAGEMENT

Confidentiality affects two aspects of the Mexico NEI development process: data collection and data dissemination. Data collection focuses not only on actual emissions data, but also on physical parameters (e.g., industrial process description, physical location, etc.) and overall data quality. Data dissemination refers to reporting of inventory data and results. Data dissemination allows the results to be used externally by others for comparisons, modeling, and other potential uses. At the present time, the issues associated with data dissemination are more problematic than those associated with data collection. Confidentiality agreements currently being developed address the issue of data collection, mainly pertaining to the SNIFF and RETC databases.

As established by Mexican laws and regulations, information that is reported to official agencies on a mandatory basis is confidential and cannot be released to the public. Public access to confidential information cannot be provided without permission from specific industrial facilities, unless references to specific facilities are omitted along with any information that could be used to identify specific facilities. In general, most information obtained from official records is confidential and cannot be made available to the public, unless the same information can be obtained from other publicly available sources (e.g., newspapers, company reports, etc.). However, emission quantities from several point sources may be reported as "aggregated" sources for a specific industrial sector without violating confidentiality requirements. The public may request access to RETC information, provided that they submit an application requesting the information wanted, describe the purpose of the request, and identify the intended use of the information. However, SEMARNAT may deny this request.

Point source data are significantly affected by confidentiality restrictions. Because it is impractical to survey all point sources in Mexico, it is necessary to rely heavily upon existing point source data in order to develop point source emission estimates for the Mexico NEI (e.g., SNIFF, RETC, COA submittals, etc.) All of these data are considered to be confidential and currently cannot be released to the public. For the most part, confidentiality does not significantly affect emissions data pertaining to area sources, mobile sources, and natural sources.

Developing Emissions Data Management Systems

The Mexico NEI requires the compilation of considerable amounts of emissions and other related inventory data. The amount of data will be too large to effectively manage using hard-copy records or even electronic spreadsheets. Therefore, database software (e.g., Access or similar database programs) will be used to compile and summarize the Mexico NEI data. At the present time, the Mexico NEI database is envisioned to be a "data repository". Emission estimates will be calculated externally and will then be stored inside the database using U.S. EPA's National Emissions Inventory Input Format (NIF) format. In addition, the database will be designed so that emissions inventory data can be easily imported into a GIS. A database specification is currently being developed.

INVENTORY CHARACTERISTICS

Five important characteristics of the Mexico NEI are described below. These were defined based on the objectives and end uses described above.

Base Year

The inventory base year is 1999. The 1999 base year emissions inventory corresponds with data needed by RPOs to meet U.S. Regional Haze Rule modeling requirements. Although the current scope of the Mexico NEI is limited to the development of 1999 estimates, a methodology will be developed in this project for projecting emissions to the future. This methodology will address data and procedures

for determining changes in emissions due to growth and expected controls implemented in Mexico to the year of 2018.

Geographic Domain

The geographic domain for the Mexico NEI is the entire country of Mexico (Figure 1). In Phases I and II, the inventory will focus on the six northern Mexican states that border the United States (i.e., Baja California, Sonora, Chihuahua, Coahuila de Zaragoza, Nuevo León, and Tamaulipas). The emissions inventory will include the entire area of these states and will not be limited to only metropolitan areas or to the border region that is within 100 kilometers of the Mexico/U.S. border (the domain covered by the North American Free Trade Agreement [NAFTA] programs). In Phase III, an emissions inventory for the remaining 24 Mexican states and the Federal District (i.e., Distrito Federal) will be developed. The overall Mexico NEI will consist of the merged inventories from these two steps.

It should be noted that U.S. EPA is in the process of improving spatial allocation factors in order to refine the area source emissions to be used in future regulatory photochemical and other atmospheric simulation models. As part of this effort, U.S. EPA has developed a 4 km grid domain that covers the continental United States and large portions of Canada and Mexico.[16] Although the six-state Mexico NEI domain (Figure 1) does not include the entire area within Mexico that is covered by the 4 km grid domain, emissions for the excluded portions of Mexico (plus the remainder of the country) will be developed under Phase III of the NEI project.

Pollutants

The Mexico NEI will include emissions estimates for six pollutants: volatile organic compounds (VOC); carbon monoxide (CO); nitrogen oxides (NO_x); sulfur dioxide (SO_2); particulate matter (PM); and ammonia (NH_3). All other pollutants including other visibility pollutants (i.e., elemental carbon and organic carbon), greenhouse gases (e.g., carbon dioxide [CO_2], methane, nitrous oxide, chlorofluorocarbons, etc.), and individual air toxic species will not be included.

