# Development of MOVES-Mexico
## Stage I: Ciudad Juárez, Chihuahua and the Quantification of Uncertainties

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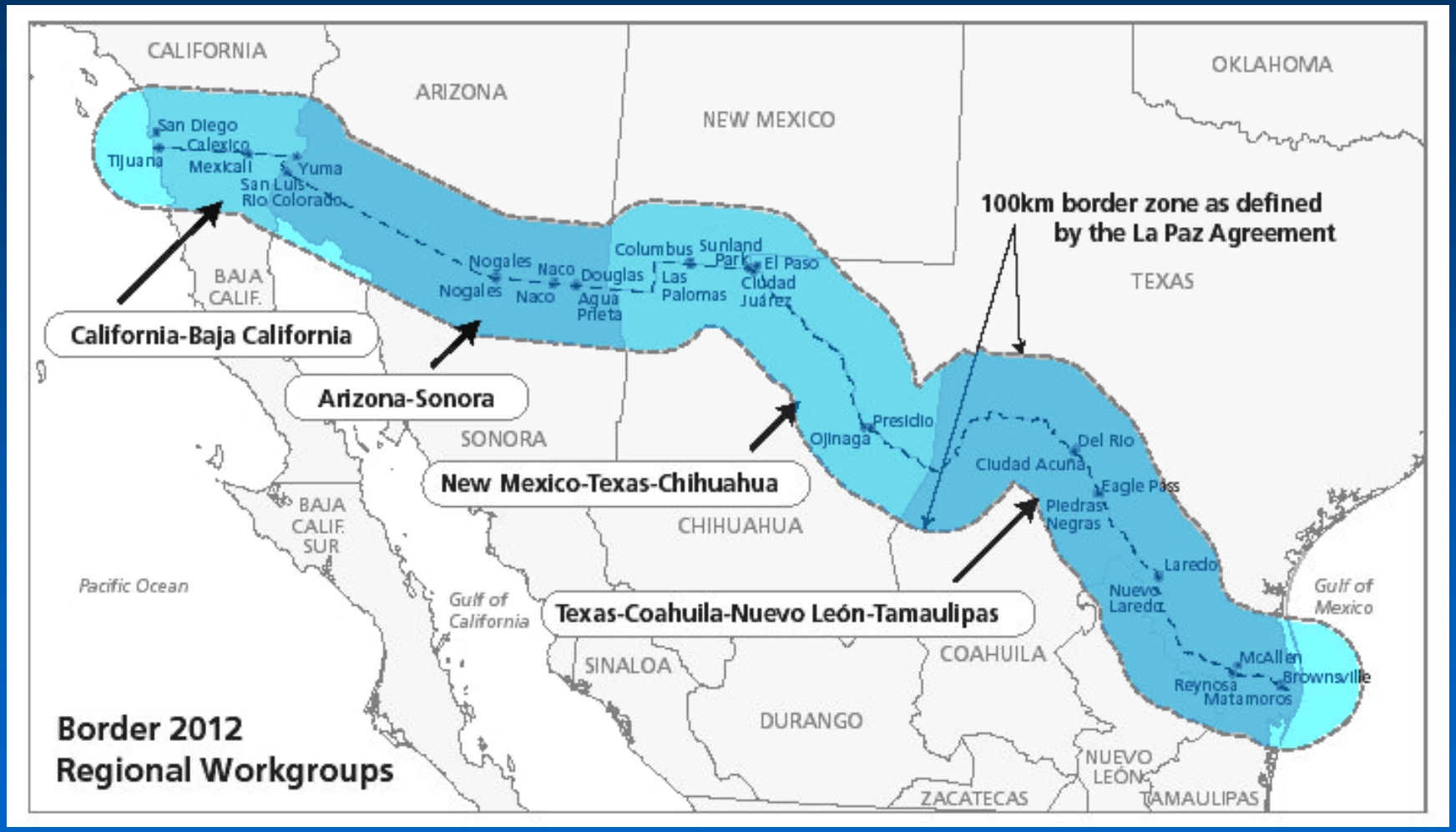
# Outline

- Introduction
- The Current Status of MOVES Input Data in Ciudad Juárez, Chihuahua
- The Estimation of Onroad Mobile Source Emissions in Ciudad Juárez, Chihuahua, 2008
- Bulk Emission Factors and the Quantification of Uncertainty

# The U.S. – Mexico border zone*




*Border 2012: U.S. – Mexico Environmental Program, State of the Border Region Indicator Report 2010

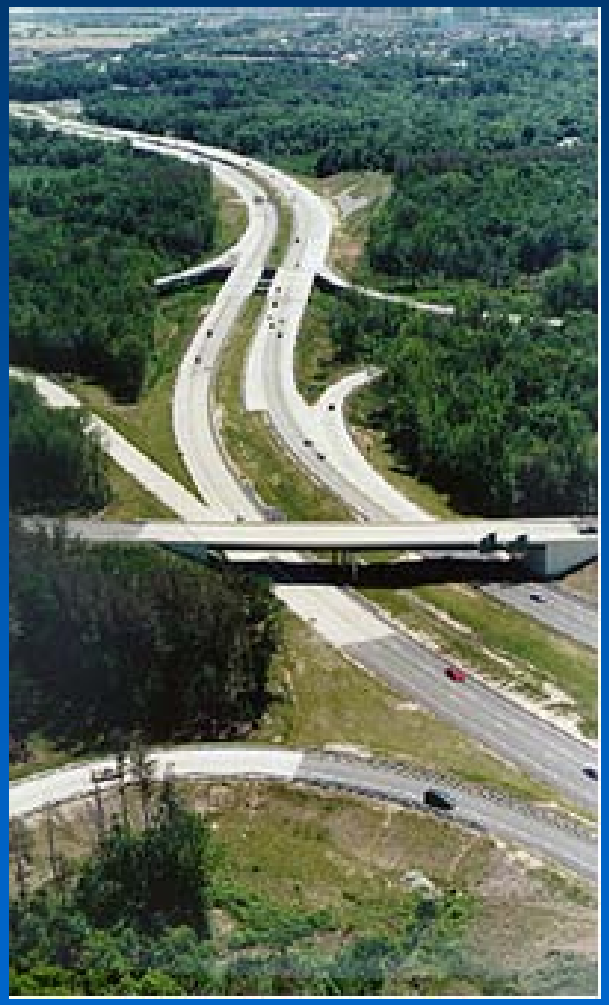
# The Current Status of Input Data in Ciudad Juárez, Chihuahua

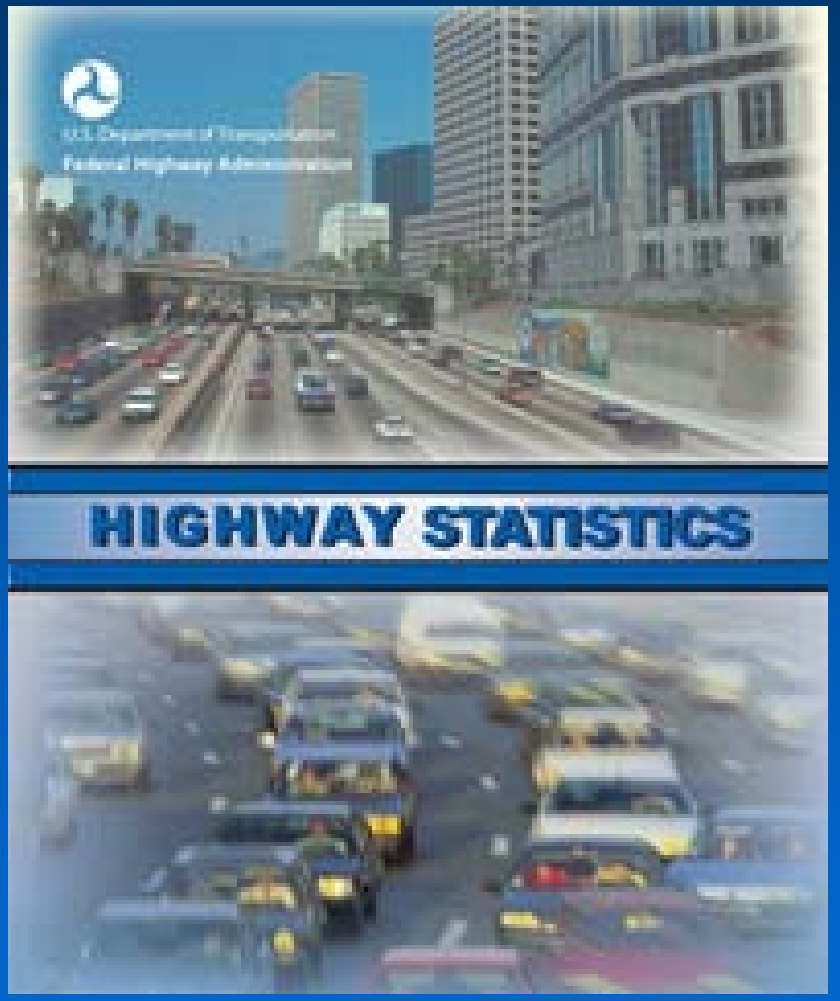
# Required MOVES Inputs for SIP and Conformity Analysis in the U.S.

