PART5-TX1: TNRCC's In-House Tool for Estimating PM-10 from In-Use Vehicles

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Overview of PART5-TX1 Presentation

- Project Background
- Features of PART5-TX1
- Comparison to PART5 and other studies
- Conclusions

Project Background

- TNRCC saw the need for a better mobile source particulate model
  - Perceived shortcomings of PART5
  - NAAQS changes Y more non-attainment areas
  - Emergence of PM as a more pressing problem
- ERG was contracted to research options and develop an "in-house" PM estimation tool for mobile sources

Perceived Shortcomings of PART5

- Based upon too little “in-use” data
- Generally under-predicts PM but over-predicts sulfate (see paper for references)
- Assumes no emissions increase over the life of a vehicle
- No recent updates

Major Features of PART5-TX1

- Only direct exhaust emission estimates are changed from PART5
- Only “in-use” data are used
- Empirical deterioration rates are calculated
- Simple I/M for smoke is modeled
- Fuel sulfur effects are modeled
- Other general updates (PSD, VMT, etc.)

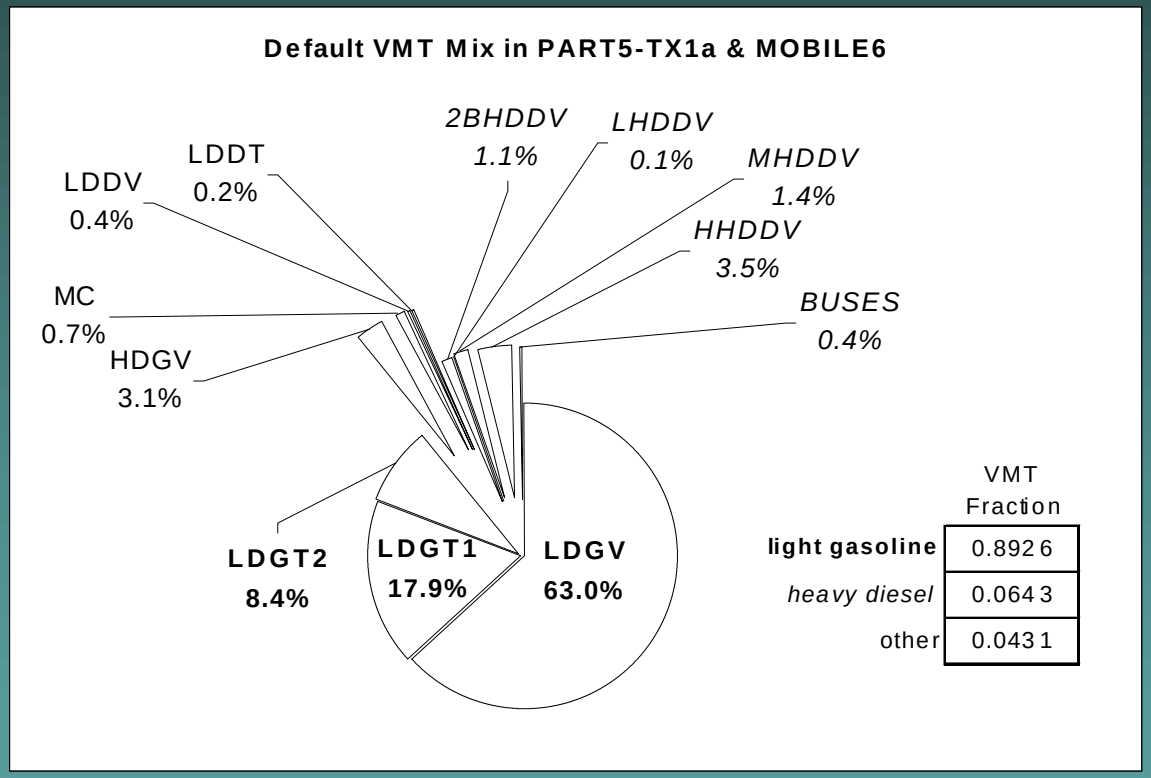
Updateable Features

- Most major assumptions are easily updated via external data files, e.g.:
  - "Zero-mile" emission levels
  - Deterioration rates
  - Fuel sulfur effect
  - Particle size distribution
  - Heavy- & visible-smoker relative emission rates

"In-Use" Data for PART5-TX1

- Total LDGVs: > 600 data points
- Total HDDVs: > 400 data points
- Mostly from previous studies, e.g.:
  - National Renewable Energy Laboratory
  - Coordinating Research Council
  - Northern Front Range Air Quality Study
- 4 HDDVs measured for this project