VOC species are a subset of a broader group of hydrocarbons (HCs) called total organic gases (TOG), which include all carbonaceous compounds except for carbonates, metallic carbides, CO, CO_2, and carbonic acid. The distinguishing feature between TOG and VOC is that VOC does not include those TOG compounds that have limited, or no, photochemical reactivity. VOC includes only those hydrocarbons that are considered to be photochemically reactive; an alternative term for VOC is reactive organic gas (ROG). Most current emission factors are presented in terms of VOC. Some previous emission inventory efforts in Mexico have been somewhat ambiguous in using hydrocarbon nomenclature (i.e., emissions have been presented as TOG, VOC, and/or HC); hydrocarbon emissions in the Mexico NEI will be presented in terms of VOC. The scope of Phase II includes reconciliation of these ambiguous HC definitions within the existing inventories for Mexico.

Some previous emission inventory efforts in Mexico have estimated total suspended particulate (TSP) emissions (i.e., PM emissions smaller than 30 µm in aerodynamic diameter; however, the Mexico NEI will focus on fine PM: PM_{10} and $PM_{2.5}$ (i.e., smaller than 10 micrometers (µm) and 2.5 µm in aerodynamic diameter, respectively). Many PM emission factors are in terms of PM_{10}. $PM_{2.5}$ is important because of its visibility and regional haze impacts.

Spatial Resolution

Spatial resolution describes how specifically the geographic location of pollution sources in an inventory will be defined. In general, air quality modeling will require a detailed description of the spatial distribution of emission sources, while data limitations will often reduce the level of specificity

that can actually be provided. It is expected that the most basic level of spatial resolution for the Mexico NEI will be the state-level. It is possible that state-level emissions can be disaggregated down to the municipality-level based upon various types of surrogates, such as population or other types of census data. New information on spatial surrogates currently being developed by U.S. EPA will be reviewed and used, as appropriate, for the Mexico NEI.

A gridded inventory would be the most useful type of spatial resolution for air quality modeling. However, the current scope of the Mexico NEI project does not include development of gridded emissions. In addition, the use of grid cells that are too small might impact the confidentiality of individual point sources (i.e., only one point source is located in a particular grid cell, which clearly identifies the point source). In order to improve the usability of the Mexico NEI for modeling purposes, point source Universal Transverse Mercator (UTM) coordinates will be obtained wherever possible. The UTM coordinates, however, may need to be excluded from the reported results so that an appropriate level of confidentiality can be maintained.

Temporal Resolution

It is expected that the most basic level of temporal resolution for the Mexico NEI will be annual emissions for the 1999 base year. Development of emissions at the other levels of temporal resolution (e.g., seasonal, monthly, average daily, episodic daily, etc.) is not included in the Mexico NEI scope; however, this may be included in the future Mexico NEI updates.

EMISSIONS ESTIMATION METHODOLOGY

The overall approach for estimating emissions for the Mexico NEI uses a combination of "top-down" and "bottom-up" techniques. "Top down" generally means to apply national or regional data to estimate emissions on a smaller scale using allocation methods; "bottom-up" generally means using local activity data in combination with emission factors or models.

Point Sources

In the United States, point sources are typically defined using emission thresholds (e.g., greater than 100 tons per year of a criteria pollutant). However, in Mexico, point sources are defined as any facility that is established in one place only, with the purpose of developing industrial or commercial processes, service works, or activities that generate or can generate air pollutant emissions. A point source definition based upon emission quantities is not practical in Mexico given the different types of jurisdictions that exist. There are several different types of point sources in Mexico, which are based upon regulatory jurisdiction and/or ownership. Federal jurisdiction point sources are defined by two sets of criteria: source location and source type. Industrial sources that do not meet the source location and source type criteria are classified as state jurisdiction point sources. The source location criteria include industrial sources located at airports, train and bus stations, or ports under federal jurisdiction; located in industrial parks on federal land; and located within 25 km of the coastline. The source type criteria include the following:

- Industrial sources that are in 11 specific industrial sectors (i.e., chemical, petroleum and petrochemical, paints and inks, automotive, pulp and paper, metallurgical, glass, electricity generation, asbestos, cement and lime, and hazardous waste treatment);
- Industrial sources associated with industrial, commercial, and other activities conducted by federal agencies;
- Industrial sources located in the Metropolitan Zone of Mexico City;
- Industrial sources that affect neighboring states;

- Industrial sources that affect other countries;
- Industrial sources associated with the federal transportation system; and
- Industrial sources that are complex enough to require the participation of SEMARNAT.