**Vehicle Population (VPOP), Vehicle Age Distribution**
**Vehicle Miles Traveled (VMT), Road Type Distribution**
**Average Speed Distribution**
**Fuel Supply, Fuel Formulation**
**I/M Coverage**
**Month VMT Fraction, Day VMT Fraction, Hour VMT Fraction**
**Ramp Fraction**
**Meteorology**

Alternate Vehicles Fuels Technologies (AVFT)
SCC Road Type Distribution

# Highway Performance Monitoring System in the U.S.





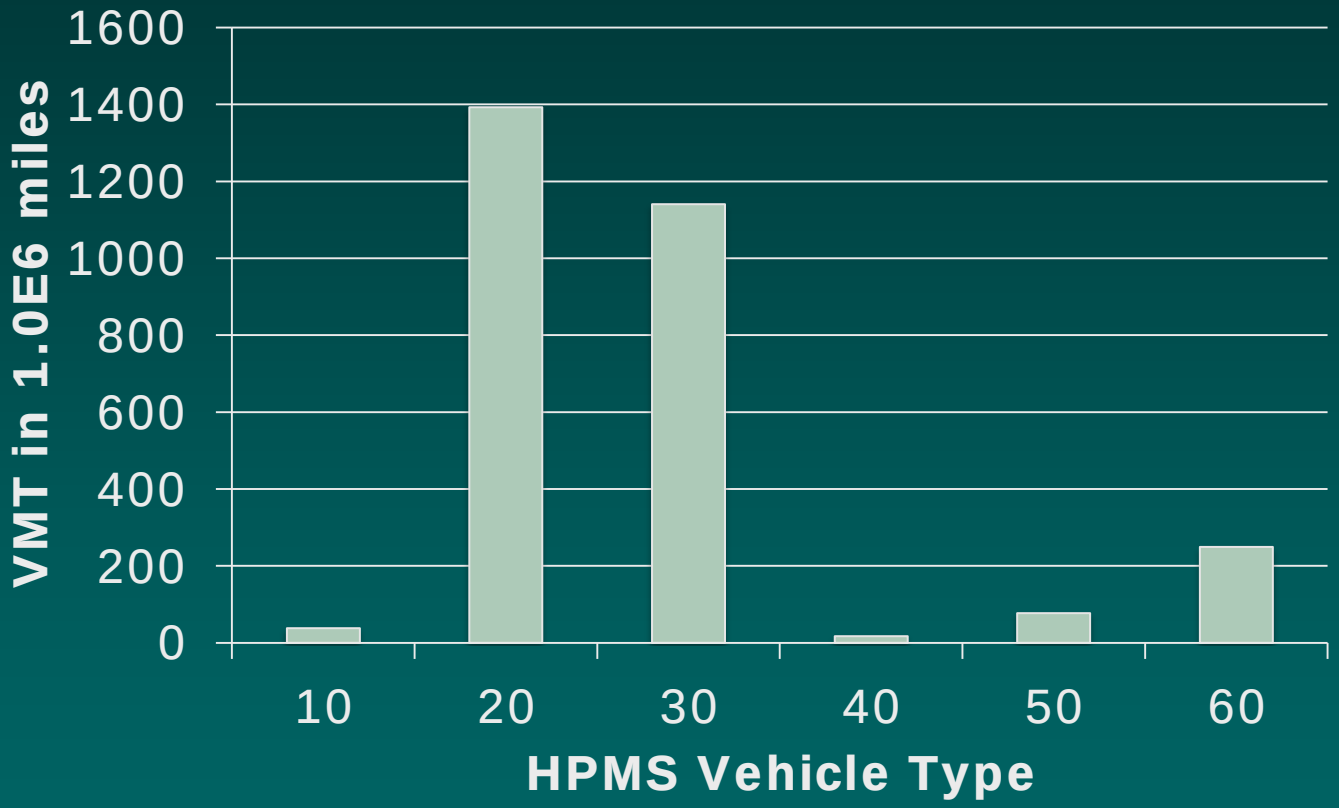
# Available Input Data
## in Ciudad Juárez, Chihuahua

- the average day VMT (by road type)[1]
- the average speed distribution (by road type)[1]
- the hour VMT distribution[1]
- the ramp fraction[1]
- the total VPOP
- the vehicle registration (age distribution)[2]
- the distribution of VMT by vehicle type[2]
- meteorology

[1]From the Travel Demand Model; [2]From MOBILE6-Mexico, TCEQ

# The Estimation of Onroad Mobile Source Emissions in Ciudad Juárez, Chihuahua, 2008

# 2008 Annual HPMS Vehicle Type VMT
# Ciudad Juárez, Chihuahua



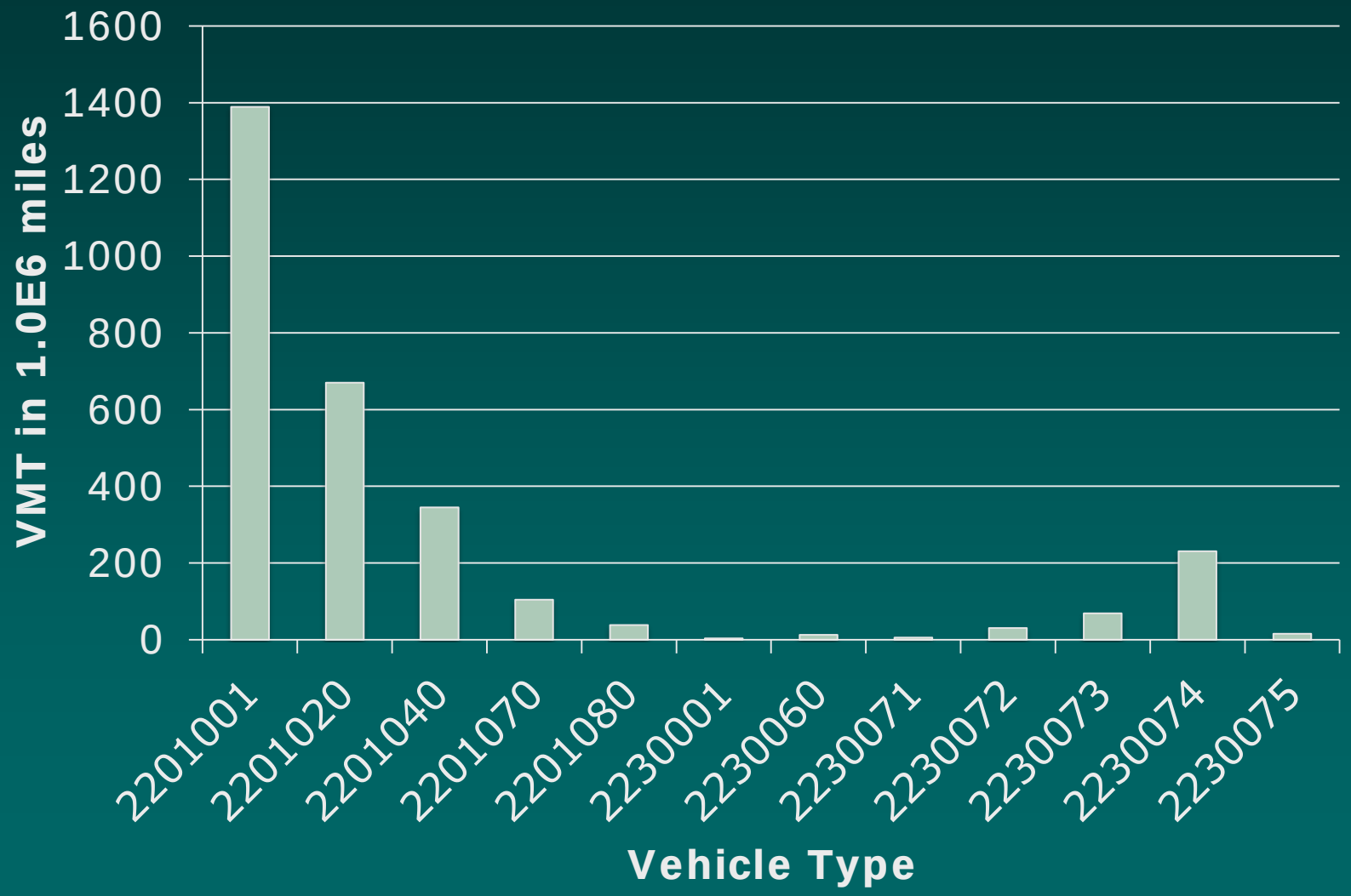

| | | | |
|---|---|---|---|
| 10 | Motorcycles | 40 | Buses |
| 20 | Passenger Cars | 50 | Single Unit Trucks |
| 30 | Other 2 axle-4 tire vehicles | 60 | Combination Trucks |

