Wilmington Air Quality Study: Emissions Inventory Development and Evaluation

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ABSTRACT

The California Air Resources Board is conducting an emissions inventory and air quality modeling study in the Wilmington neighborhood of Los Angeles as part of its ongoing Neighborhood Assessment Program. Our study objective is to assess the application and performance of regional and local scale models used to estimate pollutant concentrations in the community at a fine resolution. We use local scale models to estimate pollutant concentrations caused by the direct transport of pollutants from sources in the modeling domain. Because local scale modeling results are dependent upon the quantity and location of emissions, we are focusing on developing and evaluating a spatially resolved emissions inventory. Our local scale modeling inventory is divided into three non-traditional categories based on data collection methodologies: industrial and commercial facilities, on-road mobile sources, and off-road engines related to marine terminals and other sources. Our goal is to compile as representative and robust an inventory for local scale modeling as possible, and to evaluate the quality and performance of this inventory to support local scale modeling and risk assessment. Results from our evaluation will be used to improve inventory and modeling methodologies for neighborhood assessment. In this paper, we describe our methodologies for inventory development and plans for inventory data evaluation.

INTRODUCTION

In 1999, the California Air Resources Board (ARB) initiated its Neighborhood Assessment Program to develop and test methodologies for evaluating the impacts of air pollution on a neighborhood scale[1]. In order to conduct neighborhood assessments, ARB staff uses regional and local scale models. Regional models are used to assess long-range transport and transformation of pollutants within an air basin while local scale models are used to assess the direct transport of pollutants to receptors. To evaluate and improve this methodology, we have initiated several studies. We focused our first neighborhood assessment on Barrio Logan, a neighborhood in San Diego. Our second study is focused on Wilmington, a neighborhood in the city of Los Angeles located near the Ports of Los Angeles and Long Beach. We chose Wilmington for several reasons. In 1998, the South Coast Air Quality Management District (SCAQMD) identified Wilmington as one of the communities most impacted by air pollution in the Los Angeles region[2]. Wilmington is located in close proximity to major freeways, ports, petroleum refineries, and other sources. Smaller local emissions sources are present in Wilmington, some of which are located in close proximity to residential areas. The Wilmington study domain is shown in Figure 1, and includes Wilmington (defined as ZIP code 90744), and surrounding ZIP codes.

The objective of the Wilmington Air Quality Study (WAQS) is to develop and evaluate a modeling methodology capable of assessing the impact of toxic air contaminants in the community at a fine resolution. Because model evaluation is an important goal of our study, we have designed our analysis to focus on both emissions inventories and the application of models to assess exposure. Using different model evaluation techniques allows us to assess the performance of our modeling system so that we can better understand how to interpret and improve modeling results. Figure 2 displays a conceptual diagram of the WAQS study design.

Because emissions inventories are critical inputs to local scale dispersion models, their accuracy and performance must be considered when evaluating model results. This paper describes our methodology for compiling local scale emissions inventories for neighborhood assessment, as applied to our study in Wilmington. We divide our local scale inventories into three non-traditional categories based on how data are collected and calculated for this study: industrial and commercial facilities, on-road mobile sources, and off-road engines related to marine terminals and other sources. Our goal is to develop a robust, spatially resolved, process and stack level inventory for use in local scale models. This paper also describes our plan for evaluating the performance of these inventories to support local scale modeling. To evaluate inventory performance in this study, we apply improved quality control and assurance procedures to assess data accuracy, completeness, and uncertainty. Our evaluation is designed to answer specific hypothesis about how future local scale inventories should be developed.

INDUSTRIAL AND COMMERCIAL FACILITIES

For the purposes of this study, we initially consider all industrial and commercial facilities that might impact pollutant concentrations in Wilmington. We include in this category all point and mobile emissions sources that can be identified to occur at these facilities, excluding emissions due to on-road and off-road activities at marine terminals, and operation of locomotives. To compile this inventory, we first develop a list of facilities. We then collect inventory data from as many different sources as possible, and identify data gaps. We conduct surveys to augment inventories to fill data gaps, and to enhance our ability to assess data quality. The inventory is compiled to a single database by assigning inventory from the most complete data source or sources representing each facility.