Maquiladoras are Mexican assembly/manufacturing facilities that import duty-free component parts for processing. In general, maquiladoras do not meet the source type criteria described above and are considered to be state jurisdiction point sources. One exception to this is in the state of Chihuahua, where the local authorities have decided that the maquiladoras in the border region (i.e., within 100 km of the border) do have the potential to affect air quality in the United States. Thus, Chihuahua maquiladoras within 100 km of the region are designated as federal jurisdiction point sources.

For purposes of the Mexico NEI, point sources will be defined as federal jurisdiction point sources and state jurisdiction point sources (including maquiladoras). All federal and state jurisdiction point sources are required to have an air permit and to monitor their emissions according to the Mexican Official Standards (Normas Oficiales Mexicanas or NOMs). Monitoring is generally limited to particulate emissions and combustion gas emissions. Finally, all federal and state jurisdiction point sources submit an annual updated emissions inventory, which is called the Cédula de Operación Anual or COA. Point source facilities submit their annual COA updates in various formats; some facilities submit in electronic format, while other submit in hard copy format. The voluntary submittals of Section V of the COA provide data for the RETC database; however, the data may be incomplete.

The methodology used to develop point source emission estimates for the Mexico NEI will be based on emissions information from existing databases (i.e., SNIFF and RETC) and other types of records. Emissions data from these sources will be incorporated into the Mexico NEI without modification; however, a qualitative assessment of the accuracy and reliability of these data will be conducted as part of the quality assurance/quality control (QA/QC) process. In general, the methodology used to develop the six-state border region inventory, (Phases I and II) and the overall national inventory (Phase III) will not be significantly different. Due to their proximity to the United States, a larger number of maquiladora facilities are expected to be included in the six-state border region inventory.

Existing point source data are limited to seven regional inventories described above, and provide emissions aggregated by industrial sector. In addition, there are several other specialized inventories that provide some limited point source data.[11, 12, 13] Federal jurisdiction point source emissions data are contained in the SNIFF database. For the Mexico NEI development, the SNIFF data can be supplemented by other point source-related information that can be obtained from the RETC database. The ability to obtain these data is subject to approval of confidentiality agreements currently being developed. State- and local-jurisdiction point source emissions data will be obtained from state government offices and local authorities. Information pertaining to “micro-industries” (i.e., small, dispersed industrial activities such as dry cleaners, autobody shops, etc.) will be obtained from state/local authorities; these are expected to be in the form of business licenses, tax records, or simple observations. Note that micro-industry emissions may be included within the area source categories

Area Sources

Area sources are those sources that are too numerous and dispersed to be effectively included in the point source inventory. Collectively, however, area sources are a significant source of emissions. As discussed above, the definition of the point sources and area sources in the Mexico NEI will be based upon jurisdiction and/or ownership. For purposes of the Mexico NEI, area sources are defined as all stationary sources (except for federal and state jurisdiction point sources, which are defined as point sources~~s~~ point sources), as well as nonroad mobile sources (e.g., construction equipment, marine vessels, agricultural equipment).

For most area source categories, emissions will be calculated using activity data and an emission factor that relates the quantity of a pollutant released to a unit of that particular activity. A matrix showing all area source categories that will be included in the Mexico NEI is provided in Table 1. The source categories were identified according to the Volume V Area Source Manual, recent U.S. EPA inventory guidance, and Emission Inventory Improvement Program (EIIP) Area Source guidance documents.[1, 17, 18] Also, Table 1 identifies preferred and alternative data sources that are expected to be used in the development of area source emissions in the Mexico NEI.

Mobile Sources

For the Mexico NEI, mobile sources are defined as on-road motor vehicles (i.e., automobiles, trucks, and buses that were designed and licensed to operate on public roads). Non-road mobile sources, and motor vehicle emissions that occur due to idling at fixed, discrete locations (e.g., border crossings, bus depots, etc.) are considered to be area sources.

An innovative method for determining onroad motor vehicle activity (i.e., vehicle kilometers traveled, or VKT) was developed for the Mexico NEI . This method is based on development of average daily per capita emission estimates for seven different representative urban area sizes, then applying these per capita factors to all urban areas of similar size throughout the country of Mexico. The option of using daily per vehicle emission estimates instead of per capita emission estimates was examined; however, because of concerns about the accuracy of Mexico vehicle registration records, it was decided that per capita emission estimates would be more appropriate. Traffic volumes and congestion levels will be modeled for a representative urban area in each of seven size categories, from which per capita emission estimates can be developed (i.e., Mexico City; >2,000,000 people; 1,000,000-2,000,000 people; 250,000-1,000,000 people; 100,000-250,000 people; 25,000-100,000 people; and <25,000 people).