Major Vehicle Groups

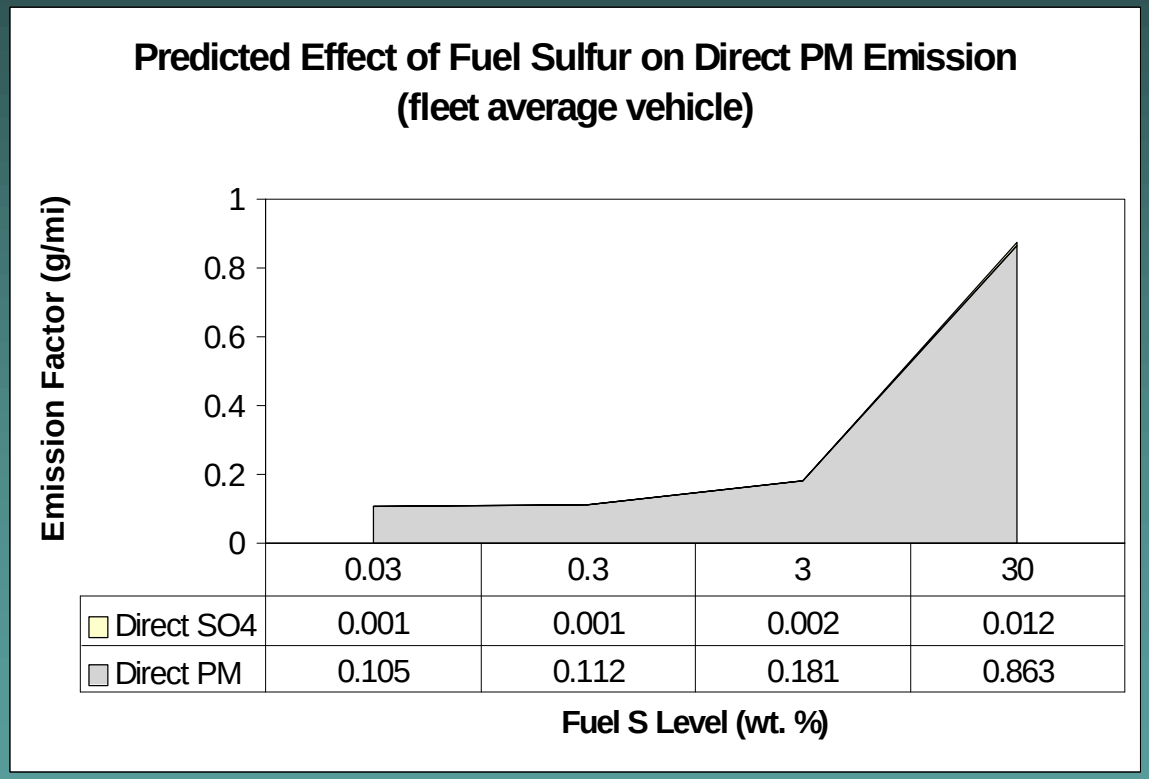


- LDGVs and HDDVs are most important and have the most in-use data
- Engineering assumptions for the rest

I/M for Smoke

- Gasoline vehicles
  - Vehicles with visible smoke (1% in baseline fleet) emit 9X more than non-smokers
- Diesel vehicles
  - Vehicles with snap-acceleration opacity > 40% (10% in baseline fleet) emit 1.6X more than vehicles with <40% opacity
- Local baseline data is critical!

Fuel Sulfur Effects



- SO_4 emission proportional to wt% S, relative to a base fuel
- Similar technique used by EPA for Tier 2 rulemaking

Fleet Comparison to PART5 and Other Studies

1997 Calendar Year (approx.) LDGV Fleet Emissions as Determined from Various Sources	
Source	**Emissions Rate**
Calculated by Whitney[a] (with smokers)	0.119 g/mi[b]
Predicted by PART5-TX1	0.048 g/mi
Calculated from Cadle[a] (with smokers)[c]	0.033 g/mi
Predicted by PART5	0.015 g/mi