# Vehicle Type Codes and Descriptions by SCC

| SCC | Description |
|---|---|
| 2201001 | LDGV: Light Duty Gasoline Vehicles |
| 2201020 | LDGT1: Light Duty Gasoline Trucks 1 |
| 2201040 | LDGT2: Light Duty Gasoline Trucks 2 |
| 2201070 | HDGV: Heavy Duty Gasoline Trucks |
| 2201080 | MC: Motorcycles |
| 2230001 | LDDV: Light Duty Diesel Vehicles |
| 2230060 | LDDT: Light Duty Diesel Trucks |
| 2230071 | 2BHDDV: Heavy Duty Diesel Vehicles 2B |
| 2230072 | LHDDV: Light Heavy Duty Diesel Vehicles 3, 4, 5 |
| 2230073 | MHDDV: Medium Heavy Duty Diesel Vehicles 6, 7, 8A |
| 2230074 | HHDDV: Heavy Heavy Duty Diesel Vehicles 8B |
| 2230075 | BUSES: Diesel Transit, Urban and School Buses |

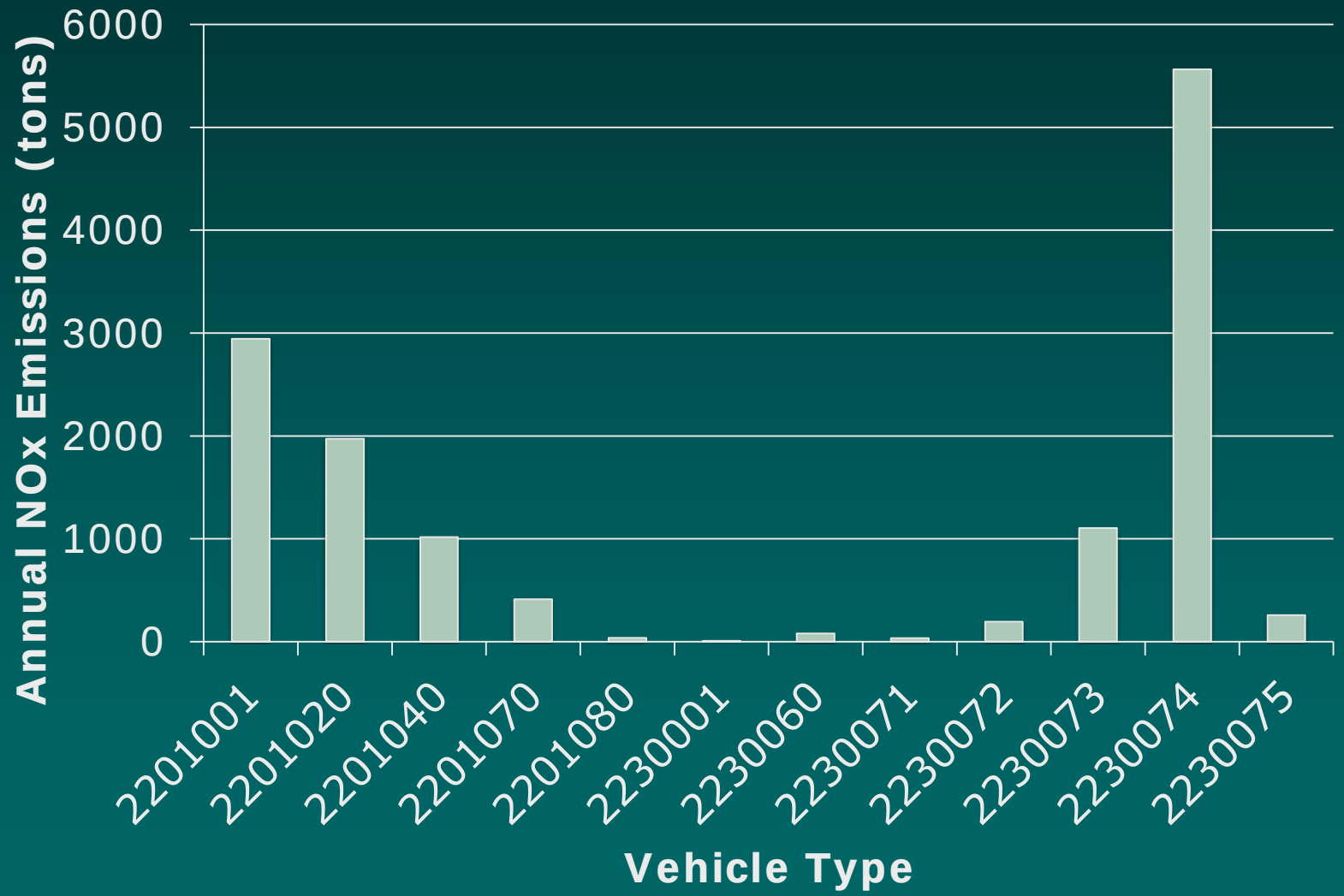
# 2008 annual SCC vehicle type VMT

## Ciudad Juárez, Chihuahua, Mexico



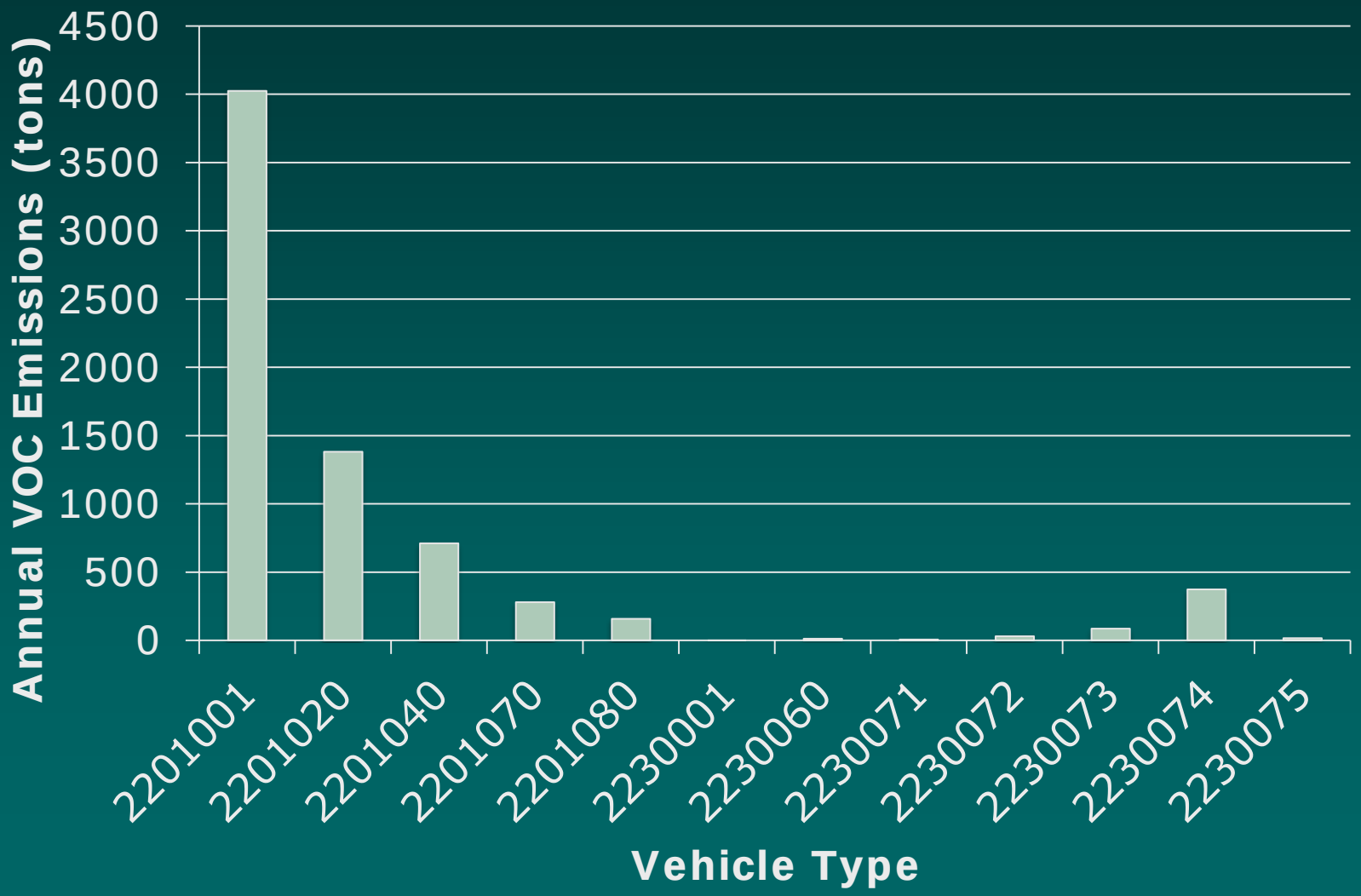
# 2008 onroad mobile source NOx emissions

