CLEARING THE AIR

Air Quality and Mobile Sources

Clearing the Air Workshop #5: September 28, 2021

DEPARTMENT OF **ENERGY & ENVIRONMENT**

WE ARE WASHINGTON DC GOVERNMENT OF THE DISTRICT OF COLUMBIA **MURIEL BOWSER, MAYOR**

TAG THIS PRESENTATION @DOEE_DC

Air Quality Review

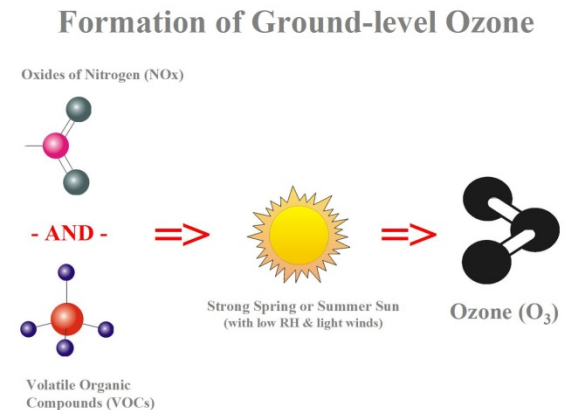Defined as a measure of how clean or polluted the air we breathe is

Why planning is important:

- Protect public health;

- Identify sources of pollution;

- Develop pollution control strategies.

What are the Criteria Pollutants?

EPA established health-based standards for these SIX harmful air pollutants, called the criteria air pollutants:

- Carbon Monoxide (CO)
- Sulfur Dioxide (SO_2)
- Ground-level Ozone (O_3)
- Lead (Pb)
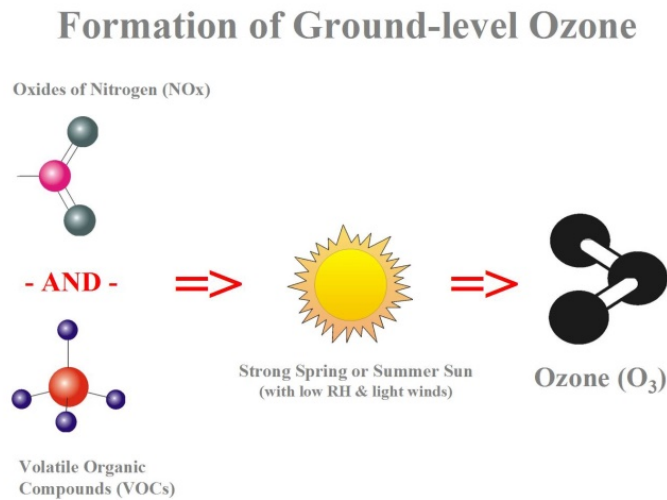- Nitrogen Dioxide (NO_2)
- Particulate Matter (PM_{10} & $PM_{2.5}$)

Formation of Ground-level Ozone

Oxides of Nitrogen (NOx)

- AND -

Strong Spring or Summer Sun
(with low RH & light winds)

Volatile Organic
Compounds (VOCs)

Ozone (O_3)

National Ambient Air Quality Standards (NAAQS)

| Pollutant	NAAQS
Ozone	70 ppb
Fine PM ($PM_{2.5}$) Coarse (PM_{10})	35 µg/m^3 & 12 µg/m^3 150 µg/m^3
Carbon Monoxide	35 ppm & 9 ppm
Nitrogen Dioxide	100 ppb & 53 ppb
Sulfur Dioxide	75 ppb
Lead	0.15 µg/m^3

Source: https://www.epa.gov/criteria-air-pollutants/naaqs-table

Vehicle Inspections control emissions

- The vehicle inspection and maintenance (I/M) program is a control method

Formation of Ground-level Ozone

Oxides of Nitrogen (NOx)

- AND - => Strong Spring or Summer Sun (with low RH & light winds) => Ozone (O$_3$)

Volatile Organic Compounds (VOCs)

- On-Road sources (e.g. cars and trucks) make up 48% of our NOX emissions, and 28% of our VOC emissions

Emission testing timeline in D.C.