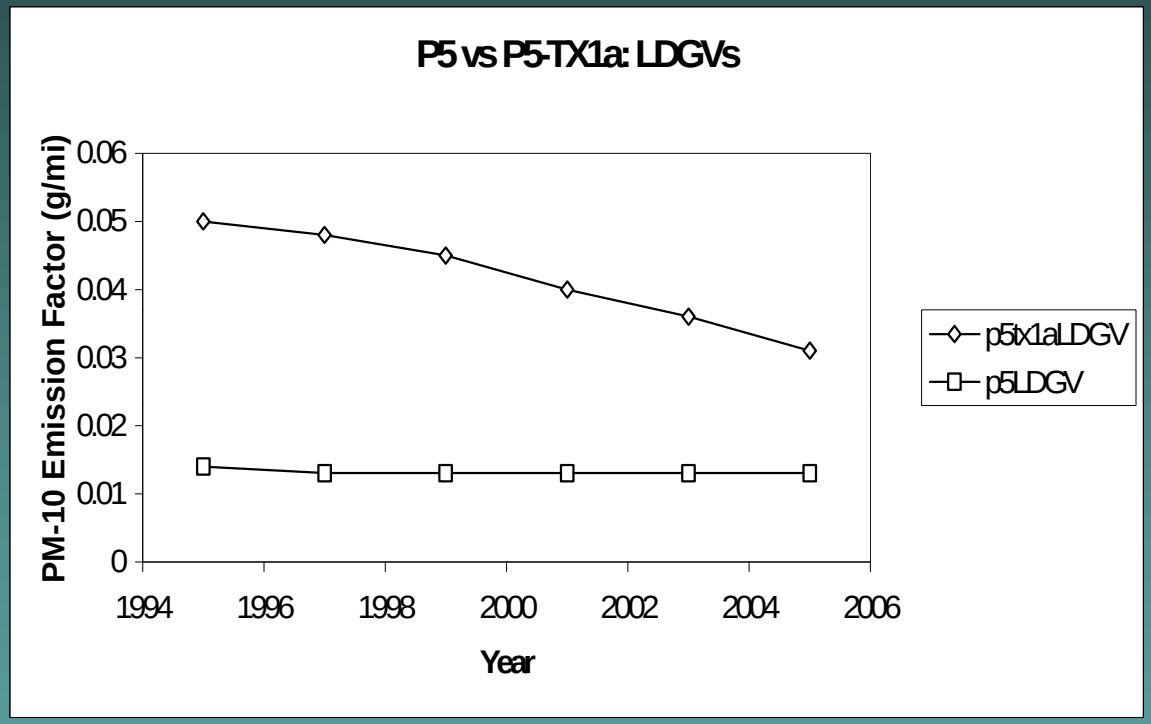
[a] See paper for references.

[b] Estimate is probably high. Smoker emissions in the fleet average were apparently not weighted by VMT and are probably over-represented.

[c] VMT-weighted average was calculated by ERG from data in the referenced report. Study assumed smoker VMT = 0.9% of LDV Fleet VMT.

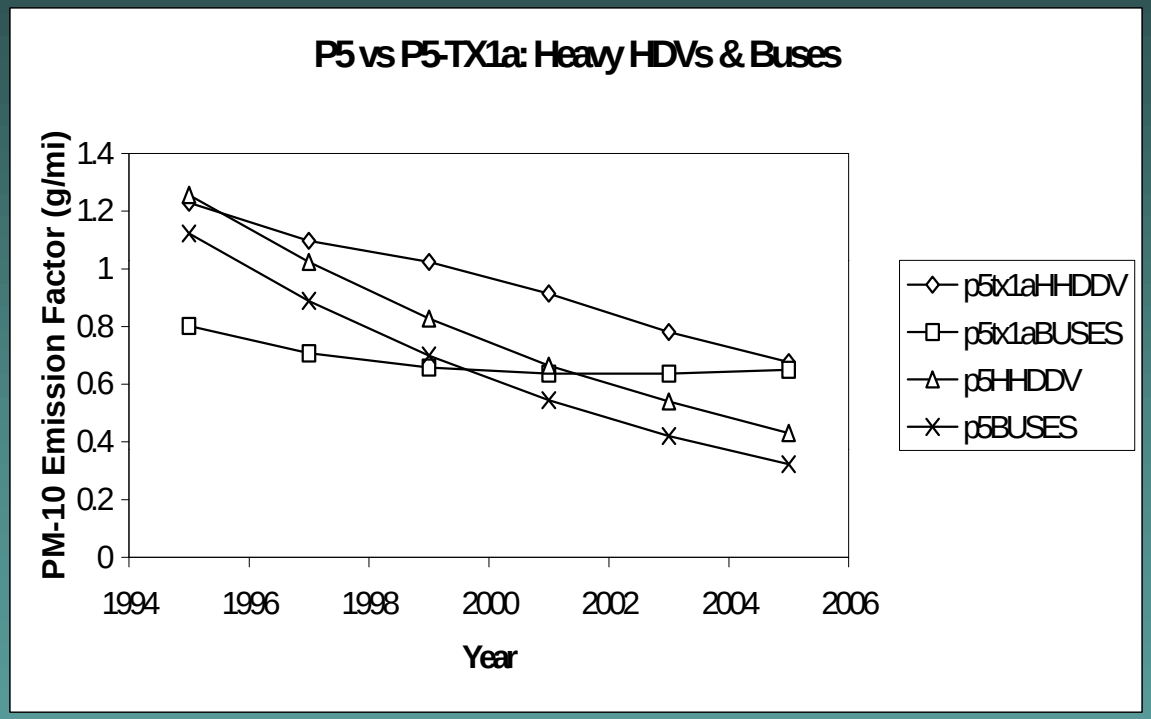
- PART5-TX1 predictions fall within range of empirical studies of in-use vehicles, but well-above PART5 predictions

