

MOBILE5-Mexico: An Emission Factor Model for On-Road Vehicles in Mexico

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Overview of Today's Presentation

- Project Background
- General Model Concepts
- Comparison of Model Performance
- Areas for Improvement



Project Background

- Part of Mexico Emissions Inventory Development Program sponsored by Western Governors' Association (since 1994)
- Mexico-specific motor vehicle emission factor model
- Model framework based upon U.S. EPA's MOBILE5 model
- Uses Mexico emissions testing data



Previous Models

- MOBILE-MCMA (Mexico City Metropolitan Area - MOBILE4- and MOBILE5-based)
- MOBILE-MMAp (Monterrey Metropolitan Area)
- MOBILE-Juárez (Ciudad Juárez)
- Similar MOBILE-based models in other countries



General Concepts of MOBILE5-Mexico

- Applicable to entire country of Mexico with ability to select specific region types
- Capability to include effects of U.S.-registered vehicles
- Mexico-specific basic emission rates (BERs) based on data collected in Mexico



Specific Region Types

- Mexico City
- Interior Urban (>75,000 people and >50 km from border - e.g., Monterrey, Guadalajara)
- Interior Rural (<75,000 people and >50 km from border)
- Border Urban (>75,000 people and <50 km from border - e.g., Ciudad Juárez, Mexicali)
- Border Rural (<75,000 people and <50 km from border)



U.S.-Registered Vehicles

- Fleet in U.S.-Mexico border region consists of both U.S.- and Mexico-registered vehicles
- Previous modeling required two separate model runs
- Fraction of Mexico-registered vehicles (not Mexico-manufactured vehicles) can be set in external data file (lower limit of 50%)
- Only applicable for border urban and border rural

Mexico-Specific BERs

- BERs for Mexico City module based upon “technology equivalence matrix” for Mexico City
- BERs for interior urban and border urban modules derived directly from emissions testing data from Aguascalientes and Ciudad Juárez (only for exhaust)



Comparison of Model Results

- Interior urban module: 3 different I/M scenarios
- Different modules: Mexico City, interior urban, and border urban
- Mexico-U.S. scenarios: Mexico City and Denver, Colorado

