

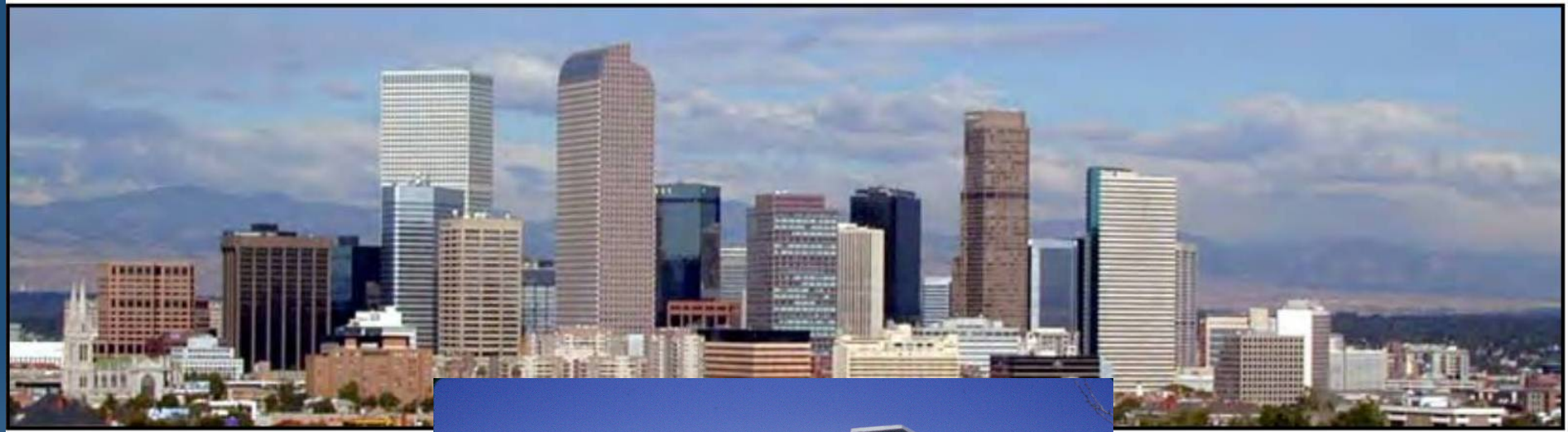


Interaction of Science and Policy: Mobile Sources

NCAR Presentation
July 26, 2016

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Director,
Mobile Sources Program
Colorado Dept of Public Health
and Environment





Mobile Sources

What are the source categories?

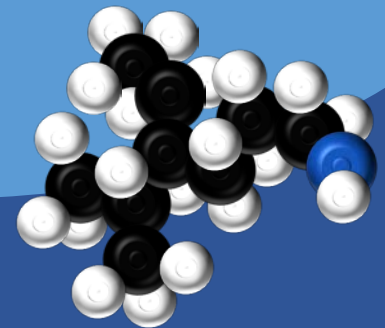
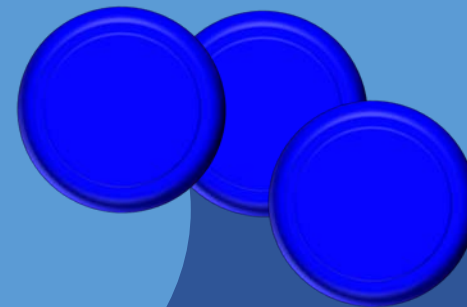
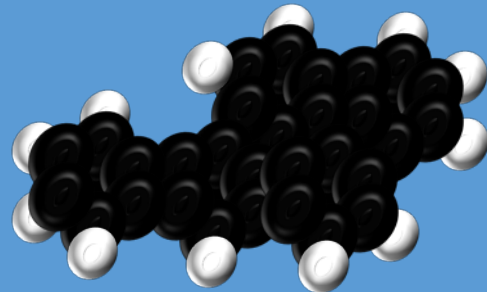
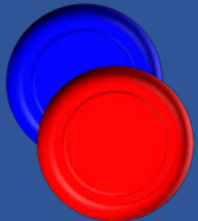
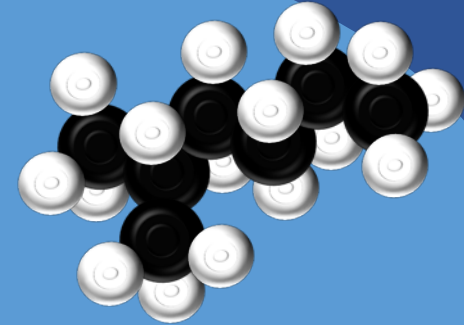
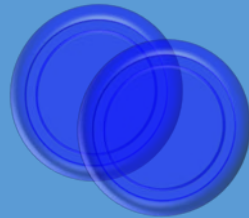
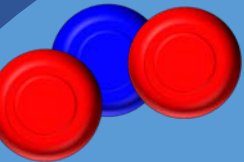
What are the inventory contributions?

What are the control strategies?

What's trending in mobile sources?

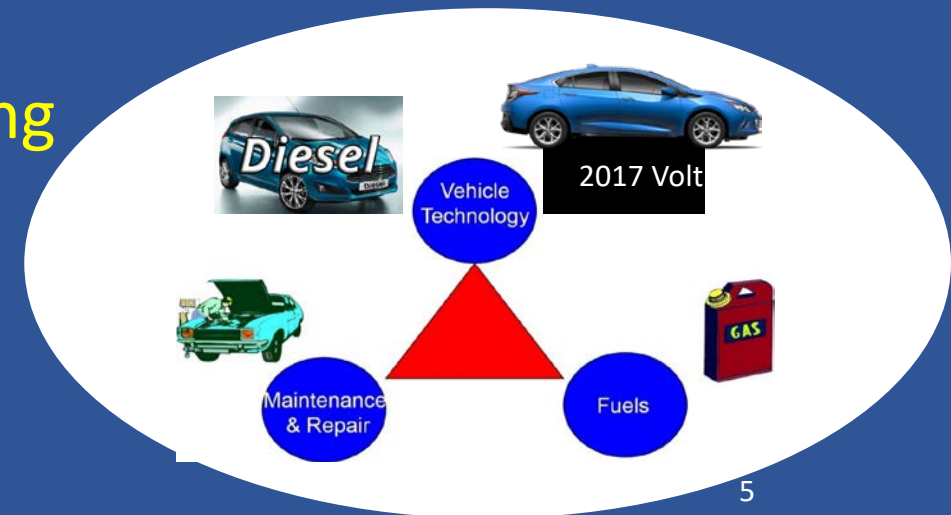
Mobile Sources

Major source of NO_x, VOC, PM, toxics



Mobile Sources

- Emissions from mobile sources are dependent on many factors including:
 - Vehicle Fleet makeup – on-Road - Gas/diesel;- Ave. Age of fleet
 - VMT, idling
 - Fuel Quality
 - Ref CAAA section 200, 40 CFR part 85 and 86 (1065 gas and 1066 dsl)
- Emissions may be quantified through modeling
 - MOVES Emissions model v. 2014a Nov 2015 release
 - *New Tech Guidance out July 2016



