Studies of Air Pollutants and their Impact on Respiratory and Cardiovascular Diseases in the El Paso North Region with Emphasis on Mobile Emissions.

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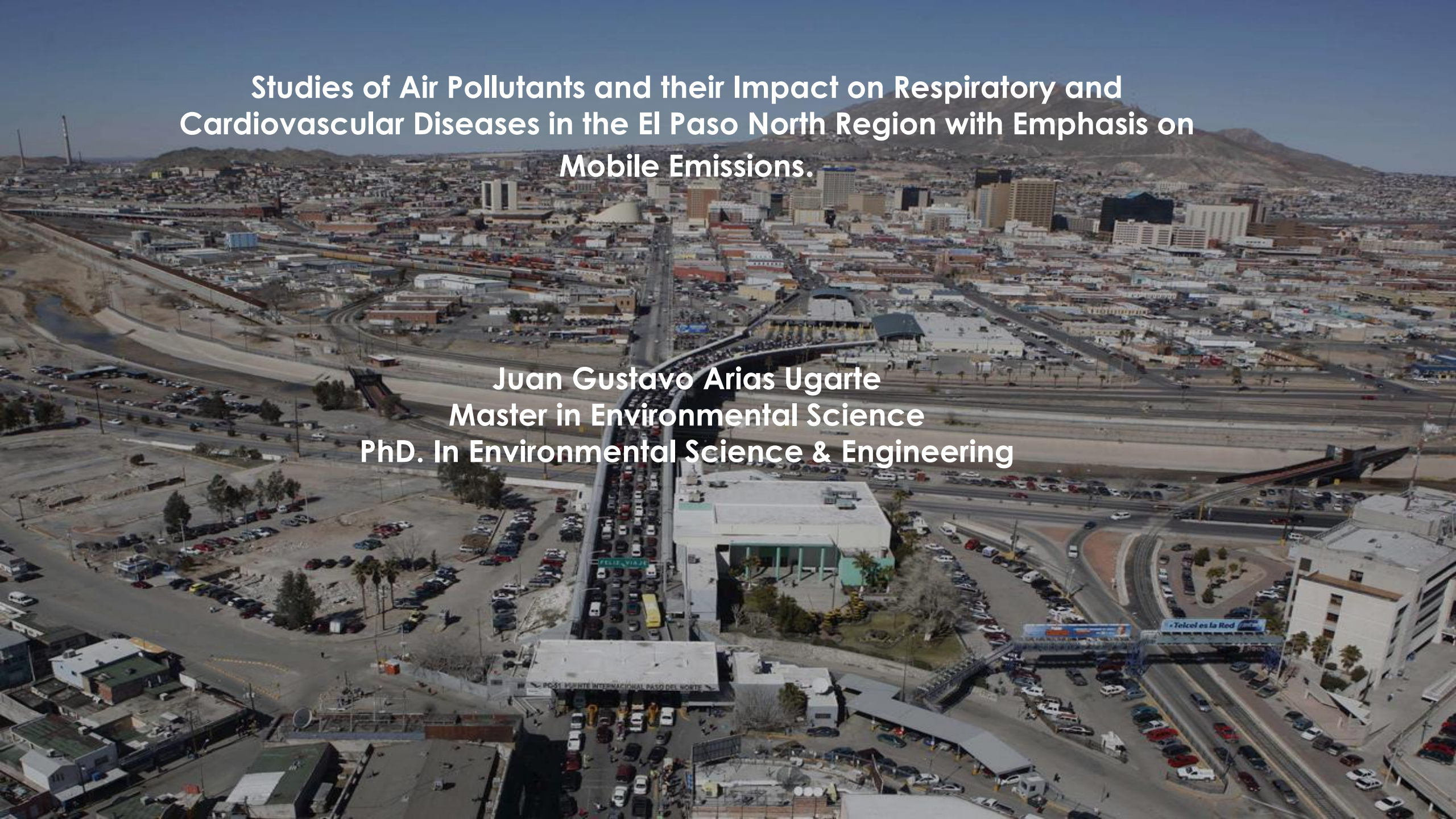

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ABSTRACT

The focus of this research is the study of mobile emissions in the Paso del Norte (PdN) region, with the objective of establishing an association between mobile emissions and health.

This association will allow a comparison of different exposure and risk situations relative to the emission source (Exhaust and Non-Exhaust Emission) and to the particle size, PM 10 (coarse) and PM2.5 (inhalable), with the adverse effects on respiratory (RD) and cardiovascular diseases (CVD).

The times selected for this study are periods in 2006 and 2010. Two areas associated with high traffic density were selected, highway I-10 in the Chamizal urban area, zip code 79905, and Dona Ana county urban areas, zip codes 88021,88027,88072,88048. The mobile simulations were performed using the Motor Vehicle Emission (MOVES model version 2014a) simulating weekly, monthly and annual data of mobile emissions.

Estimates of the Health and Economic Effects of Air Pollution in the El PdN region were performed using the Environmental Benefits Mapping and Analysis Program, and GIS Software was used for visualization purposes.

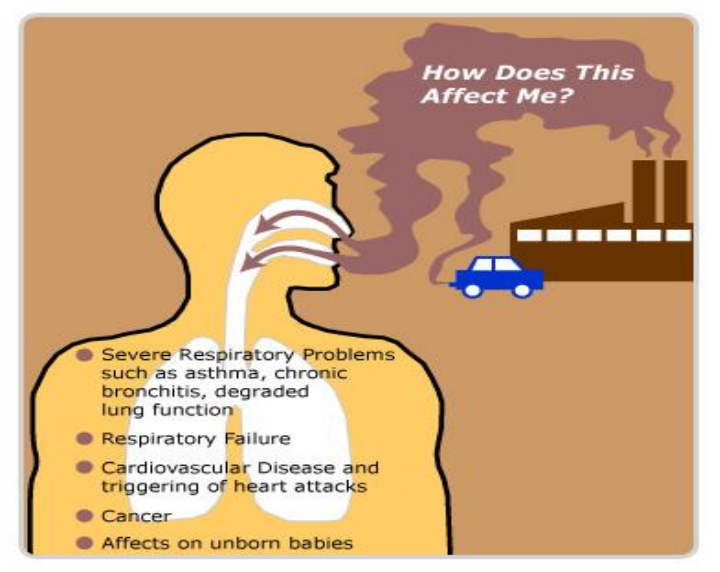
In addition, NOx is a major component of mobile emissions and is an ozone precursor. Therefore, we have studied its concentrations during high episodes and analyzed the meteorological factors that also contribute to high NOx and Ozone concentrations and performed corresponding air quality simulations for the PdN region.

Purpose

- The purpose of this research was establishing an association between mobile emissions and health. This association will allow a comparison of different exposure and risk situations relative to the location, emission source (Exhaust and Non-Exhaust Emission) and to the particle size, PM 10 (coarse) and PM2.5 (inhalable), with the adverse effects on respiratory (RD) and cardiovascular diseases (CVD).

Introduction

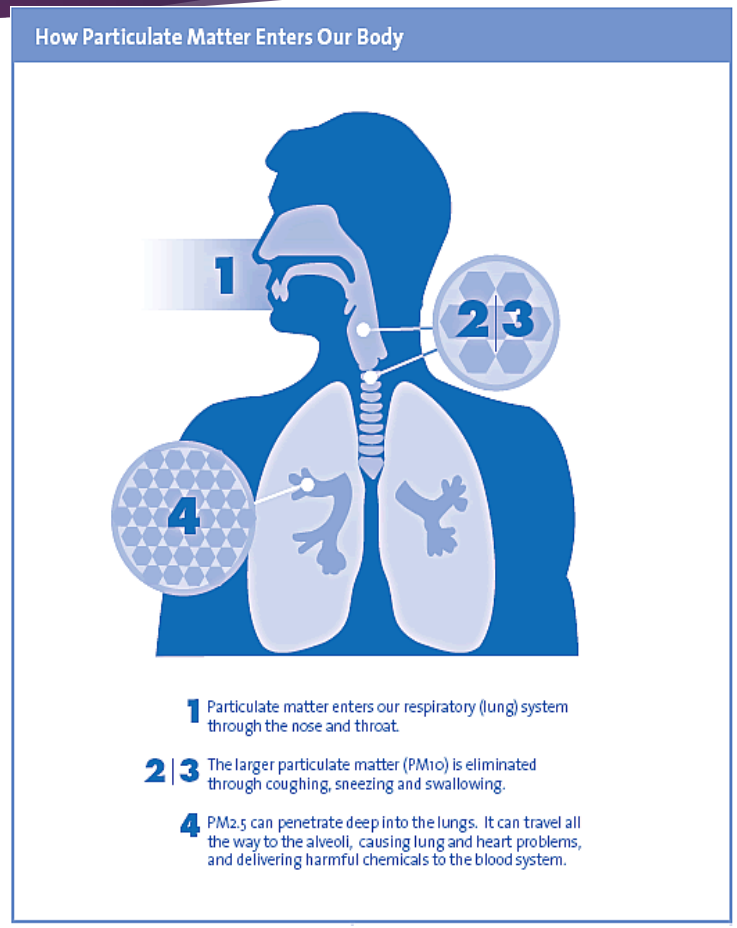
- The Paso del Norte (PdN) region is one of the largest metropolitan areas along the U.S.-Mexico border. This includes El Paso, Ciudad Juarez, Mexico. Each year, over 18 million vehicles cross the three international ports of entry between El Paso and Cuidad Juárez.



- Approximately one-quarter of the population in The Paso del Norte (PdN) region lives close to major roadways, exposing the people to risks of severe respiratory infections and cardiovascular diseases. (Trainer M, Parrish DD and Goldan PD, 2000).

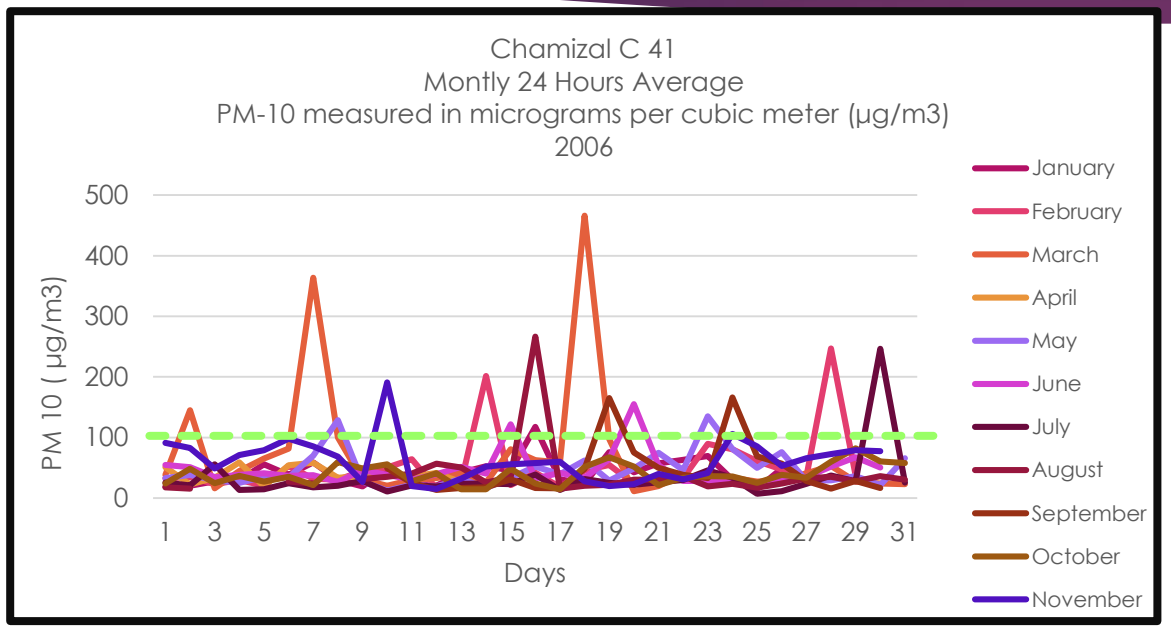
Significance of the Work

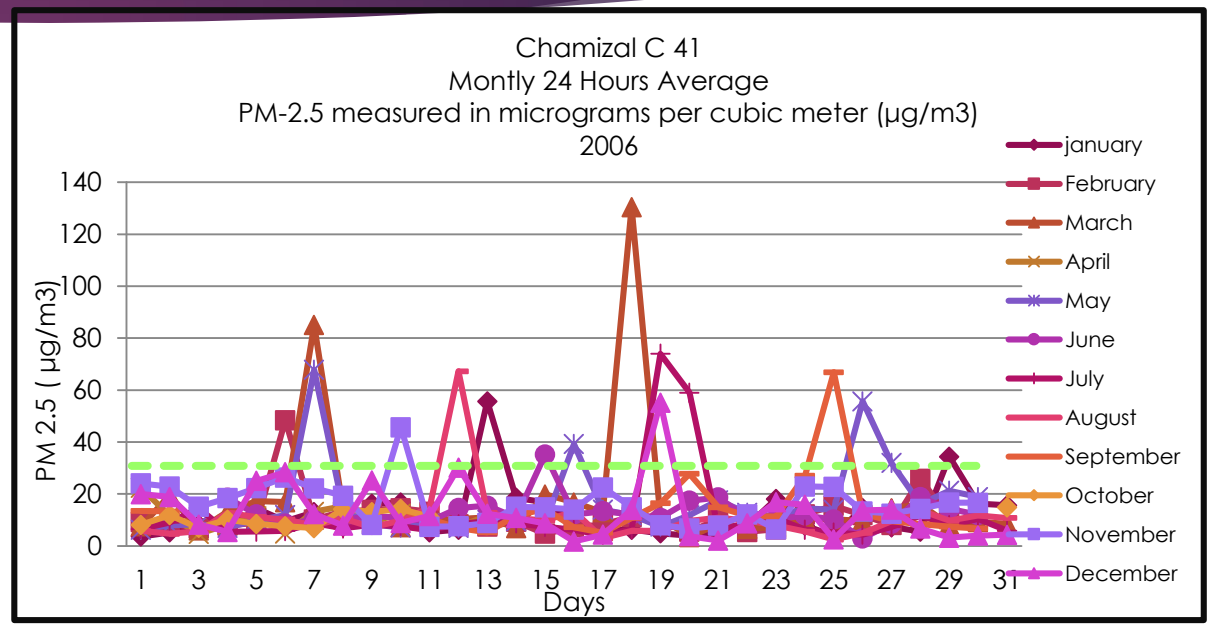
- Traffic is a major source of mobile emissions causing air pollution. Mobile emissions such as:
- Exhaust Emissions (Carbon Monoxide, Nitrogen Oxides and Hydrocarbons), and Non-exhaust (Brake and Tire). Particulate emissions can also be very damaging to health because their tiny diameter can enter the respiratory system easily and possibly cause adverse health impacts (pulmonary carcinogen, inflammatory and toxic effect on the lung (IARC, 1989; Et al., 2013) (Kelly and Fussell, 2012). (iron(Fe) copper(Cu) , Manganese(Mn), antimony(Sb), barium(Ba), zinc(Zn).
- Therefore, the relevance of this research→ provides a key knowledge to understand the impacts of traffic emissions on air quality and the magnitude of public health risks associated with exposure to mobile emissions.



Problem Statement

The National Ambient Air Quality Standard (NAAQS) for PM was Exceeded in The PdN Region during 2006, 2010. Analysis of Chamizal Area Zip Code 79905
These chart illustrates two high spikes that occurred, which exceeds the 24 hour average.

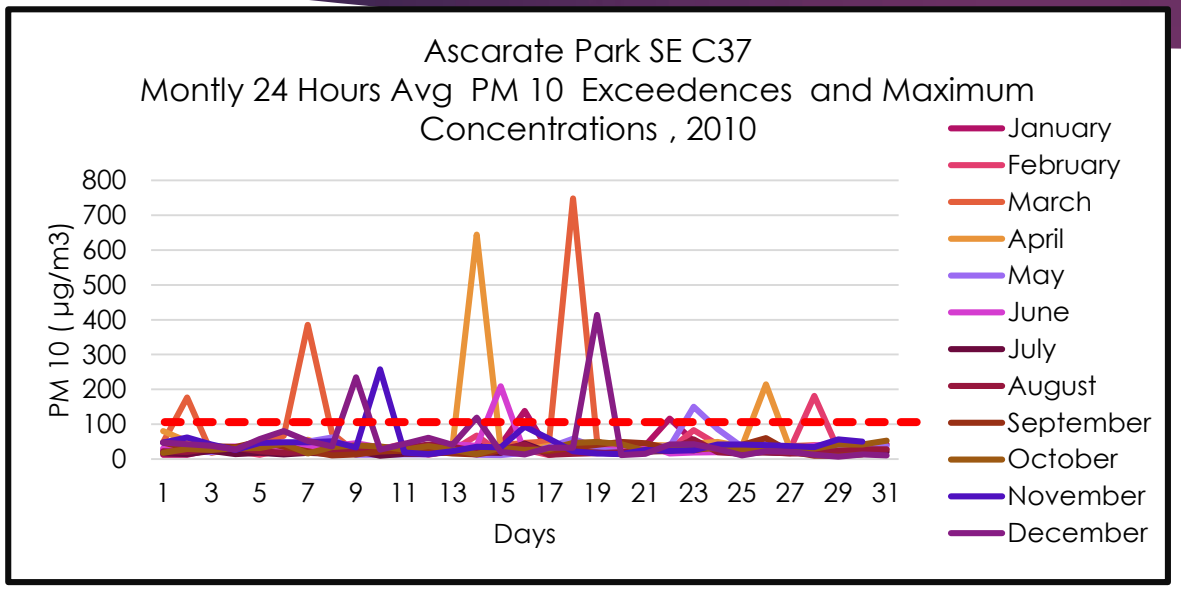




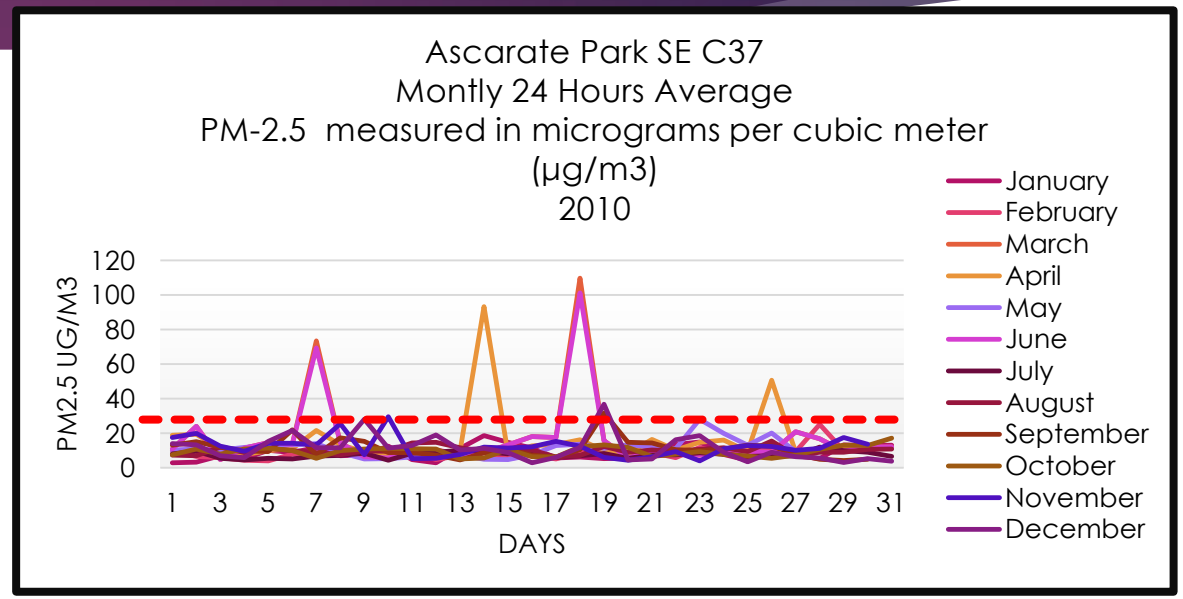
Chamizal C41Monitoring Station: The National Ambient Air Quality Standard (NAAQS) for PM 10 and 2.5 was exceeded but in 24 hour average. The NAAQS for PM 2.5 for 24-hour average is PM2.5:35 µg/m³ and PM10: 50-100 µg/m³ .The highest concentration occurred several times: PM10(150,200,300,450 µg/m³) PM2.5(40,50,60,70,80,120 µg/m³)

Problem Statement

The National Ambient Air Quality Standard (NAAQS) for PM was Exceeded in The PdN Region 2006, 2010
Analysis of Ascarate Area Zip Code 79905
These chart is to illustrate there are two high spikes that occurred, which exceeds the 24 hour average.



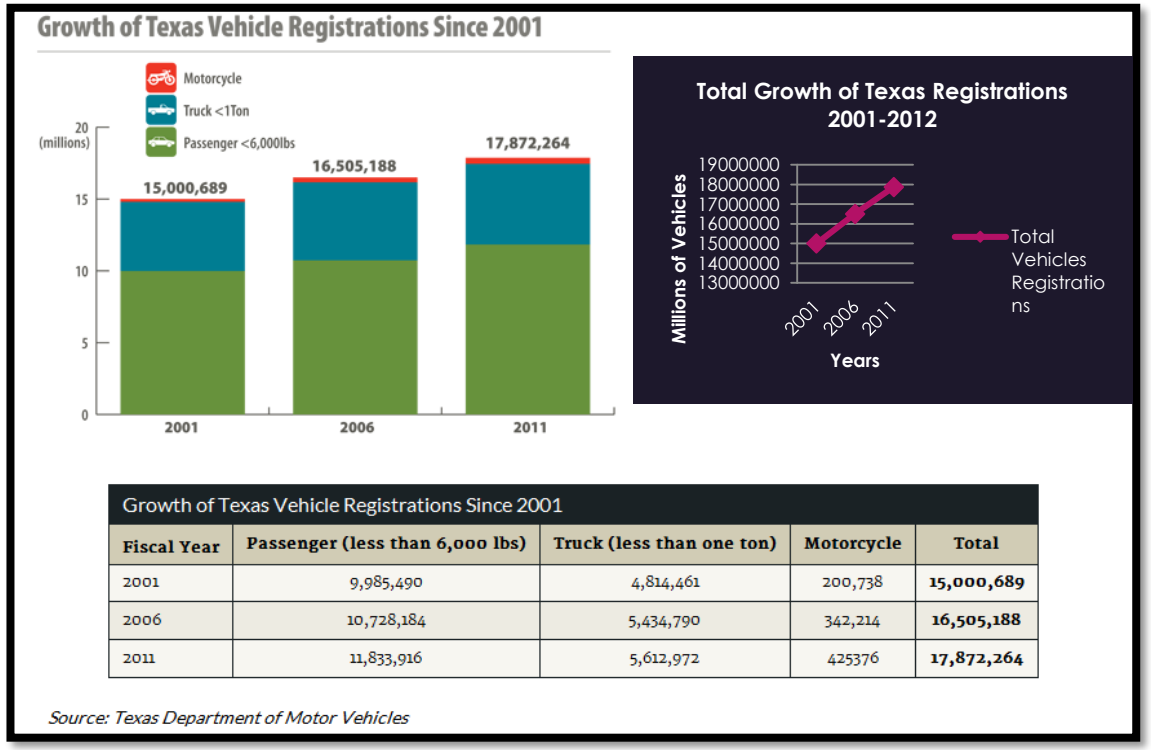
Graph 1 : Source: TCEQ (Texas Commission on Environmental Quality) Ascarate Park monitoring station Data 2010



Graph 2 : Source: TCEQ (Texas Commission on Environmental Quality) Ascarate Park monitoring station Data 2010

Ascarate Park C37 Monitoring Station: The National Ambient Air Quality Standard (NAAQS) for PM 10 and 2.5 was exceeded but in 24 hour average. The NAAQS for PM 2.5 for 24-hour average is PM2.5:35 µg/m³ and PM10: 50-100 µg/m³ . The highest concentration occurred several times: PM10(200,250,300,400,600,720 µg/m³) PM2.5(40,90,120,µg/m³)

Problem Statement



Growth of Texas Vehicle Registrations Since 2001

Fiscal Year	Passenger (less than 6,000 lbs)	Truck (less than one ton)	Motorcycle	Total
2001	9,985,490	4,814,461	200,738	**15,000,689**
2006	10,728,184	5,434,790	342,214	**16,505,188**
2011	11,833,916	5,612,972	425376	**17,872,264**

Source: Texas Department of Motor Vehicles

Fig: Number of registered automobiles in Texas. The Statistics show the number of registered automobiles, truck, motorcycle in Texas, Source: Texas department motor vehicles