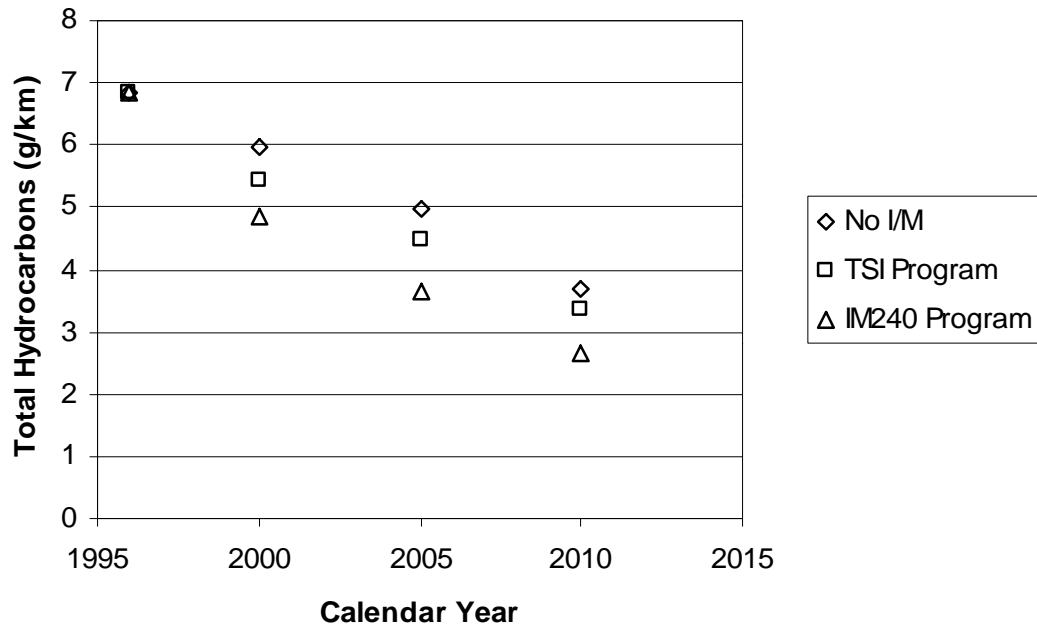
Interior Urban Module - Scenarios

Parameter	Value	Comment
Common Input Parameters		
Region	High altitude	Higher than 5000 feet
Reformulated gasoline	No	No oxygenates added
Reid Vapor Pressure	6.5 psi	Fuel volatility
Average Speed	31.5 km/hr	All vehicle types
VKT Fractions	LDGV = 0.592, LDGT1 = 0.336, LDGT2 = 0.011, HDGV = 0.013, LDDV = 0.001, LDDT = 0, HDDV = 0.033, MC = 0.015	
TSI Scenario I/M Parameters		
First I/M Year	1996	
Model Years Covered	1968 – 2010	
Cutpoints	HC = 220 ppm CO = 1.2%	Annual test
Vehicle Types Covered	All gasoline-powered vehicles	
Anti-Tampering Program	Yes	Catalyst, evaporative system, gas cap
IM240 Scenario I/M Parameters		
First I/M Year	1996	
Model Years Covered	1968 – 2010	
Cutpoints	HC = 1.2 g/mi (0.75 g/km) CO = 20 g/mi (12.4 g/km) NO _x = 2 g/mi (1.24 g/km)	Annual test
Vehicle Types Covered	All gasoline-powered vehicles	
Anti-Tampering Program	Yes	Catalyst, evaporative system, gas cap