Because the trip generation rates are stable, it is possible to transfer known rates from limited case studies in Mexico (e.g., Ciudad Juárez) to other urban areas in the country. Disaggregated trip rates for Ciudad Juárez can be used as a basis for estimating traffic volumes in other urban areas. Trip rates can be then be disaggregated by household size and income. In addition to the trip generation estimation, a network system will be developed for each selected representative urban area. The final result will be "loaded" networks for the selected representative urban areas with traffic volumes and speeds at each of the links of the network. Traffic volume by link will be multiplied by the link's length to establish VKT by link. Finally, VKT by link will be summed for all links in the network to establish total VKT for the urban area. These estimated traffic volumes for the selected representative urban areas will be combined with emission factors that have been estimated using the MOBILE-Mexico and PART5 emission factor models to derive average daily per capita emission rates. These average daily per capita emission rates for each urban area size category can then be applied to any urban area in Mexico. In this procedure, comprehensive population statistics will be obtained from the Instituto Nacional de Estadísta Geografía e Informática (INEGI); regional temperature data will be obtained from the Comisión Nacional del Agua (CNA); and fuel characteristic data will be obtained from Petróleos Mexicanos (PEMEX).

Natural Sources

For purposes of the Mexico NEI, natural sources are defined as biogenic VOC emissions, soil NO_x emissions, and volcanic SO_2 emissions. Oil seeps and lightning are not included. The Volume VII Natural Source Manual, currently being developed by ERG, will be used for establishing natural source methodology for the Mexico NEI. The biogenic VOC emissions and soil NO_x emissions will be estimated using one of several biogenics models that currently exist. These biogenics models utilize species-specific biomass and vegetation data, temporal and meteorological data, land use/land cover

data, and biogenic emission mechanisms to estimate emissions. Volcanic SO_2 emissions are a natural source category that can be significant in Mexico given the level of volcanic activity. Most volcanoes located in Mexico have monitors in place. Although these monitoring data will likely not be as accurate or complete as typical point source monitoring data, they will be used to estimate volcanic SO_2 emissions.

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Figure 1. Overall Mexico NEI Domain