## Ciudad Juárez, Chihuahua, Mexico



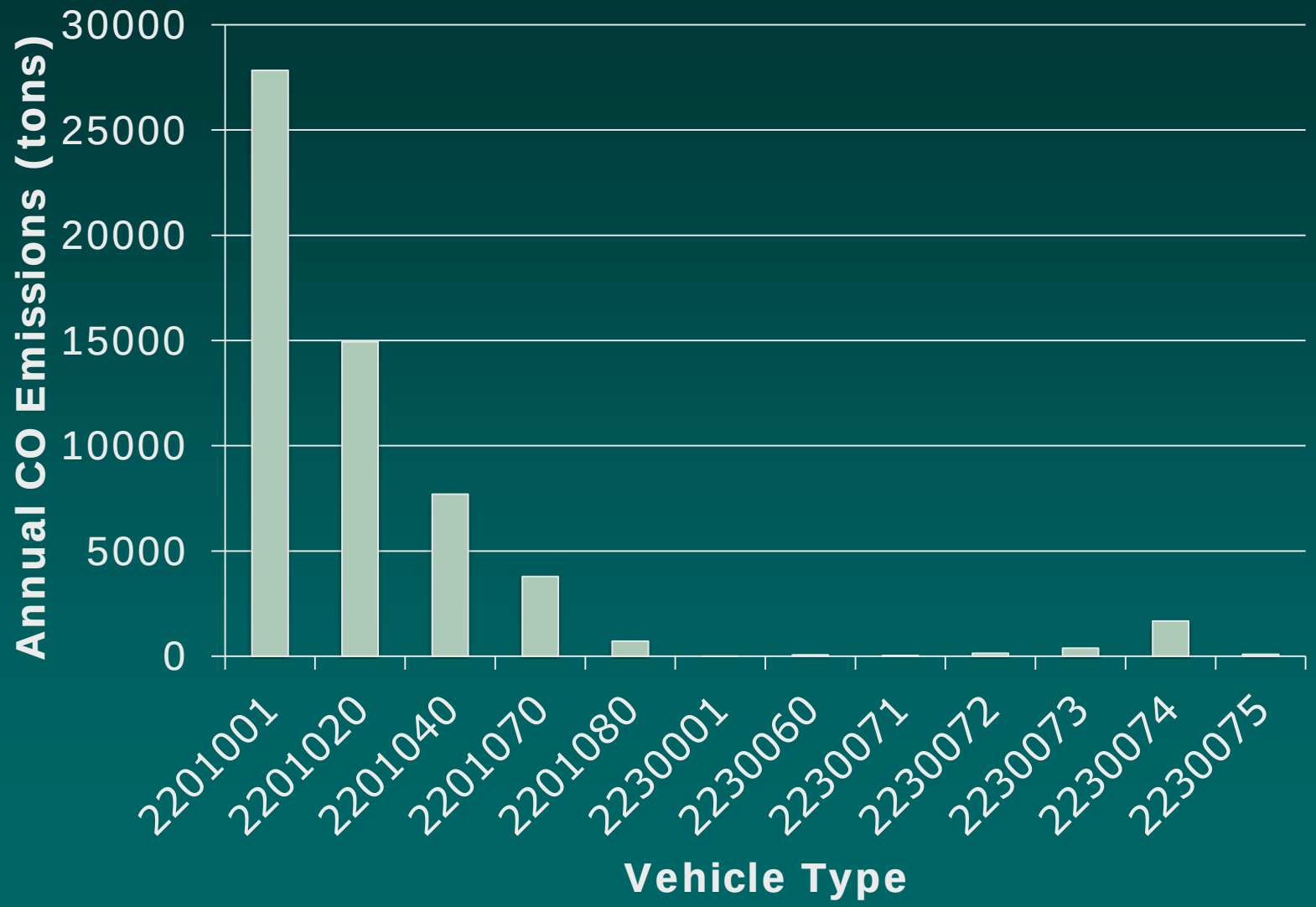
# 2008 onroad mobile source VOC emissions

## Ciudad Juárez, Chihuahua, Mexico



# 2008 onroad mobile source CO emissions

## Ciudad Juárez, Chihuahua, Mexico

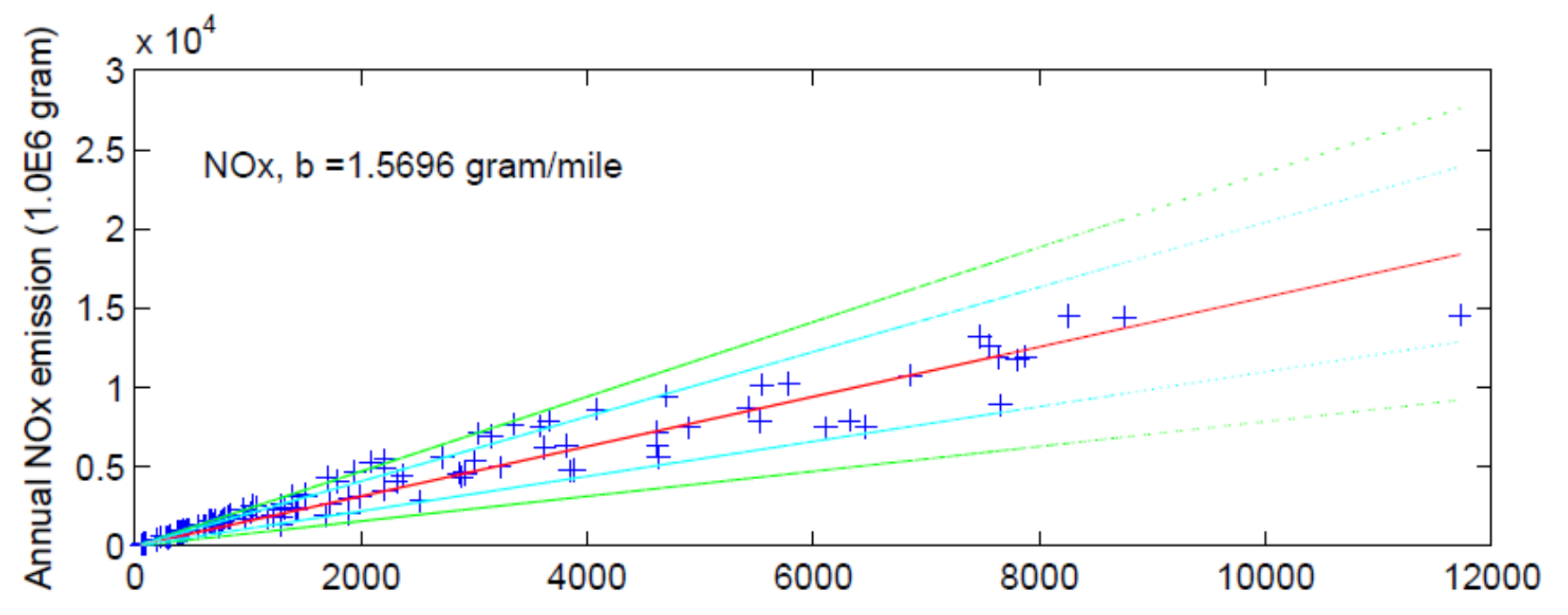


# Bulk Emission Factors and the Quantification of Uncertainty

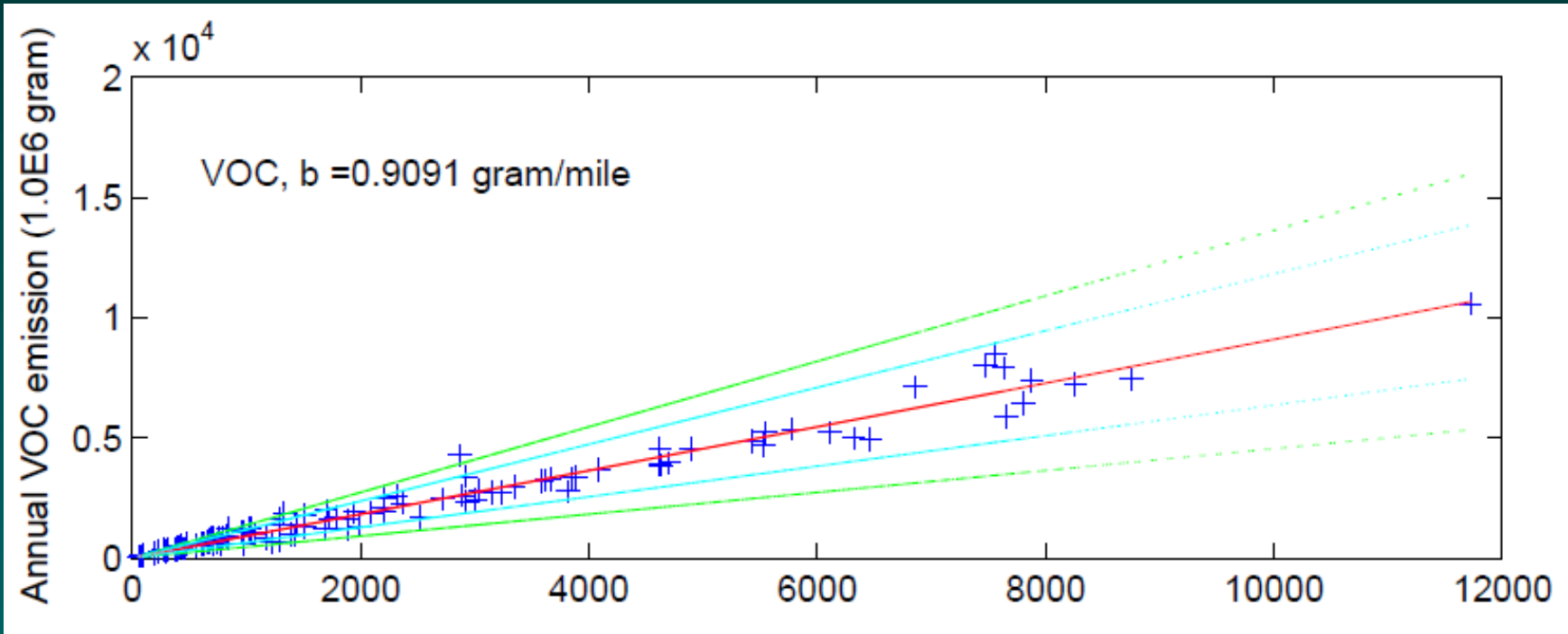
The linear regression of 2007 onroad mobile source emissions against VMT for 116 counties in the Mid-Atlantic and Northeast in the U.S., assuming the diversity they represent is typical and adequate.