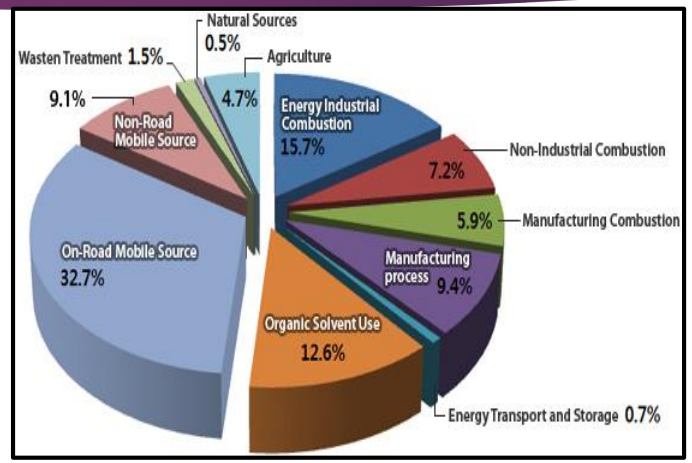


Fig: in U.S. On-road mobile sources constitute the largest single source category of air pollution with (32.7%)

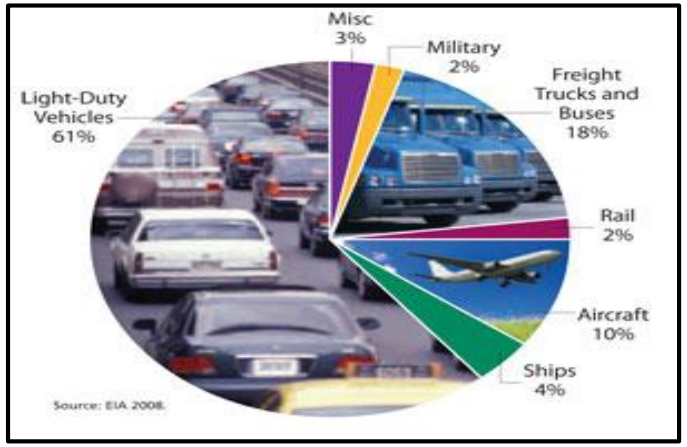
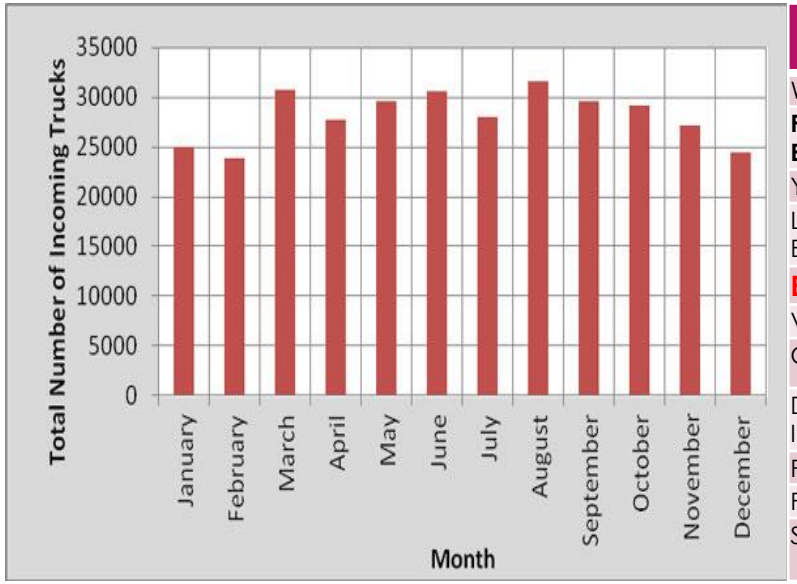


Fig: More than 61 percent of U.S. transportation emissions come from cars and light trucks .

Problem Statement

El Paso, Texas and ciudad Juarez currently has commercial movements through El Paso–Ciudad Juarez gateways peaked at 715,000 trucks in the year 2010 and Approximately 40,000 vehicles pass these roads each laborable day.



Bridge	Number of US-bound Truck Crossings year 2010
World Trade Bridge	1,327,479
Pharr – Reynosa International Bridge	**452,821**
Ysleta – Zaragoza Bridge	379,508
Laredo – Colombia Solidarity Bridge	374,781
Bridge of the Americas	**337,609**
Veterans International Bridge	177,986
Camino Real International Bridge	106,423
Del Rio – Ciudad Acuna International Bridge	62,966
Progreso International Bridge	42,605
Free Trade Bridge	30,773
Source: CBP	

Source: .US. Department of Transportation, Bureau of Transportation Statistics 2010

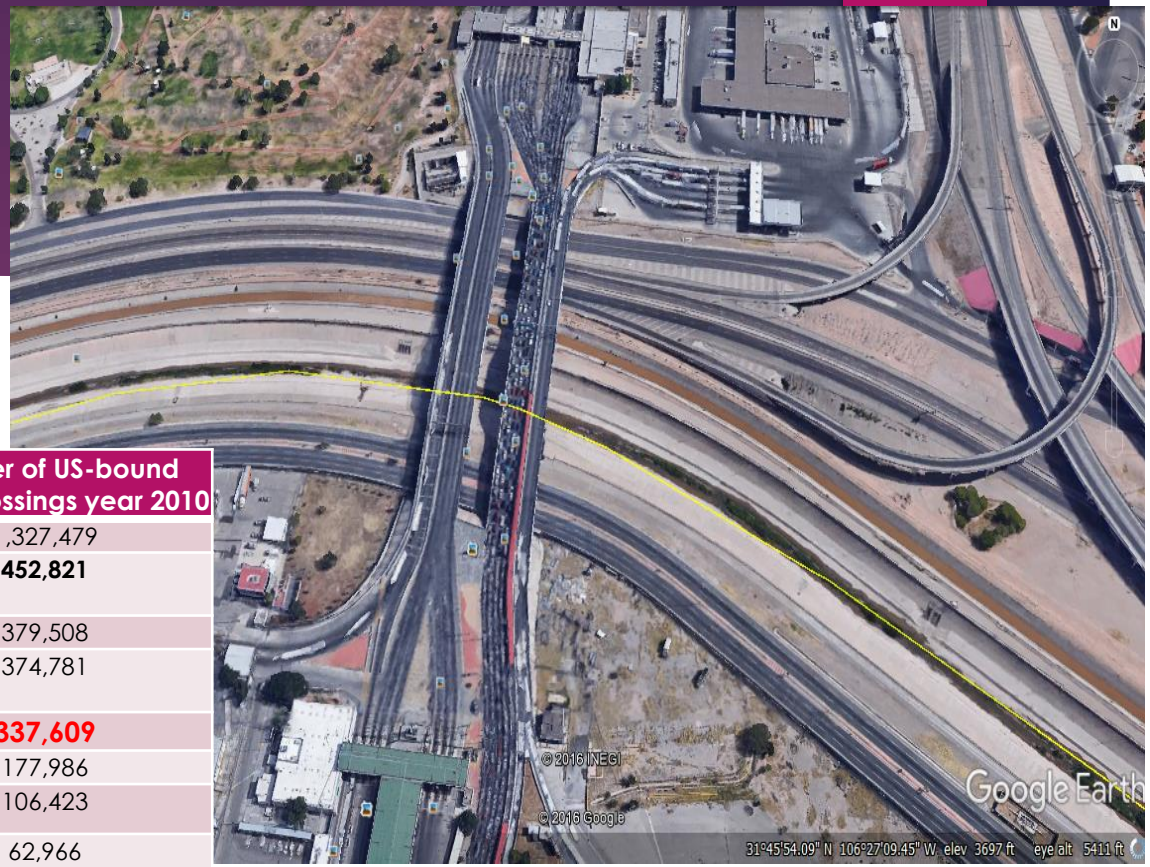


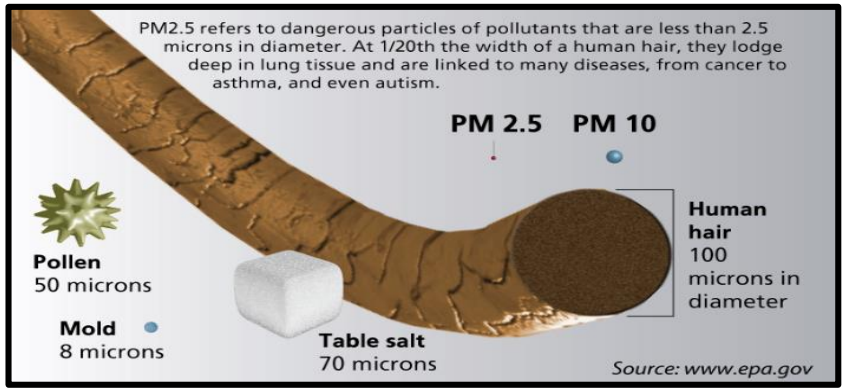
Fig : Bridge of the Americas (Puente Cordova)

Publications Review to examine the relationship between exposure to motor vehicle emissions and respiratory and cardiovascular disease.

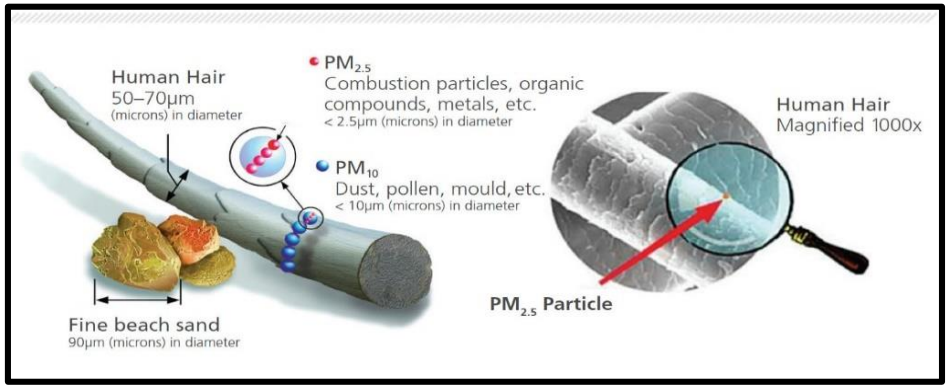
- We have analyzed the current literature, which have served as the basis for this project.
- Some studies determined that traffic-related emissions have been recognized as a major contributor to urban air pollution in particular major cities, proximity to major roadways and exposure to motor vehicle exhaust and Non-exhaust emissions are associated with increased risks of cardiovascular, respiratory and other diseases (Brugge et al., 2007; Gan et al., 2010; Gauderman et al., 2007; Jerrett et al., 2009; Laden et al., 2007; McConnell et al., 2006).
- Effect of traffic pollution on respiratory and allergic disease in adults: cross-sectional and longitudinal analyses, Mar Pujades-Rodríguez, Tricia McKeever, Sarah Lewis, Duncan Whyatt, John Britton and Andrea Venn· http://www.sciencedaily.com/releases/2008/11/081114081003.htm. April 2011.
- Traffic Pollution Increases Asthma in Adults Several research results revealed adults who suffer asthma and were exposed to heavy traffic pollution experienced an 80 per cent increase. University of Melbourne , Rev. Public Health, 15 (1994), pp. 107–132. August 2010.
- Traffic Pollution Aggravates Symptoms In Asthmatic Children: Traffic pollution, especially in cities, adversely affects respiratory health in children with asthma. studies suggest that traffic pollution, and diesel particles in particular, may have a greater effect on respiratory health than **other pollutants. http://www.sciencedaily.com/releases/2008/11/081114081003.htm. September 2010.**
- Traffic-related air pollution associated with prevalence of asthma and COPD/chronic bronchitis. A cross-sectional study in Southern Sweden Anna Lindgren, Emilie Stroh, Peter Montnémery, September 2009.
- Acute respiratory health effects of air pollution on children with asthma in US inner cities Benjamin Vaughn, MS, Meyer Kattan, MD, Herman Mitchell, PhD. May 2008.
- Comparison of Air Quality–Related Mortality Impacts of two Different source of emission Transportation in the United States http://www.trb.org/Main/Blurbs/166402.aspx. January 2008.
- Long-term exposure to traffic-related air pollution and cardiovascular mortality. Chen H, Goldberg MS, Burnett RT, Jerrett M, Wheeler AJ, Villeneuve PJ. Source Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec, Canada. January 2011
- heavy-duty vehicles: chemical composition, impact of exhaust after treatment, and fuel parameters. Environ Health Perspect 102(suppl 4):13–23 (1994).

Particulate Matter

- PM is a mixture of solid and liquid particles suspended in the atmosphere as atmospheric aerosols. Mobile Pollutants are formed by chemical reactions of gaseous components from burning of fossil fuel in vehicles (Gasoline & diesel motor vehicles).



Source: EPA (2012). United States Environmental Protection Agency. Particulate matter basic information. Cited October 30th, 2012. Available online at: http://www.epa. gov/airquality/particlepollution/basic.html.

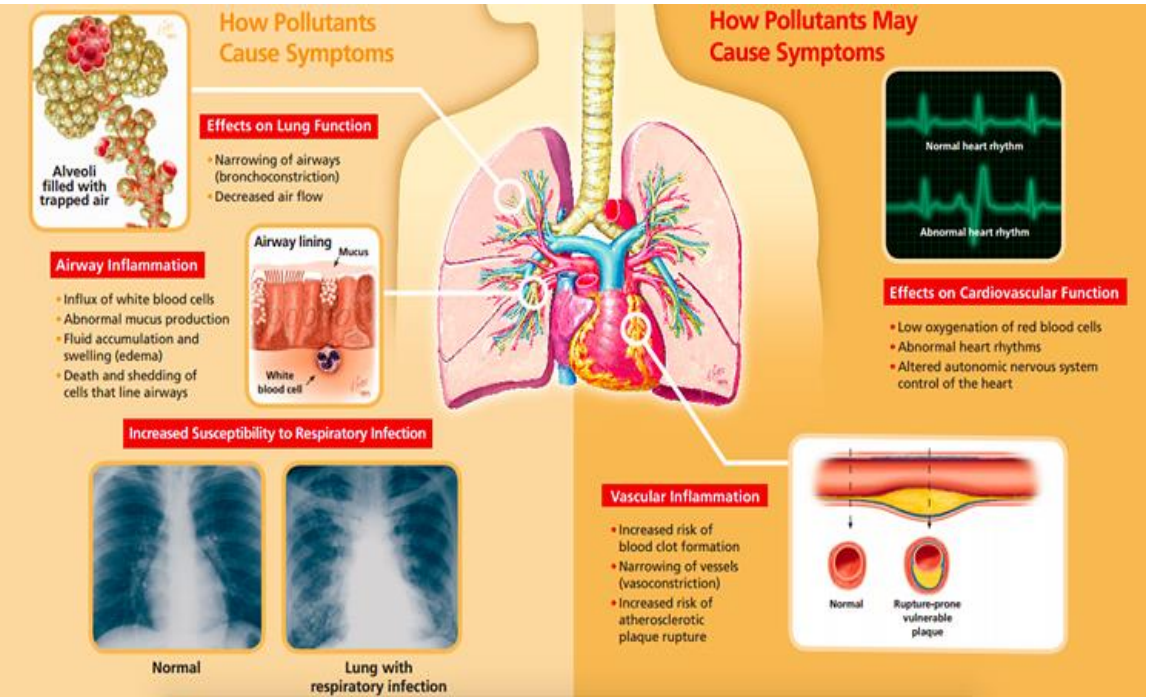


Source: EPA (2012). United States Environmental Protection Agency. Particulate matter basic information. Cited October 30th, 2012. Available online at: http://www.epa. gov/airquality/particlepollution/basic.html.

PM10, 2.5 Long Term Exposure – Chronic Health Consequences

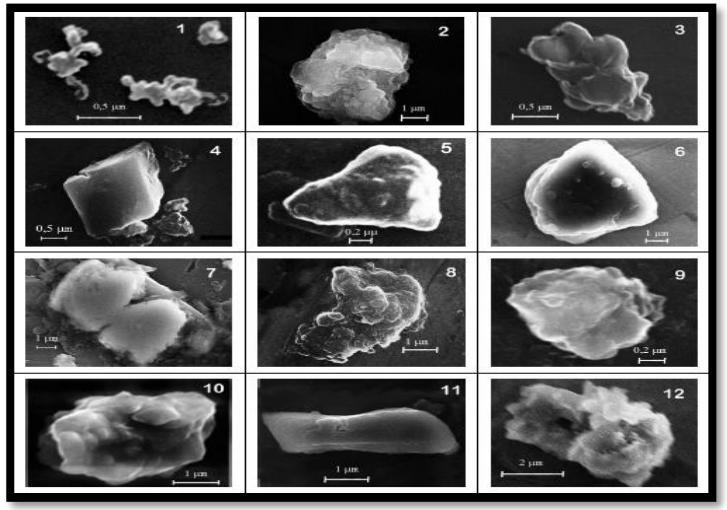
These particles are associated with a variety of problems including:

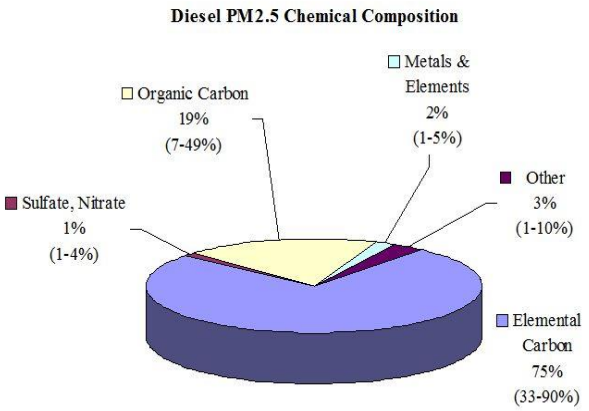
- Aggravated asthma; Chronic bronchitis;
- Decreased lung function;
- Increased respiratory symptoms, coughing or difficulty breathing;
- Increased Cardiopulmonary Mortality;
- Increased Risk of Lung Cancer;



Sources of Particulate Matter Emissions from traffic.
Diesel exhaust particulate matter :

- This particulate toxic potential has been associated with serious adverse Health effects, including respiratory symptoms Pulmonary function and cardiovascular diseases (Geller et al. 2006; Bernstein et al., 2004).





Brake wear particulate matter

- **Brake wear particulate matter Chemical content : (iron(Fe) copper(Cu) , Antimony(Sb), barium(Ba).** this type of particulate can cause severe respiratory and cardiovascular damages and it is also known that Sb has been classified as a possible human pulmonary carcinogen by the International Agency for Research on Cancer (IARC, 1989; Et al., 2013).

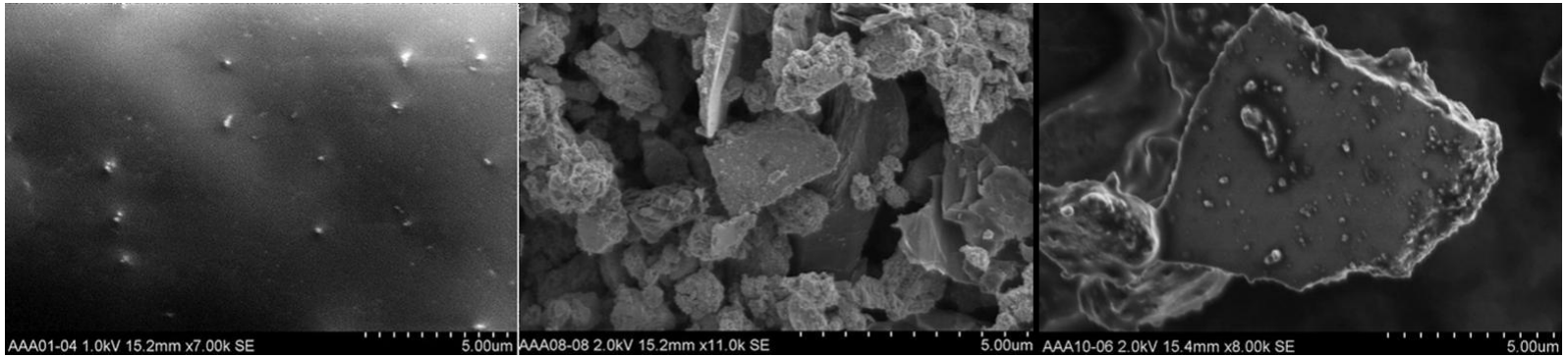


Fig.: images of brake wear particles generated at a road simulation study (centre <2.5 µm, right <10 µm). Source: [Kukutschová et al., 2011]

Tire wear particulate matter

- The tire wear particles of the tires are generated either by frictional forces between the tread and the road pavement. The chemical content: Fe, Cr / Pb, Ti , Cr, Cu, Zn, Sr, Y, Zr, Sn, Sb, Ba, La, Ce and Pb).

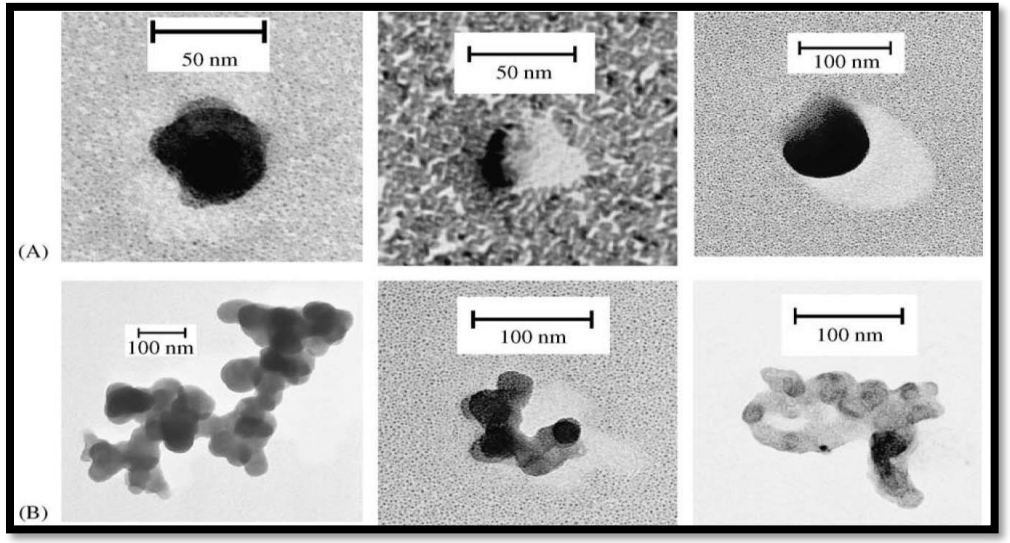
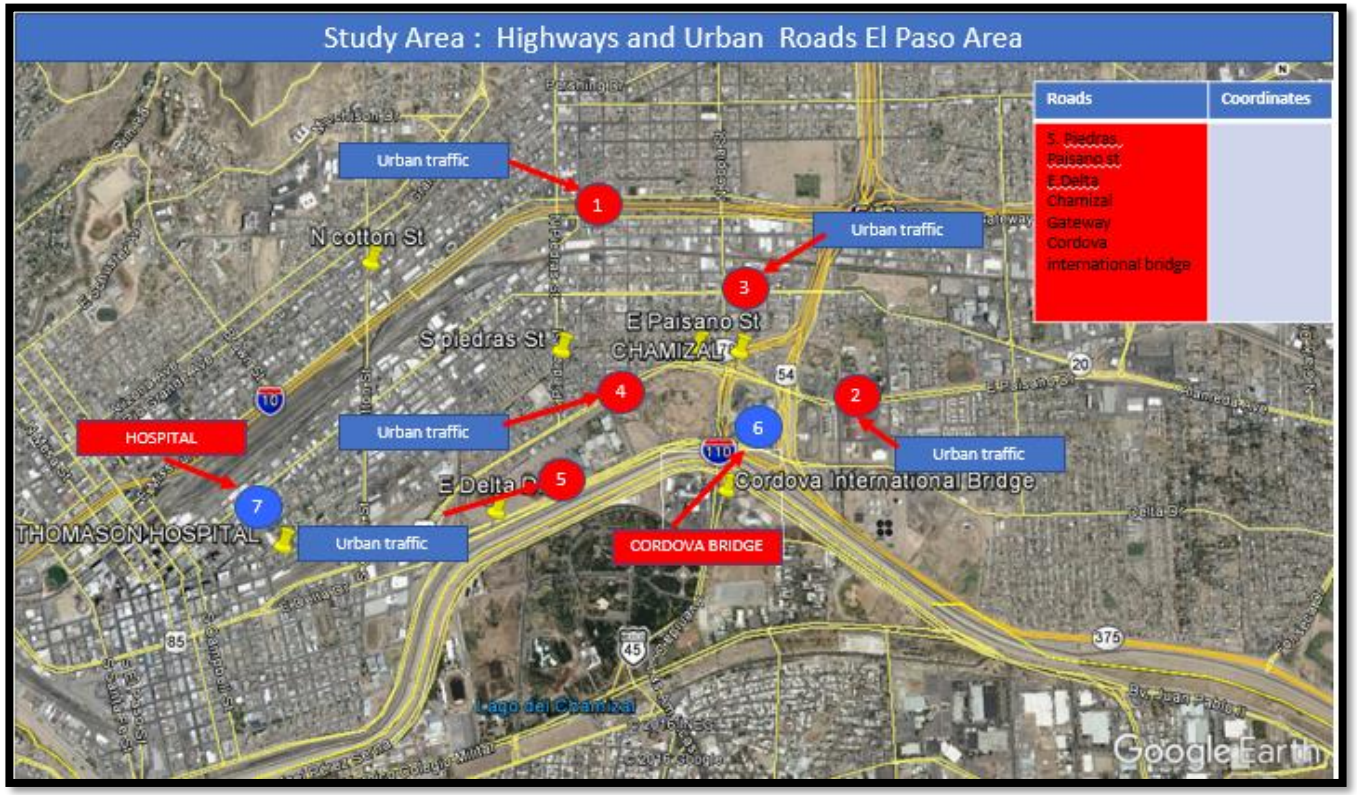


Fig. : Examples of near spherical particles PM 10 and, 2.5 which are originate from interaction of tires and pavements Source: [Dahl et al., 2006]

Study Area

- The Paso del Norte (PdN) region: Selected two strategic areas of study: El Paso County zip code 79905, Urban area and Dona Ana County Zip Code 88021,88027,88072 Rural Restricted urban access (freeways and interstates)



Map of the area of the simulation by the MOVES model in the study area.

