Section 12.0 MEXICAN VEHICLES

This section discusses Mexican vehicle activity and emissions in San Diego and Imperial Counties. Mexican vehicles will be modeled into four new technology groups.

12.1 Introduction

Emissions from Mexican vehicles may account for a significant portion of the mobile source inventory in the U.S./Mexico border region. To characterize the fleet crossing into California and to estimate the contribution of these vehicles, activity and emissions data from various sources will be used in developing a mobile source inventory for this region.

The U.S. Customs Service surveys the number of Mexican vehicles entering California annually. This data was used to estimate the population of Mexican plated vehicles operating in California.

In addition, Colorado State University has collected data on approximately 200 vehicles that originated from Juarez and entered into the El Paso region. The Texas Natural Resource Conservation Commission contracted with Mantech Environmental to conduct IM240 tests on these vehicles, and the emissions collected were evaluated to estimate the emissions of Mexican vehicles crossing the border. By utilizing the Juarez fleet, the assumption is made these vehicles are representative of all Mexican vehicles that enter California. The average emission rates for each pollutant were compared to the average emissions for the same technology groups of California cars tested in the 1994 ARB Inspection and Maintenance Pilot Program. Therefore, it is suggested that emissions from Mexican vehicles can be modeled using existing CALIMFAC technology groups adjusted by the ratios of the means of their emissions.

12.2 Activity

The U.S. Customs Service monitors and gathers statistics on the number of vehicles entering California annually. Additionally, the U.S. Customs Service monitors the fraction of the fleet with Mexican plates. The total number of vehicles arriving in fiscal year 1995 is multiplied by the percentage of Mexican cars to approximate annual Mexican vehicle crossings.

Andrade is the smallest of the five crossings from Mexico to California and is located in southeast Imperial County. The fleet is composed of 24.0 percent Mexican plated vehicles, and the number of Mexican passenger cars entering California from Mexico is estimated to be 126,753 annually.

Calexico is also located in Imperial County. The fleet includes 40.7 percent Mexican passenger vehicles. The annual number of Mexican passenger cars entering Calexico is approximately 2,982,623.

Otay Mesa is located in southwestern San Diego County. The fleet crossing the border consists of about 28.7 percent Mexican passenger vehicles, or about 1,317,769 annually.

San Ysidro is in the extreme southwestern corner of San Diego County. This is the most active U.S. Customs border station. The fleet distribution was found to be 25.1 percent Mexican, and the annual traffic is approximately 3,472,262 Mexican passenger cars.

Tecate is in central San Diego County. The passenger vehicles crossing the border were 28.6 percent Mexican. The annual number of Mexican plated cars entering California is estimated at 298,021.

12.3 Emissions

To determine the current and future technology mix, the light-duty Juarez fleet was disaggregated (after the U.S. and Canadian vehicles were removed from the dataset) into four technology groups: (1) carbureted, no catalyst (CN); (2) carbureted, oxidation catalyst (CO_x); (3) carbureted, three-way catalyst (CT_w); and (4) fuel injected, three-way catalyst (FT_w).

Table 12-1 presents the technology group/model year matrix with each year normalized to 100 percent. The registration distribution was then determined by renormalizing the sum of all model years to unity (Table 12-2). The average HC, CO and NO_x emission rates from IM240 tests were calculated for each technology group.

Approximately 600 vehicles from the ARB's I/M pilot program were evaluated. Medium-duty trucks and vehicles with thermal reactors were removed from the dataset since these vehicle types were not identified in the Juarez fleet. The vehicles were classified into the same four technology groups described earlier, and the average IM240 emissions were calculated for each pollutant.

12.4 Results

Most of the Mexican vehicles crossing northbound into California go through the San Diego County border stations. Table 12-3 shows the activity estimates of Mexican vehicles traveling northbound through the five crossings.

The adjustment factor for Mexican vehicles was determined by dividing the average Mexican emissions reading by the corresponding pilot program average reading for the same pollutant:

$$\text{adjustment factor} = \frac{\text{avg. emissions for Mexican vehs}}{\text{avg. emissions for I/M pilot program vehs}}$$

The adjustment factors are shown in Table 12-4, and these factors were applied to CALIMFAC technology groups 1, 7, 10 and 13. The following four technology groups were created for Mexican vehicles with the same regime growth rates:

Tech Group 40 (= Tech 1, noncat/no air)
Tech Group 41 (= Tech7, oxycat/air)
Tech Group 42 (= Tech 10, TBI/carb)
Tech Group 43 (=Tech 13, MPFI/0.7NO_x)

Table 12-1. Technology Classification of Mexican Fleet.