Growth in Vehicle Miles Traveled - 2011 - 2017

VMT (miles)	2011	2017
DRCOG		
Light-Duty Vehicles	66,707,056	80,068,234
Medium and Heavy-Duty Vehicles	2,205,459	2,610,525
NFRMPO		
Light-Duty Vehicles	10,697,402	12,072,795
Medium and Heavy-Duty Vehicles	567,078	617,273
TOTAL	80,176,994	95,368,827

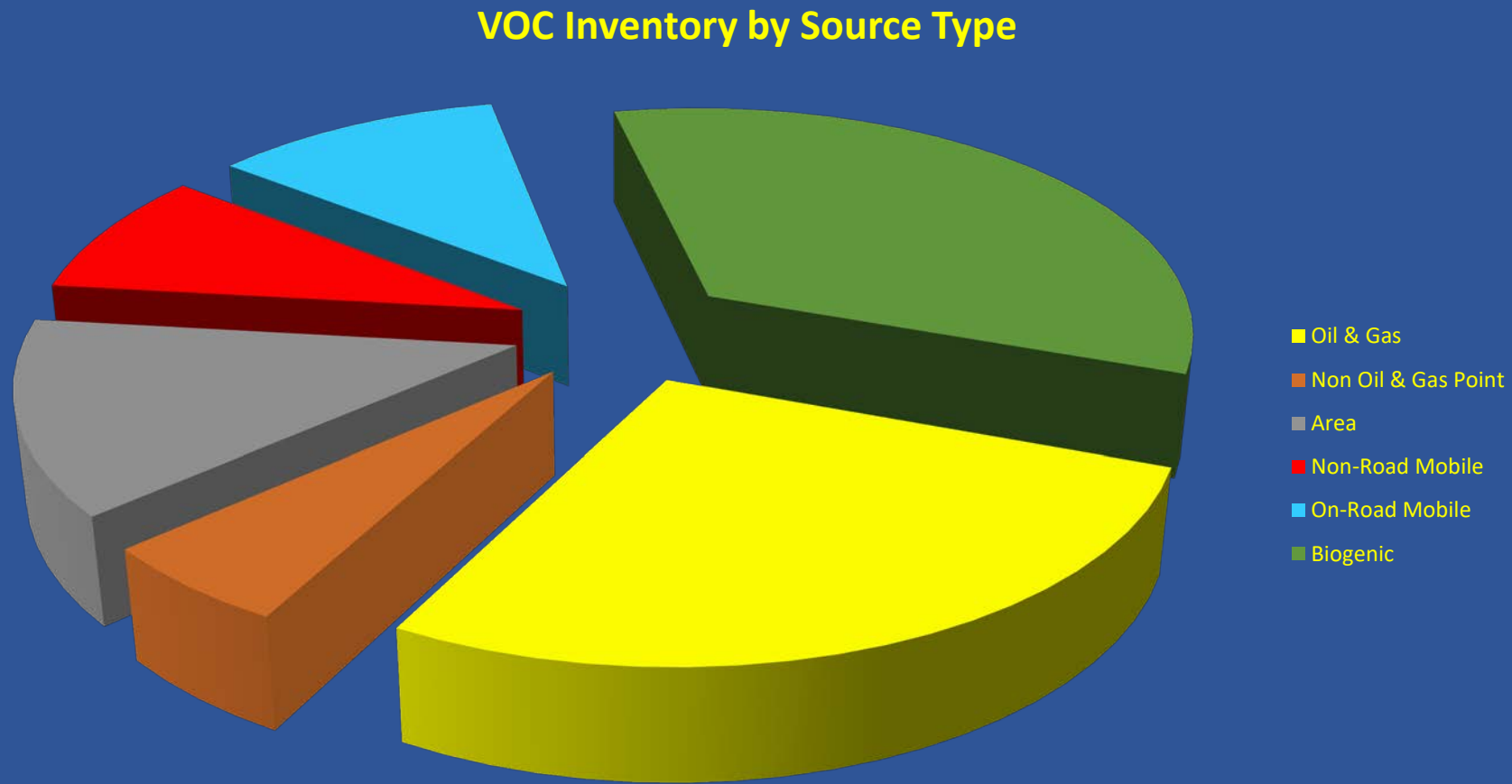
- VMT is based on model output data from the Denver Regional Council of Governments (DRCOG) and the North Front Range Metropolitan Planning Organization (NFRMPO).
- 2017 vehicle population was grown from 2014, by the ratio of the VMT increase from 2014, to 2017

Non-Road Mobile Sources (Federal Controls)

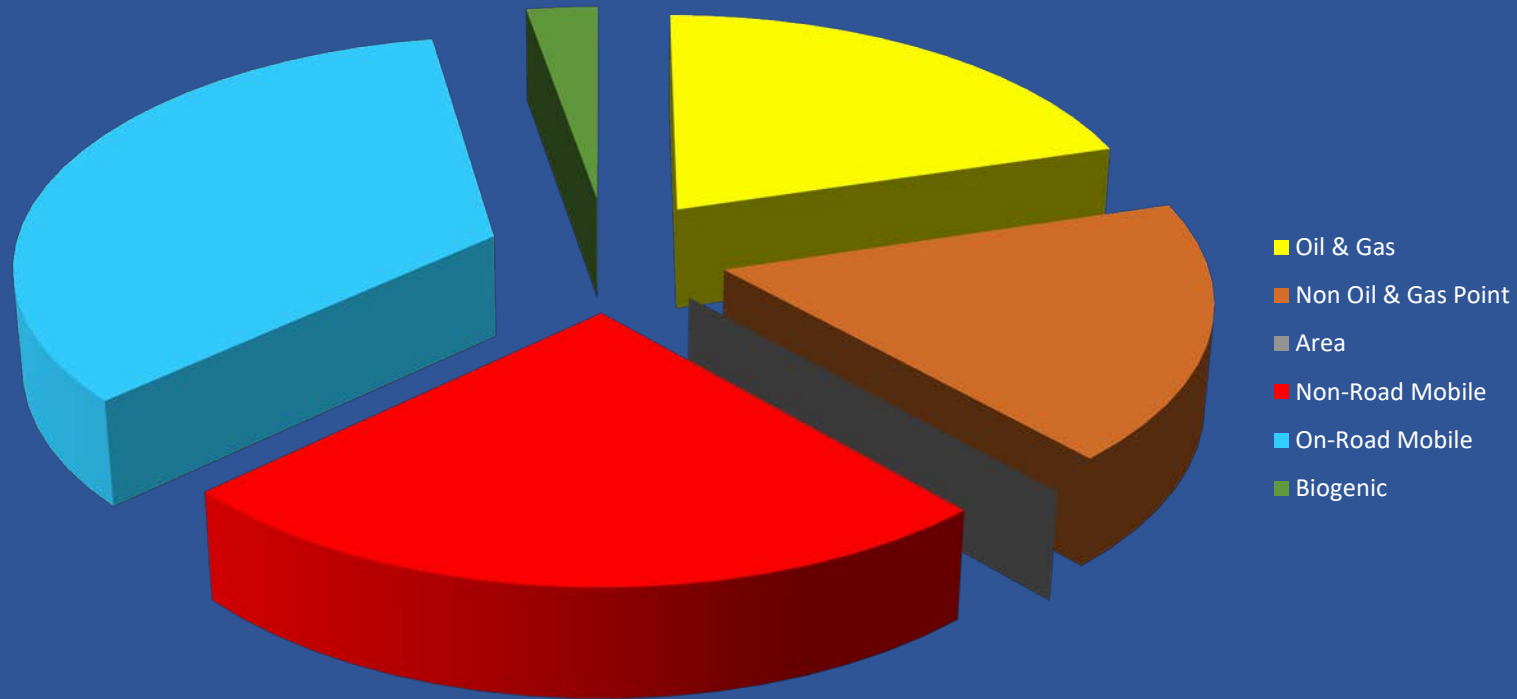
- Federally regulated Mobile Sources: Aircraft, Railroad, (Oceangoing)
 - “Federal Pre-emption”
- *Construction Equipment*
 - Regulated separately from Mobile Sources
 - Independent private ownership, very mobile, little regulation