Development of Facility Lists

We develop a facility list to ensure all point sources in the modeling domain are identified. Since the community of Wilmington is the focus of our study, we included all businesses in ZIP code 90744, and only facilities outside of ZIP code 90744 whose volume or toxicity of emissions might impact predicted pollutant concentrations in Wilmington. To compile our list, we used eight data sources:

- InfoUSA – commercial business list (90744)
- City of Los Angeles – business permit list (90744)
- South Coast Air Quality Management District – list of facilities with permits (90744)
- California Department of Toxics Substances Control – list of hazardous waste generators and/or treatment, storage, and disposal facilities (90744)
- Los Angeles Regional Water Quality Control Board – list of facilities that must comply with storm water requirements (90744)
- U.S. Environmental Protection Agency (EPA)– ENVIROFACTS list of federally regulated facilities (90744)
- ARB Periodic Smoke Inspection Program – list of regulated facilities (90744)
- ARB Emissions Inventory Database – list of facilities with emissions inventories (all ZIP codes)

After collecting data from each of these databases, we merged them into a single file. We removed duplicates if several record names and addresses matched, even if they were not completely identical.

Collection of Data Sources

After compiling a facility list, we collect emissions inventory data from databases maintained by federal, state, and local governments. We obtained data from the following databases:

- EPA Toxics Release Inventory (TRI) – Facilities covered by regulated SIC codes that release selected pollutants in excess of minimum thresholds must perform a mass balance to quantify and report environmental releases. We collected available TRI data for all facilities in the modeling domain.

- ARB CEIDARS Toxics database – The Hot Spots Program regulates facilities in California whose emissions exceed specified minimum thresholds. Facilities covered by this program must report emissions of air toxics periodically and report emissions inventories to local air districts. Districts subsequently report these data to ARB, and we maintain these data in the CEIDARS database. We collected available data for all facilities in the modeling domain for database years 1996-2000. To enhance quality control and assurance, we also collected data for 21 facilities directly from publicly available air district files.
- Health Risk Assessments Conducted for the Hot Spots Program – The Hot Spots Program requires facilities whose estimated health risks exceed screening criteria to perform a health risk assessment, document results, and submit a report to local districts. We collected health risk assessment data for every facility required to prepare one in the modeling domain.
- ARB CEIDARS Criteria database – The ARB collects criteria pollutant emissions data from multiple sources available at local districts and maintains data in the CEIDARS database. We obtained available data for all facilities in the modeling domain from database years 1996-2000.
- SCAQMD Annual Emissions Reports – SCAQMD requires facilities that emit pollutants in excess of specific thresholds to report emissions of criteria and selected toxic pollutants on an annual basis. Reporting years begin in June and end in May of the following year. We obtained data for facilities in ZIP code 90744. We collected reporting years 1998-1999 and 1999-2000, the most recent validated inventory data available.
- SCAQMD Permit Emission Estimates – We collected copies of permits for equipment located at facilities in ZIP code 90744 whose facility-total emissions did not exceed annual emission reporting requirements, and for selected categories of equipment like stationary diesel engines at all facilities in the modeling domain. Some permits contained emission estimates for criteria or toxic pollutants; others contained information that we used to estimate emissions. In a database, we compiled both reported and calculated emissions estimates from 590 permits.
- California Energy Commission Database of Emergency Generators – The California Energy Commission maintains a database providing the location and characteristics of diesel engines used for emergency power generation. We collected data and estimated emissions for engines located in ZIP code 90744.
- Los Angeles Unified School District (LAUSD) – The LAUSD periodically conducts facility surveys in the vicinity of proposed school sites. In the Spring of 2001, LAUSD staff surveyed over 50 facilities in ZIP code 90744. In 2002, we collected these data from LAUSD.

Facility Surveys

We use surveys to help fill data gaps for facilities not covered by emissions inventory data sources. Our approach was to first evaluate our facility list to identify those in ZIP code 90744 for which emissions inventory data were not available. These facilities were targeted for survey. When surveying these facilities, we quantified emissions from solvent and paint usage, gasoline dispensing, welding and related processes, operation of on-road and off-road diesel-fired equipment and other processes. We also identified the location and condition of emission releases. Overall, we attempted to survey 263 of these facilities in selected categories, as shown in Table 1. We found many of these businesses to be out of business, closed for business during our survey, or to have no emissions of consequence. We completed surveys and calculated inventories for 118 facilities.