Model Year	Carbureted, No Catalyst (CN)	Carbureted, Oxidization Catalyst (CO_x)	Carbureted, Three-way Catalyst (CT_w)	Fuel injected, Three-way Catalyst (FT_w)
pre-63	100%			
63	100%			
64	100%			
65	100%			
66	100%			
67	100%			
68	100%			
69	100%			
70	100%			
71	100%			
72	100%			
73	100%			
74	100%			
75	33%	67%		
76	33%	67%		
77	33%	67%		
78	15%	85%		
79	15%	85%		
80		92%	8%	
81		42%	46%	12%
82		42%	46%	12%
83		32%	47%	21%
84		32%	47%	21%
85		10%	38%	52%
86		7%	38%	55%
87			20%	80%
88				100%
89				100%
90				100%
91				100%
92				100%
93				100%
94				100%

Table 12-2. Registration Distribution of Mexican Vehicles for 1995.

Model Year	Carbureted, No Catalyst (CN)	Carbureted, Oxidation Catalyst (CO_x)	Carbureted, Three-way Catalyst (CT_w)	Fuel injected, Three-way Catalyst (FT_w)	Age Distribution
pre-63	0.56%	0.00%	0.00%	0.00%	0.56%
63	0.56%	0.00%	0.00%	0.00%	0.56%
64	0.56%	0.00%	0.00%	0.00%	0.56%
65	0.56%	0.00%	0.00%	0.00%	0.56%
66	0.56%	0.00%	0.00%	0.00%	0.56%
67	0.56%	0.00%	0.00%	0.00%	0.56%
68	0.56%	0.00%	0.00%	0.00%	0.56%
69	0.56%	0.00%	0.00%	0.00%	0.56%
70	0.56%	0.00%	0.00%	0.00%	0.56%
71	2.23%	0.00%	0.00%	0.00%	2.23%
72	0.56%	0.00%	0.00%	0.00%	0.56%
73	1.12%	0.00%	0.00%	0.00%	1.12%
74	1.12%	0.00%	0.00%	0.00%	1.12%
75	0.56%	1.12%	0.00%	0.00%	1.68%
76	0.56%	1.12%	0.00%	0.00%	1.68%
77	0.56%	1.12%	0.00%	0.00%	1.68%
78	1.12%	6.70%	0.00%	0.00%	7.82%
79	1.12%	6.70%	0.00%	0.00%	7.82%
80	0.00%	6.15%	0.56%	0.00%	6.70%
81	0.00%	3.07%	3.35%	0.84%	7.26%
82	0.00%	3.07%	3.35%	0.84%	7.26%
83	0.00%	3.07%	4.47%	1.96%	9.50%
84	0.00%	3.07%	4.47%	1.96%	9.50%
85	0.00%	0.56%	2.23%	3.07%	5.87%
86	0.00%	0.56%	2.23%	3.07%	5.87%
87	0.00%	0.00%	1.12%	4.47%	5.59%
88	0.00%	0.00%	0.00%	5.03%	5.03%
89	0.00%	0.00%	0.00%	2.23%	2.23%
90	0.00%	0.00%	0.00%	1.68%	1.68%
91	0.00%	0.00%	0.00%	0.56%	0.70%
92	0.00%	0.00%	0.00%	0.56%	0.70%
93	0.00%	0.00%	0.00%	1.12%	0.70%
94	0.00%	0.00%	0.00%	0.56%	0.70%

Table 12-3. Mexican Vehicle Activity Estimates.

BORDER STATION	MEX LDV (per day)
IMPERIAL	
ANDRADE	347
CALEXICO	8,172
TOTAL	8,519
SAN DIEGO	
OTAY MESA	3,610
SAN YSIDRO	9,513
TECATE	816
TOTAL	13,939

Table 12-4. Emissions Adjustment Factors.