LDGV Predictions



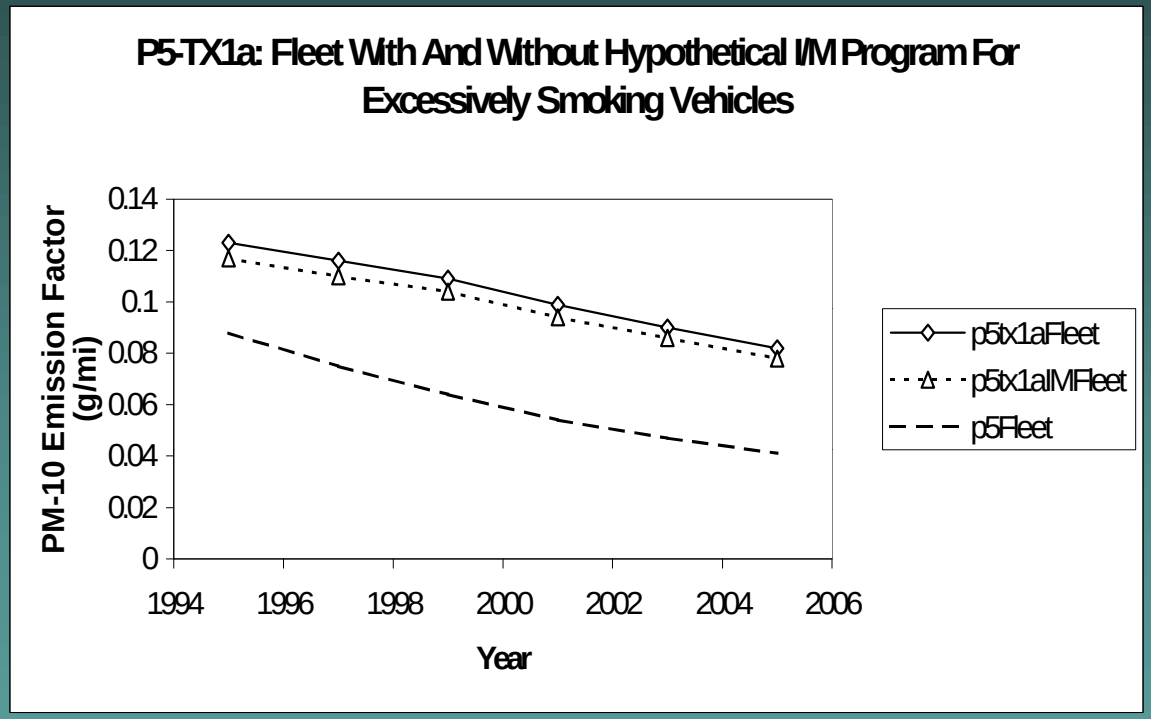
- Fleet average vehicle
- PART5-TX1 estimates much higher PM now, but convergence in the future

HDDV/Bus Predictions



- Much different than LDGV comparison
- PART5-TX1 similar now, but diverges in the future

Simple I/M Program for Smoke



- Diesel "snap-accel." I/M
- Gasoline "visible smoker" I/M
- Both 80% effective

Conclusions

- PART5-TX1 is more appropriate for in-use, on-road exhaust emissions than PART5
- Fuel sulfur effect and I/M effect predictions are reasonable
- PART5-TX1 is easily updated as new data become available
- Further improvements are desirable, especially:
  - humidity effects
  - temperature effects