FIG. 1. Map of the area of the simulation by the MOVES model in the study area.

Geographic Domain: Zip Code 79905 Urban Area (El Paso County) Zip Codes 88021,88027,88072,88048 (Dona Ana County)

El Paso County

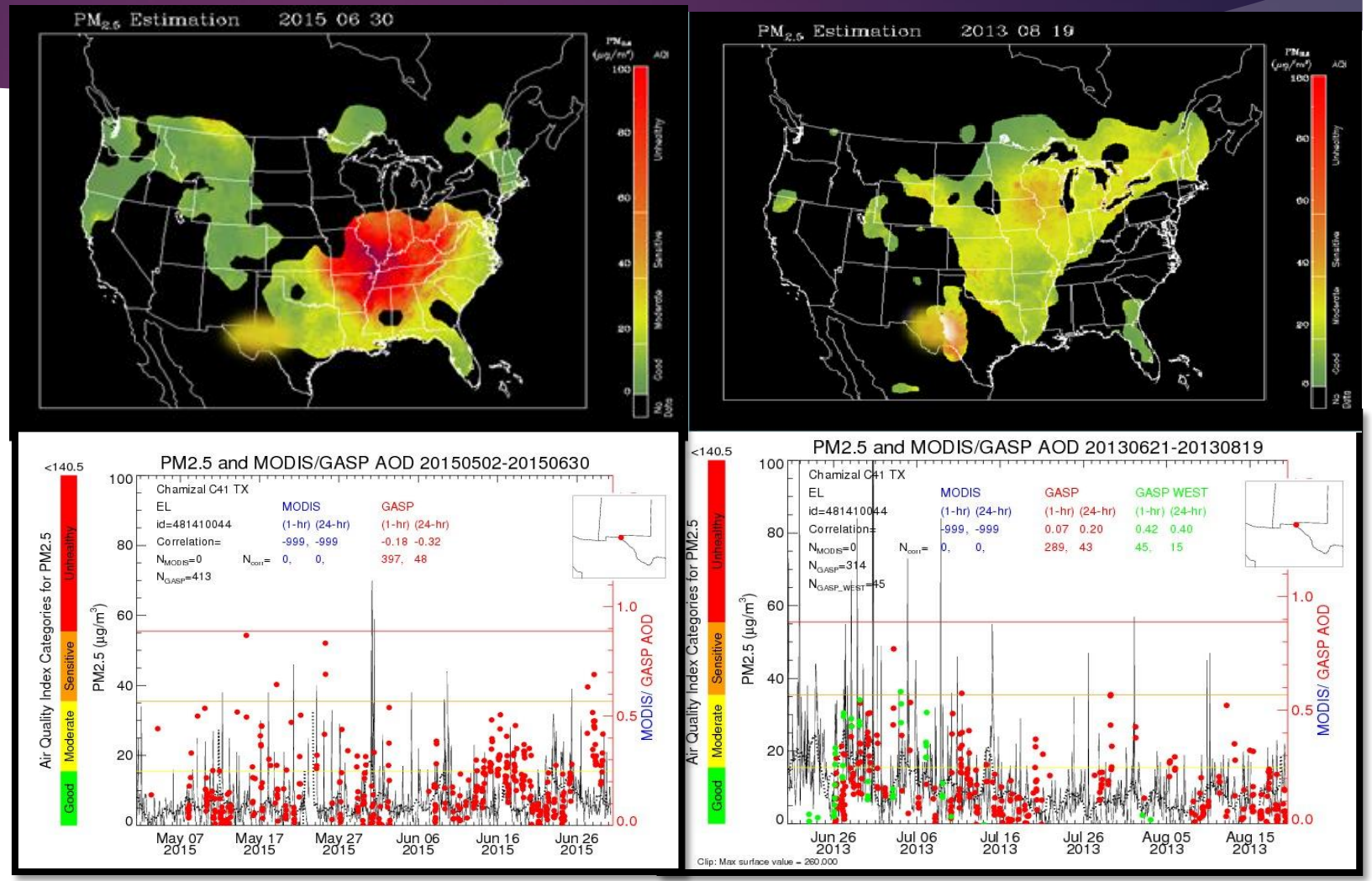
Urban road Delta Dr St	31° 45' 56.37- 106° 27' 12.12	1.0 miles
Cordova Bridge of the Americas	31° 45' 43.67- 106° 27' 05.06	1.5 miles
478 Highway interstate	31° 46' 13.26- 106° 27' 03.27	0.5 miles
110 Highway interstate	31° 46' 12.10- 106° 27' 00.66	1.0 miles
10 Interstate Gateway Blvd	31° 46' 39.7- 106° 26' 47.69	0.5 miles
Chamizal Loop 478	31° 46' 66.8- 106° 26' 54.56	0.5 miles
Alameda Loop 20	31° 46' 13.23- 106° 27' 03.28	1.0 miles
Paisano Dr St Patriot freeway route 62	31° 46' 06.69- 106° 27' 21.2	1.5 miles
St Piedras	31° 46' 13.26- 106° 27' 03.27	1.0 miles

Geographic domain : To obtain the simulation mobile data from model MOVES2010a was configurated the coordinates selected in the study areas.

Dona Ana County		Miles
Interstate 25	32° 23' 05.61 -106 48 10.54, 32° 23' 34.34- -106 48 10.54, 32° 23' 56.60 106 48 43.14	5.0

PM2.5 Estimation from Aerosol Optical Depth (AOD) using satellites

- We examined the relationship between Aerosol Optical Depth (AOD) estimated from satellite data at 5 km spatial resolution and the mass of fine particles ≤2.5 µm in aerodynamic diameter ($PM_{2.5}$) monitored on the ground in El PdN area. $PM_{2.5}$ data was recorded from air quality monitoring Chamizal station (TCEQ) on different periods.
- Our analysis shows a significant positive association between AOD and $PM_{2.5}$.



Time-series and scatter plots of AOD, estimated PM2.5 and surface PM2.5

Analysis of the meteorological factors and synoptic conditions leading to a local high ozone event, episode June 12-21, 2006.

- Meteorology plays a critical role in determining atmospheric ozone concentrations. A good synoptic scale weather forecast is essential to accurately forecast tropospheric and surface ozone concentrations.

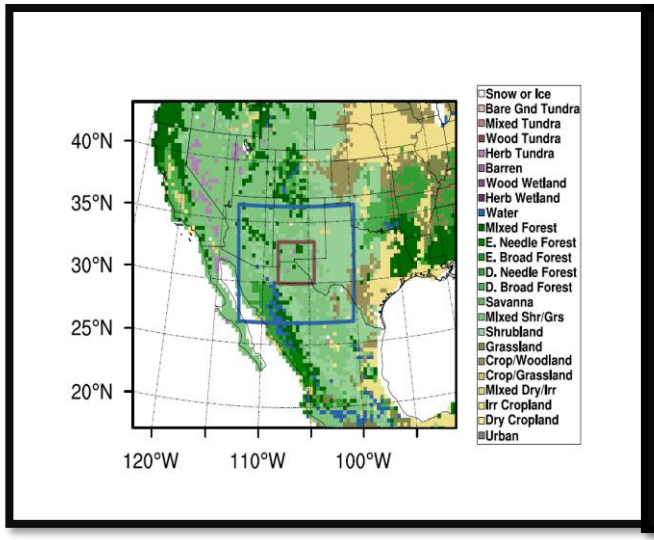


Figure 1. The domain configuration and Landuse categories, resolution 2.5 km domain

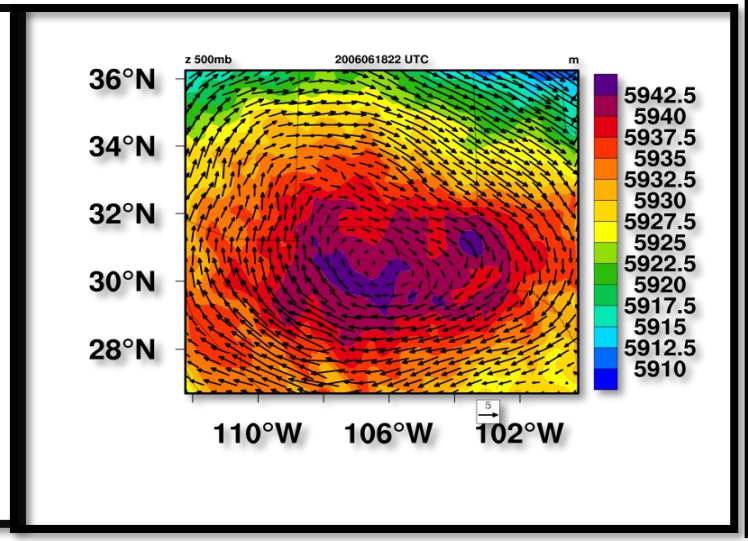


Figure 2, The Geopotential height at 500 mb,

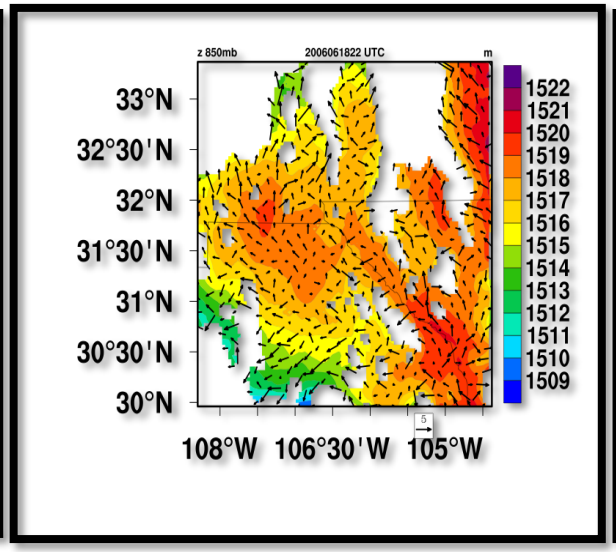


Figure 3 depicts the 850 mb, at a lower altitude. The white regions observed in the graph correspond to mountainous areas

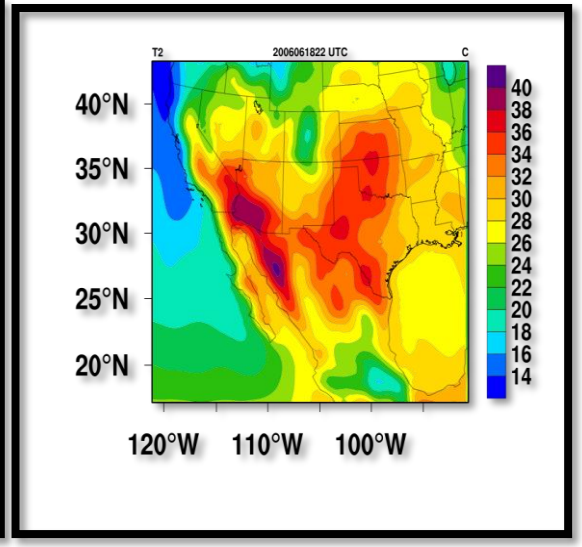
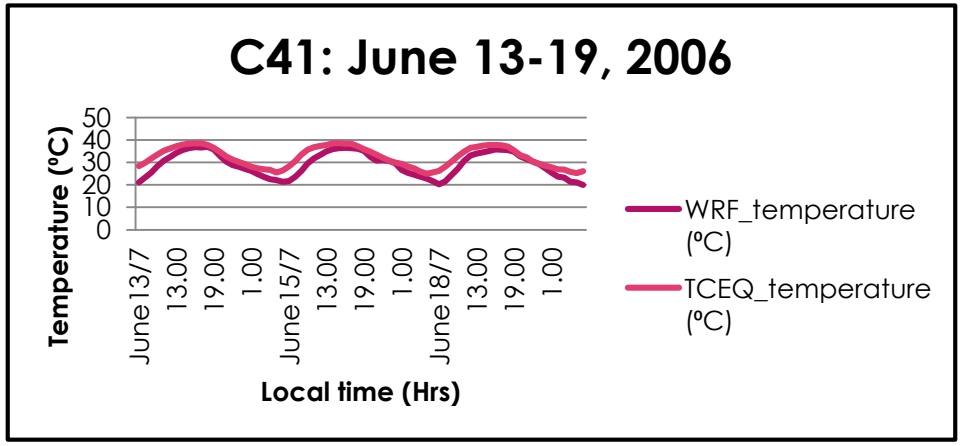
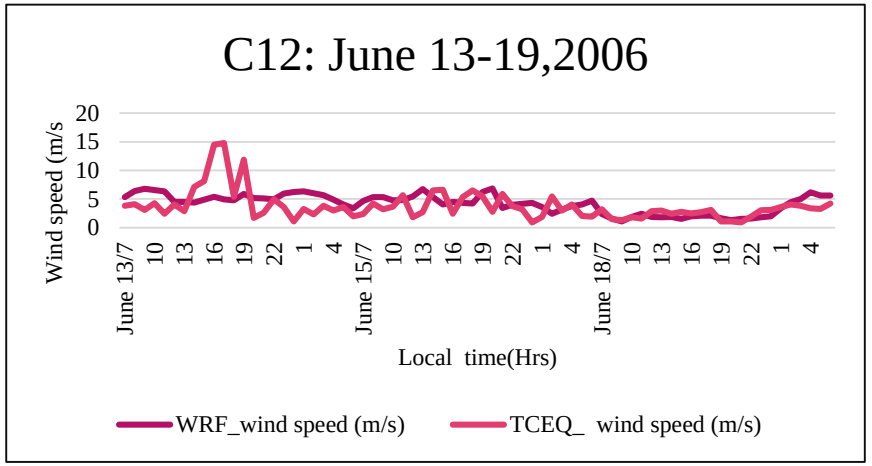
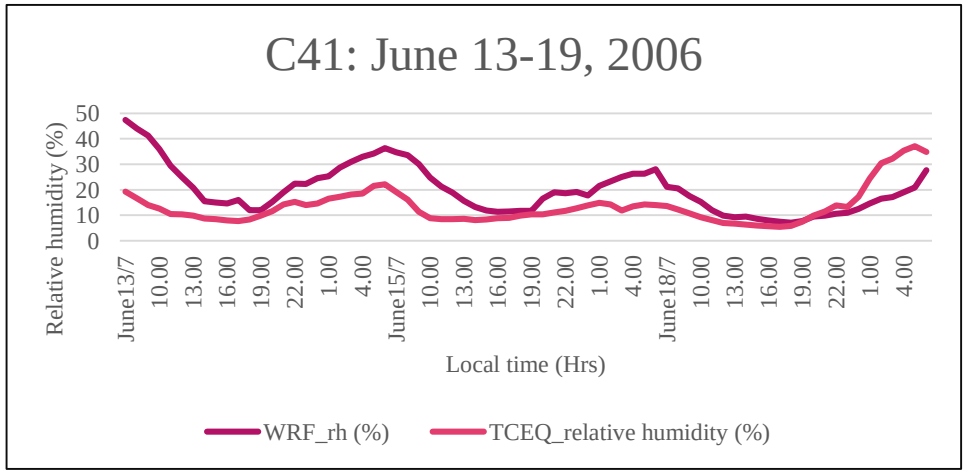


Figure 4. Temperature at 2m height above surface at 22 UTC, June 18, 2006, 36 km resolution

Performance Evaluation



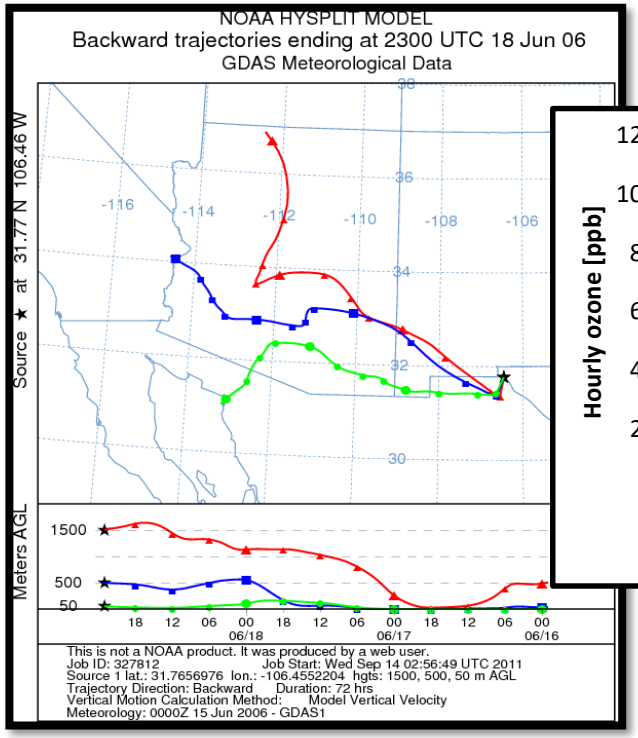




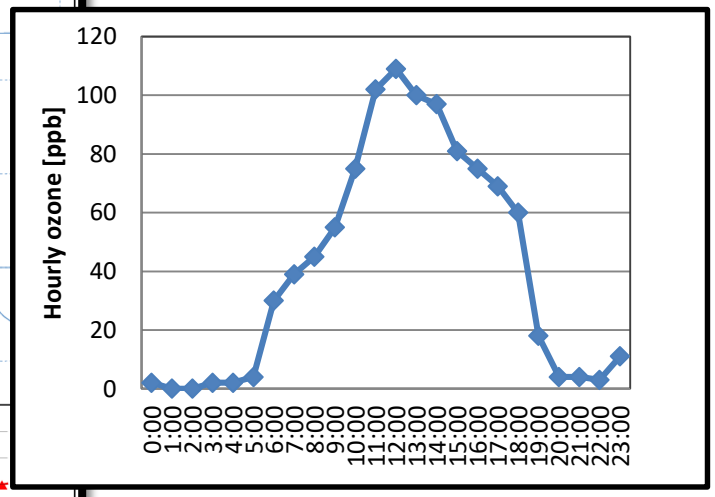
We evaluate the WRF model's performance by comparing against corresponding experimental TCEQ data and performing the required statistical analysis.

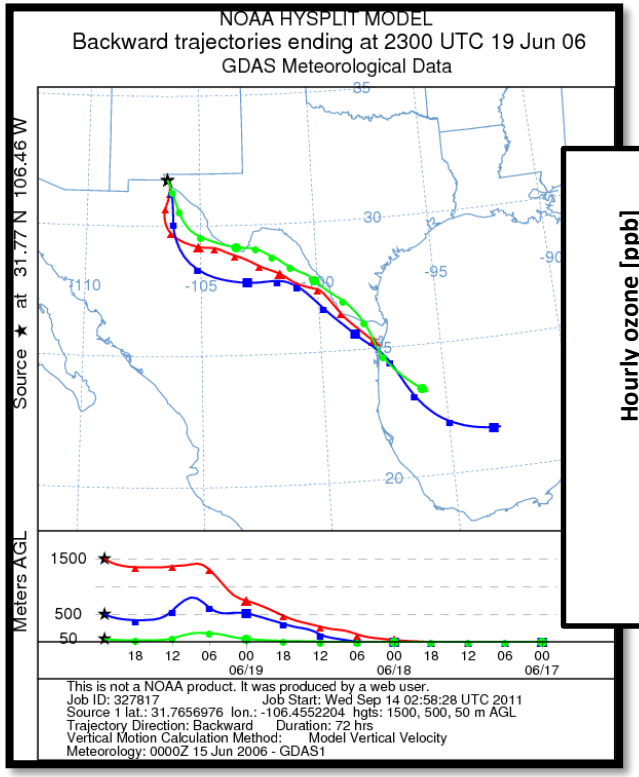
HYSPLIT Model

HYSPLIT was simulated and showed that the ozone is mostly transported to El Paso from north western and south western US and Mexican regions during the 72 hours duration of the simulation.