# The Bulk Emission Factors

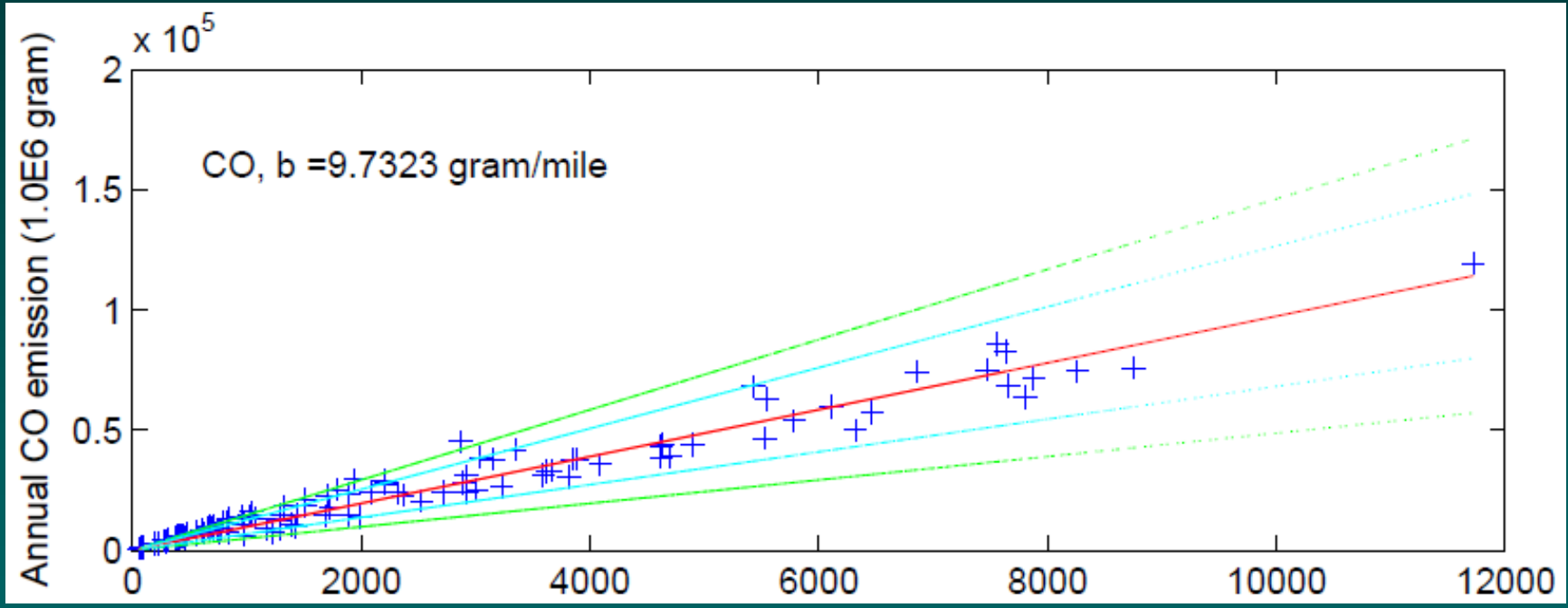
# NOx Emissions and VMT



# VOC Emissions and VMT

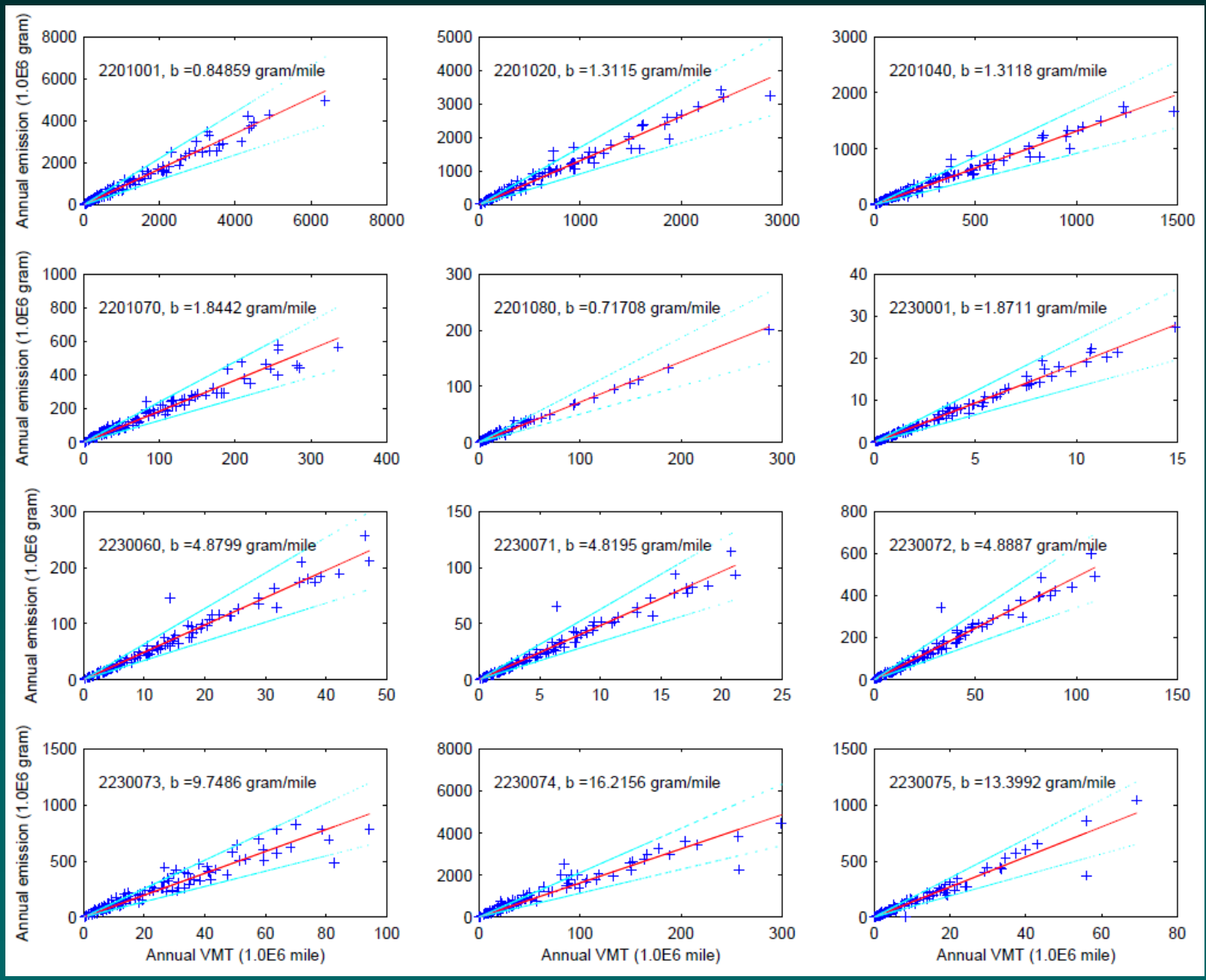


# CO Emissions and VMT




Annual VMT (1.0E6 mile)