1983   **1997**   **1999**   **2004**
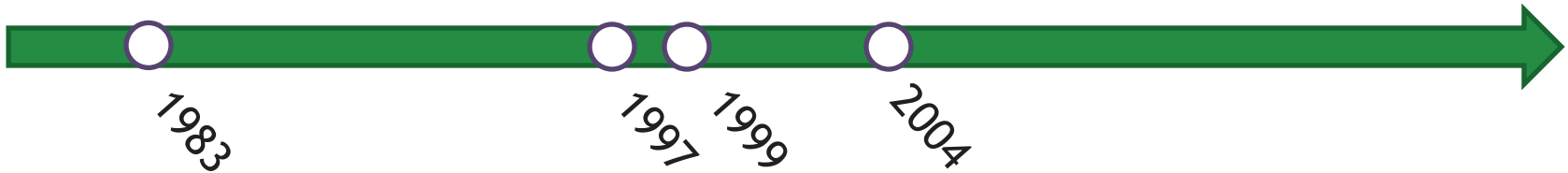
- **1983**: Idle test started as the first emission test
- **1997**: New plan (SIP) adopted, conformed to the updated enhanced I/M program requirements
- **1999**: new plan fully implemented, dynamometer testing started
- **2004**: The District starts performing modern OBD testing

Maryland, Virginia, and other states

- As a part of our non-attainment area Maryland and Virginia also operate similar I/M programs

- 34 of 50 states and the district have some type of emission inspection program

Monitor Names
1. Takoma Park
2. River Terrace
3. McMillian
4. Prince George's County Equestrain Center
5. Beltsville
6. Rockville
7. Southern Maryland
8. Frederick
9. Calvert
10. Alexandria
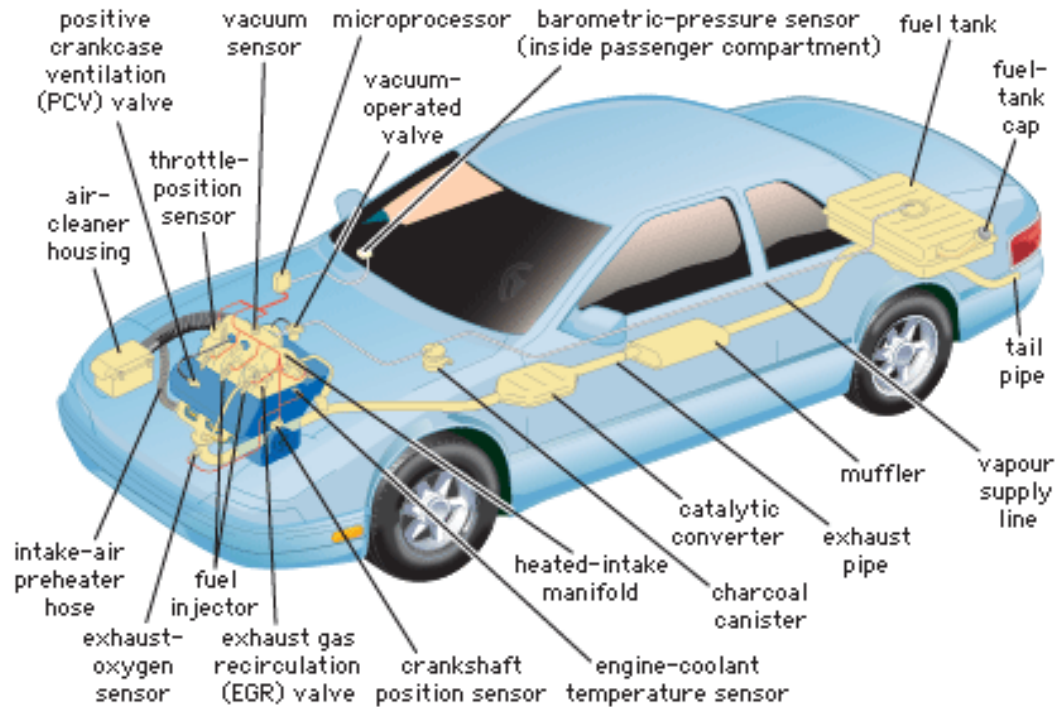11. Aurora Hills
12. Long Park
13. Ashburn
14. Franconia