We also use surveys to enhance our ability to assure inventory quality. We identified 52 facilities in our CEIDARS database that, because of toxicity or volume of emissions, were expected to have a strong impact on modeling results. Our approach was to survey each facility by requesting most recent SCAQMD annual emission reports, health risk assessments, and other inventory related data sources as available. We then toured the facility to identify the location and release parameters associated with major emission release points. During surveys, we collected information about the operation of dieselfueled trucks and off-road equipment on facility property, as well as other emissions sources not included in reported inventories. Overall, we collected data representing all 52 facilities as shown in Table 1. Because we conduct surveys on a voluntary basis, some facilities chose not to participate. For this reason, and because appointments could not be scheduled for several others, we could not complete some surveys. Instead, we collected limited data, either from the facility or local district, representing 13 of these facilities. After conducting surveys, we compiled emissions inventory and release data into a single inventory characterizing emissions from each facility.

Inventory Compilation

To compile an inventory of emissions from industrial and commercial facilities, we first established a format for inventory data, which included process rate and emissions factor information, location coordinates, daily and monthly temporal activity, and release parameters for modeling. We then formatted all inventory data sources and established a hierarchy for incorporating these data into a single draft inventory each for criteria and toxic pollutants. We based our hierarchy on three principles: surveyed data are preferable to data from non-surveyed sources, more recent data are preferable to older data, and more comprehensive data sources are preferable to less comprehensive data sources. Table 2 describes the number of facilities integrated into these databases from each inventory source. The first draft of this inventory, completed in February 2003, contained criteria inventories for 260 facilities and toxics inventories for 406 facilities.

When compiling the inventory, we placed a higher priority on including inventory data sources, like surveys or health risk assessments, which contained information about release parameters or temporal activity patterns. When these data were not present, we made assumptions and assigned defaults. We assigned default activity patterns to facilities based on the types of processes known to occur at each facility. We assigned default spatial locations using geographical information systems (GIS) with a 10 meter default setback from the street. We assigned default release parameters by SCC code or process description using default stack parameters developed for EMS-HAP,[3] an emissions inventory software program developed by the U.S. EPA. If SCC codes and process descriptions were not available, or if emissions were estimated to be released at ground level, we assigned a default five cubic meter volume source. Overall, we assigned release parameter and location defaults for 30% of the toxics inventory records and 70% of the criteria inventory records.

ON-ROAD MOBILE SOURCES

In California, emissions inventories representing on-road vehicles are compiled at a coarse resolution, such as a county. When necessary for regional modeling, they are spatially allocated to grid cells that are several kilometers square in size. Because local scale models require a greater spatial resolution than surrogates are designed to provide, we use an alternate approach for this study. Our alternate approach requires information about the number, speed, hourly distribution, and other characteristics of the vehicle fleet on each street link. A link is defined as a discrete section of a roadway that can be characterized using a single estimate for the number and average speed of vehicles. Vehicle fleet characteristics include vehicle classification, model year, technology type, and fuel. To calculate emissions, link specific data are matched to composite emission factors, developed using EMFAC 2002[4], that account for temperature, relative humidity, and fleet characteristics in Los Angeles County. Speciation profiles, developed by ARB, are applied to quantify toxics emissions associated with criteria pollutants. UC Davis compiled temporal activity profiles for the South Coast Air Basin[5] and these are used for this study.