# NOx Emissions and VMT by Vehicle Types



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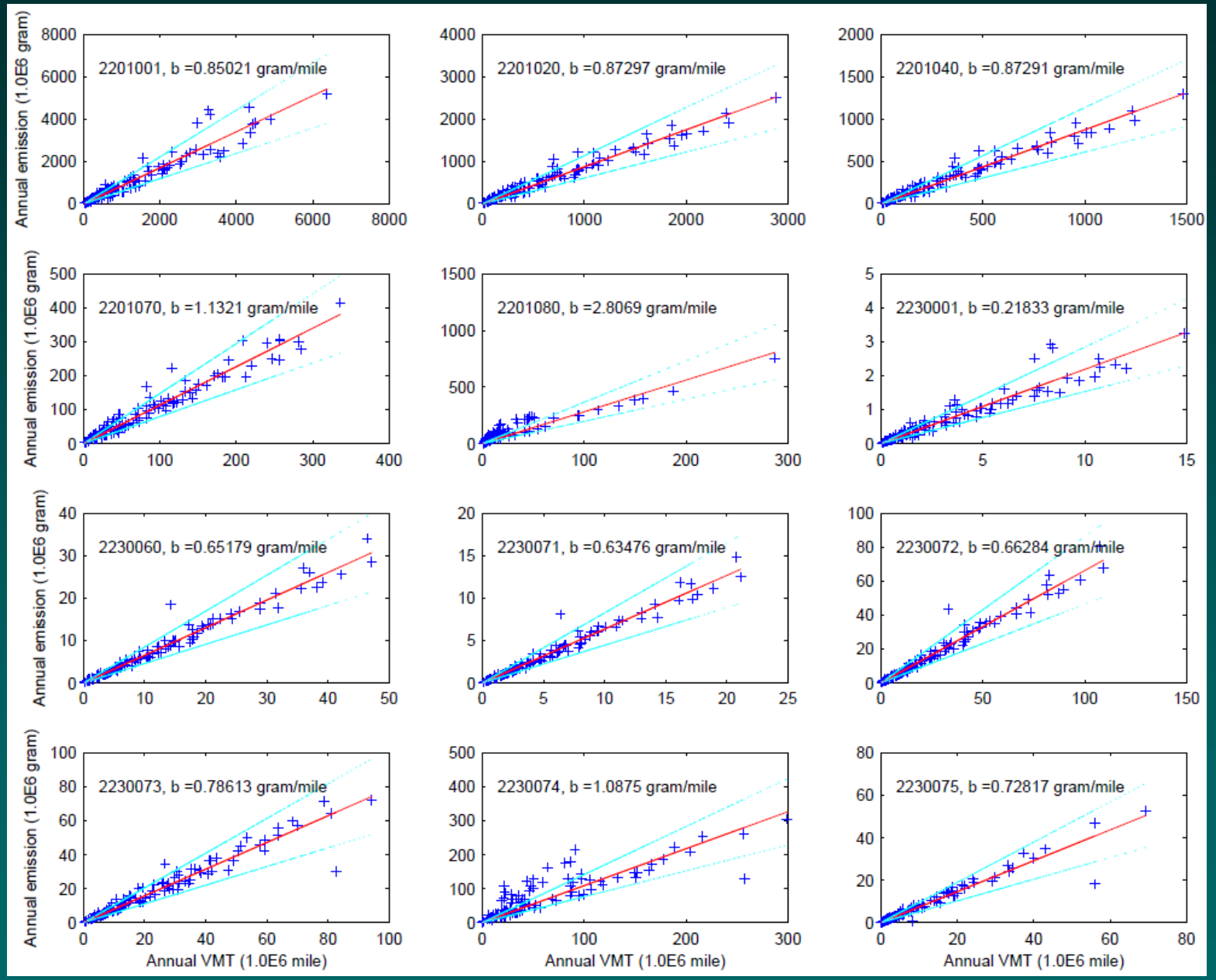
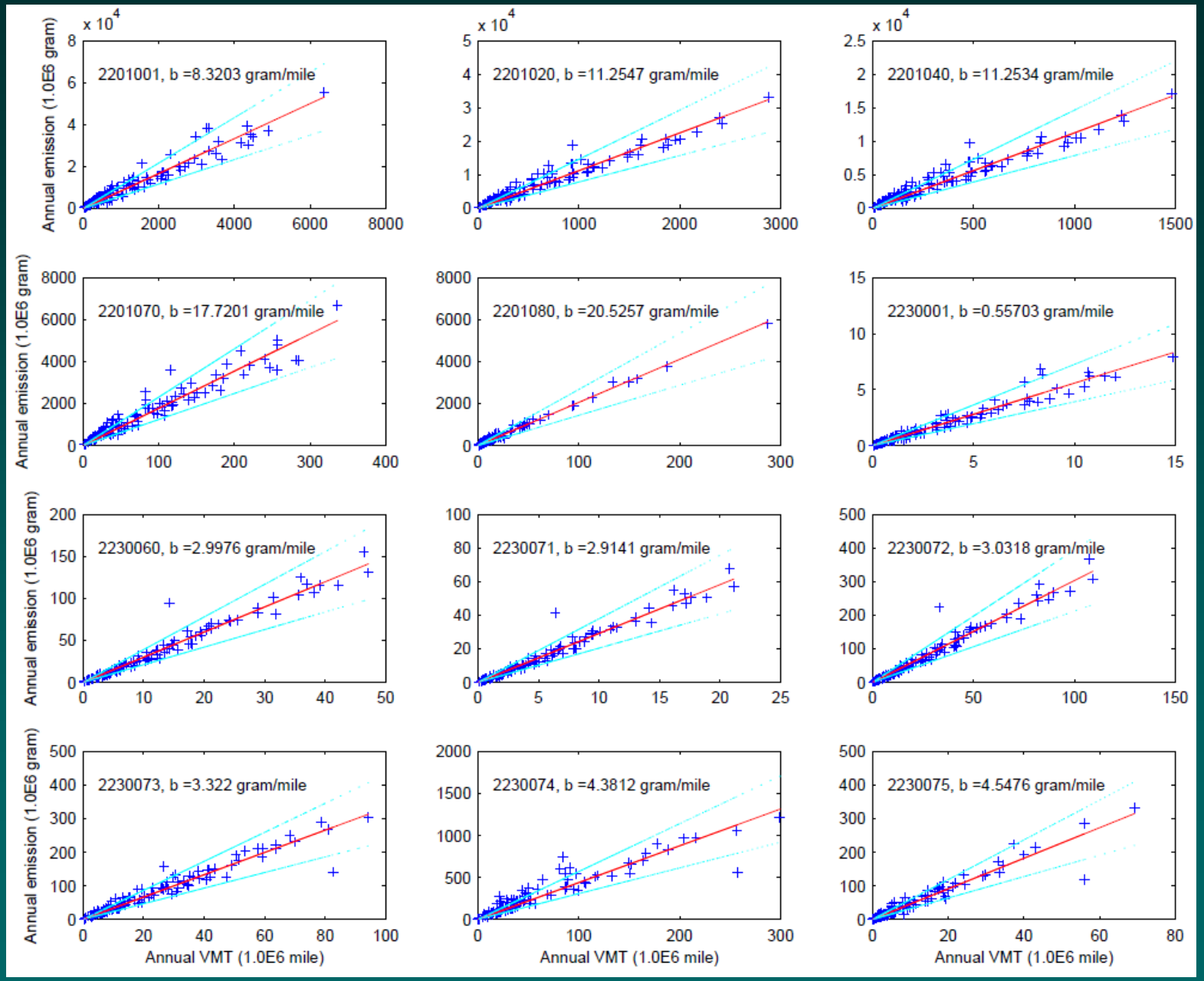
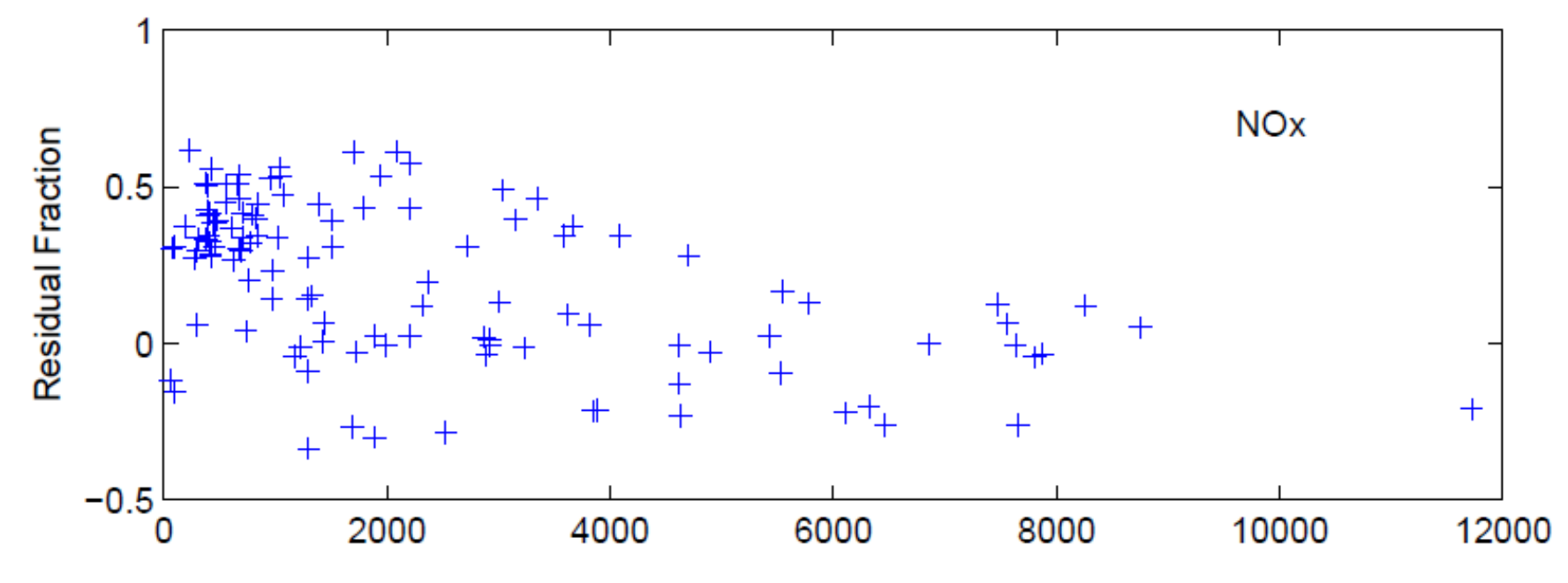