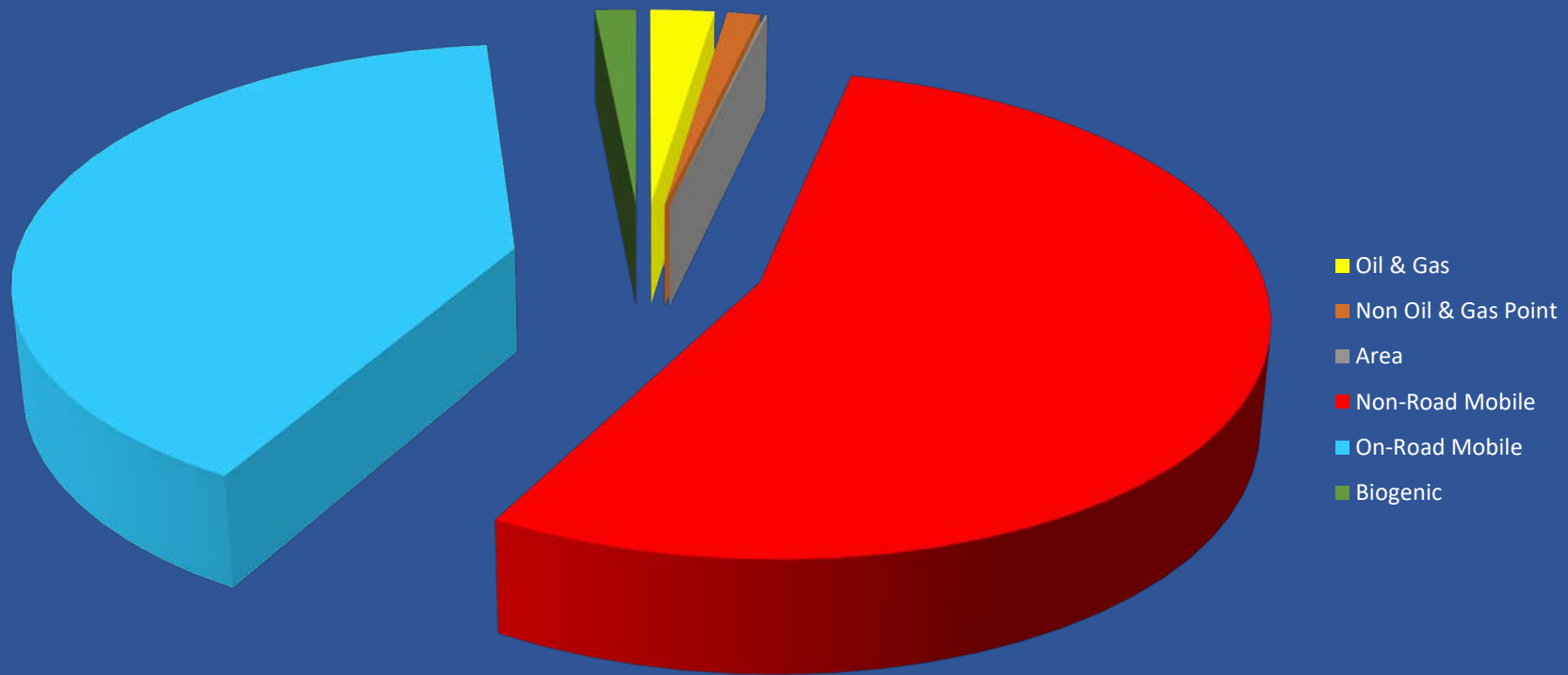
VOC Inventory by Source Type



NOx Inventory by Source Type

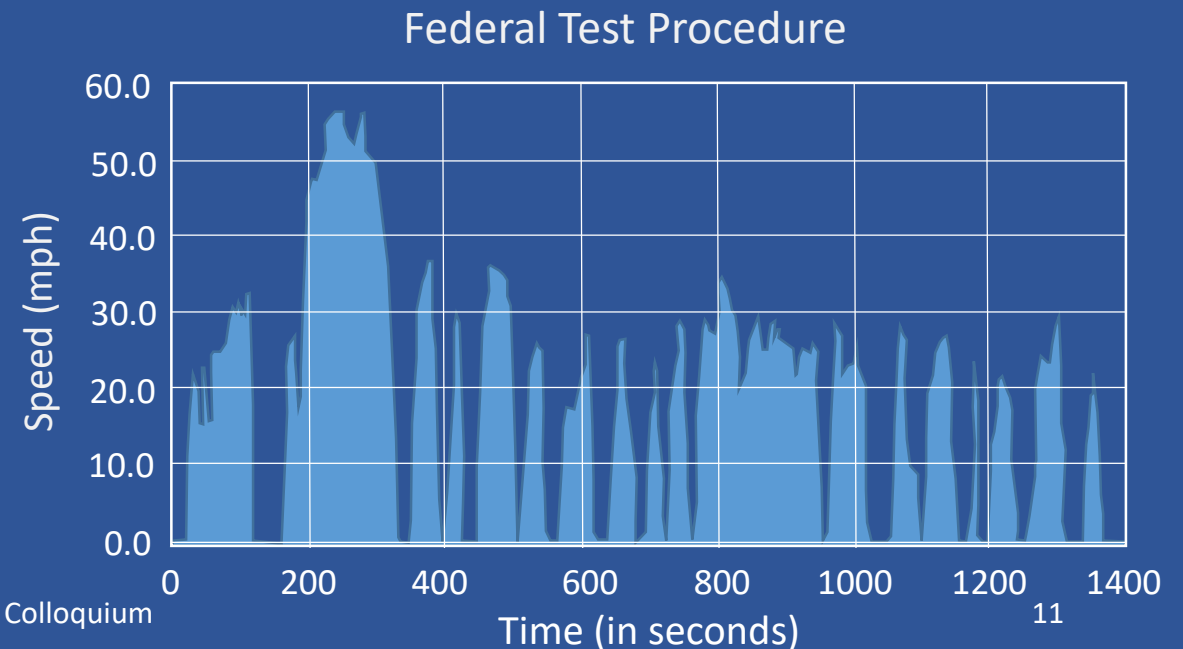


CO Inventory by Source Type



New Vehicle Emissions Certification

- Manufacturer builds to a transient, loaded emissions test: US- Federal Test Procedure (FTP), 'Homologation' (Euro, Japan Type Standard, etc)
 - Tier II 2004-2016
 - Tier III 2017
- Emissions, useful life, deterioration, warranty, availability of service info, etc
- OBD
 - Commonality
 - Triggers and codes
 - Has become the default for I/M
- HD Diesel – Engine only certification
 - Tier IV



Ozone Nonattainment SIPs

		NSR offset ratio	Major source threshold
EXTREME (20 years to attain)	TRAFFIC CONGESTION CONTROLS (if appropriate)	1.5 : 1 Extreme	10
	CLEAN FUELS REQUIREMENT FOR BOILERS		
SEVERE (15/17 years to attain)	PENALTY FEE PROGRAM FOR MAJOR SOURCES	1.3 : 1 Severe	25
	LOW VOC REFORMULATED GAS (as appropriate)		
	VMT GROWTH DEMONSTRATION (& TCMs if needed)	1.2 : 1 Serious	50
	VMT DEMONSTRATION (& TCMs if needed)		
SERIOUS (9 years to attain)	NSR REQUIREMENTS FOR EXISTING SOURCE MODS	1.15 : 1 Moderate	100
	ENHANCED MONITORING PLAN		
	CLEAN FUELS PROGRAM (if applicable)		
	MODELED DEMO OF ATTAINMENT		
	MILESTONE DEMONSTRATIONS and CONTINGENCY MEASURES FOR RFP		
	3% ANNUAL RFP UNTIL ATTAINMENT		
MODERATE (6 years to attain)	ENHANCED I/M for larger population areas	1.1 : 1 Marginal	100
	CONTINGENCY MEASURES FOR FAILURE TO ATTAIN		
	Stage II Gasoline Vapor Recovery		
	BASIC VEHICLE I/M for larger population areas		
	15% VOC ROP or 15% VOC/NOx RFP (OVER 6 YEARS)		
MARGINAL (3 years to attain)	VOC/NOx RACT for MAJOR/CTG SOURCES	1.1 : 1 Marginal	100
	ATTAINMENT DEMONSTRATION		
	TRANSPORTATION CONFORMITY DEMONSTRATION (MVEBs)		
	NONATTAINMENT NEW SOURCE REVIEW PROGRAM		
	BASELINE EMISSION INVENTORY (EI)		
	PERIODIC EMISSION INVENTORY UPDATES		
	MAJOR SOURCE EMISSION STATEMENTS		

Clean Air Act Mobile Sources Strategies

- “Basic Inspection and Maintenance Program” (***Basic I/M***) at the Ozone ***Moderate*** non-attainment classification
- Enhanced Inspection and Maintenance Program (***Enhanced I/M***) at the Ozone ***Serious*** non-attainment classification
- Gasoline powered on-road vehicles only
 - No SIP credit for diesel I/M
- MOVES Model



The I/M Philosophy

- Inspect all vehicles to find the high emitters
- Need a test procedure that correlates to new vehicle certification
- Public is directly affected – Time, convenience, cost, information
 - Human Behavioral Factors
 - Incentive for preventative maintenance before ‘the test’
 - Enforcement, Avoidance, Tampering, Fraud



Inspection and Maintenance in Practice



- Periodic Inspection

- Measure gas concentrations at the tailpipe
- OR
- Query On Board Diagnostics
- Must pass standards



- Repair/Reinspection for failing vehicles – Repair Industry engaged
- Mature concept and testing technology
- Add-ins – Tampering, Smoke, Evaporative, Safety