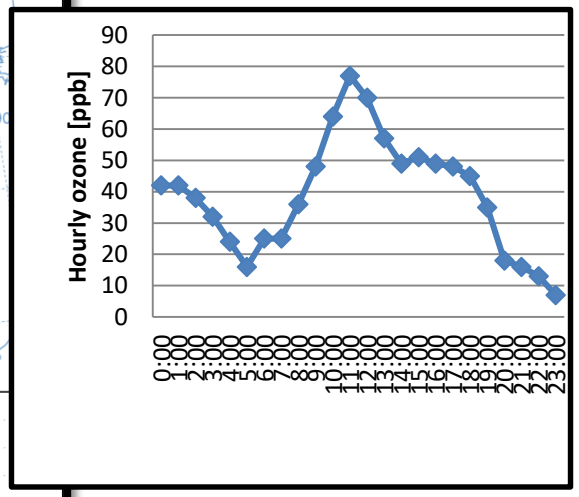


June 18th

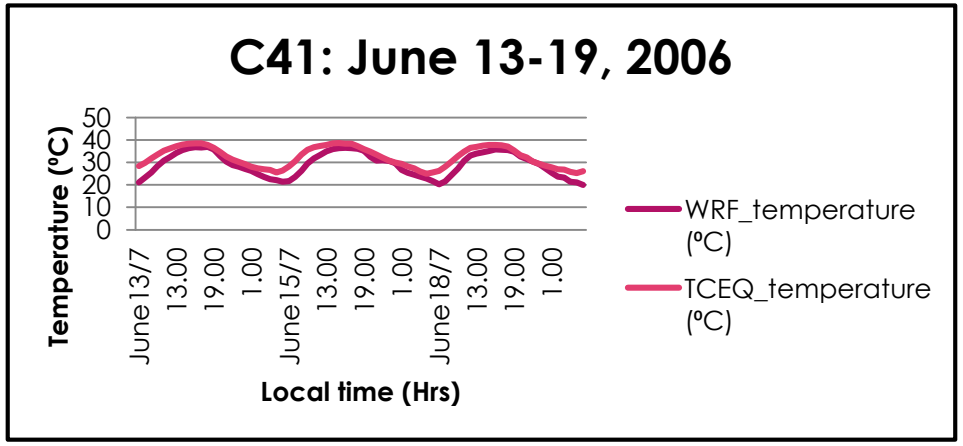


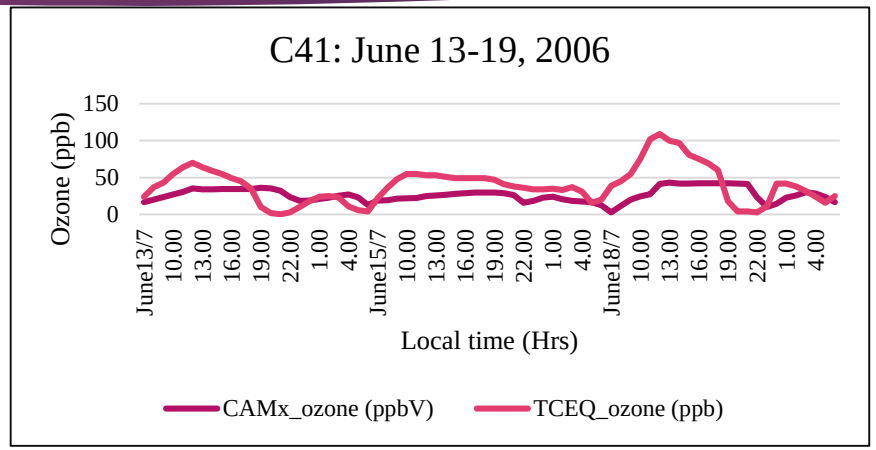


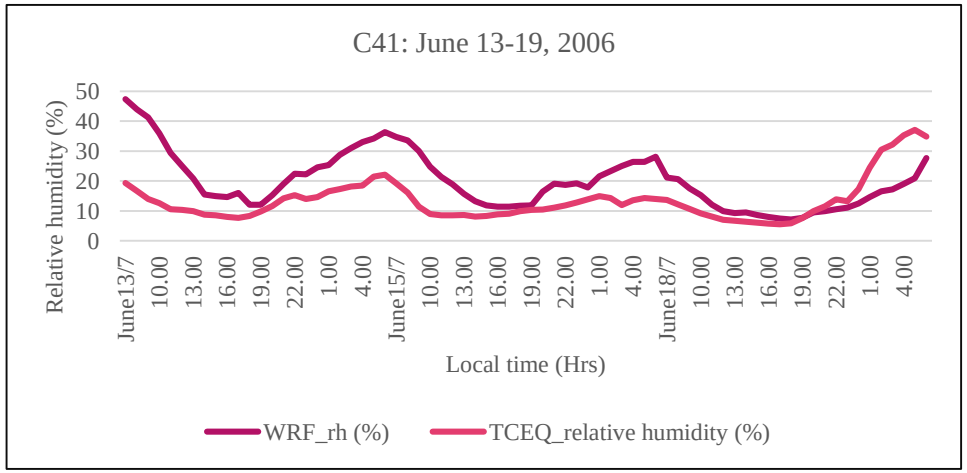
June 19th

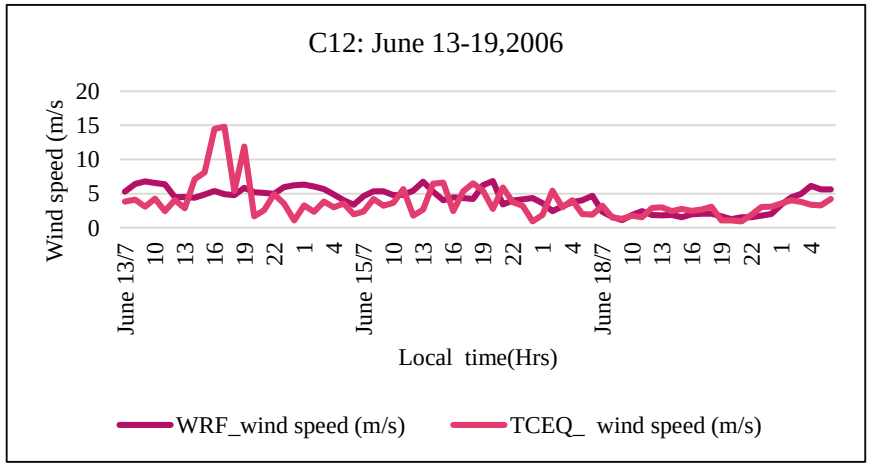


Performance Evaluation









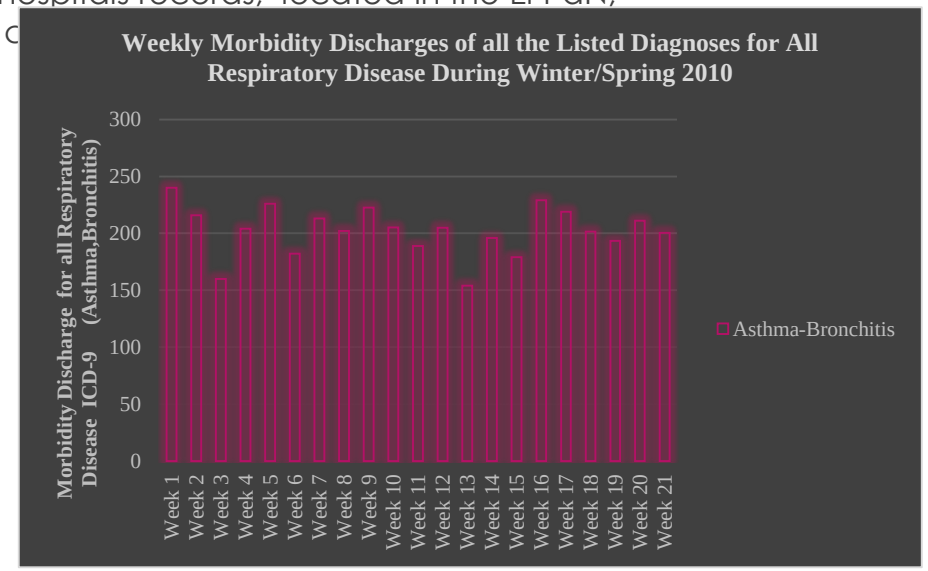
Methodology

Medical Data

- The data by weekly, monthly and year for daily emergency room and hospital admission for the respiratory infections (RD) and cardiovascular diseases (CVD) was extracted from hospitals records, located in the El PdN,

RESPIRATORY DISEASE
Bronquitis & Chronic Bronchitis 466 - 466.1, 491 - 491.9
Asthma 463 - 493.9
Emphysema 492
Respiratory failure 518.81
HEART DISEASE
Accute Myocardial Infarction 410
Coronary Athersclerosis 414.0
Other Ischemic Heart Disease 411-413.9, 414.1-414.9
Cardiac Dyshythmias 427
Essential hypertension 401
Acute myocardial infarction 410
Congestive Heart Failure 428.0, 428.2-428.4
Hypertensive heart disease 402

Table 1: ICD -9 Codes for Respiratory and Cardiovascular Diseases



EPA MOVES Model for Estimating Emission Inventories

Motor Vehicle Emission Simulator (MOVES 2010b) will be configured in The El Paso North Region for Calculate five categories of PM10 PM2.5 total Emission inventories from all on-road traffic over a variety of scales within periods of time selected: weeks, months and years .

Moves (Motor Vehicle Emission Simulator)

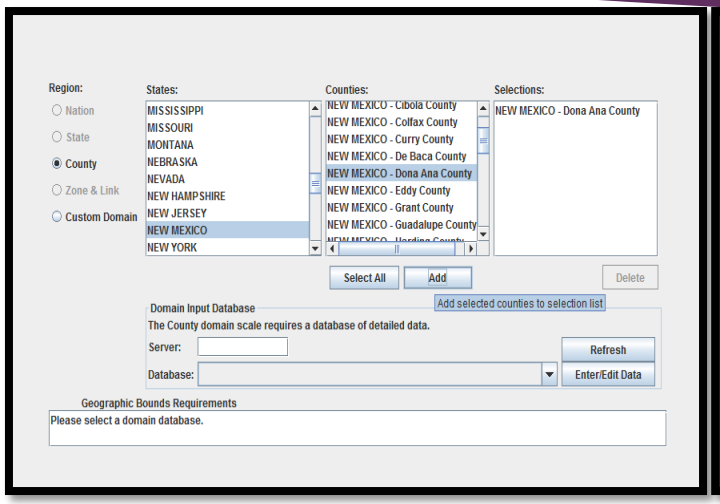
- The emission model is develop using the current equation to calculate direct traffic emissions from vehicles in the form of PM is:

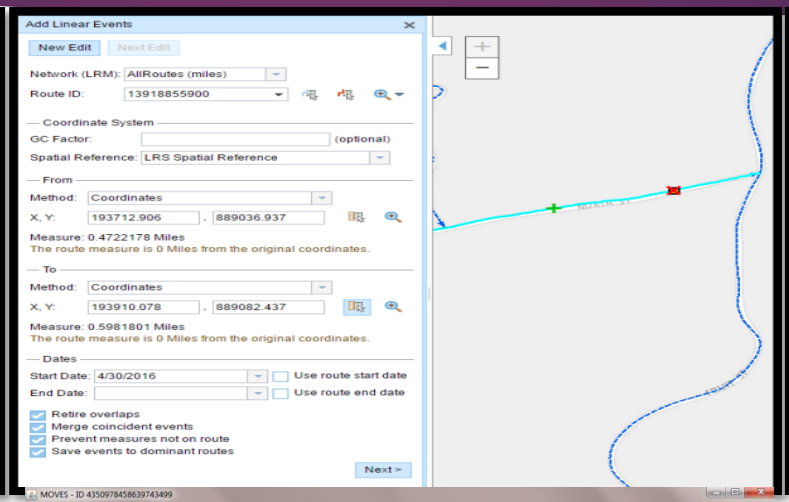
$$E_{ext} = \left[k\left(\frac{sL}{2}\right)^{0.65}\left(\frac{W}{3}\right)^{1.5} - C\right]\left(1 - \frac{P}{4N}\right)$$

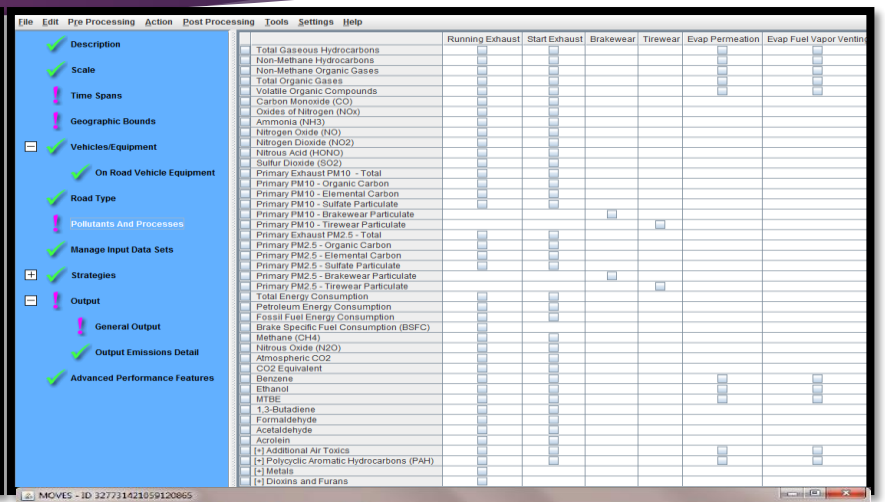
- **Eext:** annual emissions are measured in grams of miles traveled by the vehicle (g/VMT)
- **SL**: is the road surface loading in (g/m2)
- **W**: is the average weight in tons of the vehicles on the road
- **K:** is the particle size multiplier for particle size range (e.g., g/VMT for PM10 when using grams and miles)
- **P**: is the 7 number of wet days with at least 0.254 mm of precipitation during the averaging period
- **N:** is the number of years considered in the averaging period
- **C:** is the particle size specific emissions factor in units of interest vehicle direct exhaust, brake wear and tire wear.

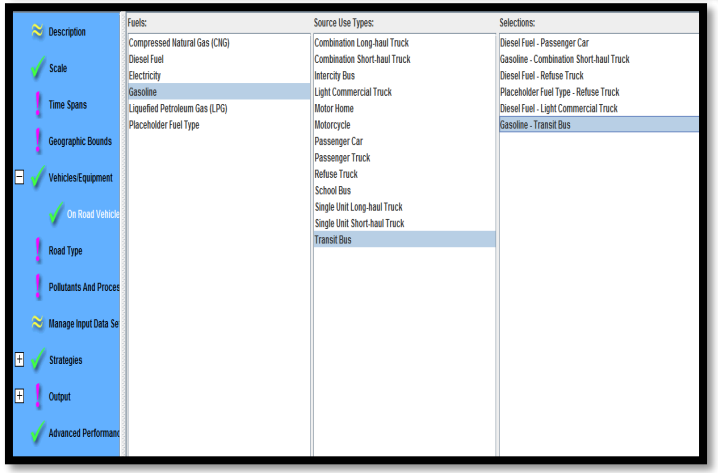
Modeling Simulation Domain and Emissions Scenarios

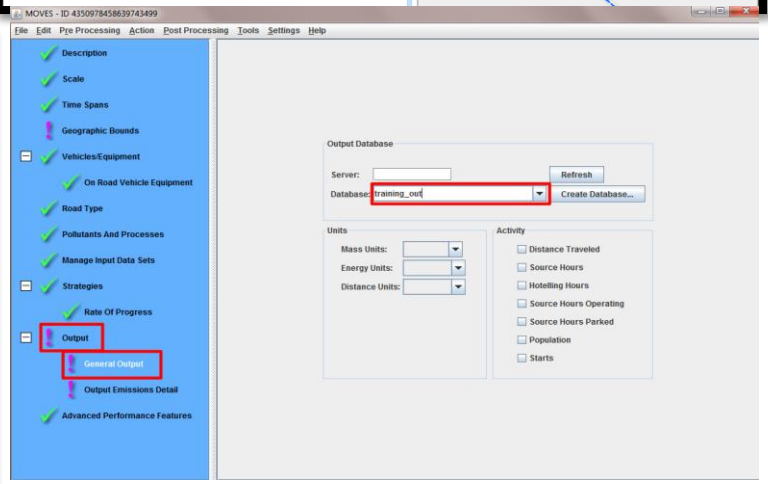
For simulations of mobile air quality emission inventories, a motor vehicle emission simulator EPA (MOVES 2014a) was used.

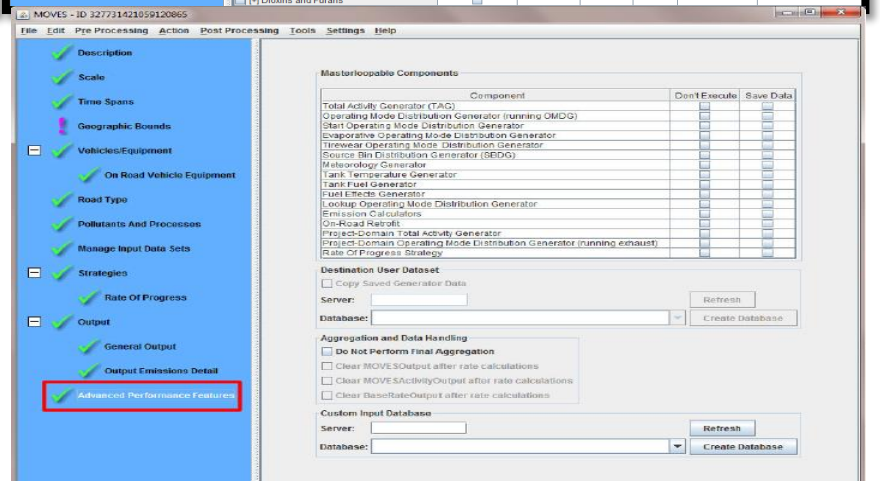












The modeling use input factors divided into seven section parameters :

On-Road Inventory local data input
Scale
Geographic Bounds
Traffic intensity
Vehicle Type
Pollutants
Road Type
Fuel Types

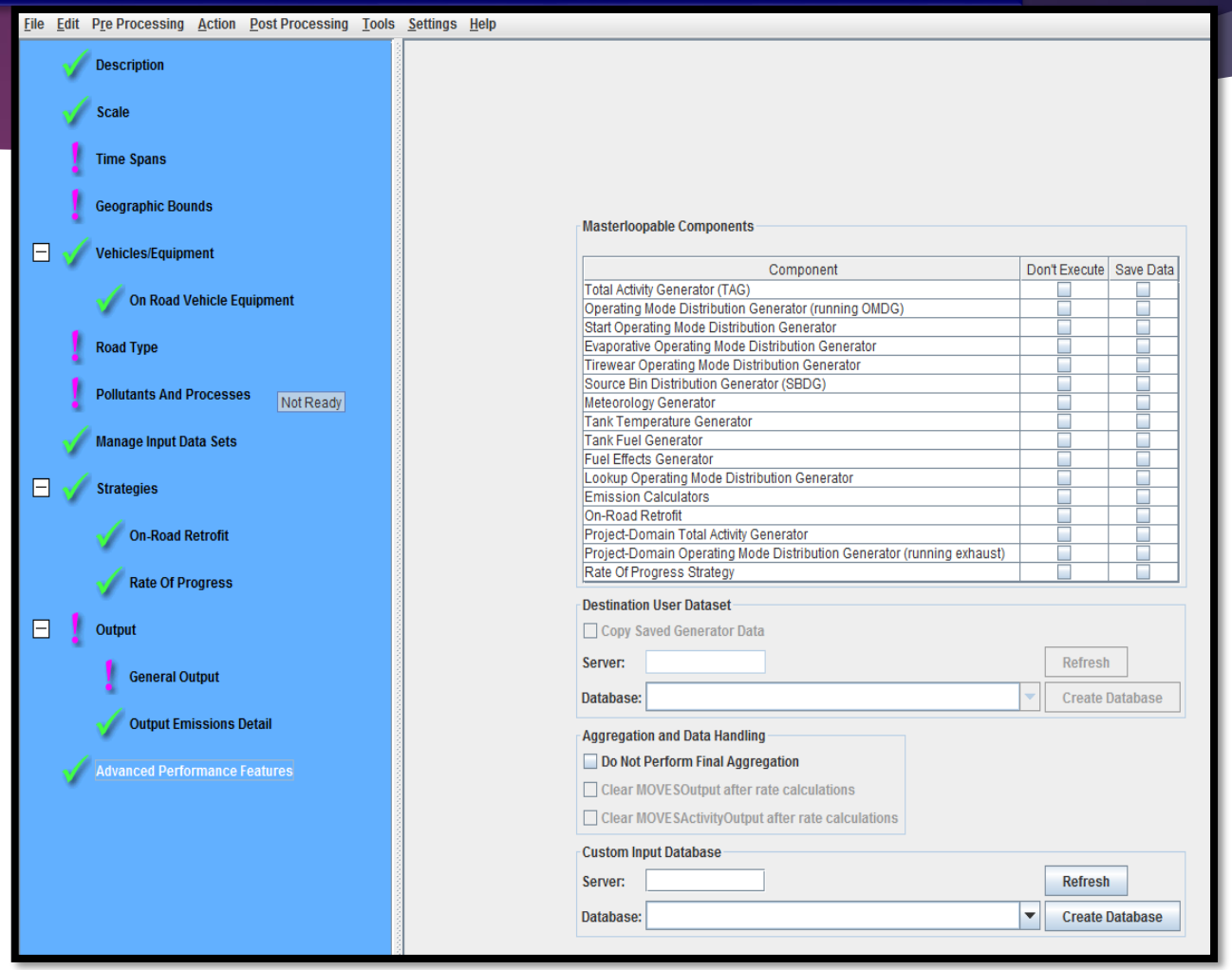


Figure : Source: EPA US Environmental Protection Agency 2012- Moves 2010b Model

EPA Moves 2014a: The modeling used input factors divided into six section parameters

On-Road Inventory local data input

Geographic Domains: County/Nonattainment Area.

Vehicle-Miles Traveled (VMT): is the total number of miles driven by all vehicles within
a given time period and geographic area.

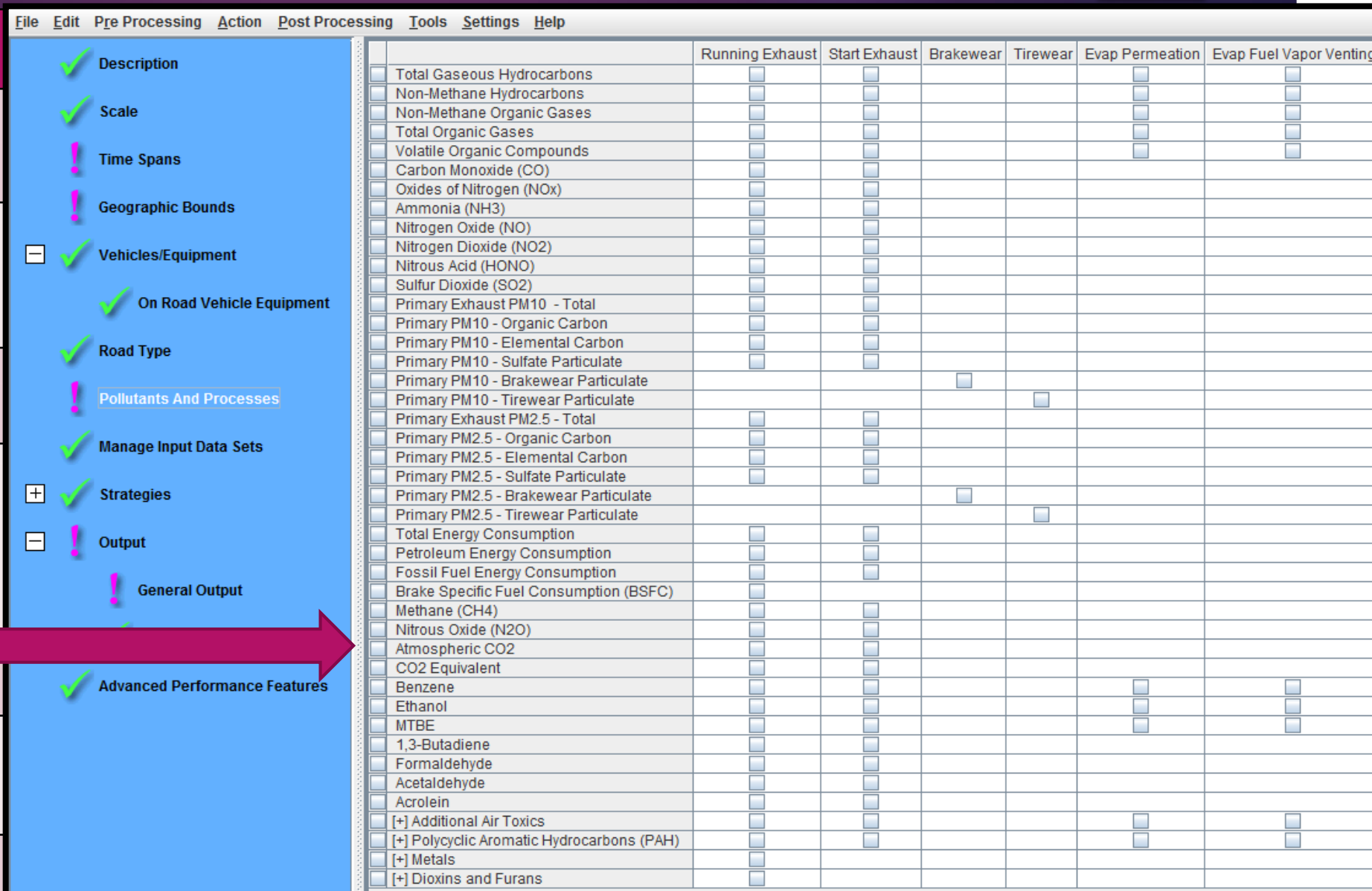
Average speed: range from 2.5 miles per hour to 65 miles per hour.

Vehicle Classes: Motorcycle, Passenger Car/Truks, light-duty Commercial Truck (6,001-8,500 lbs), Buses, heave-duty trucks, Refuse trucks, School Bus, Single Unit Short Haul-truck, Single Unit Long Haul-truck, Long Haul Truck, Heavy-Duty Vehicles (26,001-33,000 lbs)

Pollutants

Road Type: Rural restricted Acces (Freeways and interstates) Rural and Restricted Acces, Urban Restricted Acces, Off-Network.

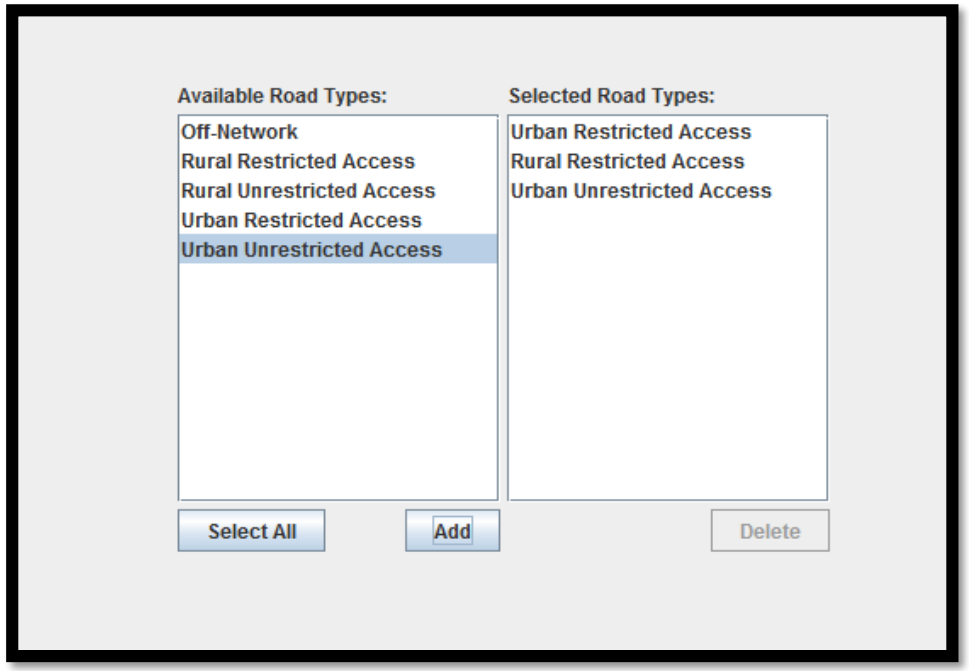
Fuel Types: Gasoline, Diesel Fuel.