# CO Emissions and VMT by Vehicle Types

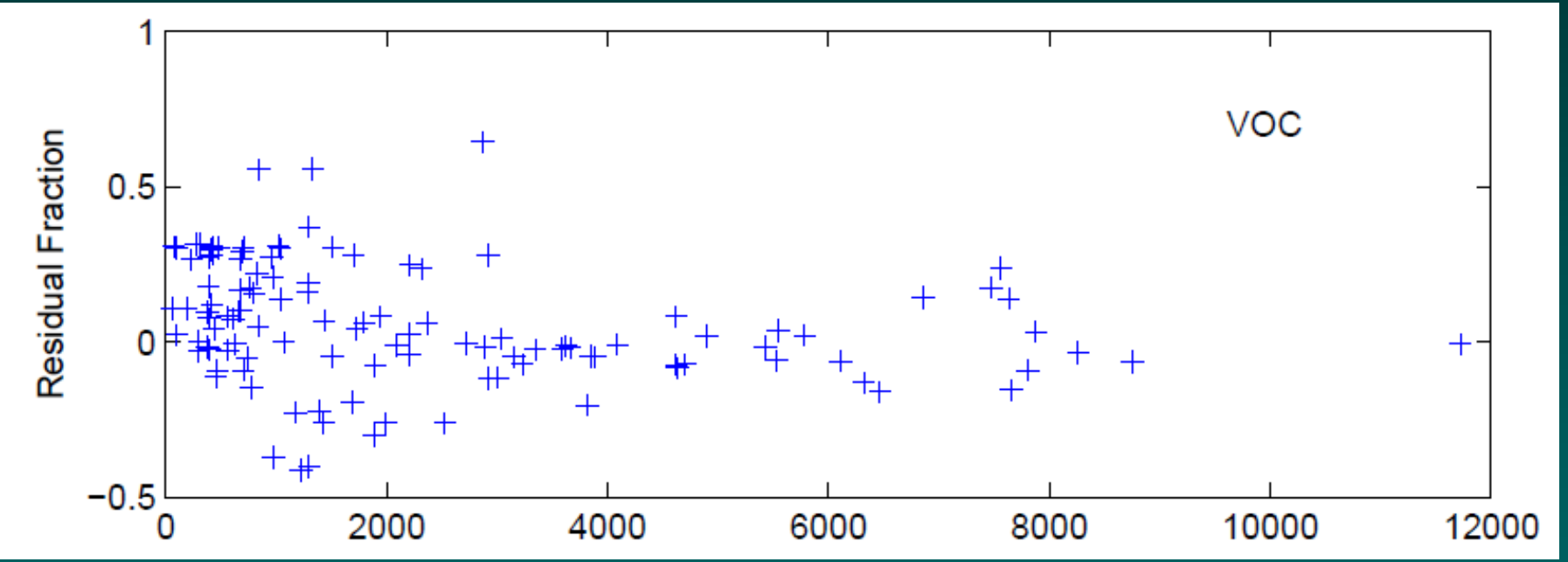


# Estimation of Uncertainties

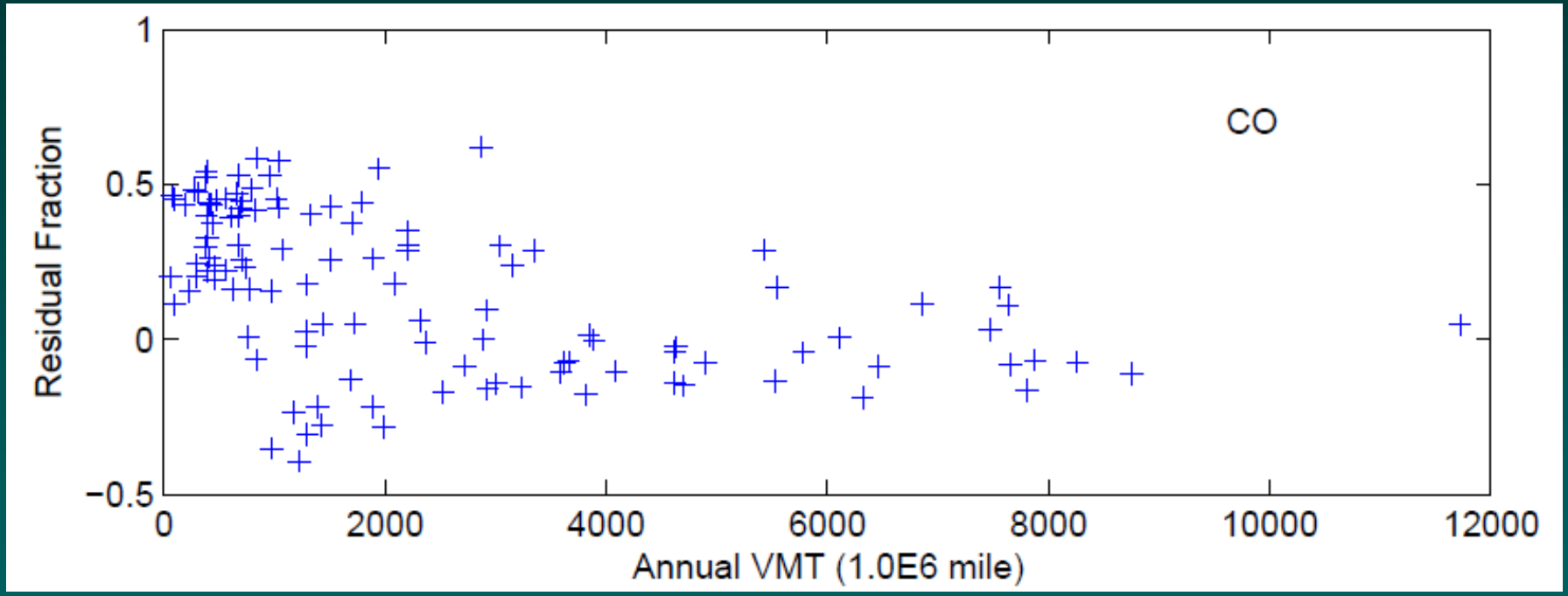
# Residual Fraction of NOx Emissions



# Residual Fraction of VOC Emissions

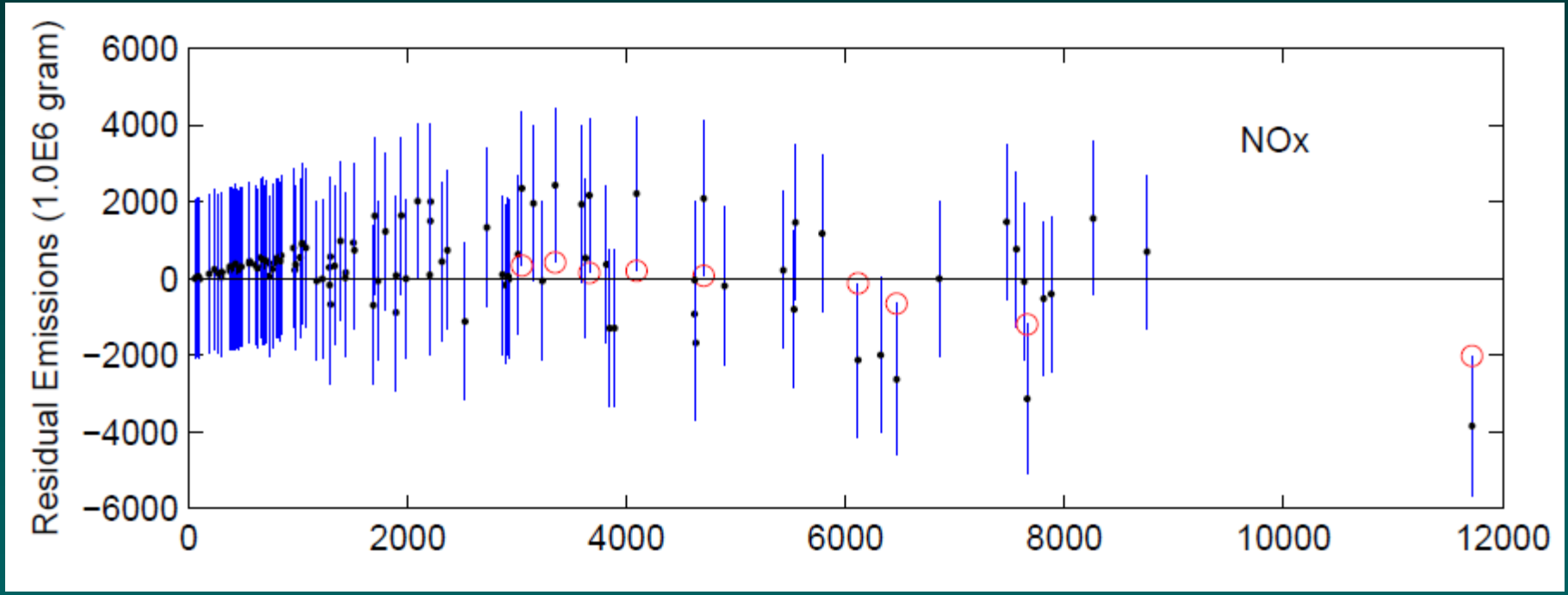


# Residual Fraction of CO Emissions




Annual VMT (1.0E6 mile)

# Residuals and 95% Confidence Level of NOx Emissions



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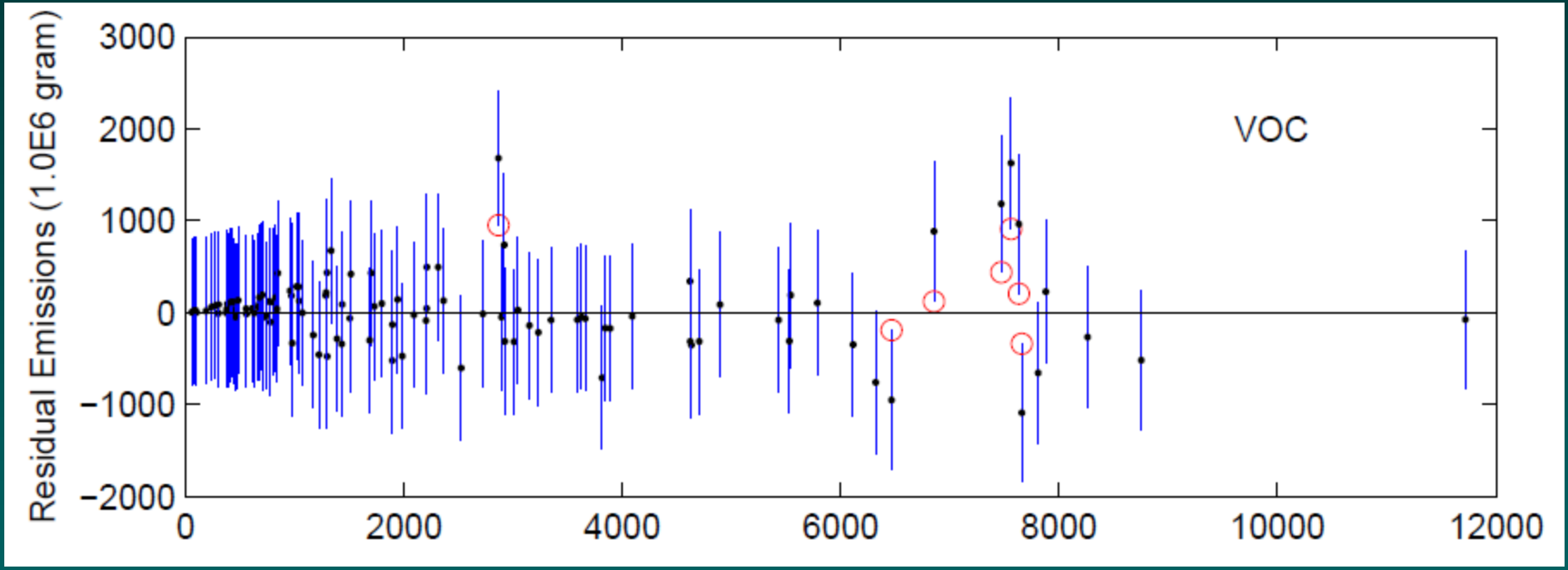

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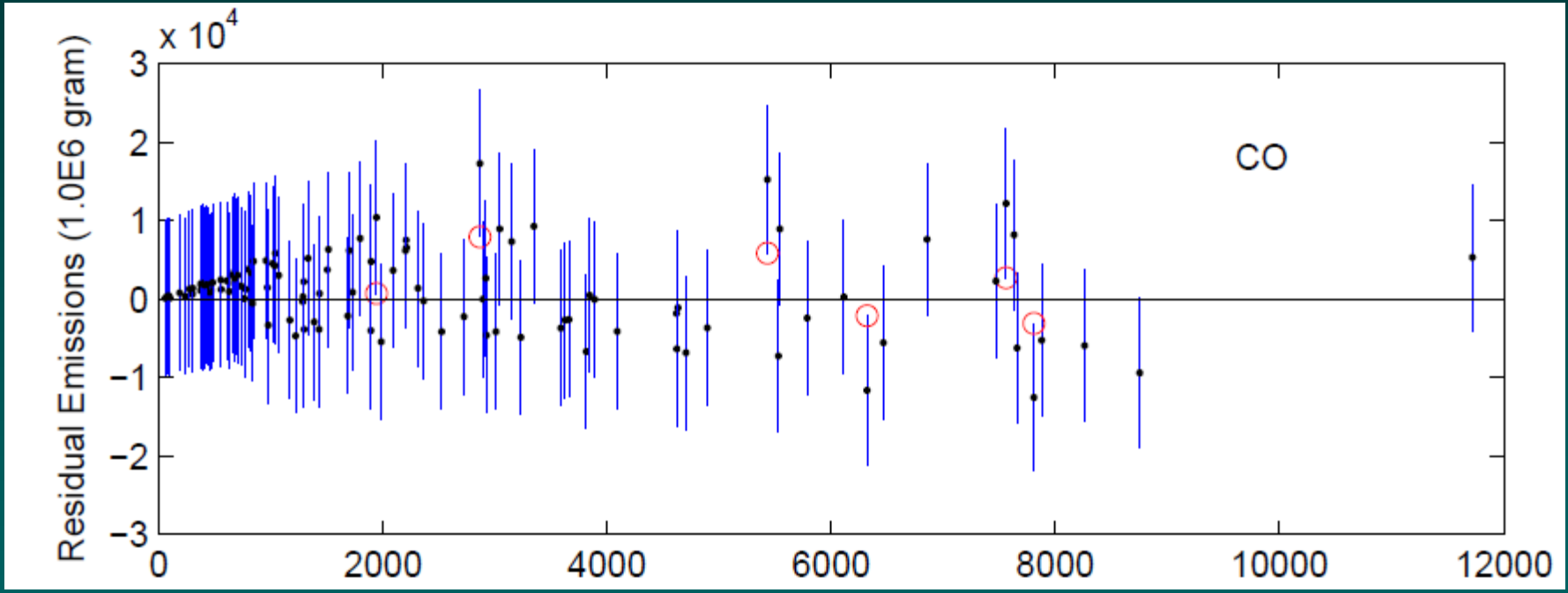

# Summary and Conclusion

The current status of MOVES inputs in Ciudad Juárez, Chihuahua is investigated and the onroad mobile source emissions are estimated in MOVES. However, the lack of local data in Juárez prevents one from simulating emissions in MOVES as accurately as in the U.S.

The onroad emissions from 116 counties in 10 states in the Mid-Atlantic and Northeast in the U.S. are analyzed to estimate bulk emission factors and the uncertainty range of emissions of the linear regression model against annual VMT. The emission uncertainty of an individual county is about $\mp 50\%$ of the fitted values. The emission uncertainty is expected to decrease when more inputs are available beyond the annual total VMT, for example, the vehicle type VMT.

This study has focused on uncertainties caused by the lack of certain activity data. Emission factors could bring big uncertainties to emissions as well. Emission standards, for example, determine the emission factors of new cars. The regulation of emissions of Mexican new vehicles generally lag the U.S. In this case, an early U.S. modeling year could be used to represent a more recent Mexican modeling year.

# Acknowledgements


- Dr. Koupal and Dr. Michaels from the U.S. EPA
- Dr. Rincón and Mr. Luthans from the U.S. EPA Region 6; Ms. Contreras Vigil and Dr. Barrios from SEMARNAT Mexico
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- Mid-Atlantic Regional Air Management Association (MARAMA)
- Mid-Atlantic/Northeast Visibility Union (MANE-VU)
- New York Department of Environmental Conservation Virginia Department of Environmental Quality
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# Questions and Answers