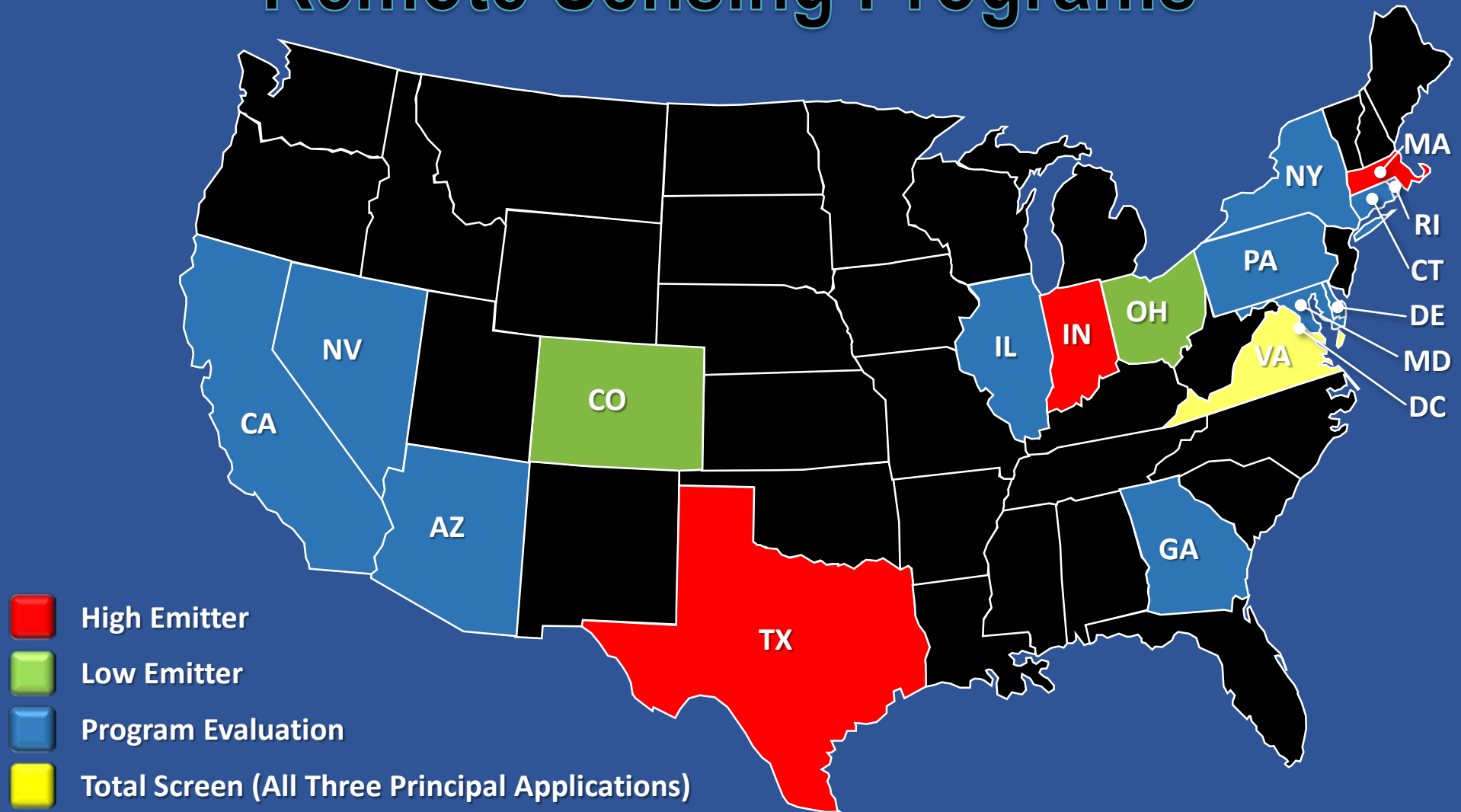


Remote Sensing Devices (RSD)

- Takes a 0.4 Second 'snapshot' of emissions while driving past
- Roadside
- Lots of real-life emissions data in a hurry
- Fleet Characterization was the original intent
- ID High emitters, low emitters, pre-screening at inspection lanes, Program eval...
- Gasoline and diesel engines
- VW TDI identification