Specific Road Types

Two road types for running emission from the MOVES can be selected :

- (freeways and interstates)
- Interior urban Urban



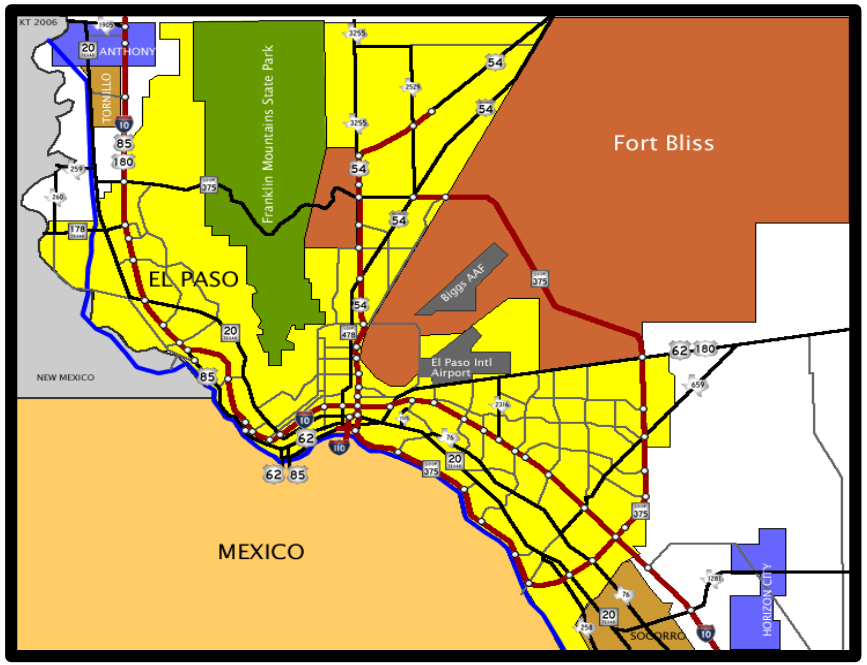
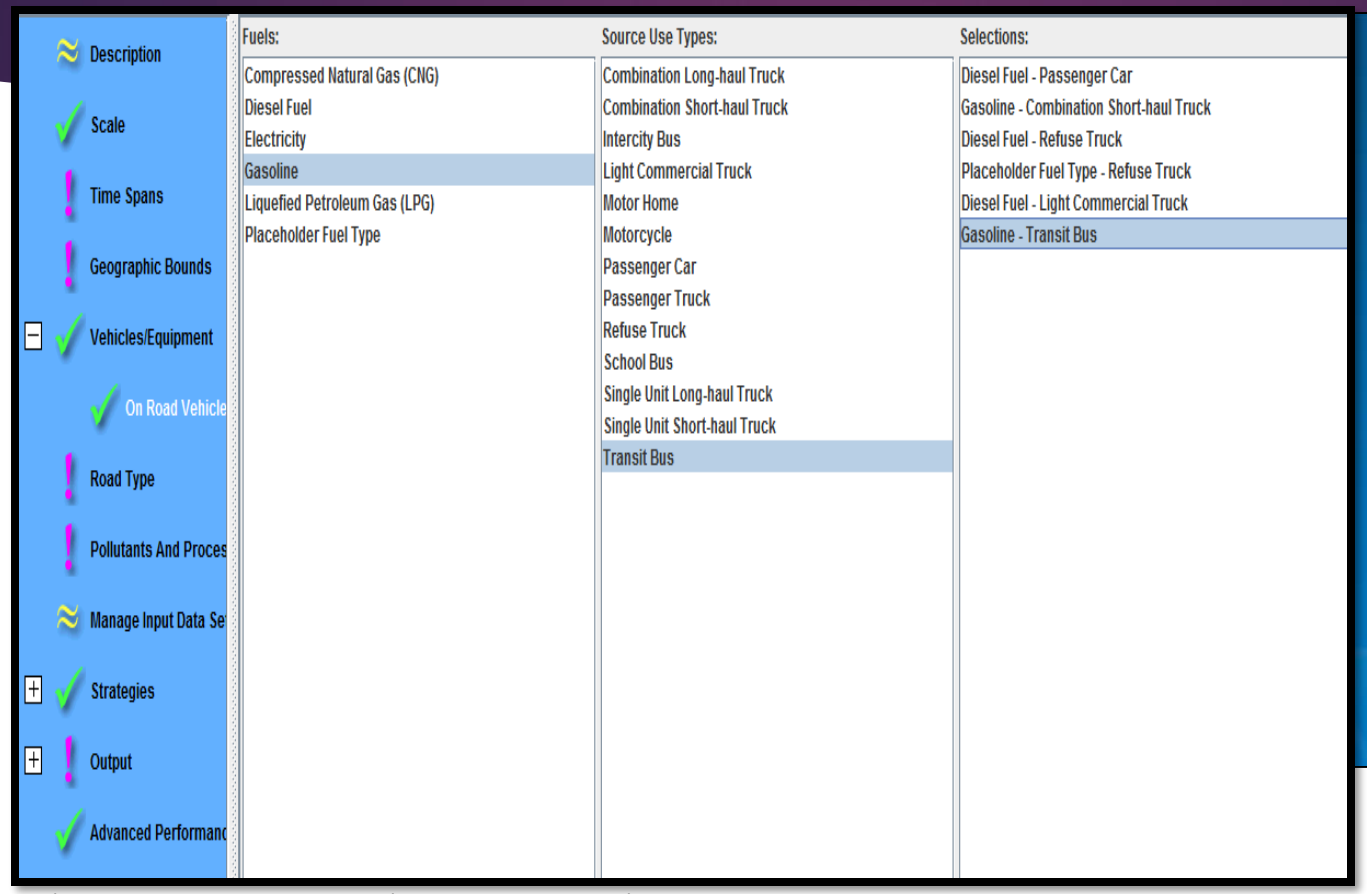


Figure : Source: EPA US Environmental Protection Agency 2012- Moves 2010b Model

Vehicles/Equipment

This panel show which on-road vehicles will be modeled.



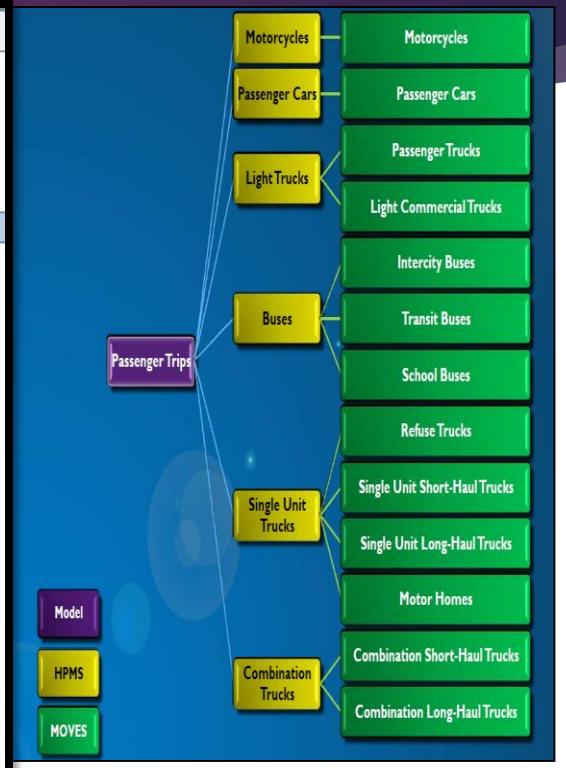


Figure : Source: EPA US Environmental Protection Agency 2012- Moves 2010b Model

Based on Department of Transportation Highway , MOVES will Estimates Traffic Emissions from Cars, Trucks & Motorcycles.

Transit bus

Motor home

Motorcycle

Long haul truck

Short haul truck

Inercity bus

Ligth comercial truck

Passenger car

Passenger truck

Refuse truck

School bus

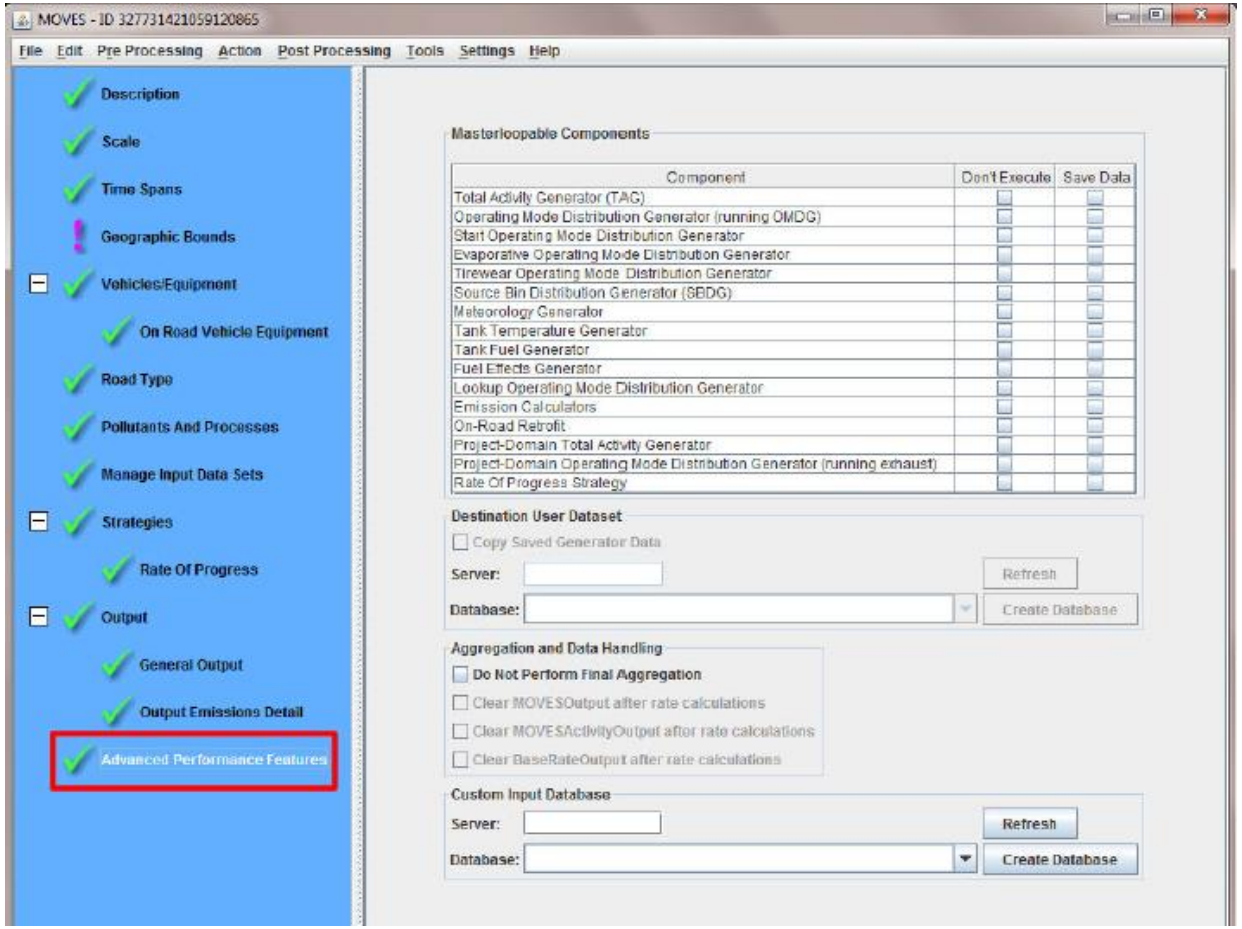
Single unit long haul-truck

Single unit short haul-truck

Output Data Moves 2014a

Inventories of PM $_{10, 2.5}$ Mobile Emission from all on-Road Traffic:

- Exhaust Emission PM $_{10, 2.5}$ grams/mile
- Brake Wear Emission PM $_{10, 2.5}$ grams/mile
- Tire wear Emission PM $_{10, 2.5}$ grams/mile
- Date of Vehicle miles traveled (VMT) for Day, Week, Month, Year.
- Total Vehicle population,
- Vehicle age distribution.



Simulation of Mobile Emission in the El PdN Region Zip Code 79905

Total Emissions from Road Traffic in El Paso County, PM10,2.5 Exhaust and Non exhaust Emission in kilograms/month

Taking the interests to the health risks related to PM 10,2.5 mobile emission, were simulated.

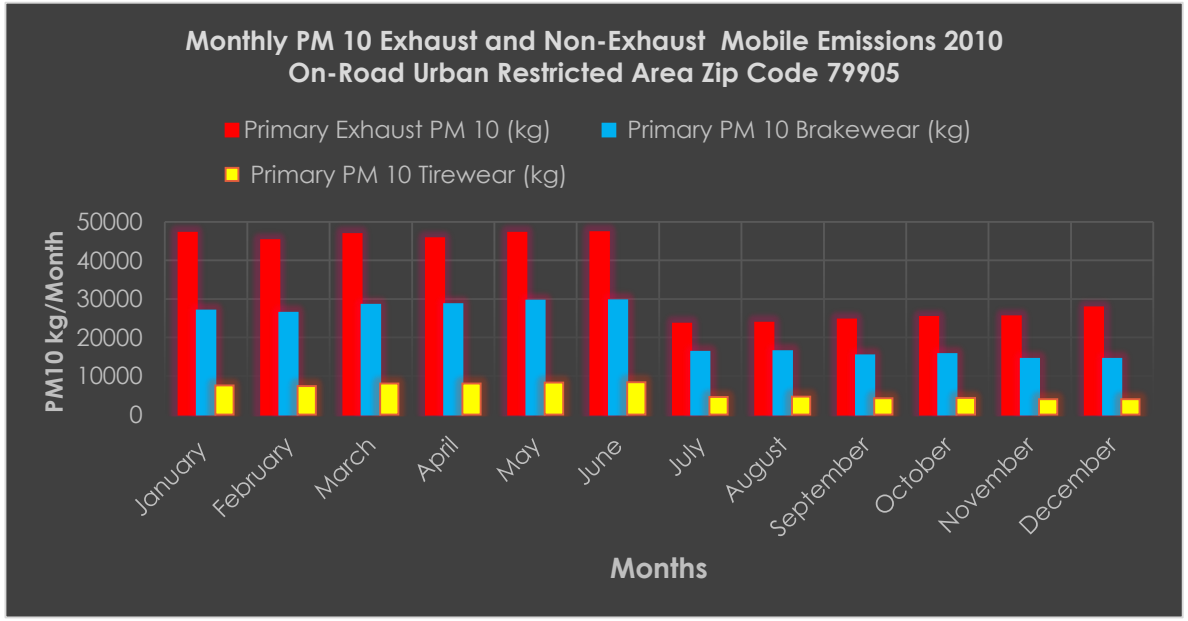


Figure: Total Emissions from road traffic in El Paso TX Area were estimated for PM10 Exhaust and Non exhaust emission in kilograms/month : (Source: EPA MOVES 2014a)

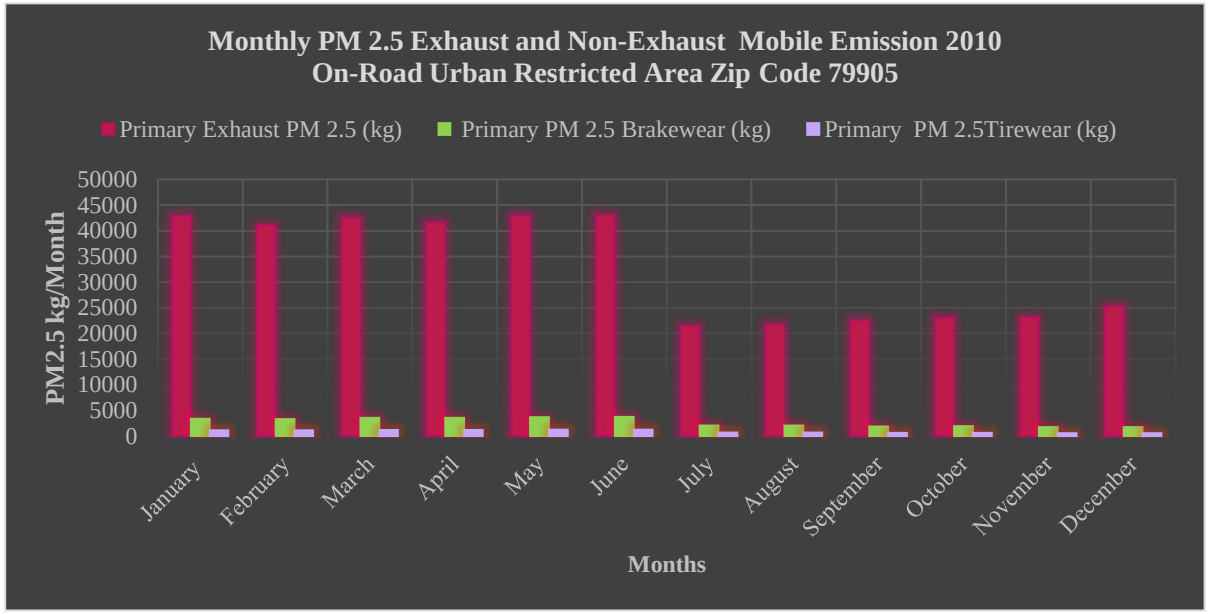


Figure: Total Emissions from road traffic in El Paso TX Area were estimated for PM2.5 Exhaust and Non exhaust emission in kilograms/month : (Source: EPA MOVES 2014a)

Exhaust and Non-exhaust emissions contribute almost equally to total traffic-related PM10,2.5 Emissions (Querol et al., 2004; Bukowiecki et al., 2009a; Amato et al., 2011),

Monthly PM $_{10\ 2.5}$ Exhaust and Non-Exhaust (Brakewear,Tirewear) Mobile Emission 2010 On-Road Urban Restricted Area Zip Code 79905

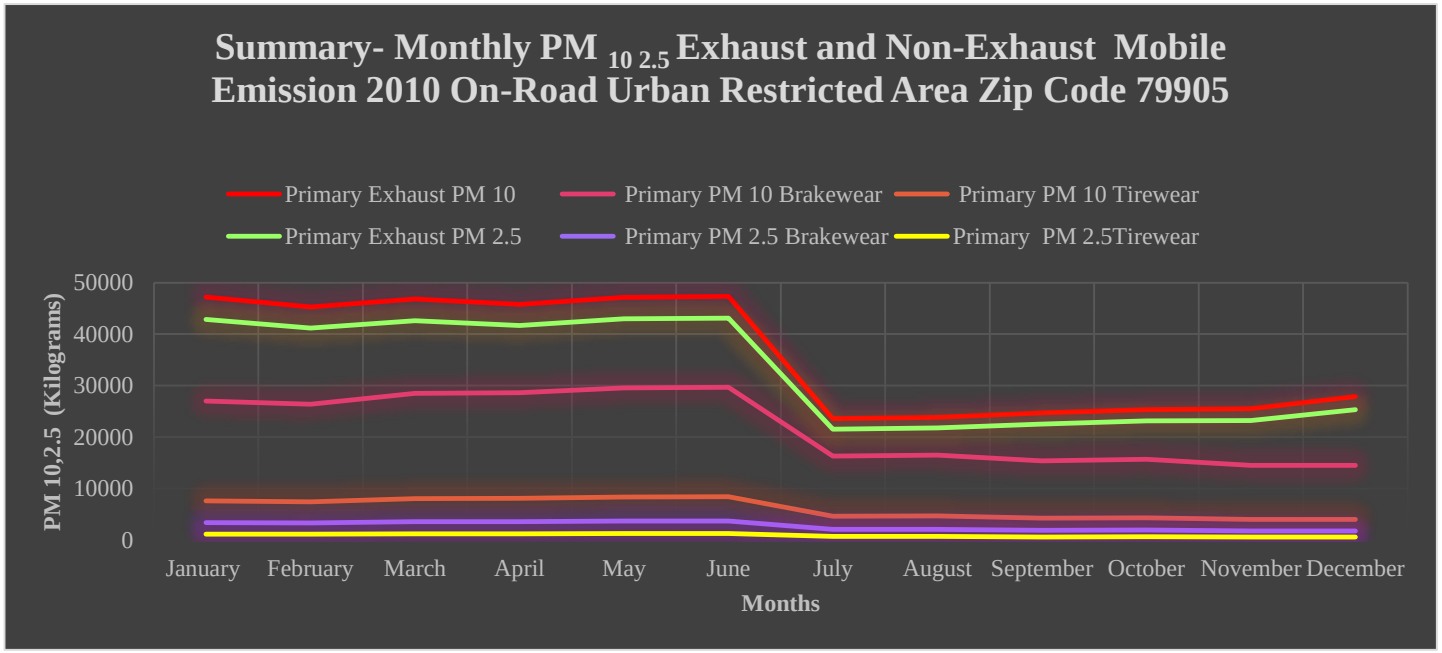


Figure: Total Emissions from road traffic in El Paso TX Area were estimated for PM10, 2.5 Exhaust and Non Exhaust mobile emission in kilograms per month : (Source: EPA MOVES)

Exhaust Emissions PM10,2.5 is reaching maximum emission 48,000-42,000 thousand of Kg/month, followed by Brake wear 29,000-5000 thousand kg/month and Tire wear with 9,000-2,000 kg/month. The results show that the emissions of PM derived mainly from Exhaust and Brake are significantly higher in Urban Area.