To develop this inventory, we use output from travel demand models. In Los Angeles, the Southern California Association of Governments (SCAG) maintains a travel demand model that is used to forecast travel behavior on a regional basis. The SCAG model estimates the volume and speed of lightduty and heavy-duty vehicles on a link specific basis. Model network links are classified into freeways, ramps, major arterials, minor arterials, collectors, and centroid connectors. The model predicts vehicle volumes and speeds using algorithms that depend upon socioeconomic data that depict housing and employment characteristics surrounding each link. The SCAG model network is shown in Figure 3. This network is intended to be merely a sketch of existing roads and is meant to summarize travel in a given region. As a regional model, the majority of validation efforts use traffic counts on freeways where vehicle travel is most concentrated. In some cases, especially minor arterials and residential streets, the roadway network in the model is not consistent with more accurate roadway layers developed for GIS. Therefore, the accuracy of vehicle volume and speed estimates on each link, as well as the estimated location of each link declines as traffic volume on a link decreases. For these reasons, we expect exhaust emissions estimates generated based on travel demand models to be uncertain. We expect both uncertainty in emissions estimates and the spatial allocation of emissions for minor arterials, collectors, and centroid connectors to be much greater than for higher volume freeways.

While the development of a link-based inventory is technically feasible, it is unclear the extent to which available databases are sufficiently accurate to support such an assessment. Assumptions, such as temporal activity patterns or fleet characteristics, which make sense in a regional evaluation, may not pertain to conditions on individual links. Some emissions categories are not easily calculated or spatially allocated on a local scale in a meaningful way. These include vehicle starts and non-running vehicle evaporative losses. These categories do contribute substantially to air toxic emissions. As a result, we focus our efforts on both development and evaluation of this inventory. Our first draft inventory contains almost 2000 links, of which about 48% are freeways, ramps, and major arterials. We estimate these links, which exclude minor arterials, collectors, and centroid connectors, account for roughly 80% of all estimated diesel particulate matter emissions in our modeling domain. We estimate our modeling domain contains roughly three percent of both the predicted vehicle miles traveled and emissions of diesel particulate matter in Los Angeles County.

OFF-ROAD EMISSIONS RELATED TO MARINE TERMINALS AND OTHER SOURCES

Marine terminals are facilities dedicated to the transport and transfer of goods to and from ocean-going vessels. These facilities may not contain traditional point sources, and may not be required to report emissions inventories to local authorities. Nevertheless, emissions in the vicinity of marine terminals generated by mobile sources that support them can be substantial, and are generated by many different categories of equipment. Emissions are generated by ocean-going vessels that pick-up and deliver goods at marine terminals and by harbor craft such as tug boats that support the operation of ocean-going vessels in the harbor area. Emissions are also generated by the use of off-road equipment such as forklifts, loaders, and yard hostlers that move goods within terminal boundaries, heavy-duty trucks that operate both outside and inside marine terminals, and locomotives.

In California, off-road mobile emissions are quantified using ARB's OFFROAD model and on-road mobile emissions are quantified using EMFAC 2002. Both of these models use a top-down inventory approach to quantify emissions on a county level. To prepare inventories for regional modeling, spatial surrogates are used to allocate emissions to grid cells. Because spatial surrogates are not designed to allocate emissions to their actual release locations, their use in local scale models can be problematic. We decided to use a bottom-up approach for off-road categories because of the large number of engines and high volume of emissions generated by activities at marine terminals and related sources in our modeling domain.

To quantify emissions of diesel particulate matter at marine terminals, we established a partnership with the Ports of Los Angeles and Long Beach. Through this partnership, the Ports are developing spatially and temporally resolved emissions inventories representing the most important diesel particulate emissions categories in our modeling domain: commercial marine vessels; harbor craft; dockside equipment including yard hostlers, top loaders, side loaders, forklifts, off-road trucks, portable equipment, rubber tire gantry cranes, and others; on-road vehicle idling and movement, and operation of locomotives. The Ports are calculating emissions from these categories that occur within the boundaries of port property. We expect to receive these data in the fall, 2003.

Off-road emissions also occur outside of port boundaries. Sources include emissions from locomotives in the modeling domain and off-road equipment used at industrial or commercial facilities and for construction. For locomotives, we work with local rail companies to estimate emissions on a rail-link specific basis. We anticipate compiling these data in the summer, 2003. On-site surveys are used to estimate emissions from on-road vehicle travel and off-road equipment operated at industrial and commercial facilities, and are incorporated into industrial and commercial facility inventories. Because not all industrial and commercial facilities could be surveyed, the contribution of diesel particulate matter from off-road sources in the community is uncertain. This is a focus of our inventory analysis. Source categories, like construction, are transient in nature. Because health risk assessments account for long-term exposures, we do not include these categories in local scale modeling applications for neighborhood assessment. Regional modeling will also be used for our study and covers all emissions categories developed using EMFAC2002 and OFFROAD.