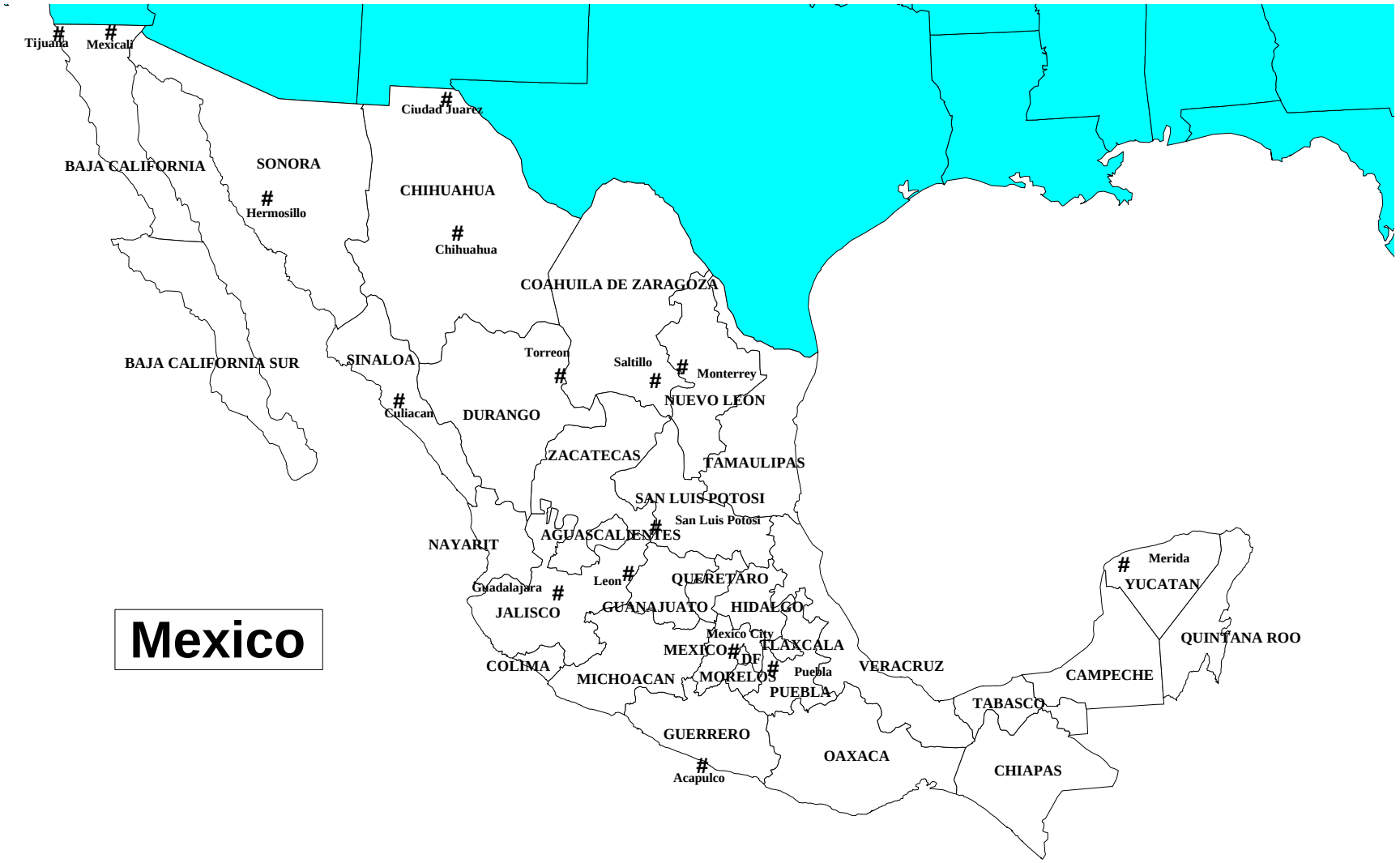

Table 1. Mexico NEI Area Source Matrix.

Category Name	Activity Data Needed	Source of Activity Data	Emission Factor or Alternative Methodology
Fuel Combustion (Fossil Fuel)	Fuel usage	Fuel balance (PEMEX and other fuel distributors)	Fuel-specific emission factors (AP-42, Chap. 1; EIIP Area Source Abstracts) or extrapolate existing inventories
Fuel Combustion (Waste-Derived Fuel, etc.)	Fuel usage	Local officials	AP-42 (Sections 1.9 and 1.10; ASM, Section 4.3) or fuel equivalence method (ASM, Section 4.3)
Locomotives	Railroad fuel usage; number of yard locomotives	FNM	ASM, Section 5.1; other U.S. EPA documents
Commercial Marine Vessels	Commercial marine fuel usage	DGP; local port authorities	ASM, Section 5.2; other U.S. EPA documents
Aircraft	Landing and takeoff data	ASA; local airport authorities	ASM, Section 5.3; other U.S. EPA documents
Other Non-Road Mobile Equipment	Equipment population	Local officials, NONROAD-Mexico	NONROAD-Mexico model
Border Crossings	Vehicle counts, wait times	U.S. Border Patrol	MOBILE-Mexico model
Bus/Truck Terminals	Vehicle counts, wait times	Bus and truck companies	MOBILE-Mexico model
Consumer Solvent Use	Solvent usage	Solvent balance (ANAFAPYT)	Per capita emission factor (EIIP – Vol. III, Chap. 5; ASM, Section 6.9)
Architectural Surface Coating	Solvent usage	Solvent balance (ANAFAPYT)	Per capita emission factor (EIIP – Vol. III, Chap. 3; ASM, Section 6.3)
Autobody Refinishing	Solvent usage	Solvent balance (ANAFAPYT)	Per employee emission factor (EIIP – Vol. III, Chap. 13; ASM, Section 6.2)
Degreasing	Solvent usage	Solvent balance (CANACINTRA)	Per employee emission factor (EIIP – Vol. III, Chap. 6; ASM, Section 6.5)
Dry Cleaning	Solvent usage	Solvent balance (CANALAVA)	Per employee/capita emission factor (EIIP – Vol. III, Chap. 4; ASM, Section 6.6)
Graphic Arts	Solvent usage	Solvent balance (ANAFAPYT)	Per capita emission factor (EIIP – Vol. III, Chap. 7; ASM, Section 6.7)
Traffic Markings	Solvent usage	Solvent balance (ANAFAPYT)	Per capita emission factor (EIIP – Vol. III, Chap. 14; ASM, Section 6.4)
Asphalt Application	Asphalt Usage	Refineries, local agencies	EIIP – Vol. III, Chap. 17; ASM, Section 6.8
Gasoline Distribution	Fuel distribution statistics	Fuel balance (PEMEX)	Fuel specific emission factors (AP-42, Chap. 5; EIIP – Vol. III, Chap. 11) or extrapolate existing inventories
LPG Distribution	LPG distribution statistics	Fuel balance (LPG distributors)	ASM, Section 7.3 or extrapolate existing inventories
Bakeries	Population	INEGI	EIIP Area Source Abstracts; ASM, Section 8.1 or extrapolate existing inventories
Brick Manufacturing	Fired brick quantities	Local agencies	ASM, Section 8.2
Construction Activities	Construction acreage or value	Cámara Nacional de la Industria de la Construcción, local agencies	ASM, Section 8.3
Charbroiling/Street Vendors	Number of charbroilers, amount of meat cooked	Local agencies	EIIP Area Source Abstracts; ASM, Section 8.4 or extrapolate existing inventories
Pesticide Application	Pesticide usage, applied acreage, application method, pesticide characteristics	SAGAR, CICOPLAFEST, local agencies	EIIP – Vol. III, Chap. 9; ASM, Section 9.1)