Remote Sensing Programs



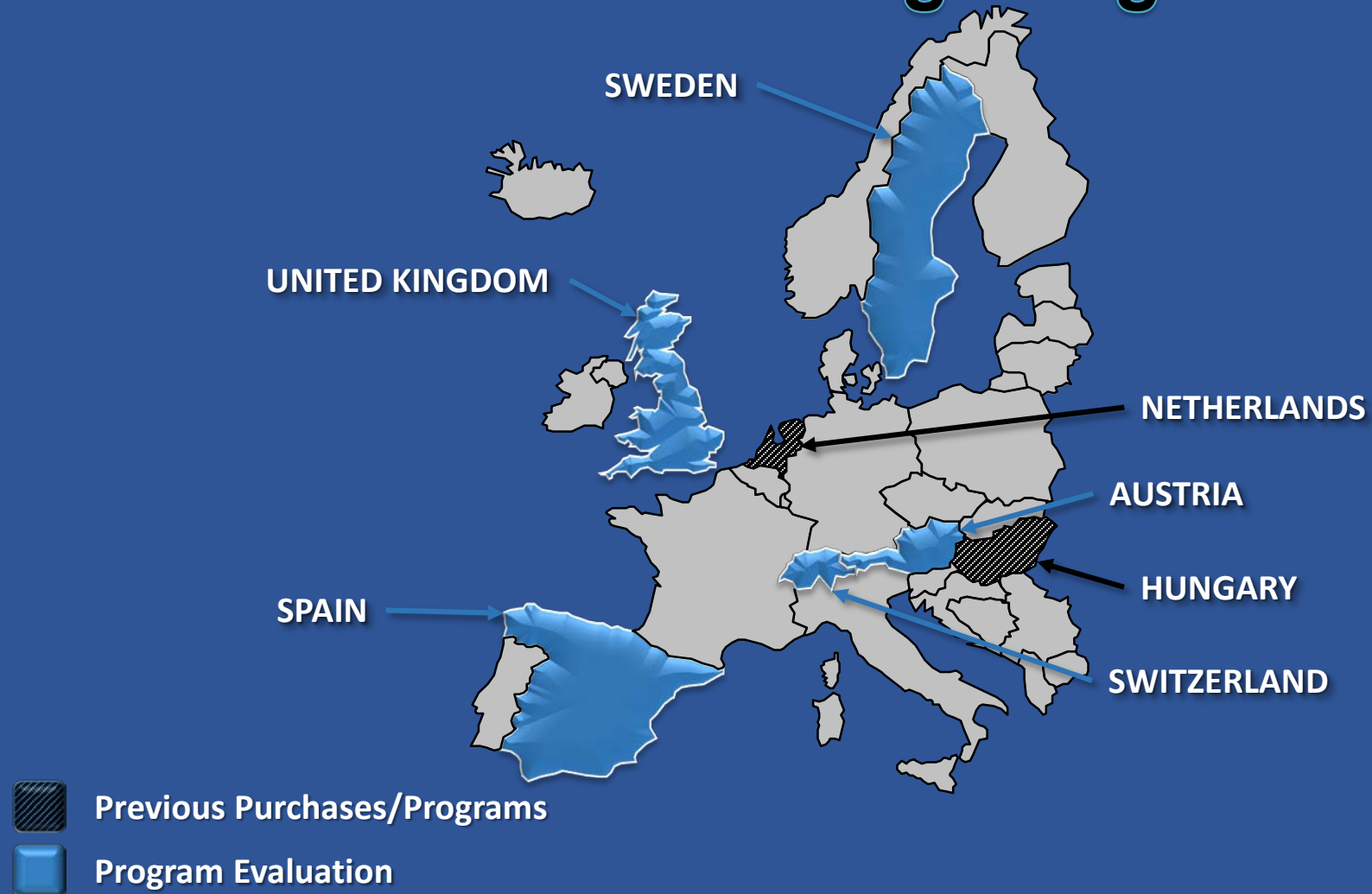
Remote Sensing Programs



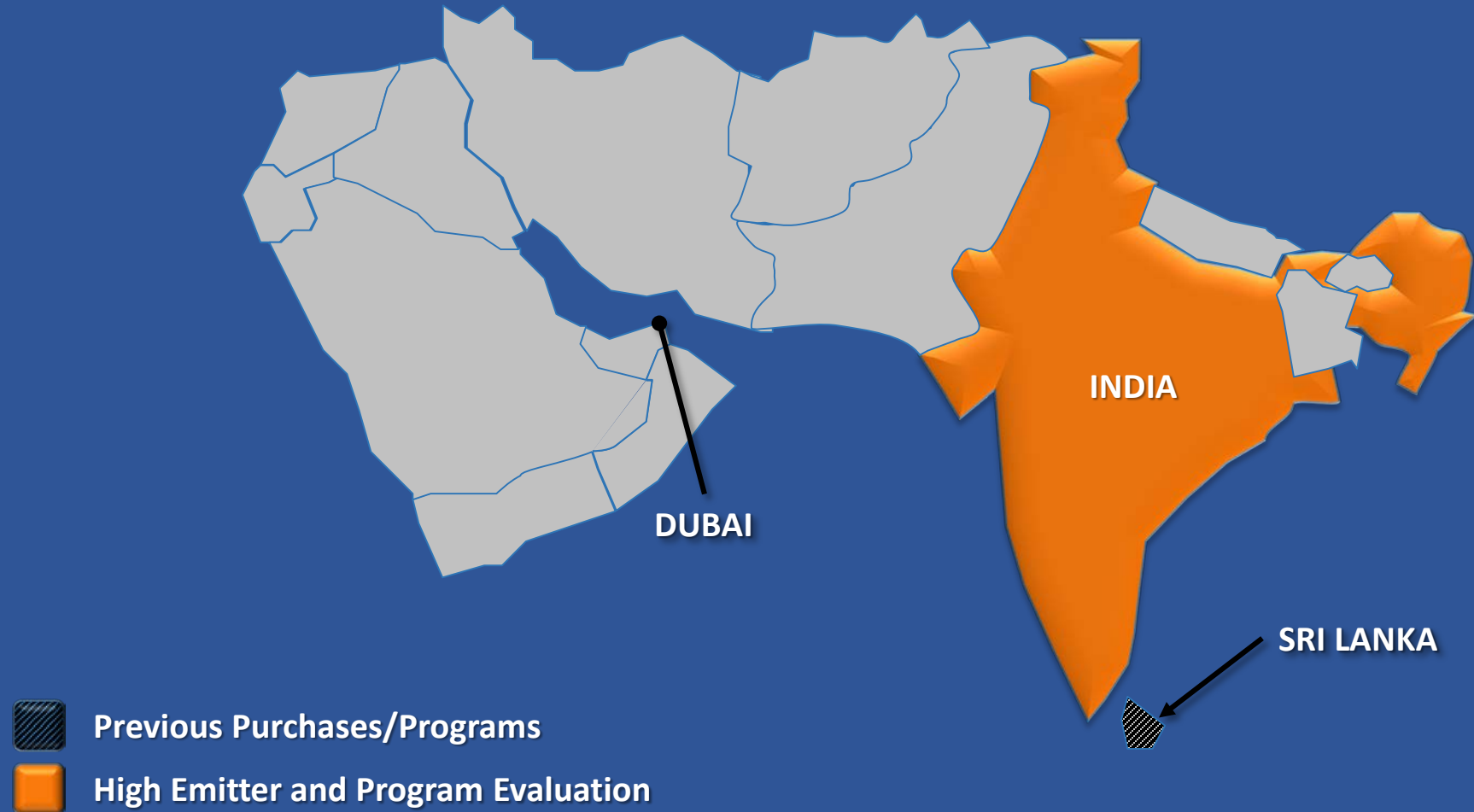
Remote Sensing Programs



Remote Sensing Programs



Remote Sensing Programs



Remote Sensing Programs



Program Evaluation

Remote Sensing Programs



Other Mobile Source Control Strategies₁

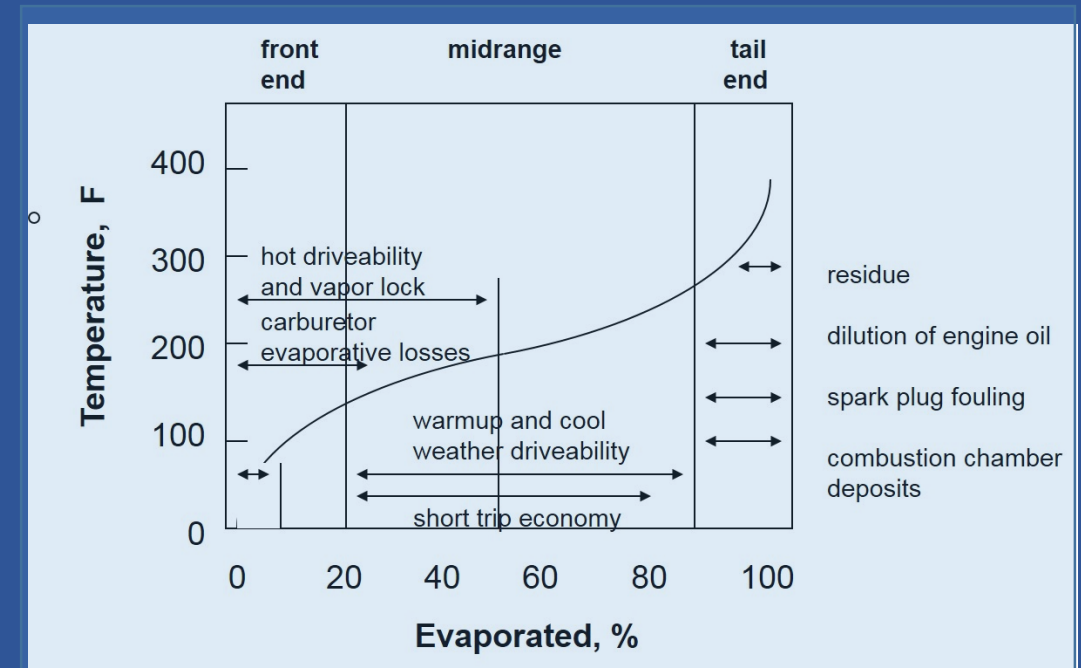
- Fuel Quality

- Gasoline – 40 CFR Part 80 - ASTM D-4814