Annual Contribution of Mobile Emission PM 10,2.5 (Kg) Zip Code 79905 El Paso County 2010

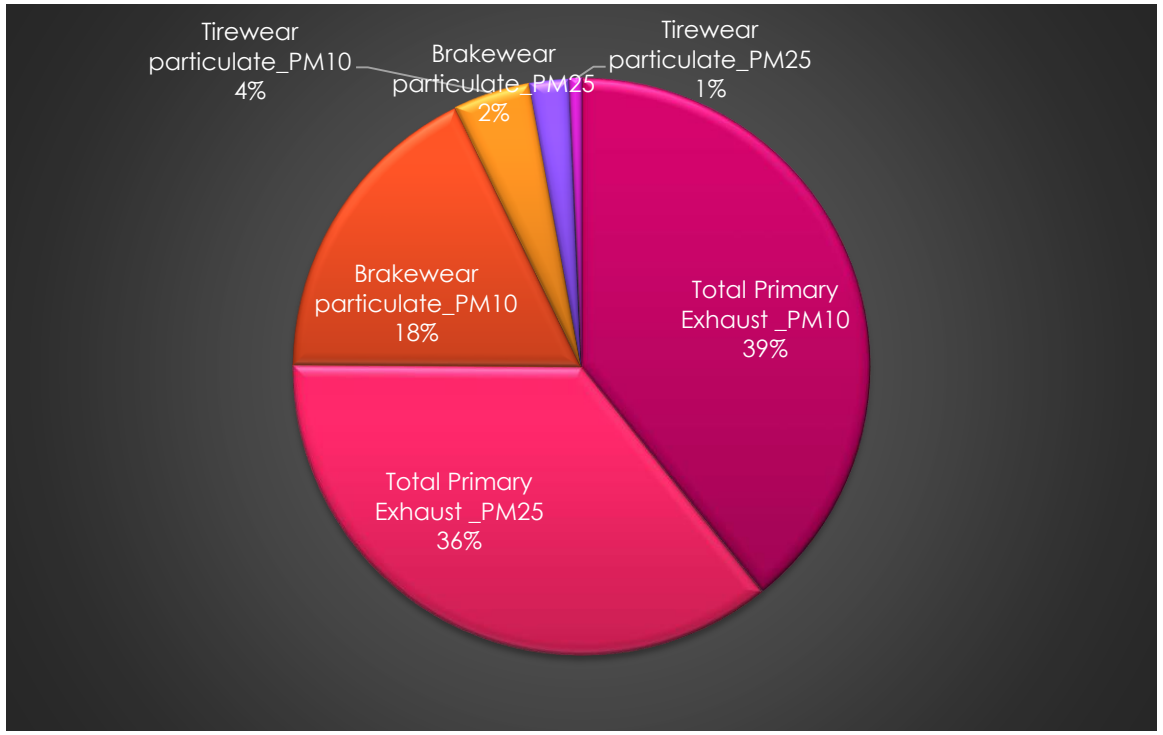
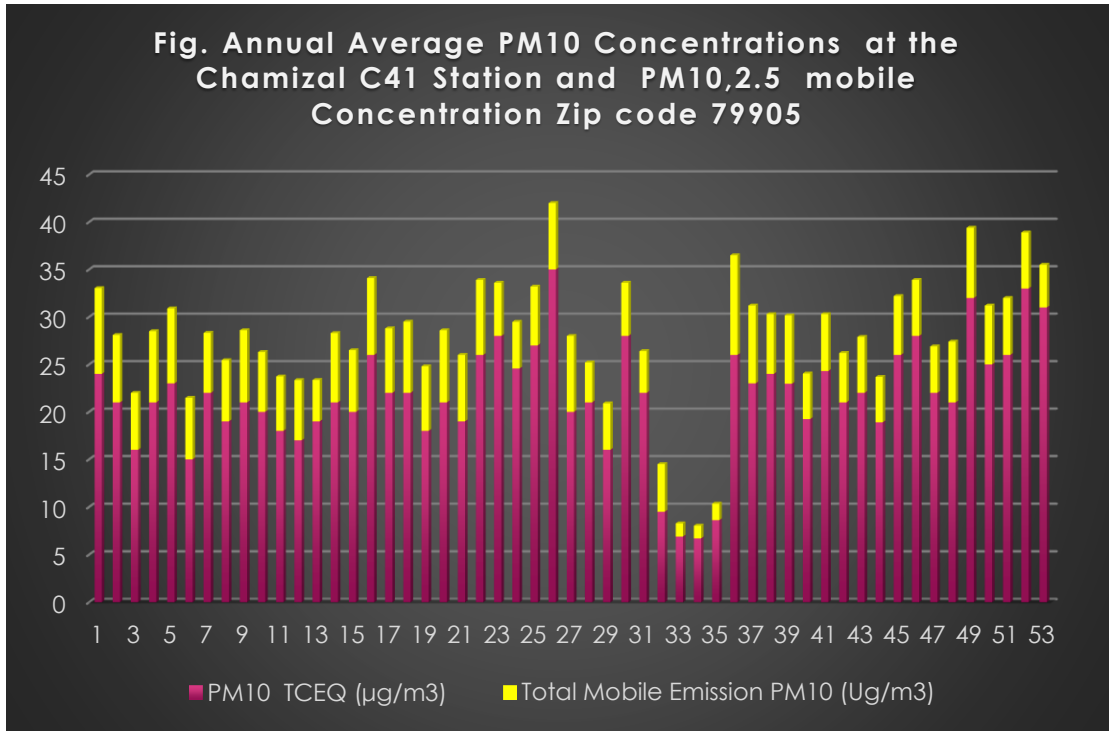


Fig: Exhaust Emission is Contributing Approximately 74% of total PM10,2.5 Mobile Emissions, following of Brake wear with 20 % and Tire wear with 5%.



Annual Average PM10,2.5 ug/m3 Mobile Emissions (Moves) 26% Chamizal C41 Monitoring Station (TCEQ Chamizal Station)

Predicting Mobile Emission and VTM Estimation The PdN Region 2010

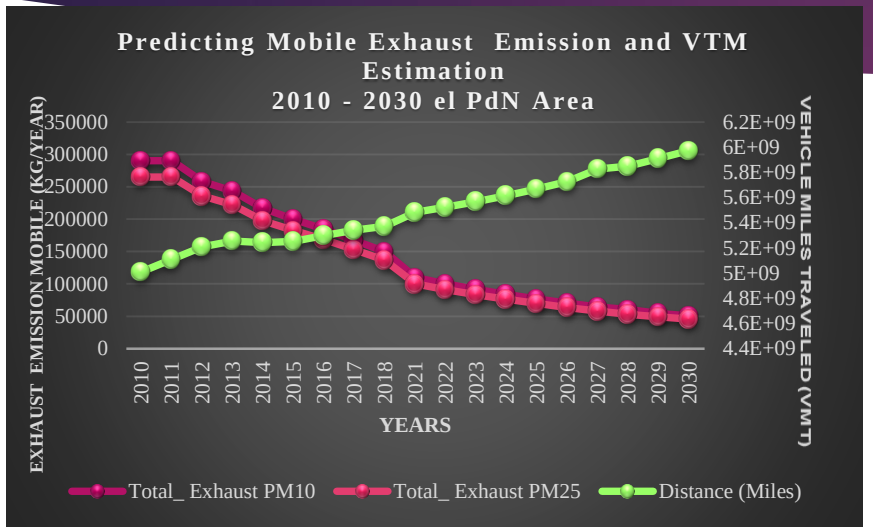


Fig: Predicting Mobile Exhaust $PM_{10,2.5}$ (kg/Month) Emission and VTM Estimation 2010 - 2030 el PdN Area.

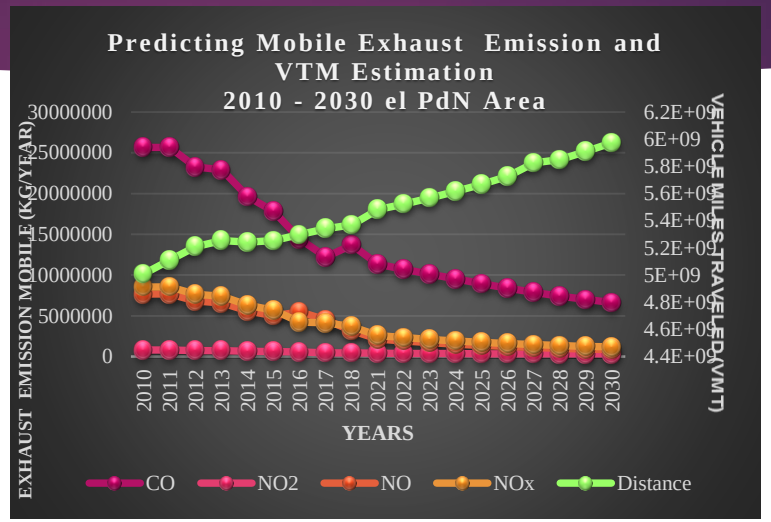


Fig: Predicting Mobile Exhaust Emission and VTM Estimation 2010 - 2030 el PdN Area in El Paso TX Area were estimated for Total CO, NOx, NO2, NO emission in kilograms per year : (Source: EPA MOVES 2014a model)

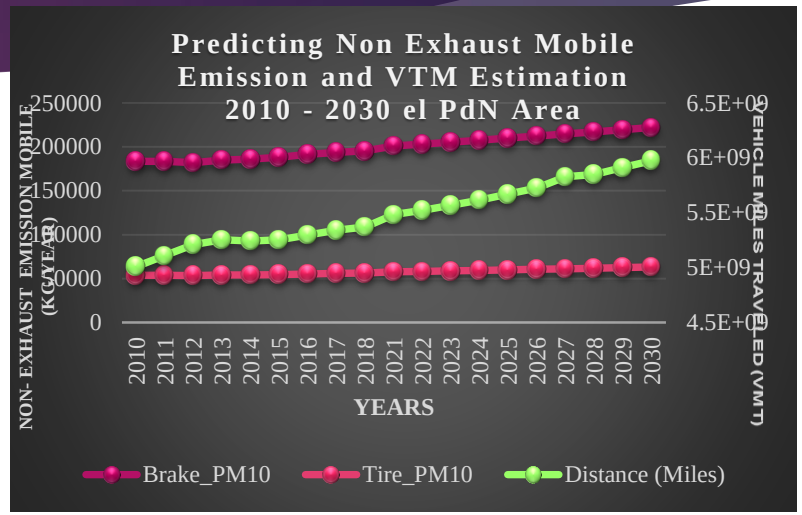


Fig: Predicting Mobile Exhaust $PM_{10,2.5}$ (kg/Month) Emission and VTM Estimation 2010 - 2030 el PdN Area.

The simulated Exhaust emissions in the future years, shows a trend of reduction of this type of emissions in the future years, one factor should be the new hybrid technology is increasing by 47,6% since 2010 to 2015 and use of catalytic converters, diesel particulate filters and improved fuels and engines. Non-exhaustive sources will increase in the coming years because there is no control in the material of manufacture composed by Fe, Cu and Mn, also not to be able to reduce the number of events of braking. (Accelerations and decelerations)..

Daily Avg. PM10,2.5
Levels of PM Mobile Emission Non-Exhaust -Rush Hour Periods Fall 2010 Zip Code 79905

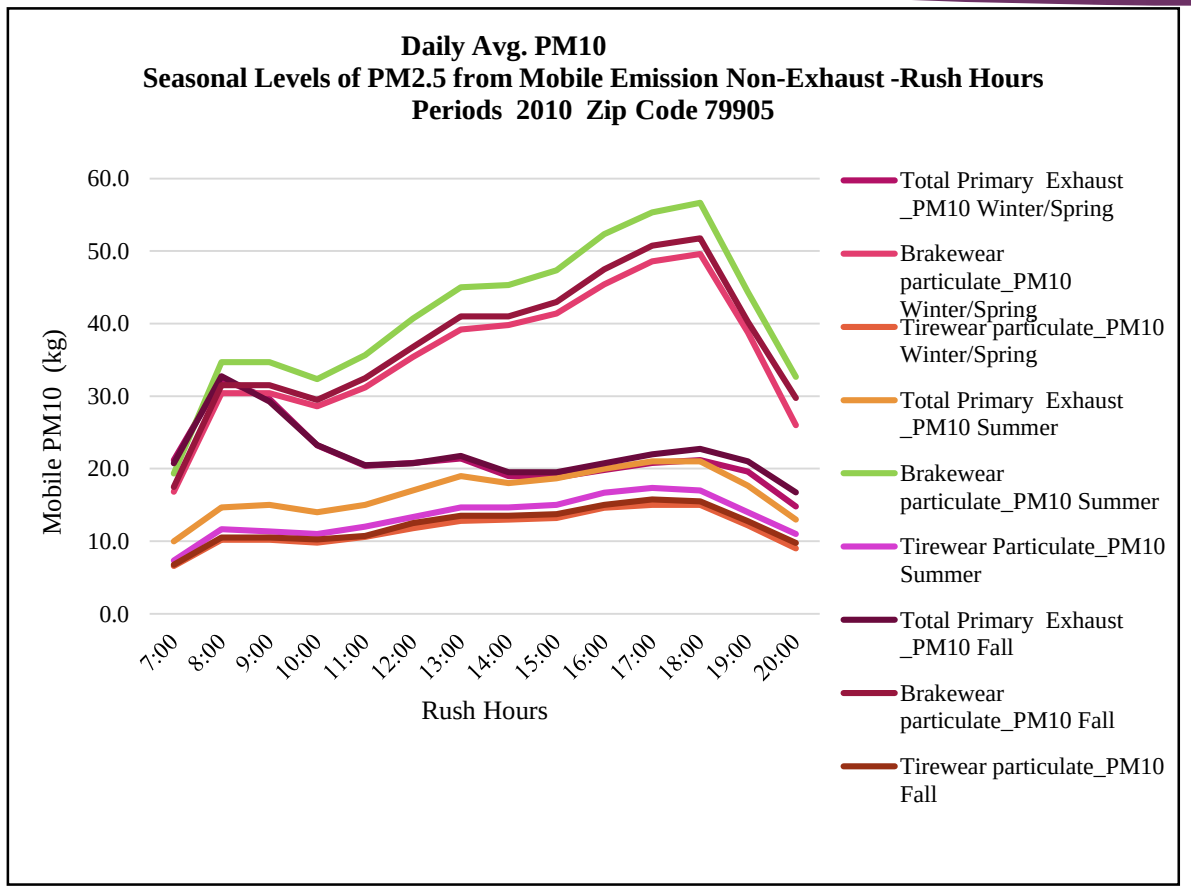


Figure: Seasonal Levels of PM2.5 from Mobile Emission Non-Exhaust -Rush Hours

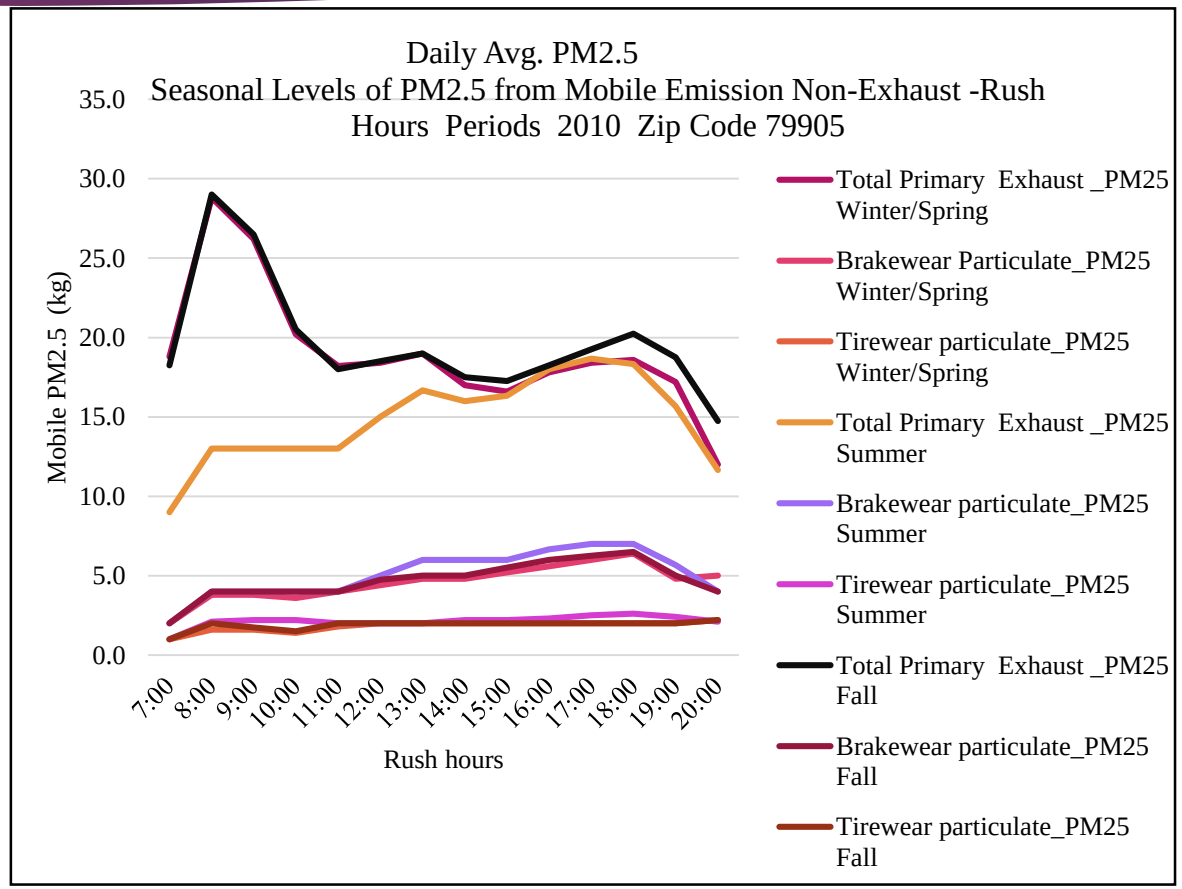
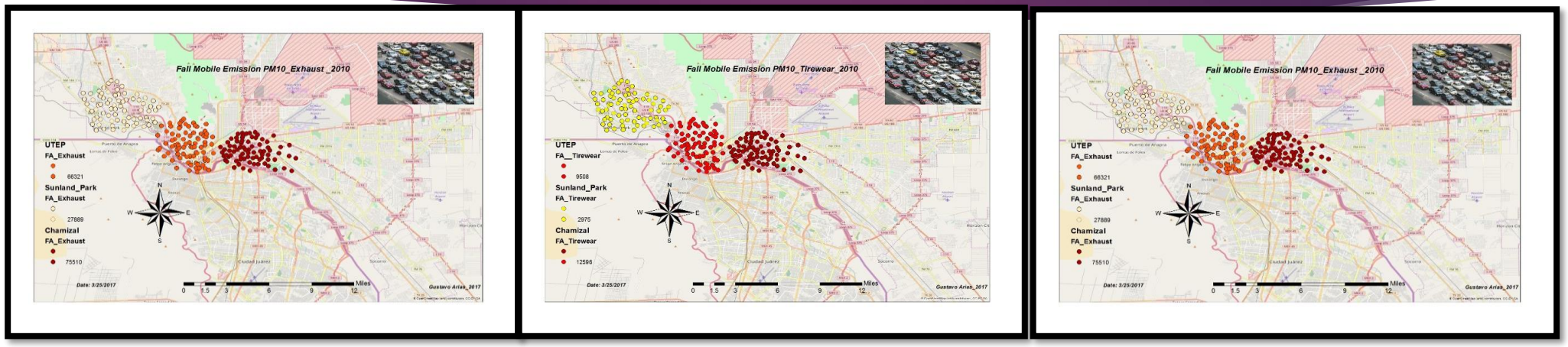


Figure: Seasonal Levels of PM2.5 from Mobile Emission Non-Exhaust -Rush Hours

GIS EMISSIONS INVENTORY SYSTEM

- A geographic information system (GIS) was used to established geographic scenarios with processed images of seasonal mobile emissions in the PdN region. Seasonal mapping is visualized for different types of pollutants: Brakewear, Exhaust and Tyrewear .

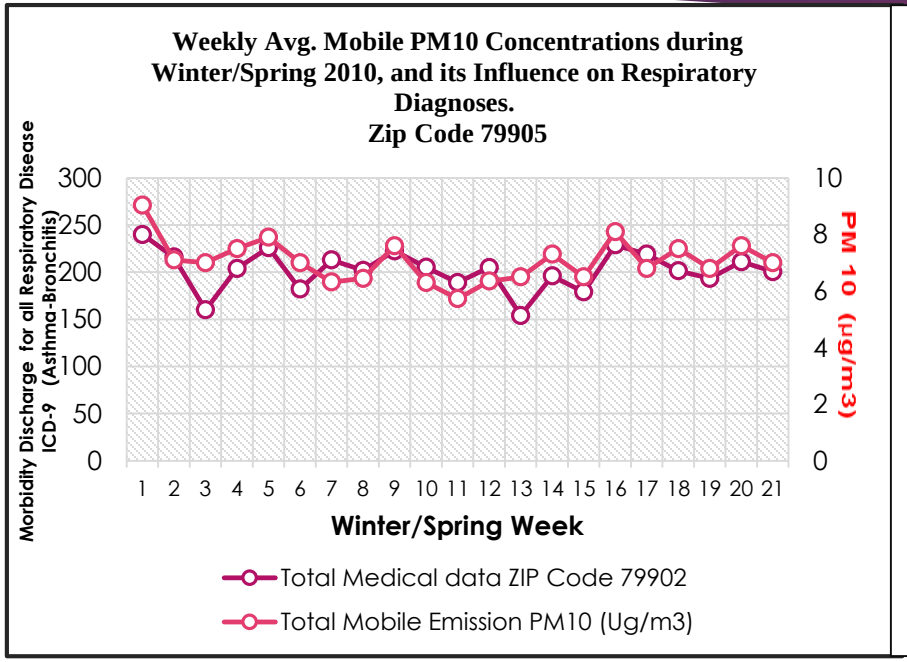


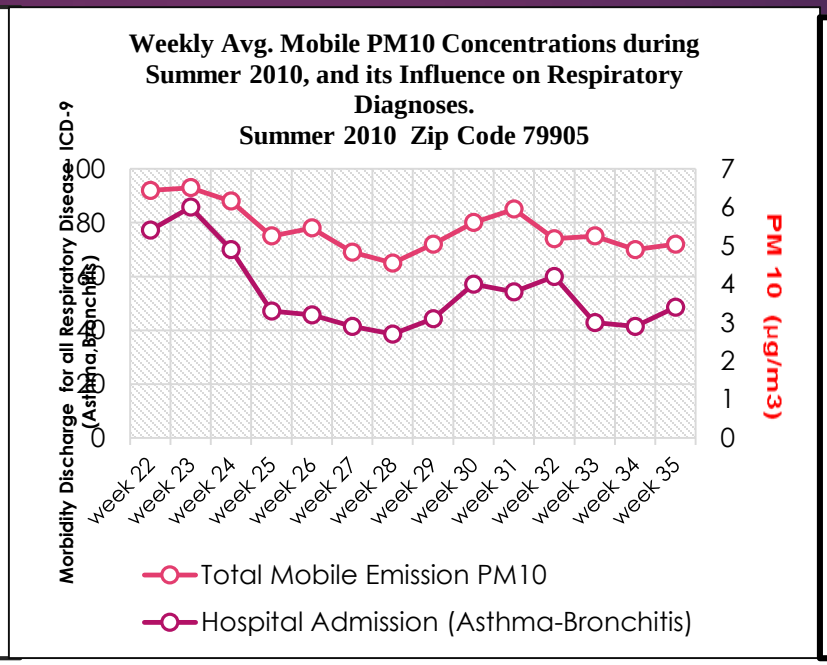
Fg: Graphics of GIS and Seasonal mobile Emission of particulate matter emission inventory: Seasonal emission simulations were performed in kilograms and five contributing inputs factors were identified for modeling. 1) On the **composition of the particulate** material from different sources, such as: Exhaust and Non exhaust (Brake wear; Tirewear). 2) ***The Vehicles / Equipment*** clasification were selected according to the use of gasoline and diesel fuel (motorcycle, passenger car, Light Duty Vehicles, Trucks, refuse, truck, Light Duty Vehicles, Light Commercial Truck, Light Duty Vehicles, School Bus).