Figure 3: Metropolitan Washington 8-hour Ozone Nonattainment Region (Washington, DC-MD-VA)
Image courtesy of the Metropolitan Washington Council of Governments
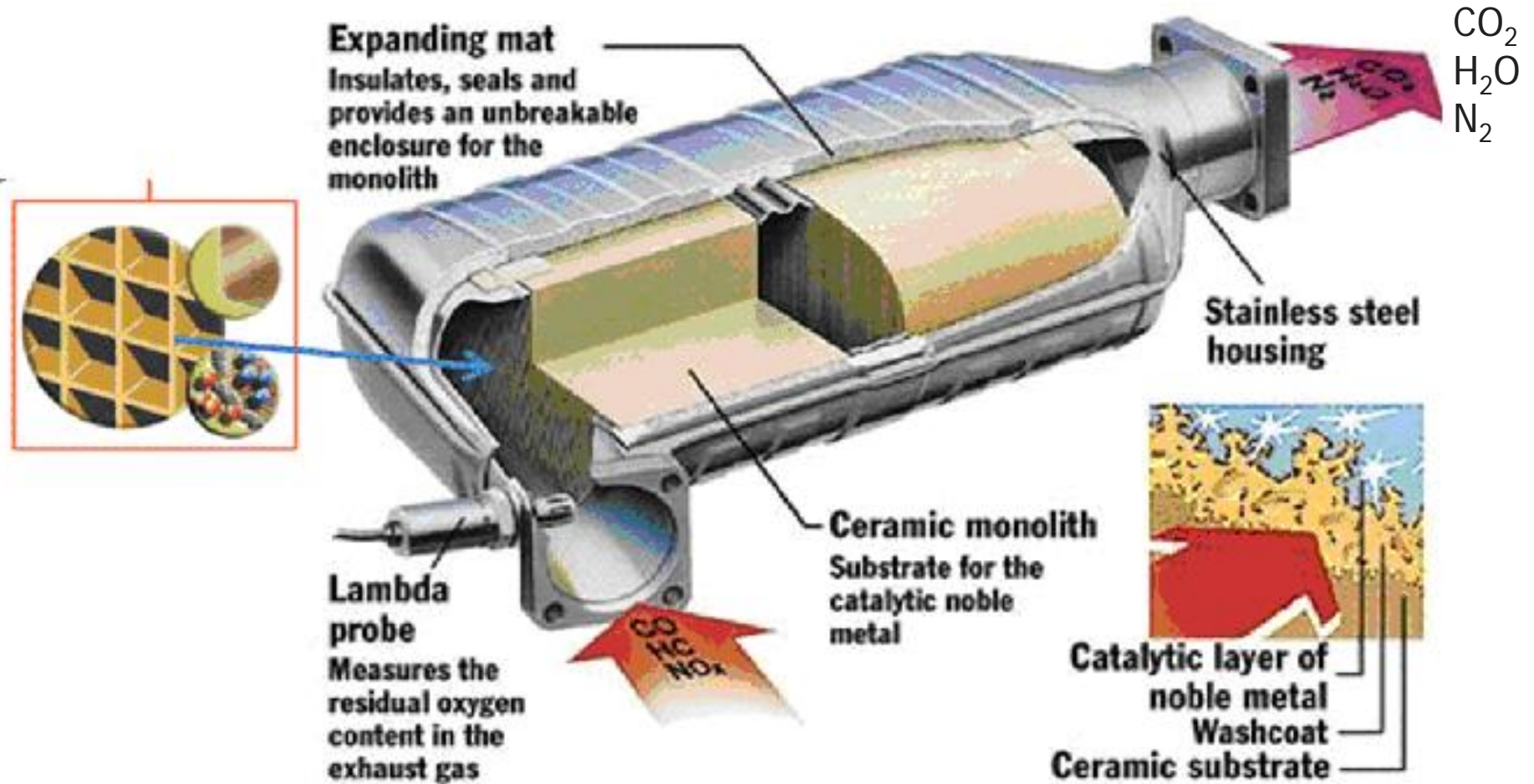
What are we testing on your vehicle