- Volatility – Reid Vapor Pressure – (Rvp) – Ethanol Waiver (VOC)
 - Reformulated Gasoline – Low aromatic VOC
 - Sulfur, lead, phosphorus, octane
 - Tier III (2017) Cert rule treats the vehicle and the fuel as a unit, for the first time

- Diesel – 40 CFR Part 80 -ASTM D-975

- Cetane
 - Sulfur - 15 ppm ULSD phase-in 2006-2010
 - Aromatics



Other Mobile Source Control Strategies₂

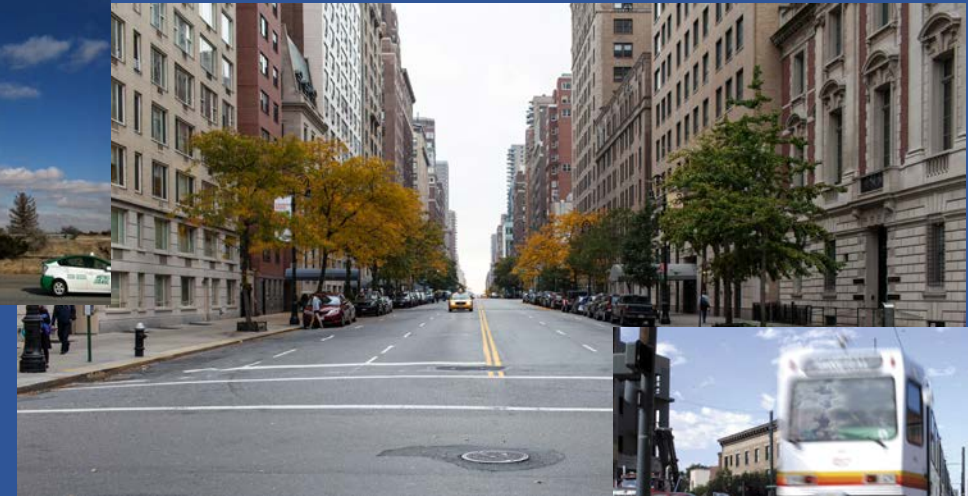
- Voluntary Measures:

- VMT reduction

- No – Drive days
 - Mass Transit/Rideshare
 - Urban planning
 - Flexplace

- Fleet Turnover

- New vehicle purchase incentives - Hybrids, Electrics, Smart cars
 - Scrappage Programs



7/26/2016

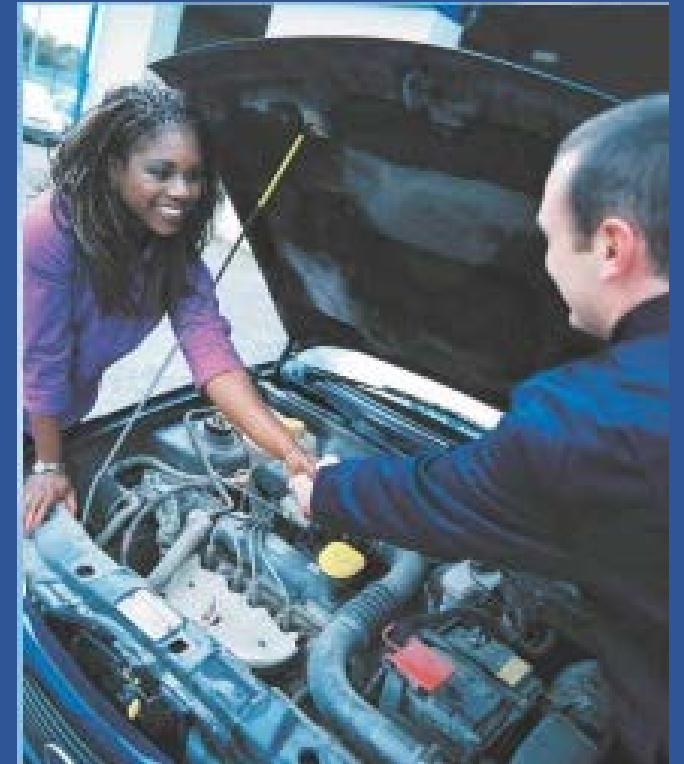


UCAR Summer Colloquium



Trends and Challenges in Mobile Sources

- **Technological Evolution - Change is a constant**
 - OEM technological advancements
 - Aftermarket hardware and software
- **Socio-Economic Evolution – Cuts both ways**
 - Public – Motorist behavior/attitudes
 - Automotive Industry & Repair Industry



Colorado's High Altitude Emissions Laboratory

- Full FTP capability with SHED and Cold Cell
- Internal studies –
 - I/M effectiveness,
 - In-use deterioration
 - OBD – I/M comparisons
 - Evaporative emissions
 - Recall/Campaign work
 - Remote Sensing validation
 - Aftermarket parts performance