ANALYSIS AND VERIFICATION OF LOCAL SCALE EMISSIONS INVENTORIES

Inventory data evaluation is a major goal of our study because the performance of local scale models is substantially affected by emissions inventories. To conduct this evaluation, we apply expanded and improved quality control and assurance procedures that meet and exceed those typically used to evaluate regional or statewide inventories. Typical quality control and assurance procedures focus on ensuring data meet standards for completeness, consistency, and accuracy that focus on the inventory database as a whole[6]. These procedures are not necessarily designed to capture errors in individual facilities. Individual errors may contribute little to regional inventory and modeling results, but may alter local scale modeling results. Therefore, we believe this higher level of quality control and assurance is necessary for local scale modeling inventories. Results from our data evaluation efforts will be used to improve methodologies for developing emissions inventories to support local scale modeling for neighborhood assessment.

Industrial and Commercial Facilities

Quality control and assurance procedures are especially important for developing point source inventories, because these inventories are reported by facilities. Government agencies are responsible for compiling and maintaining primary emissions inventory databases and apply quality control and assurance procedures designed to minimize reporting errors. Some, such as those applied by the SCAQMD for their Annual Emissions Reporting program, are quite extensive[7]. For this study, we first apply more typical quality control and assurance procedures. Through these procedures we ensure all data fields are complete and formatted correctly, and examine emission totals to ensure they appear reasonable. We summarize data by age, data source, and percentage of records with default assumptions, all of which are direct indicators of data quality.

We also apply improved quality control and assurance procedures designed to evaluate the inventory on a spatial scale, because the spatial distribution of emissions affects local scale modeling results. This analysis is not typically applied to other emissions inventories as part of normal quality control and assurance procedures. We use GIS to determine how individual inventory data sources contribute to the spatial distribution of emissions in the inventory and to identify errors that may not be identified through typical quality control and assurance procedures. We use toxicity-weighted emissions score calculations to weight emissions according to cancer potency or severity of potential chronic health impacts[8]. GIS tools can be used to display those facilities, or areas of the modeling domain with the highest scores that may require additional evaluation. GIS tools can also be used to determine which pollutants are the most important contributors to local scale risk.

Evaluating Inventory Databases

One of our objectives is to evaluate the extent to which inventory databases reflect current activities at facilities in the modeling domain. In 2002, we collected inventory data available from 52 facilities through on-site surveys. We plan to compare survey results to databases containing inventories provided through the Hot Spots Program to better understand how well these data represent current activities at facilities. We also intend to evaluate inventory data, obtained from the SCAQMD Annual Emissions Reporting program, across several reporting years for the same facilities. This evaluation will help us to better understand how rapidly conditions change over time at individual facilities, and therefore how representative a single estimate may be in representing long-term exposures. Finally, we obtained primary inventory records from publicly available data files for selected facilities in May, 2002. Evaluating these data against our statewide database will help us determine the potential for transcription or other errors in our emissions inventory that are not caught through typical quality control and assurance procedures. Results from these analyses will help us identify additional quality control and assurance techniques that we can use in the future to improve confidence in statewide and local scale emissions inventories.

Assessing the Contribution of Neighborhood Sources to a Local Scale Inventory

Another objective of our evaluation is to determine the contribution of “neighborhood” source facilities, that are not included in the statewide inventory, to local scale inventories. If neighborhood sources are not important to include in local scale inventories, they should not contribute substantially to either the overall emissions inventory or the spatial patterns of toxicity-weighted emissions in the modeling domain at a scale of resolution we wish to achieve. In 2002, we surveyed 118 facilities including gasoline stations, dry cleaners, auto body shops, metal fabricators, and other smaller manufacturing shops. These facilities typically fell below reporting thresholds for point source emissions inventory programs. During these surveys, we also focused on facilities, like warehouses, that have no traditional point sources, but serve as magnets for on-road traffic. During all surveys, we estimated emissions from any identified off-road mobile equipment. This analysis will help us determine the significance of off-road inventory sources to local scale emissions inventories.