	HC (g/mi)	CO (g/mi)	NO_x (g/mi)
I/M PILOT PROGRAM EMISSION AVERAGES			
CARB/NONCAT	5.551	49.036	3.326
CARB/OXY	4.905	42.057	2.862
CARB/TWC	1.803	28.295	1.675
FI/TWC	0.715	8.511	1.059
JUAREZ FLEET EMISSION AVERAGES			
CARB/NONCAT	6.644	74.075	2.131
CARB/OXY	5.899	87.047	1.763
CARB/TWC	5.336	101.033	1.497
FI/TWC	2.771	30.885	2.140
ADJUSTMENT FACTORS			
CARB/NONCAT	1.197	1.511	0.641
CARB/OXY	1.202	2.070	0.616
CARB/TWC	2.959	3.571	0.894
FI/TWC	3.874	3.629	2.021

Table 12-4, however, does not account for the differences in mileage accumulation between California and Mexican vehicles. The odometer readings for the Juarez fleet

were found to be unreliable, and curve-fitting odometer with respect to age resulted in regression relationships that were not statistically significant. Consequently, reported odometer values were not used in this analysis.

12.5 Discussion

Comparing the average pollutant levels of HC and CO by technology classification, the Mexican vehicles appear to have consistently higher emissions than U.S. vehicles. For NO_x, however, the reverse is true. The lower NO_x trend may indicate that the Juarez vehicles run rich, and they may have defective emission control components. It is speculated that the higher emission levels seen in the Juarez fleet are due to a high percentage of poisoned catalysts caused by misfueling. The vehicle technologies in the Juarez fleet were found to lag behind those in the U.S. by about two to three years, e.g., 1979 Juarez vehicles would have a technology mix similar to 1977 U.S. vehicles. This model year "lag" assumption may not be the same at the California/Mexico border as the data collected by CSU is limited to the Juarez/El Paso region and reflects that particular border crossing fleet.

To obtain a more complete emissions inventory, future studies should include information on model year, emission rates, fuels, control technologies, and odometer readings to differentiate between California and Frontera fleet characteristics. License plate readers should be set up at each inspection station during different months of the year to note any differences between summer and winter fleet compositions.

12.6 Conclusion

Mexican vehicle activity and emission rates have been incorporated into EMFAC2000. Table 12-2 shows technology fractions by age, as well as model year/age registration distribution. Table 12-3 was used to assess the Mexican vehicle population operating in Imperial and San Diego counties.

It is assumed that Mexican vehicles take the same number of trips per day as vehicles in San Diego and Imperial counties. Fuel effects in the model are assumed to be the same as for San Diego and Imperial counties. Additionally, the number of starts, soak times, speed distribution, and mileage accrual rates are assumed to be the same as for California vehicles of the same vintage.

Mexican vehicles are modeled as a distinct vehicle class so that Mexican vehicle-specific activity data can be input at a later date. Finally, Table 12-4 was used to develop Mexican vehicle technology groups from existing CALIMFAC technology groups.

12.6.1 Mexican Trucks

Mexican trucks are also modeled in EMFAC2000 and are assumed to comprise of Heavy-Duty Diesel trucks with the same age distribution and technology fraction splits as California Certified Diesel trucks in San Diego and Imperial Counties. Mexican trucks are assumed to emit at the same rate as California trucks up to calendar year 2000. Mexican truck standards are listed in Table 12-5. The number of truck border crossings is based on a U.S. General Accounting Office (GAO/RCED-97-68) report, which states

that approximately 2,000 and 650 trucks cross daily at Otay Mesa (San Diego County) and Calexico (Imperial County), respectively.

Table 12-5. Diesel Engines in Vehicles with Net Weight Greater Than 8485.4 lbs.

Model Year	Emissions Standards (g/brake*hp*hr)			
	HC	CO	NO_x	PM
1993	1.3	15.5	5.0	0.25
1994-1997				
Heavy heavy urban buses	1.3	15.5	5.0	0.07
Medium-heavy, light and other urban buses	1.3	15.5	5.0	0.10
1998+				
Heavy heavy urban buses	1.3	15.5	4.0*	0.05
Medium-heavy, light and other urban buses	1.3	15.5	4.0	0.10

*This standard is subject to revision according to U.S. EPA requirements, however, the standard will not exceed 5.0.