Volkswagen Defeat Device



2013 VW Passat TDI Engine
Velocityjournal.com

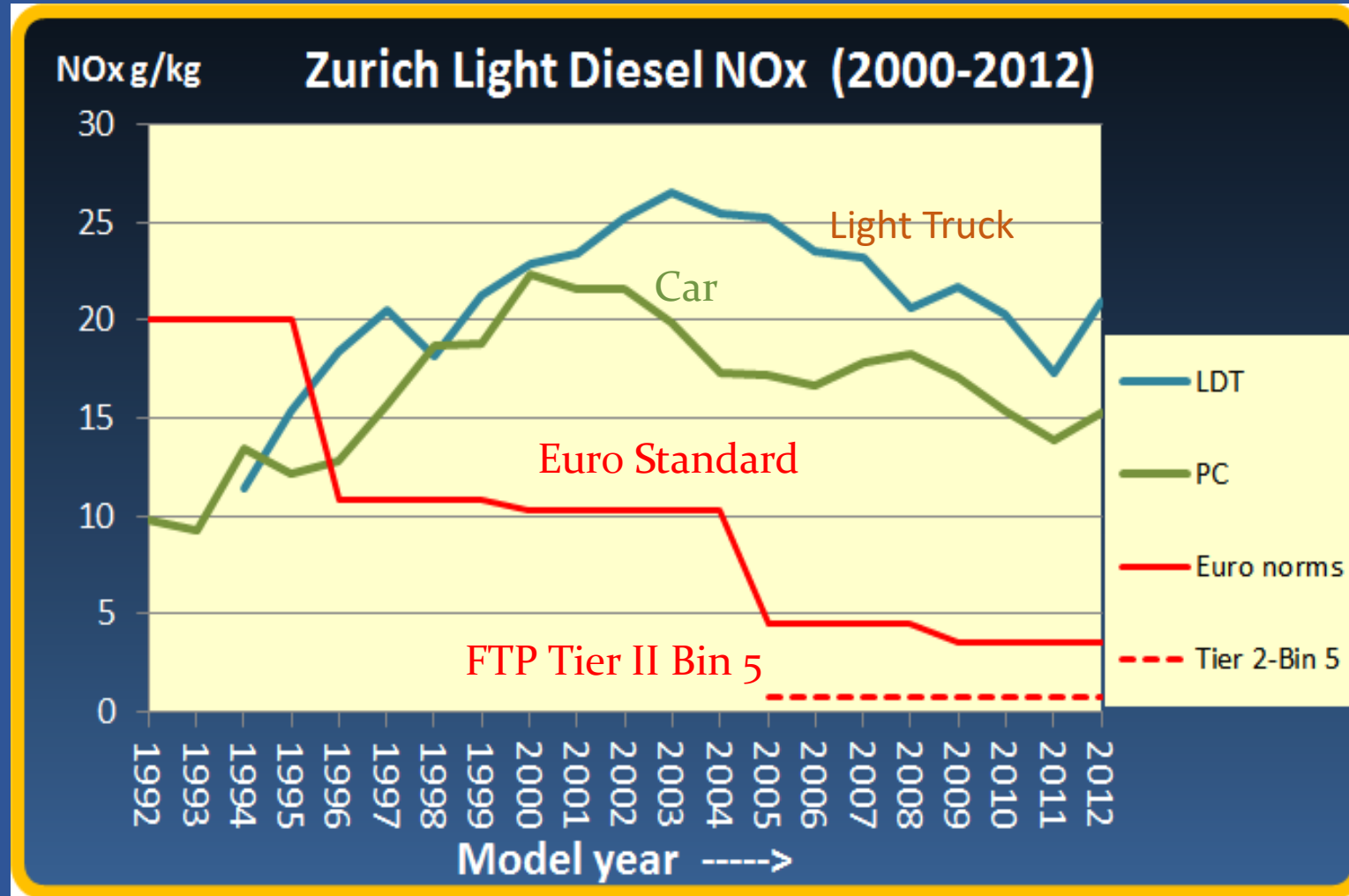
Volkswagen Defeat Device

- It appears that Volkswagen intended to deceive EPA by evading the intent of the FTP
- Volkswagen in September 2015 admitted to installing defeat device on 2.0 L engines from model year 2009 to today
- Software was designed to recognize the FTP and recalibrate engine parameters to pass (NO_x). In normal operation, emissions and performance will be higher
- Consent Decree finalized, DOJ approval pending (Oct 2016?)
- \$14.7 mm settlement

Volkswagen Defeat Device

- 11 million diesel vehicles worldwide
- 482,000 diesel vehicles with 2.0 liter E189 engine in U.S.
- First observed in Zurich that diesel vehicles not meeting certification standards when observed on-road through remote sensing
- University of West Virginia contacted to conduct in-use study of diesel vehicles in United States
 - In May 2014, University of West Virginia PEMs study was published

Europe Remote Sensing Results



University of West Virginia Study

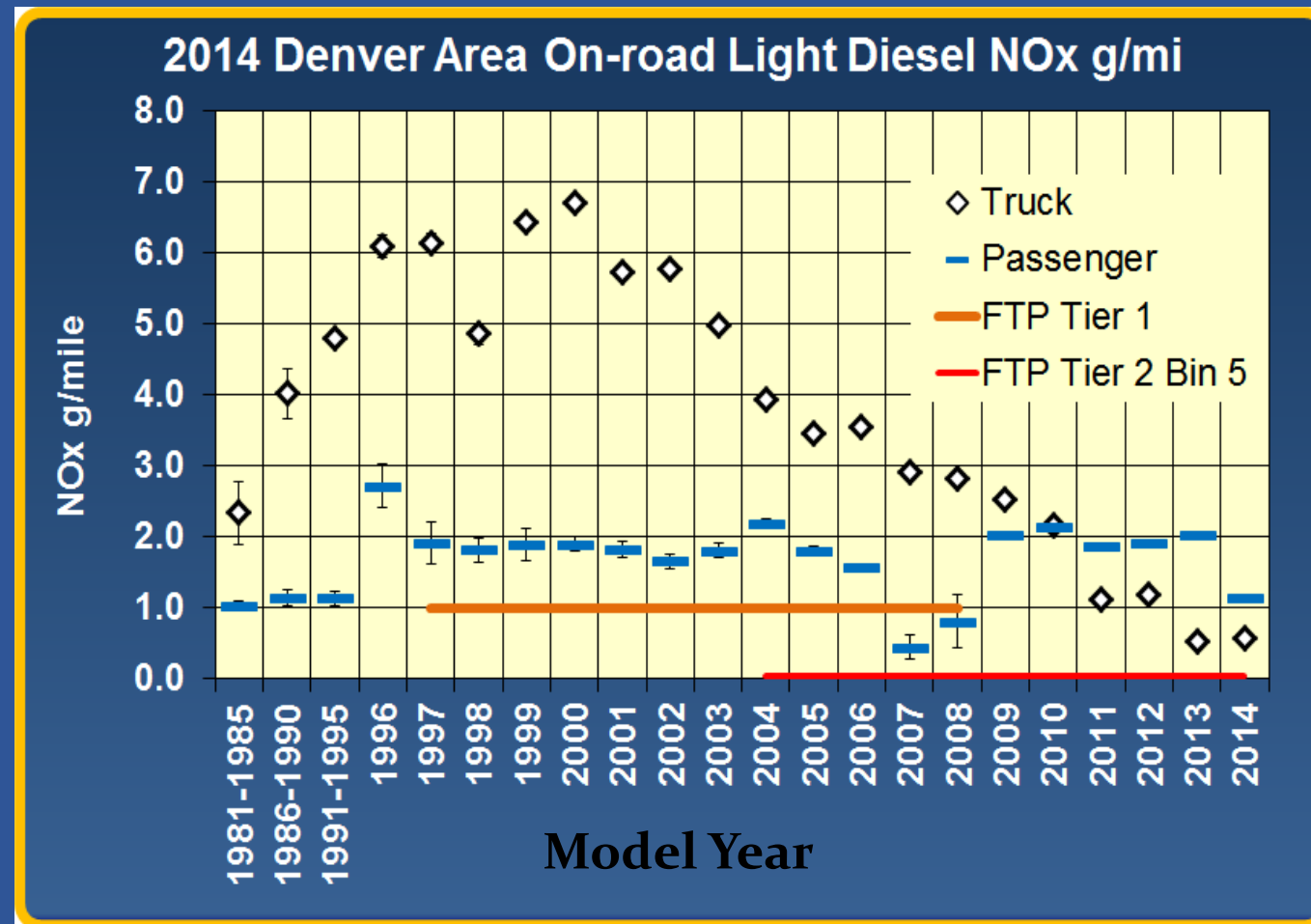
- Examined on-road diesel emissions from three vehicles
- Diesel vehicles were:
 - VW Jetta (2012 MY, LNT)
 - VW Passat (2013 MY, SCR)
 - BMW X5 (SCR)
- Five driving scenarios including:
 - Highway
 - Urban
 - Rural Hills
- Vehicles also dynamometer tested by California Air Resources Board



University of West Virginia Study

- Jetta had emissions that were 15 to 35 times the certification standards
- Passat had emissions that were 5 to 20 the standards
- BMW X5 had emissions that were generally at or below standards
- Jetta and Passat met certification standards during CARB dynamometer mass emissions testing

Light Diesel Passenger & Truck NO_x in 2014



VW Consent Decree Settlement

- **\$14.7 billion settlement:**
 - \$10b for VW owners – 85% Recall - Vehicle Buyback/Lease Termination
 - Option to repair vehicles if VW wishes
 - \$2.7b NOx Mitigation Trust Fund – to States, DC, PR and Tribes
 - Minimum allocation to each state - \$7mm
 - Allocation based on affected VW population
 - List of approved projects – Retrofit/replace/repower/Alt Fuels/Electrification
 - Environmental Justice element
 - Each state may apply to the Trustee for funds
 - \$2b for Electrification/ZEV infrastructure and public outreach

Questions?

- Thank you!

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