Estimating Uncertainty in Local Scale Emissions Inventories

Emissions inventories are affected by both error and uncertainty. Most errors can be corrected through a careful quality control and assurance process. Uncertainty is generated by errors that are not identified, by uncertain measurement techniques used to develop emission factors, by uncertain application of generic emission factors to specific equipment or processes, by variability in process rates over time, and by many other factors. One way to assess uncertainty in emissions inventories is to assess reporting uncertainty, which we define as the differences between facility reported emissions in different data sources and reporting years. To analyze reporting uncertainty, we collect and analyze data from a variety of different local, state, and federal data sources over multiple reporting years. Comparing these data will help us better understand how inventories change over time and how error and uncertainty might affect confidence in local scale modeling results.

On-Road Sources

Quality control and assurance is also an important goal for evaluating our on-road inventory. We focus both on evaluating the performance of our methodology, and on determining which types of roadways contribute in a meaningful way to local scale modeled health risks. Our first step in this process is to evaluate travel demand model data and uncertainties inherent in using travel demand models for our approach to local scale assessment. Travel demand models are used to assess the volume and speed of vehicles on individual roadway links. To assess travel demand model output, we would ideally like to compare model results to observed values over time. These data are not available. However, limited traffic count data are available from two traffic studies conducted in and around the Ports of Los Angeles and Long Beach between 2000-2003. These data will provide vehicle counts and limited classification data on individual links and intersections that can be used to evaluate travel demand model predictions of traffic volume. No data will be available to validate assumptions regarding vehicle speeds, most fleet characteristics, temporal allocation of vehicles, and other factors that affect uncertainty in the on-road inventory. As a result, we plan to conduct a sensitivity analyses to determine which model inputs will have the most important impacts on emissions inventories and model results. Through this analysis, we hope to better target future research initiatives to improve local scale on-road inventory methodologies.

Our second step in this process is to qualitatively evaluate assumptions that are made in applying our inventory methodology. We intend to highlight assumptions that limit the utility of using travel demand models and other related assumptions for developing local scale inventories. Coupling this analysis with sensitivity analysis results should help us determine the most efficient steps to improve local scale on-road inventories. Using GIS, we can assess local scale toxicity-weighted emissions at different scales of resolution. Some types of streets may not impact the spatial pattern of toxicity-weighted emissions at relevant resolution scales. This analysis will help us determine which types of streets, or estimated roadway volume/speed combinations are important to assess in a local scale inventory. This analysis will also help us determine whether errors in spatial allocation of emissions in the travel demand model network for low volume sources necessitates development of additional methods to allocate emissions in a more representative way.

Uncertainty Analysis

One way to assess model performance is to analyze sources of uncertainty in air quality models and how those various sources of uncertainty affect model results. To assess uncertainty, we expand upon a methodology developed for our first neighborhood assessment, focused in the Barrio Logan neighborhood of San Diego[9]. This methodology, developed for assessing uncertainty from several sources of one pollutant at one facility, dictates that a modeling system be separated into components, including emissions inventories. We intend to study uncertainty in predicted pollutant concentrations generated by local sources for two categories of pollutant generating processes in Wilmington: gasoline service stations and diesel internal combustion engines. Gasoline service stations were chosen because of their close proximity to residential receptors in Wilmington. Diesel engines were chosen because of their expected contribution to health risks in the community as a whole. We expect uncertainty analysis will provide insight to modeling results and help us improve neighborhood assessment guidelines.

CONCLUSIONS

The Wilmington Air Quality Study is a comprehensive air quality modeling study designed to assess the impacts of air pollution on a spatially resolved basis. To support local scale models, we develop local scale emissions inventories. Our goal is to develop inventories that are both robust and spatially resolved. We then focus on determining how data assumptions, quality, and uncertainty in these inventories might affect performance of local scale models, and how inventory development methodologies might be expanded to improve local scale modeling results.