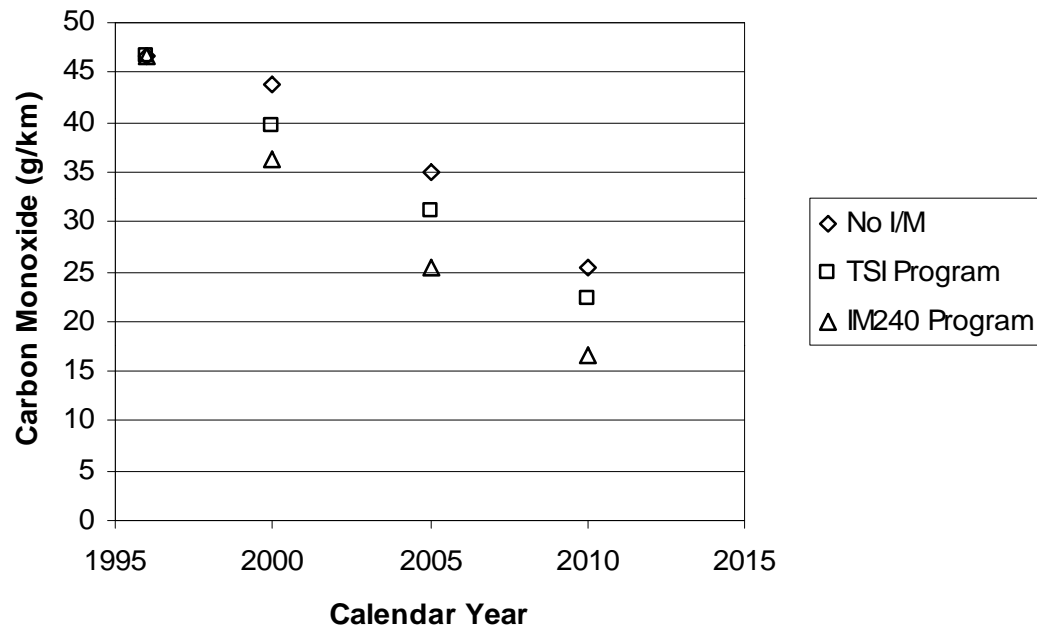
Interior Urban Module - HC Results

Aguascalientes "Fleet Average" Vehicle:
Hydrocarbon Emission Factors

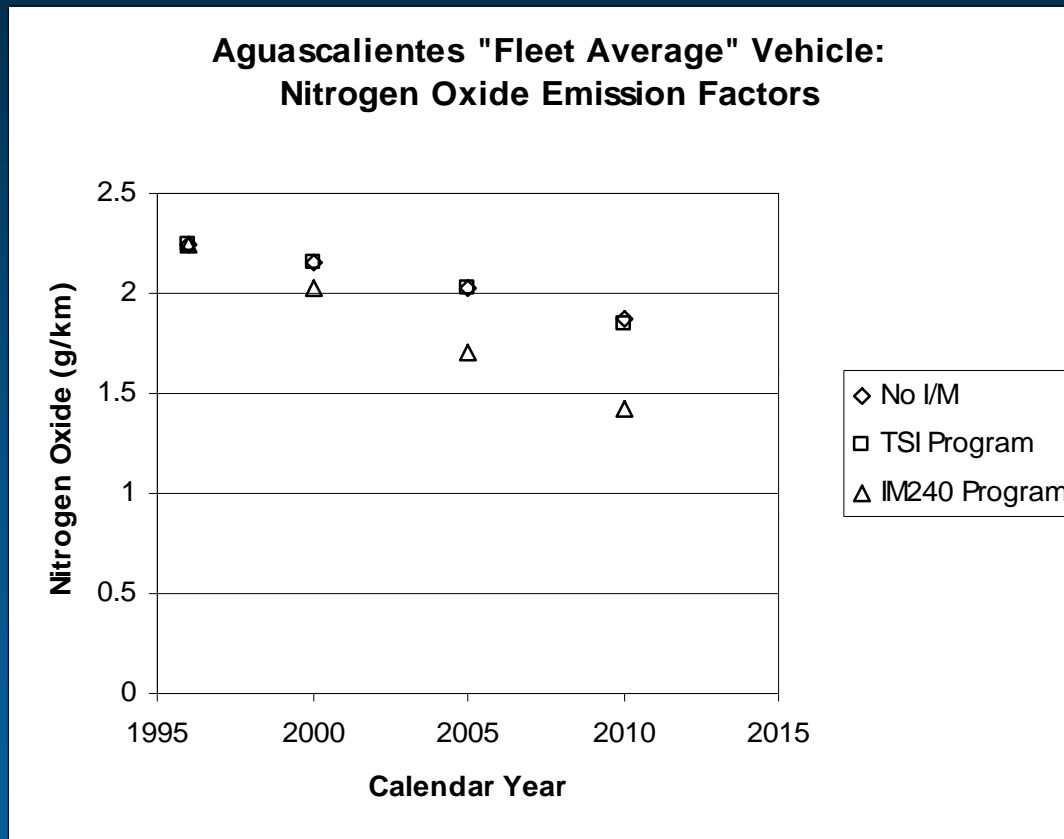


Interior Urban Module - CO Results

Aguascalientes "Fleet Average" Vehicle:
Carbon Monoxide Emission Factors



Interior Urban Module - NO_x Results

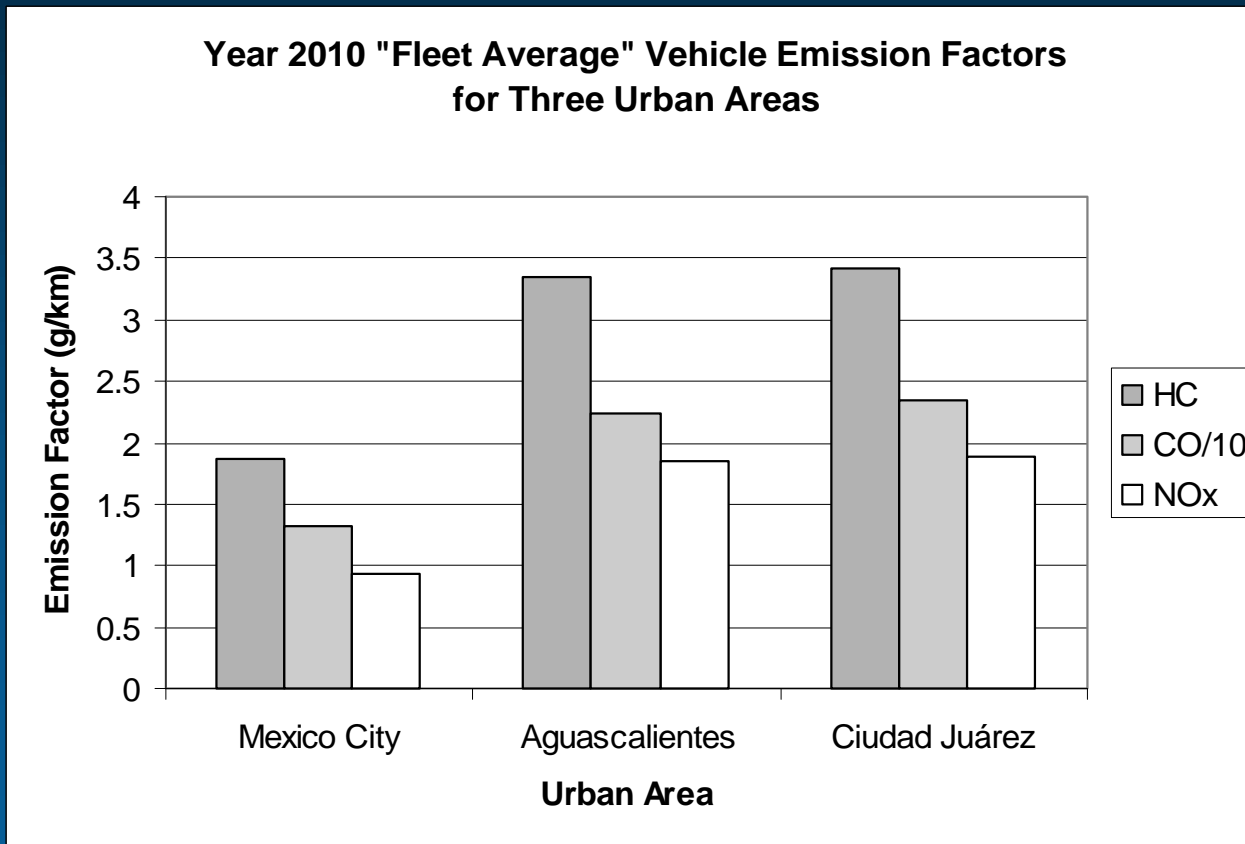


Different Modules - Scenarios

Parameter	Value	Comment
Mexico City, Distrito Federal		
Region	High altitude	Higher than 5500 feet
Reformulated gasoline	No	No oxygenates added
Reid Vapor Pressure	9.0 psi	Fuel volatility
Average Speed	25.9 km/hr	All vehicle types
First I/M Year	1996	IM 240 (annual TSI program before 1996)
Model Years Covered	1968 – 2010	
Cutpoints	HC = 0.8 g/mi (0.50 g/km) CO = 20 g/mi (12.4 g/km) NO _x = 2.0 g/mi (1.24 g/km)	Annual test
Vehicle Types Covered	All gasoline-powered vehicles	
Anti-Tampering Program	Yes	Catalyst, evaporative system, gas cap
VKT Fractions	LDGV = 0.772, LDGT1 = 0.182, LDGT2 = 0.026, HDGV = 0.002, LDDV = 0.001, LDDT = 0.002, HDDV = 0.007, MC = 0.009	
Ciudad Juárez, Chihuahua (Border Urban)		
Region	Low altitude	500 feet
Reformulated gasoline	No	No oxygenates added
Reid Vapor Pressure	7.7 psi	Fuel volatility
Average Speed	31.5 km/hr	All vehicle types
First I/M Year	1996	
Model Years Covered	1968 – 2010	
Cutpoints	HC = 220 ppm CO = 1.2%	Annual test
Vehicle Types Covered	All gasoline-powered vehicles	10% gasoline-powered vehicles and 5% diesel-powered vehicles registered in USA.
Anti-Tampering Program	Yes	Catalyst, evaporative system, gas cap
VKT Fractions	LDGV = 0.611, LDGT1 = 0.242, LDGT2 = 0.066, HDGV = 0.056, LDDV = 0, LDDT = 0, HDDV = 0.019, MC = 0.006	