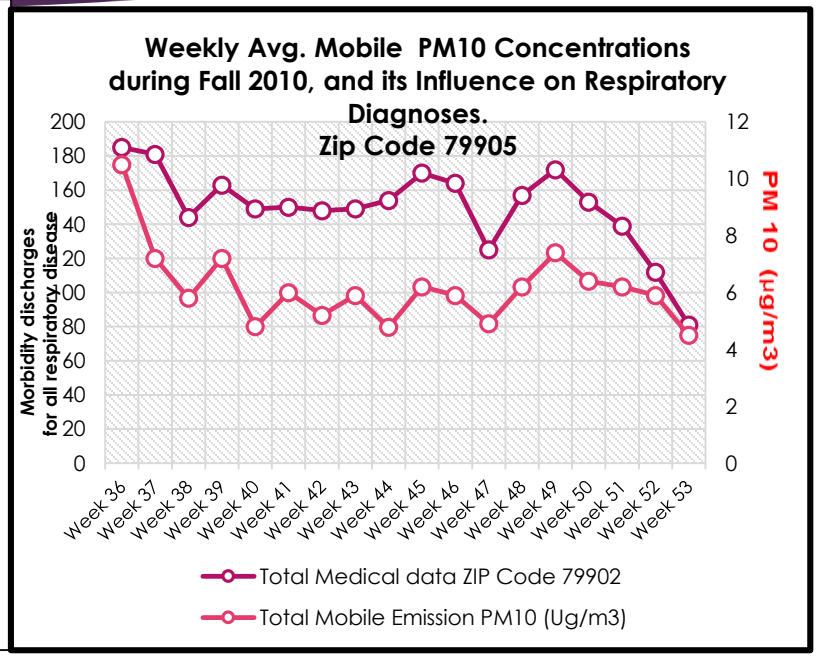
Winter	Primary Exhaust PM 10 (kg)	Primary PM 10 Brakewear (kg)	Primary PM 10 Tirewear (kg)
	120354	67860	19065
Spring	Primary Exhaust PM 10 (kg)	Primary PM 10 Brakewear (kg)	Primary PM 10 Tirewear (kg)
	139767	86702	24463
Summer	Primary Exhaust PM 10 (kg)	Primary PM 10 Brakewear (kg)	Primary PM 10 Tirewear (kg)
	94747	62481	17630
Fall	Primary Exhaust PM 10 (kg)	Primary PM 10 Brakewear (kg)	Primary PM 10 Tirewear (kg)
	75510	45542	12596

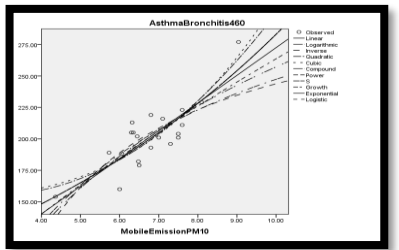
2.5.1 Descriptive Statistics Data Analysis

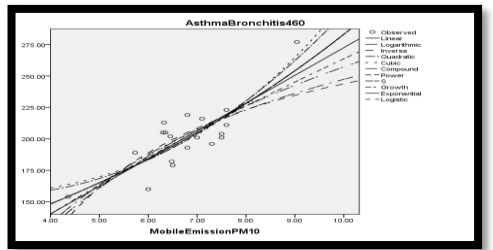
Weekly Correlation Analysis of Mobile Emission PM10 (Exhaust-Non-Exhaust) and Respiratory Diagnoses Winter/Spring, Summer and Fall 2010

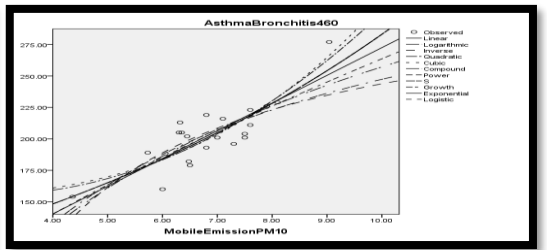








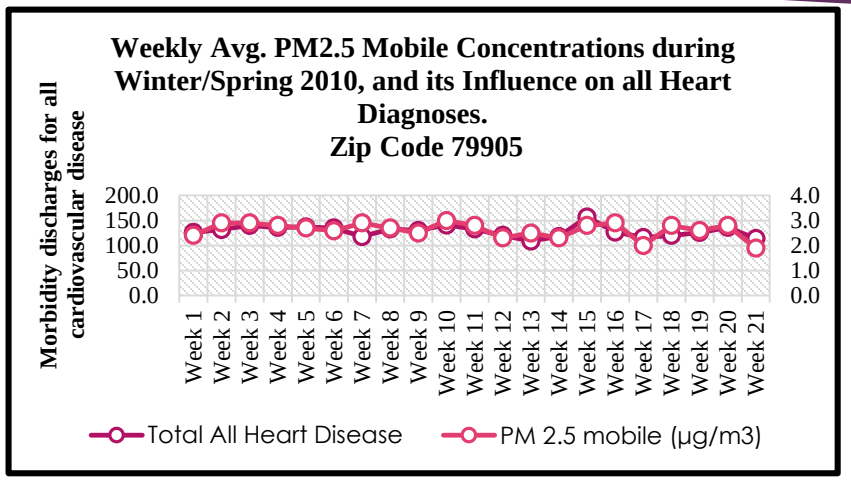


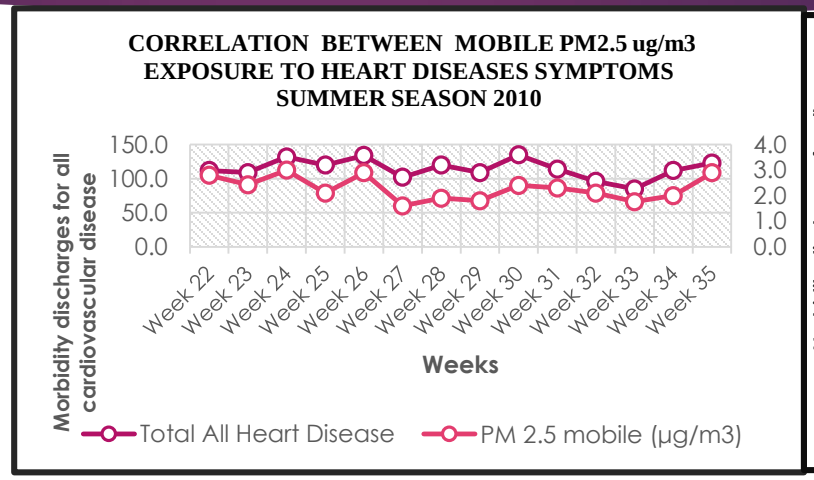


Mobile(Exhaust-Non-Exhaust) PM10 and Asthma-Bronchitis)	Linear R Square
Winter/Spring	.734 – 39%
Summer	.614 – 32%
Fall	.548 -29%

PM10 Mobile emission **(Exhaust-Non-Exhaust)**,contributed significantly association to the incidence of RD.

Weekly Correlation Analysis of PM 2.5 Mobile Emission (Exhaust-Non-Exhaust) and Cardiovascular Diagnoses Winter/Spring, Summer and Fall 2010.





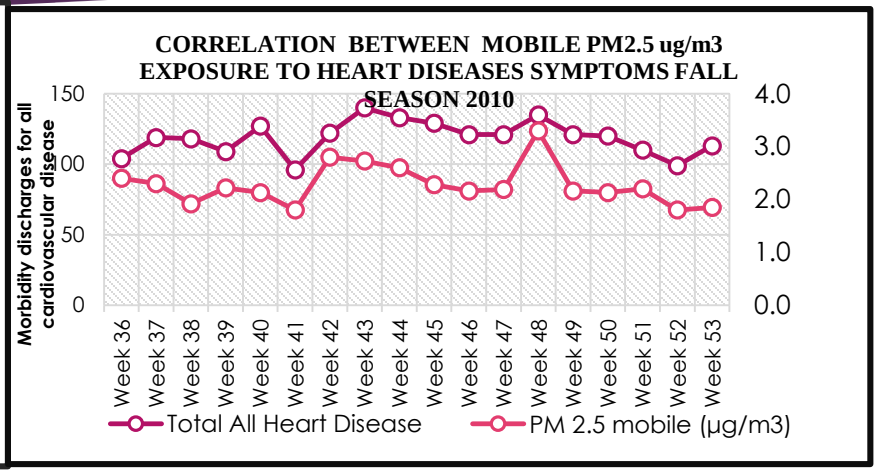
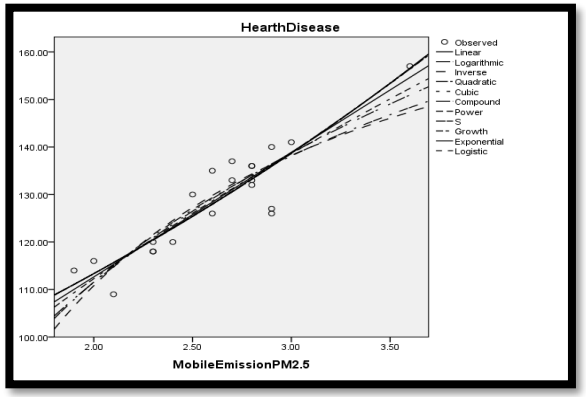
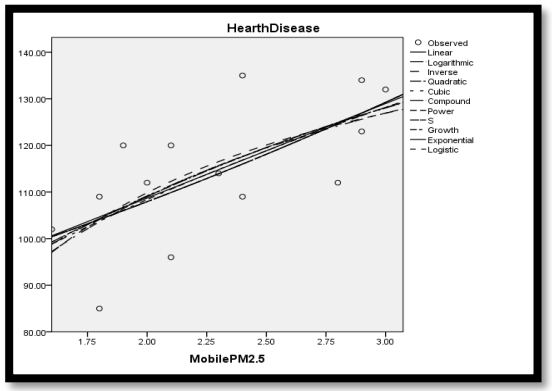
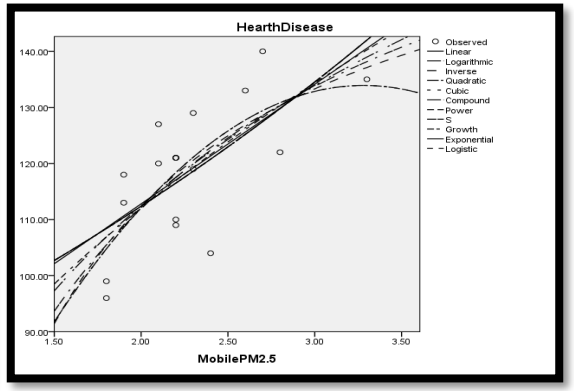


Figure : Statistical Analyses of the Relationship Between PM2.5 Caused by Traffic Emission(26% of total Emission), with Heart diseases. Source: Hospital Admissions for Asthma, Acute Bronchitis and Heart diseases. in El Paso County zip code 79905 from Texas Health Care Information Council in Austin, Texas (Texas Health Care Information Council, 2000)



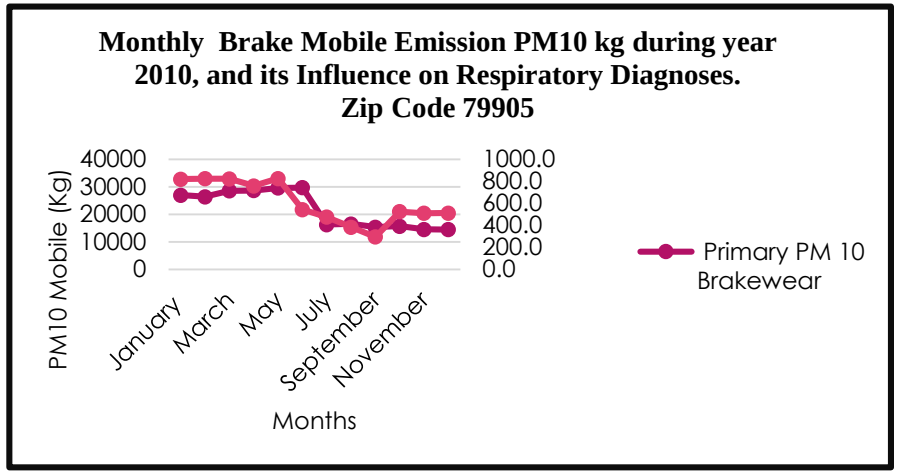


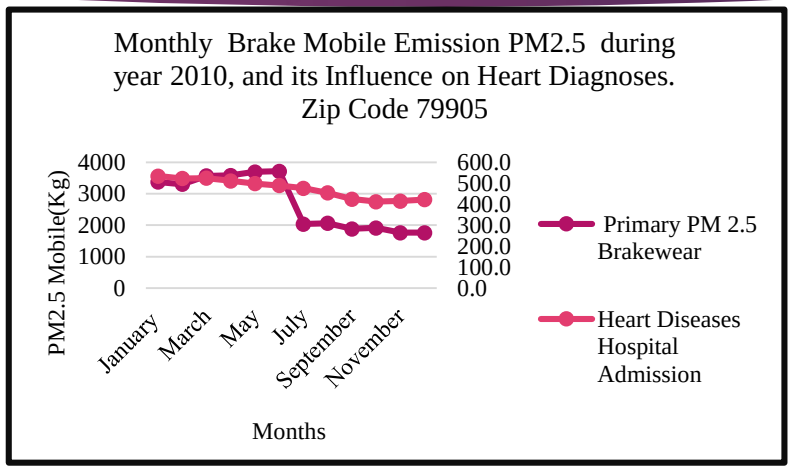


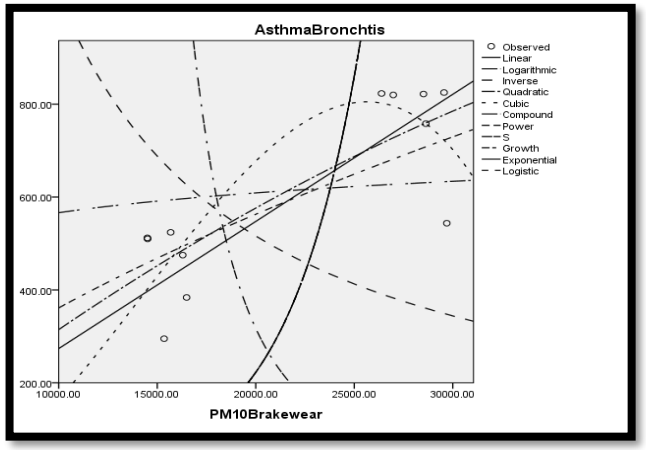
Mobile(Exhaust-Non-Exhaust) PM10 and Asthma-Bronchitis)	Linear R Square
Winter/Spring	.833 -42%
Summer	.620 -32%
Fall	.501-26%

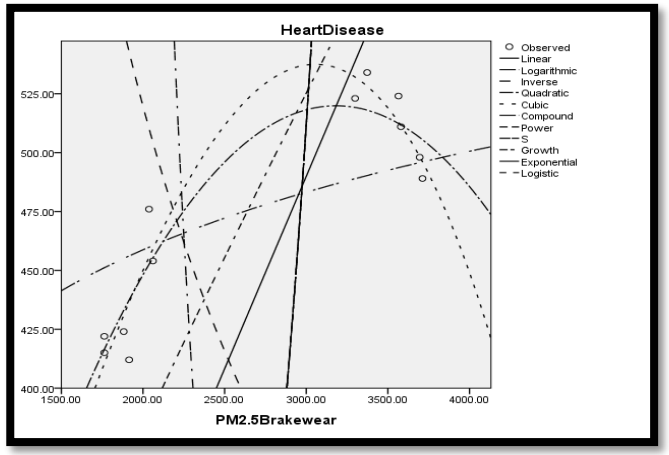
PM10 Mobile emission (Exhaust-Non-Exhaust),contributed significantly association to the incidence of CVD Diseases.

Monthly Brake Mobile Emission PM10,2.5 kg During year 2010, and its Influence on Respiratory Diagnoses. Zip Code 79905



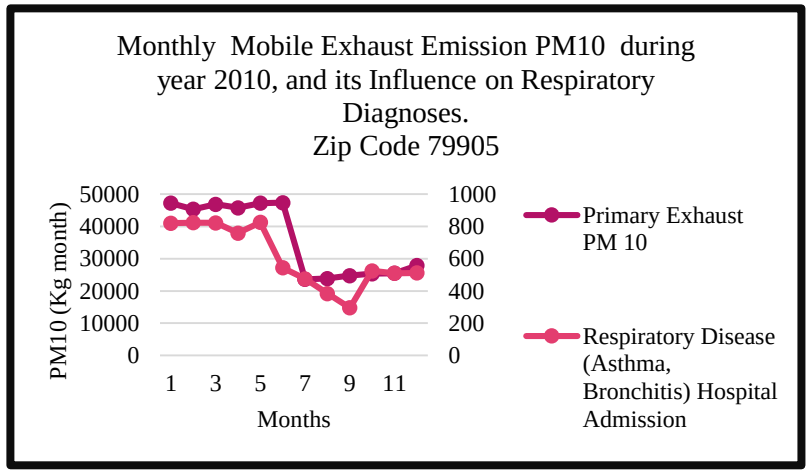


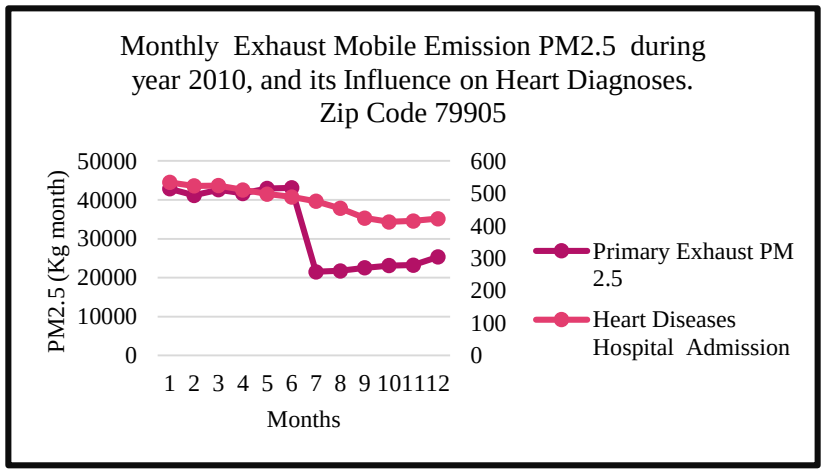


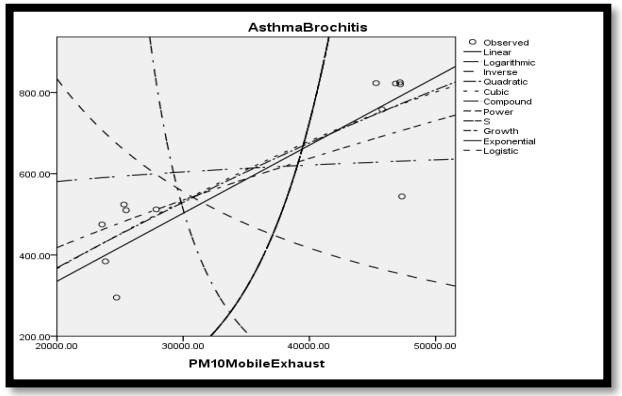


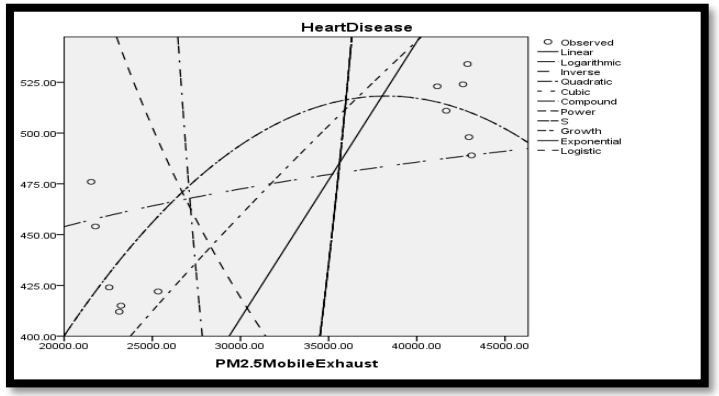
Brake Mobile Emission PM10 kg Asthma-Bronchitis)	Brake Mobile Emission PM2.5 kg and Heart Diagnoses
Linear Square R=.969	Linear Square: R=8.56

Monthly Mobile Exhaust Emission PM10,2.5 During year 2010, and its Influence on Respiratory Diagnoses. Zip Code 79905



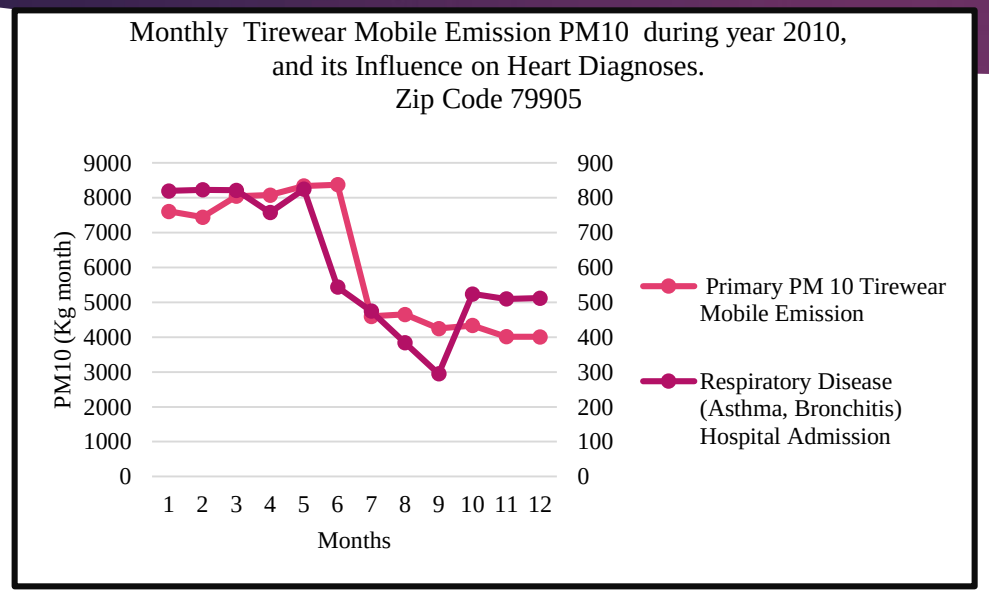


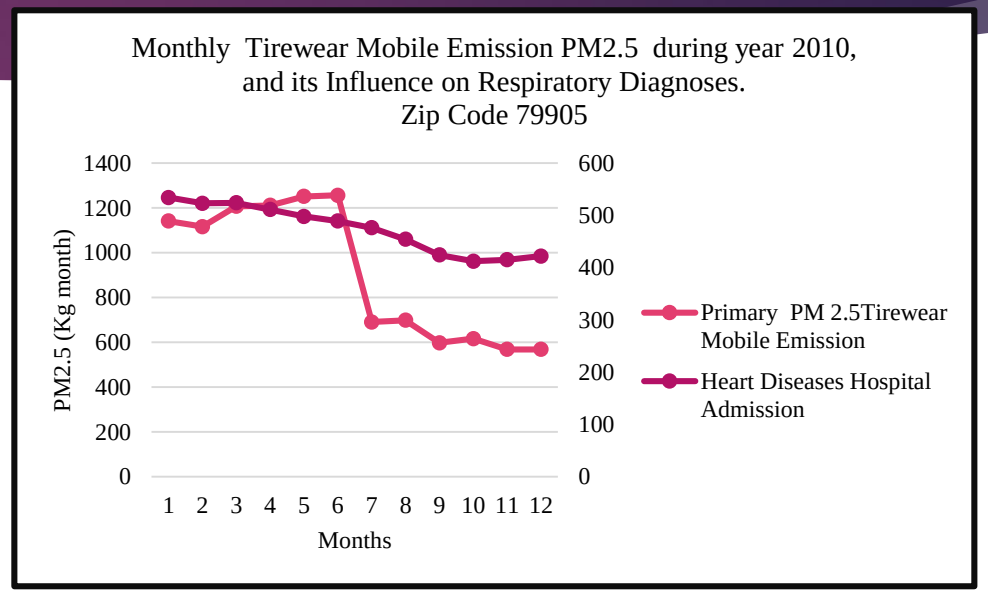


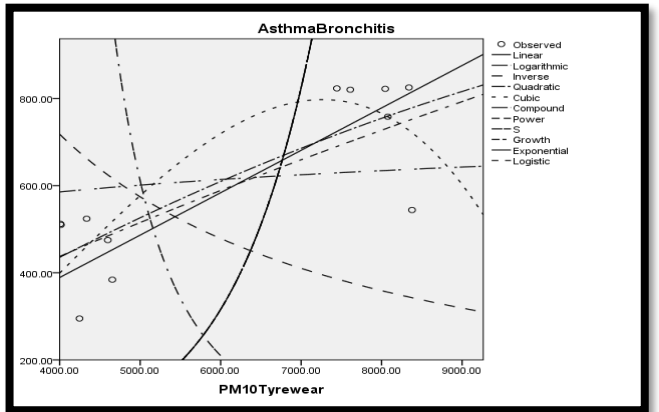


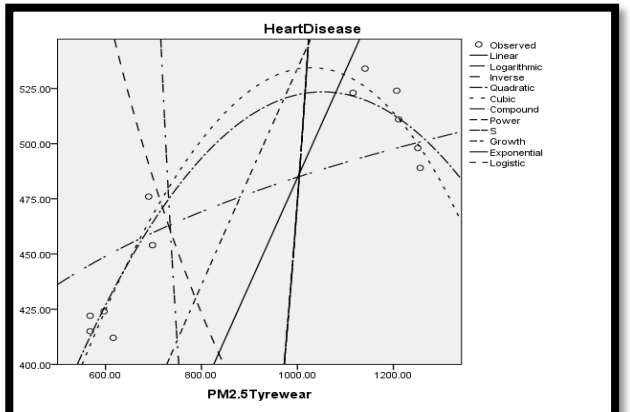
Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)	Exhaust Mobile Emission PM2.5 kg and Heart Diagnoses
Linear Square R=.929	Linear Square R=.831

Monthly Tire wear Mobile Emission PM10,2.5 During year 2010, and its Influence on Heart Diagnoses. Zip Code 79905









Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)	Exhaust Mobile Emission PM2.5 kg and Heart Diagnoses
Linear Square R=.769	Linear Square R=.715

Dona Ana County Zip Codes 88021,88027,88072,88048

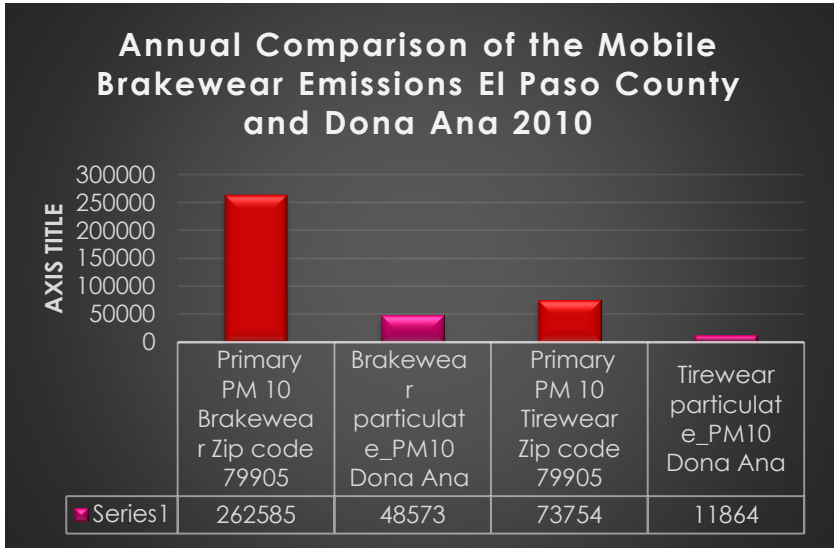


Figure: Comparison of the Annual Mobile Emissions of Primary PM10 Non-Exhauts (Brake) from Dona Ana County, New Mexico, and El Paso, Texas. Units in Kg/Month.