REFERENCES

1. California Air Resources Board, 2000: Neighborhood Assessment Program Work Plan. Available from: http://www.arb.ca.gov/ch/programs/nap/nap.htm
2. South Coast Air Quality Management District, 1999: Multiple Air Toxics Exposure Study in the South Coast Air Basin: MATES-II Final Report.
3. Strum, M., and Mason, R.: 2002. User's Guide for the Emissions Modeling System for Hazardous Air Pollutants (EMS-HAP), Version 2.0. US Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA 454/B-02-001. Available from: http://www.epa.gov/scram001/userg/other/emshapv2ug.pdf
4. California Air Resources Board, 2002: EMFAC 2002 Release, Available from http://www.arb.ca.gov/msei/on-road/latest_version.htm
5. Niemeier, D., Kim, S.E., Hicks, J., and Korve, M., 1999: Draft Final Report: Comparison of 1997 and 1998 Estimated Highway Allocation Factors: Disaggregation of Travel Demand Model Volumes to Hourly Volumes in the South Coast Air Basin. University of California at Davis Institute of Transportation Studies.
6. California Air Resources Board: 1996. Emission Inventory Procedural Manual: Volume 1 - Inventory Development Process.
7. Nazemi, M., Pirveysian, Z., Chang, E, Meskal, N., 2002. Improved Point Source Inventory Through Validation and Audit of Reported Data, South Coast Air Quality Management District.
8. California Air Pollution Control Officer's Association: 1990. Air Toxics Hot Spots Program Facility Prioritization Guidelines, California Air Pollutant Control Officers Association in consultation with the California Department of Health Services and California Air Resources Board.
9. Sax, T., and Isakov, V., 2003: A Methodology for Assessing Uncertainty in Near-Field Regulatory Air Quality Modeling Applications, submitted to *Atmospheric Environment*.

KEY WORDS

Air Toxics
Cumulative Impacts
Emissions Inventory
Environmental Justice
Neighborhood Assessment
Uncertainty Analysis

DISCLAIMER

The contents of this paper and the findings of its authors do not necessarily reflect the opinions, views, and policies of the California Air Resources Board. Mention of trade names or commercial products does not constitute endorsement or recommendation for their use.