Table 1. Continued.

Category Name	Activity Data Needed	Source of Activity Data	Emission Factor or Alternative Methodology
Beef Cattle Feedlots	Annual throughput, average stay	SAGAR, INEGI	ASM, Section 9.2
Agricultural Burning	Acreage burned, fuel loadings	SAGAR, CICOPLAFEST, local agencies	ASM, Section 9.3
Fertilizer Application	Fertilizer usage, nitrogen content	SAGAR, CICOPLAFEST, local agencies	ASM, Section 9.4
Animal Waste	Livestock population	SAGAR, CICOPLAFEST, INEGI, local agencies	ASM, Section 9.5; other ammonia emission factor documents
Agricultural Tilling	Acreage tilled, number of yearly operations, silt content	SAGAR, CICOPLAFEST, local agencies	ASM, Section 9.6
Open Burning – Waste	Quantity of waste burned	Local agencies	EIIP – Vol. III Chap. 16; ASM, Section 10.2; or per capita waste generation rates, default burning percentages
Wastewater Treatment	Quantity of wastewater treated	Comisión Nacional del Agua	ASM, Section 10.3
Wildfires	Acreage burned	INE	ASM, Section 11.1
Structure Fires	Number of fires	National fire protection association	ASM, Section 11.2
Paved/Unpaved Road Dust	VKT, silt loading content, vehicle characteristics	Developed in conjunction with mobile source emissions	AP-42, Chap. 13.2.1; ASM, Section 11.3/11.4
Wind Erosion	Disturbed acreage, soil characteristics, meteorological data	Local agencies, Comisión Nacional del Agua	ASM, Section 11.5
Domestic Ammonia Emissions	Population	INEGI	ASM, Section 11.6

ANAFAPYT = Asociación Nacional de Fabricantes de Pinturas y Tintas (National Association of Point and Dye Manufacturers)
AP-42 = *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources*[19]
ASA = Aeropuertos y Servicios Auxiliares (Airports and Auxiliary Services)
ASM = Area Source Manual[17]
CANACINTRA = Cámara Nacional de la Industria de la Transformación (National Chamber of Manufacturing Industry)
CANALAVA = Cámara Nacional de la Industria de Lavanderías (National Chamber of the Dry Cleaning Industry)
CICOPLAFEST = Comisión Intersecretarial para el Control del Proceso y Uso de los Plaguicidas, Fertilizantes y Substancias Tóxicas (Interagency Commission for Control of Pesticides, Fertilizers, and Toxic Substances)
DGP = Dirección General de Puertos (Director of Ports)
EIIP = Emission Inventory Improvement Program[18]
FNM = Ferrocarriles Nacionales de México (National Mexican Railways)
INE = Instituto Nacional de Ecología (National Institute of Ecology)
INEGI = Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography, and Computing)
LPG = Liquefied petroleum gas
PEMEX = Petróleos Mexicanos (Mexican Oil Company)
SAGAR = Secretaría de Agricultura, Ganadería y Desarrollo Rural (Secretariat of Agriculture, Livestock, and Rural Development)
VKT = vehicle kilometers traveled

KEY WORDS

Mexico
Emissions inventory
Point sources
Area sources
Mobile sources
Criteria pollutants