Different Modules - Results

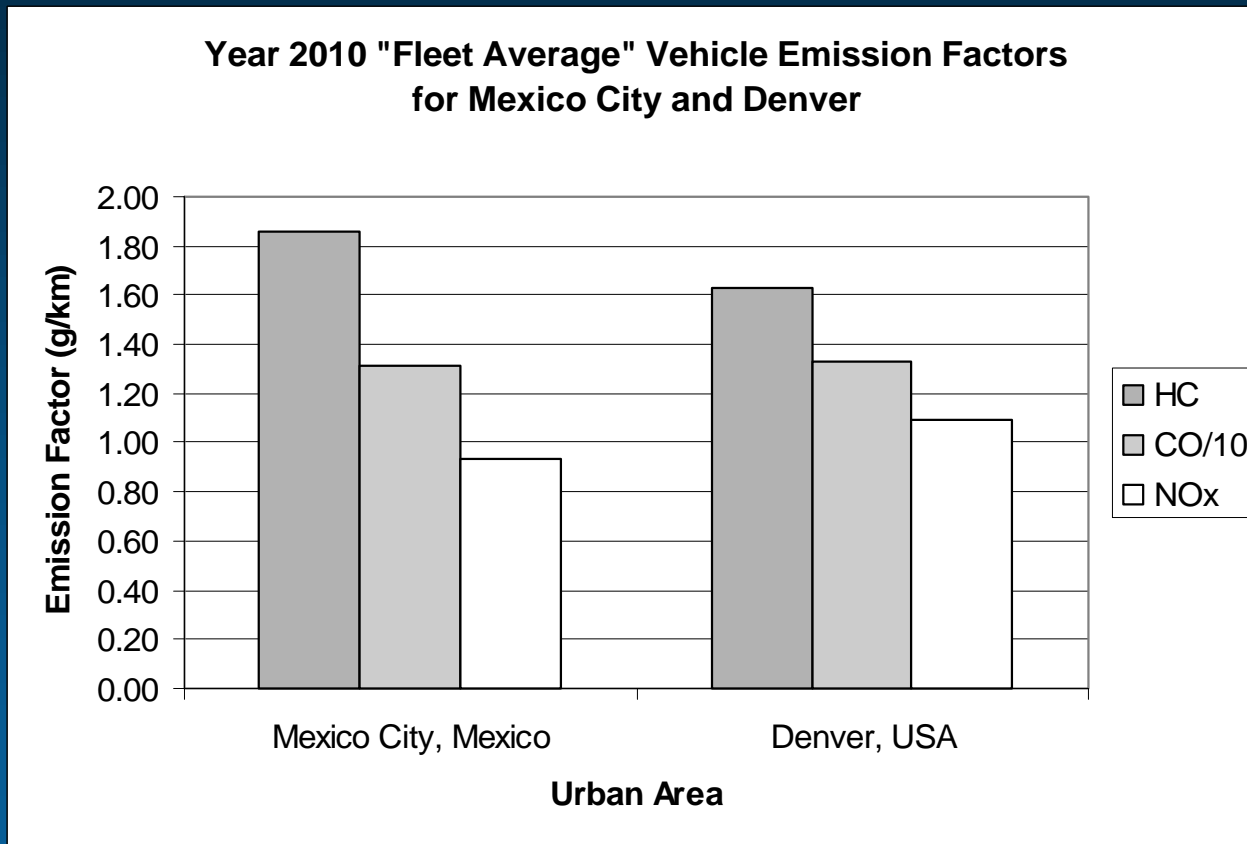


Mexico-U.S. Scenarios

Parameter	Value	Comment
Denver, Colorado (MOBILE5b)		
Region	High altitude	5500 feet
Reformulated gasoline	No	No oxygenates added
Reid Vapor Pressure	13.6 psi	Fuel volatility
Average Speed	19.6 mi/hr	All vehicle types
First I/M Year	1983	
Model Years Covered	1981 – 2010 (IM240) 1967 – 2010 (TSI)	
IM240 Cutpoints	HC = 0.8 g/mi (0.50 g/km) CO = 15 g/mi (9.3 g/km) NO _x = 2.0 g/mi (1.24 g/km)	Biennial test
TSI Cutpoints	HC = 220 ppm CO = 1.2%	Annual test
Vehicle Types Covered	All gasoline-powered vehicles	
Anti-Tampering Program	Yes	Catalyst, air pump, fuel inlet
VKT Fractions	LDGV = 0.395, LDGT1 = 0.383, LDGT2 = 0.127, HDGV = 0.023, LDDV = 0, LDDT = 0.002, HDDV = 0.065, MC = 0.005	



Mexico-U.S. Results



Areas for Improvement

- Additional light-duty emissions testing (especially Mexico City)
- Incorporate new testing data sets (second set of Ciudad Juárez data from TNRCC and Tijuana data from ARB)
- Heavy-duty emissions testing (would require equivalent of heavy-duty chassis dynamometer)
- Examine differences in Mexico driving behavior (initial work conducted in Aguascalientes)