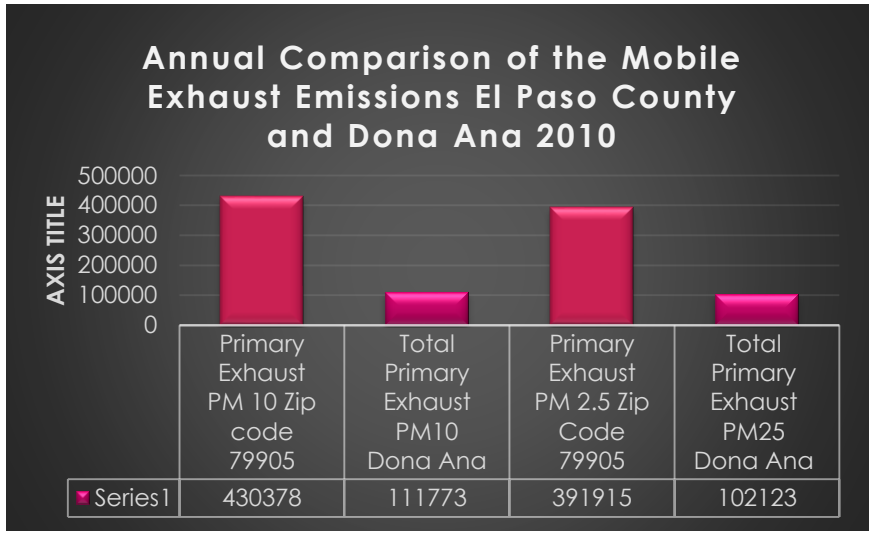


Figure: Comparison of the Annual Mobile Emissions of Primary PM10-Exhauts Emission from Dona Ana County, New Mexico, and El Paso, Texas. Units in Kg/Month.

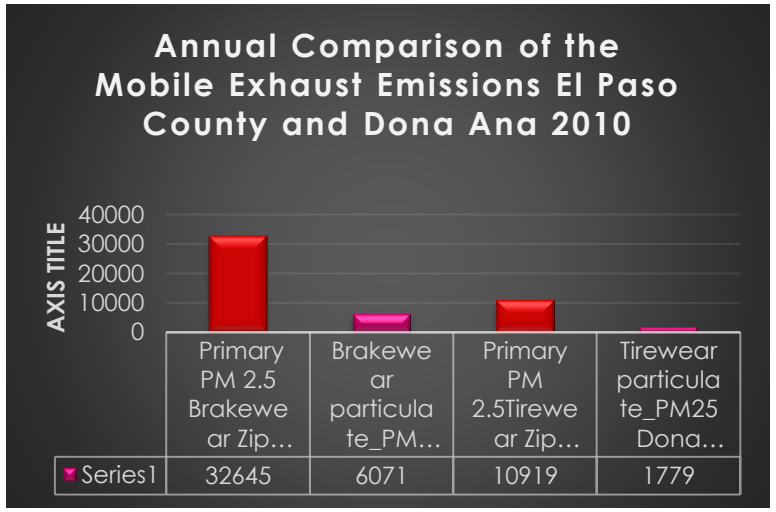
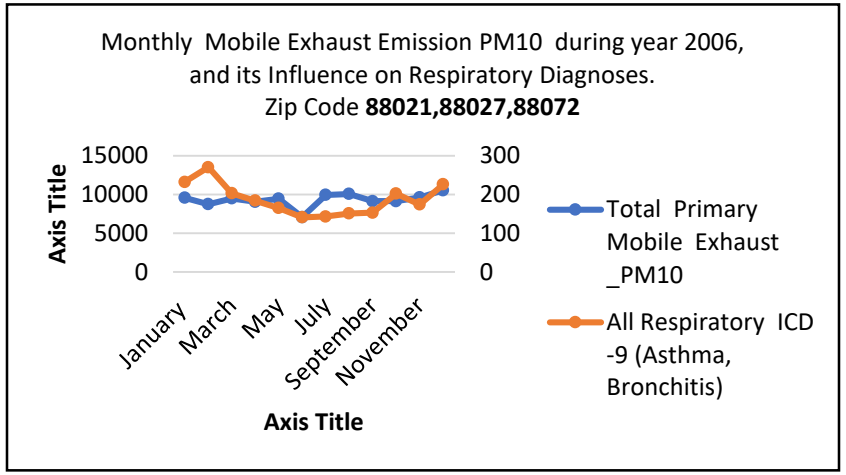
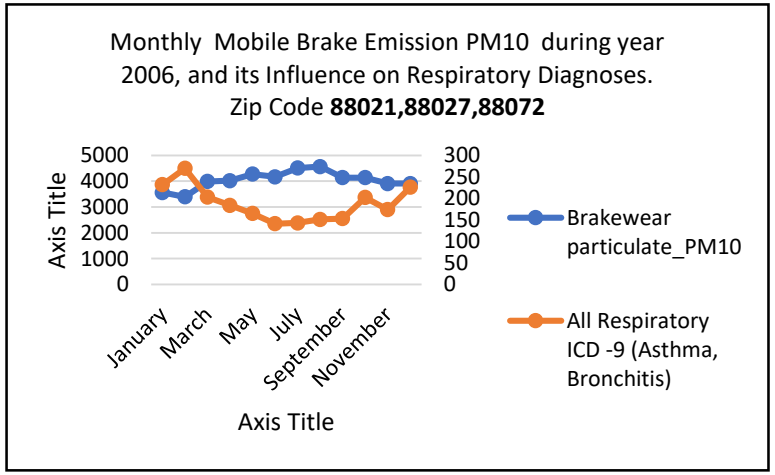
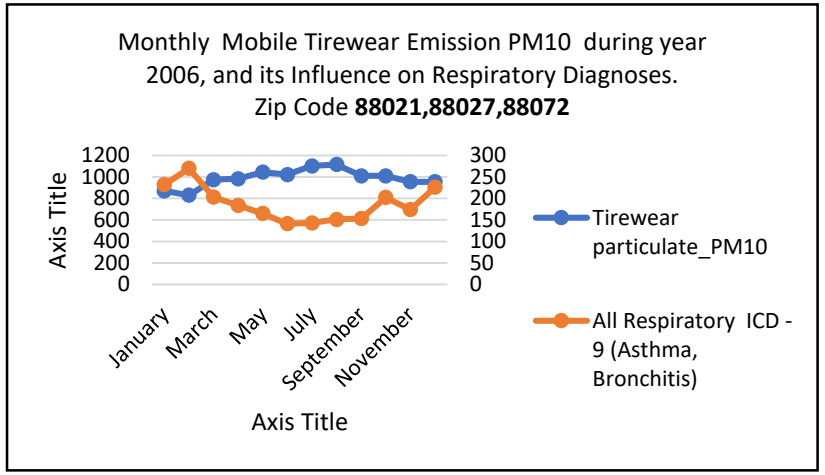


Figure: Comparison of the Annual Mobile Emissions of Primary PM10-Exhauts Emission from Dona Ana County, New Mexico, and El Paso, Texas. Units in Kg/Month.

Monthly Mobile Emission PM10,2.5 kg During year 2006, and its Influence on Respiratory Diagnoses. Dona Ana County Zip Code 88021,88027,88072







Mobile Exhauts Emission PM10 kg Asthma-Bronchitis)	Brake Mobile Emission PM10 kg and Heart Diagnoses	Tirewear Mobile Emission PM10 kg and Heart Diagnoses
Linear Square R= .951	Linear Square: R=.625	Linear Square: R=.525

Mobile Exhauts Emission PM2.5 kg Asthma-Bronchitis)	Brake Mobile Emission PM2.5 kg and Heart Diagnoses	Tirewear Mobile Emission PM2.5 kg and Heart Diagnoses
Linear Square R= .986	Linear Square: R=.691	Linear Square: R=.6.01

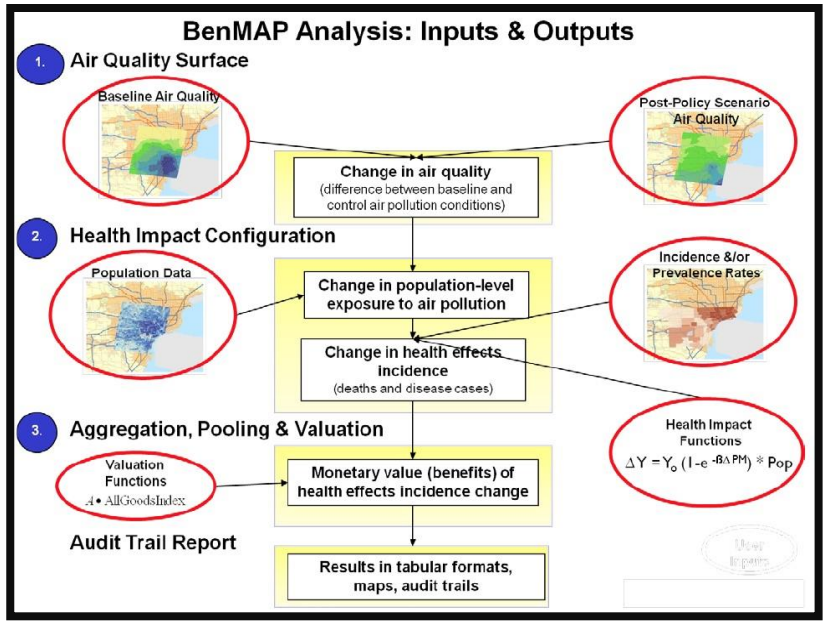
Results

The results showed that mobile PM emissions in the urban areas close to urban Road and highways is putting at risk public health and the proportion of diseases attributable to this exposure is potentially large.
Brake wear emissions is much lower in freeways due to significantly reduced number of braking events, while tire wear is much higher in areas where studded tires are used. The emission of exhaust gases are much higher in areas where there is a high vehicular traffic.

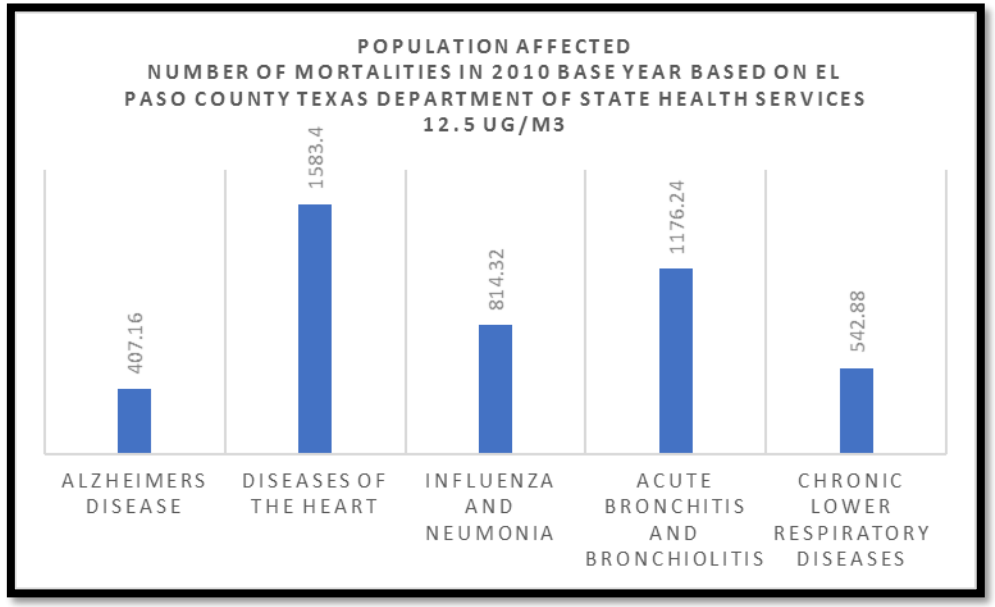
El Paso County	**Brake Mobile Emission PM10 kg Asthma-Bronchitis)**	**Brake Mobile Emission PM2.5 kg and Heart Diagnoses**	**Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)**	**Exhaust Mobile Emission PM2.5 kg and Heart Diagnoses**	**Tirewear Mobile Emission PM10 kg Asthma-Bronchitis)**	**Tirewear Mobile Emission PM2.5 kg and Heart Diagnoses**
	Linear Square R=.969	Linear Square: R=8.56	Linear Square R=.929	Linear Square R=.831	Linear Square R=.769	Linear Square R=.715
Dona Ana County	**Brake Mobile Emission PM10 kg and Heart Diagnoses**	**Brake Mobile Emission PM2.5 kg and Heart Diagnoses**	**Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)**	**Exhaust Mobile Emission PM2.5 kg Asthma-Bronchitis)**	**Tire wear Mobile Emission PM10 kg and Heart Diagnoses**	**Tirewear Mobile Emission PM2.5 kg and Heart Diagnoses**
	Linear Square: R=.625	Linear Square: R=.691	Linear Square R= .951	Linear Square R= .986	Linear Square: R=.525	Linear Square: R=.6.01

BenMAP-CE

In this analysis, the Program of Mapping and Analysis of Environmental Benefits-Community Edition (BenMAP-CE) was used to Estimate the number and economic value of health impacts resulting from changes in air pollution PM 2.5 Ug/m3 in The El Paso Area.



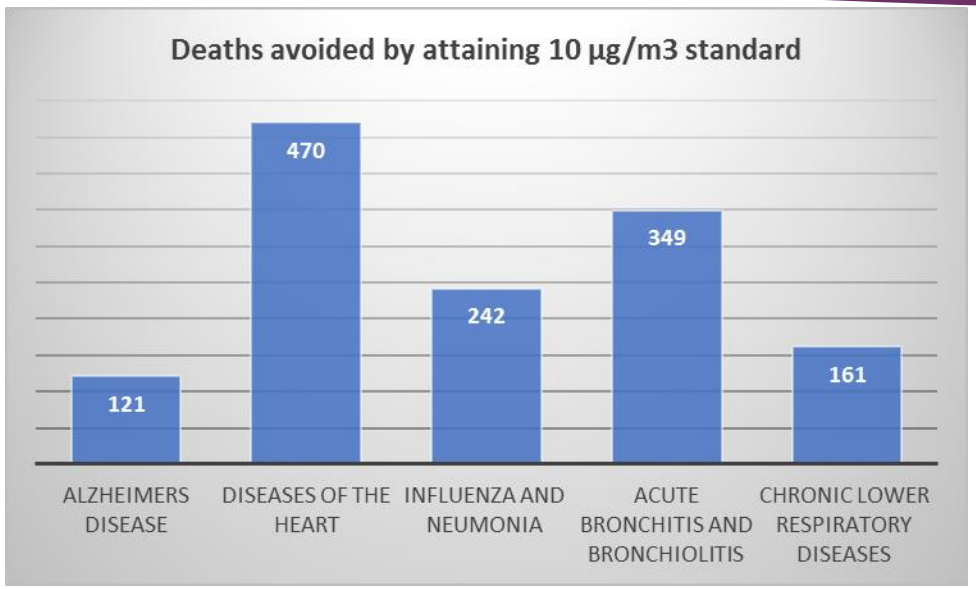
Health and Economic Benefits associated with the Response of $PM_{2.5}$ Emission between Base Year 2010



Number of Mortalities in 2010 Base Year Based on El Paso County Texas Department of State Health Services

cause of death	year 2010	Population Affected	Background Concentration	Pollutant	Rollback Type	Avoided Deaths (% Population)
alzheimers disease	2010	407.16	12.5	PM2.5	2.5 µg/mÂ³ Rollback	9
diseases of the heart	2010	1583.4	12.5	PM2.5	2.5 µg/mÂ³ Rollback	35
influenza and neumonia	2010	814.32	12.5	PM2.5	2.5 µg/mÂ³ Rollback	18
acute bronchitis and bronchiolitis	2010	1176.24	12.5	PM2.5	2.5 µg/mÂ³ Rollback	26
chronic lower respiratory diseases	2010	542.88	12.5	PM2.5	2.5 µg/mÂ³ Rollback	12

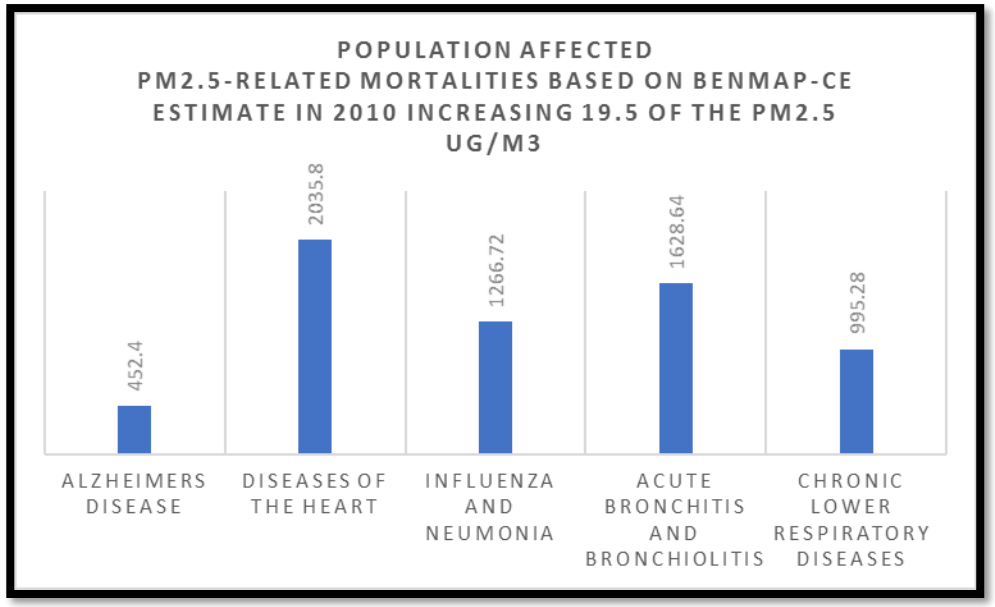
The Basin-wide decrease in 4 ug/m3 $PM_{2.5}$ concentration after this reduction control



Cause of death	year 2010	Population Affected	Background Concentration	Reduccion scenario	Pollutant	Rollback Type	Avoided Deaths (% Population)	economic benefits analysis $
Alzheimers disease	2010	121	12.5	2.5 ug/m3	PM2.5	2.5 µg/mÂ³ Rollback	9	120.00
Diseases of the heart	2010	470	12.5	2.5 ug/m3	PM2.5	2.5 µg/mÂ³ Rollback	35	350.00
Influenza and neumonia	2010	242	12.5	2.5 ug/m3	PM2.5	2.5 µg/mÂ³ Rollback	18	425.00
Acute bronchitis and bronchiolitis	2010	349	12.5	2.5 ug/m3	PM2.5	2.5 µg/mÂ³ Rollback	26	950.00
Chronic lower respiratory diseases	2010	161	12.5	2.5 ug/m3	PM2.5	2.5 µg/mÂ³ Rollback	12	450.0
								$1 295000

$PM_{2.5}$-related Mortalities Based on BenMAP-CE Estimate in 2010 Base Year with change in the concentrations levels

Health and Economic Benefits associated with the Response of $PM_{2.5}$ Emission between Base Year 2010 Increasing 7 Ug/m3



Cause of death	year 2010	Population Affected Deaths avoided by attaining 19.5 µg/m3 standard	Background Concentration	Pollutant	Rollback Type	Avoided Deaths (% Population)	economic Unbenefits analysis
Alzheimers disease	2010	452.4	19.5	PM2.5	2.5 µg/mÂ³ Rollback	19	150.000
Diseases of the heart	2010	2035.8	19.5	PM2.5	2.5 µg/mÂ³ Rollback	135	450.000
Influenza and neumonia	2010	1266.72	19.5	PM2.5	2.5 µg/mÂ³ Rollback	38	525.000
Acute bronchitis and bronchiolitis	2010	1628.64	19.5	PM2.5	2.5 µg/mÂ³ Rollback	36	122.000
Chronic lower respiratory diseases	2010	995.28	19.5	PM2.5	2.5 µg/mÂ³ Rollback	12	650.000

Conclusions

- An excellent Pearson Correlation was established to analyze the relationship in the relative risks of hospitalization of Respiratory (RD) and cardiovascular (CVD) associated with ambient exposure caused by traffic emission in relation to their size and specific sources of emission on different scenarios: interior a border Urban, Rural Urban restricted access (freeways and interstates).

El Paso County	Brake Mobile Emission PM10 kg Asthma-Bronchitis)	Brake Mobile Emission PM2.5 kg and Heart Diagnoses	Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)	Exhaust Mobile Emission PM2.5 kg and Heart Diagnoses	Tirewear Mobile Emission PM10 kg Asthma-Bronchitis)	Tirewear Mobile Emission PM2.5 kg and Heart Diagnoses
	Linear Square R=.969	Linear Square: R=8.56	Linear Square R=.929	Linear Square R=.831	Linear Square R=.769	Linear Square R=.71.5
Dona Ana County	Brake Mobile Emission PM10 kg and Heart Diagnoses	Brake Mobile Emission PM2.5 kg and Heart Diagnoses	Exhaust Mobile Emission PM10 kg Asthma-Bronchitis)	Exhaust Mobile Emission PM2.5 kg Asthma-Bronchitis)	Tire wear Mobile Emission PM10 kg and Heart Diagnoses	Tirewear Mobile Emission PM2.5 kg and Heart Diagnoses
	Linear Square: R=.625	Linear Square: R=.691	Linear Square R= .951	Linear Square R= .986	Linear Square: R=.525	Linear Square: R=.6.01

- A significant correlation of PM10,2.5 exposure from mobile emission and hospital admissions for selected Respiratory (RD) and cardiovascular (CVD) diagnoses was established. The results showed that PM emissions in urban restricted access (freeways and interstates) is mainly caused by traffic. Therefore, people living close to highways are more exposed higher vehicular emissions.

Conclusions

- We found statistically significant associations between mobile PM2.5 caused by traffic emission with Respiratory and Cardiovascular Diseases in the study area Subsequently a correlation between cardio-respiratory mortality is established .
- A significant correlation of PM10,2.5 exposure from mobile emission and hospital admissions for selected Respiratory (RD) and cardiovascular (CVD) diagnoses is established. The results showed that PM emissions in urban restricted access (freeways and interstates) is mainly caused by traffic. Therefore, people living close to highways receive higher vehicular emissions.
- The table shows the percentage of PM mobile exposure in the analyzed areas, contributing to increase the risk of Respiratory and Cardiovascular Diseases

	Brake Emission PM 10	Brake Emission PM 2.5	Exhaust Emission PM10	Exhaust Emission PM2.5	Tirewear Emission PM10	Tirewear Emission PM2.5
El Paso Zip Code 79905	61%	55%	49%	46%	59%	54%
Dona Ana Zip Code 88021,88027,88072	39%	45%	51%	54%	41%	46%

- An examination was conducted of the synoptic and local meteorology for the June 2006 ozone episode using the WRF model to determine how meteorological parameters influence the formation, transport and dispersion of ozone in the PdN. The predominant synoptic feature of the ozone event day was the expansion, intensification, and slow progression of an upper-level ridge of high pressure. The high ozone episodes are associated with highly stable atmospheres, strong temperature inversions with low mixing heights and therefore low mixing volumes. Under these conditions emissions, such as NOx, lead to highly polluted conditions that favor ozone formation.

BenMAP Conclusions

- **We have estimated the number and economic value of health impacts resulting from changes in air pollution concentrations of PM 2.5 in the PdN region**
- **Reduction of Pm 2.5 4 UG/m3= Avoided: 213 cases respiratory, cardiovascular diseses and Economic Benefits associated with the Response of $PM_{2.5}$ Emission + $ 1295000**
- **Increase of PM2.5 7 ug/m3 = increasing Dies= 326, economic Unbenefits= 2345000$.**

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