FIGURES

Figure 1. Wilmington Air Quality Study Modeling Domain

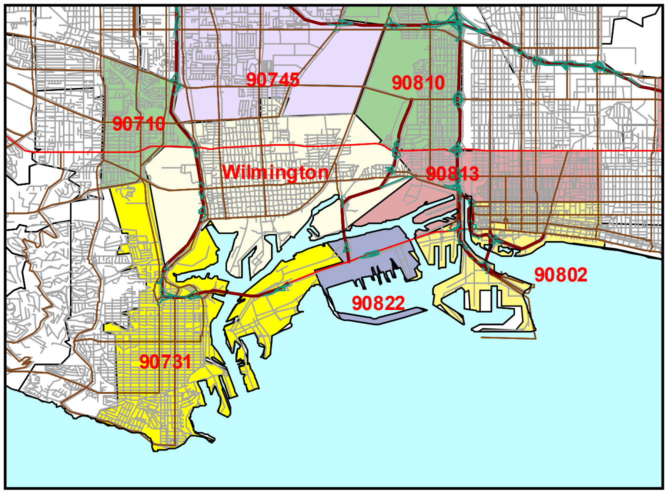


Figure 2. Wilmington Air Quality Study Conceptual Plan

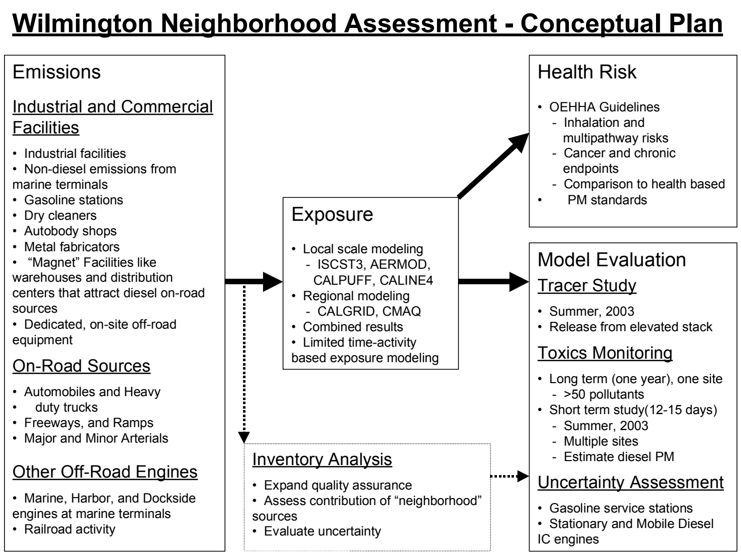
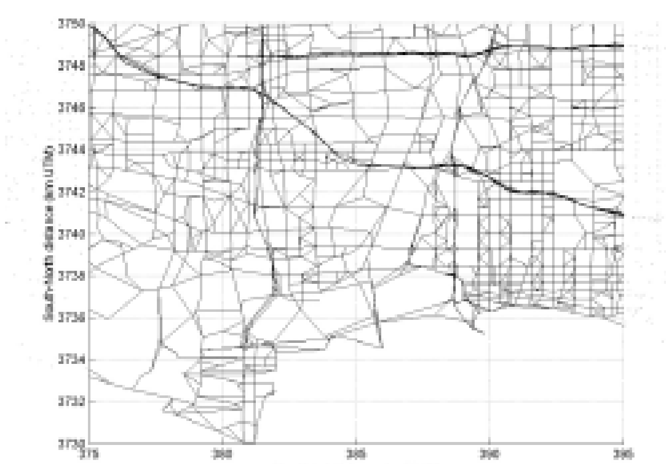


Figure 3. SCAG Travel Demand Model Network – Southern Los Angeles and Western Long Beach



TABLES

Table 1. Classification of Facilities Surveyed by ARB

	Attempted	Emissions Identified
Non-CEIDARS Facilities[1]	263	**118**
Auto Body Shops	--	9
Manufacturing	--	14
Container Storage and Repair	--	4
Dry Cleaners	--	2
Gasoline Dispensing	--	10
Metal Plater	--	5
Recycling	--	10
Waste Handling	--	3
Misc Service Related Facilities	--	6
Sulfur Handling	--	2
Truck Dispatching and Fleet Services	--	19
Welding Facility	--	5
Warehouse	--	28
Open Yard	--	1

	SIC	Number Surveyed
CEIDARS Facilities[2]		**52**
Full Survey[3]		*39*
Petroleum Refining and Support Facilities		
Petroleum Refineries	2911	5
Terminals	4226, 5171	8
Coke Facilities	2911, 5052, 2999	5
Extraction	1311	5
Other	2813, 3531, 2819	3
Ship Repair	3731	2
Other Materials Handling at Ports	4491, 723	5
Manufacturing	28xx, 39xx	3
Power Plants	4911	1
Municipal Solid Waste Incinerator	4911, 4953	1
Coast Guard Facility	--	1
Limited Survey[4]	--	*13*

1 Facilities for which emissions inventory data were not available or extremely limited. Facility categorization based upon primary activities conducted on-site.
2 Facilities for which inventory were reported in ARB's statewide emissions inventory database.
3 Full survey indicates that the latest AQMD annual emission reports, health risk assessments, and purchase or other records were collected if available. If necessary, a facility walk-through and an inventory of on-road and off-road diesel engine activity were collected on-site.

Table 2. Number of Facilities in Draft Final Inventory by Data Source

	Number of Facilities	
Data Source	**Toxics Inventory**	**Criteria Inventory**
CEIDARS Surveys		
Primary Data Source: Health Risk Assessment	10	
Primary Data Source: Annual Emissions Report	29	28
Health Risk Assessments	7	
Air Toxic Inventory Reports (available in AQMD files)	7	
Non-CEIDARS Surveys		
with no additional data	115	
with some CEIDARS data	1	
with AER data	2	
Limited Surveys (AQMD Annual Emission Reports)	13	13
AQMD Annual Emission Reports		
1998-1999	11	16
1999-2000	31	49
2001-2002		4
LAUSD Surveys	38	1
ARB Emissions Inventory Database (CEIDARS)		
Criteria Database		74
Toxics Database	69	
Both	16	
Energy Commission List of Emergency Generators	31	32
Toxics Release Inventory, Year 2000	9	
AQMD Permits - ARB Emission Estimates	17	43
Total	**406**	**260**