- **All vehicles are built with a complex emissions control system**
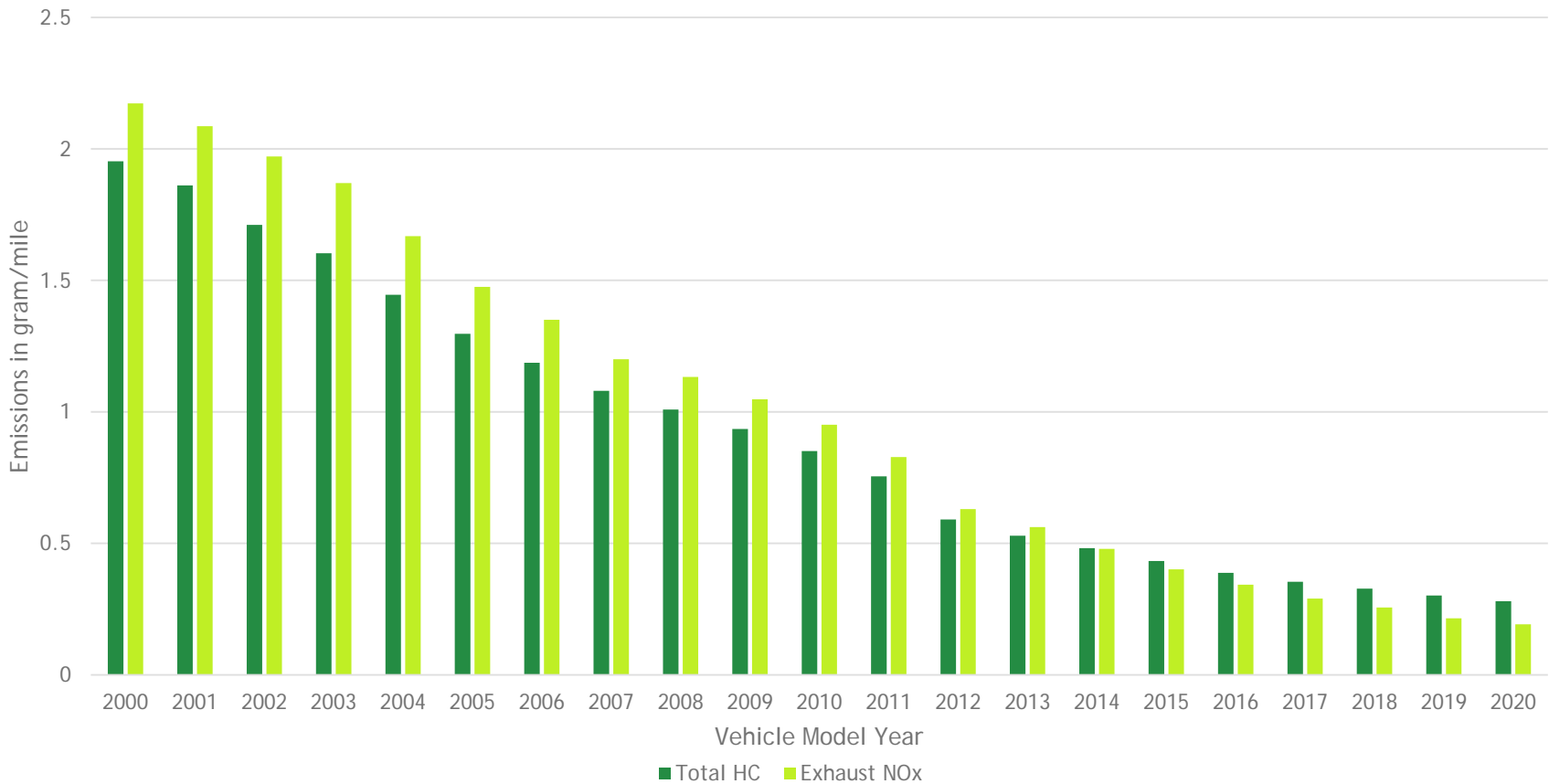

Fuel, exhaust, and emission control systems

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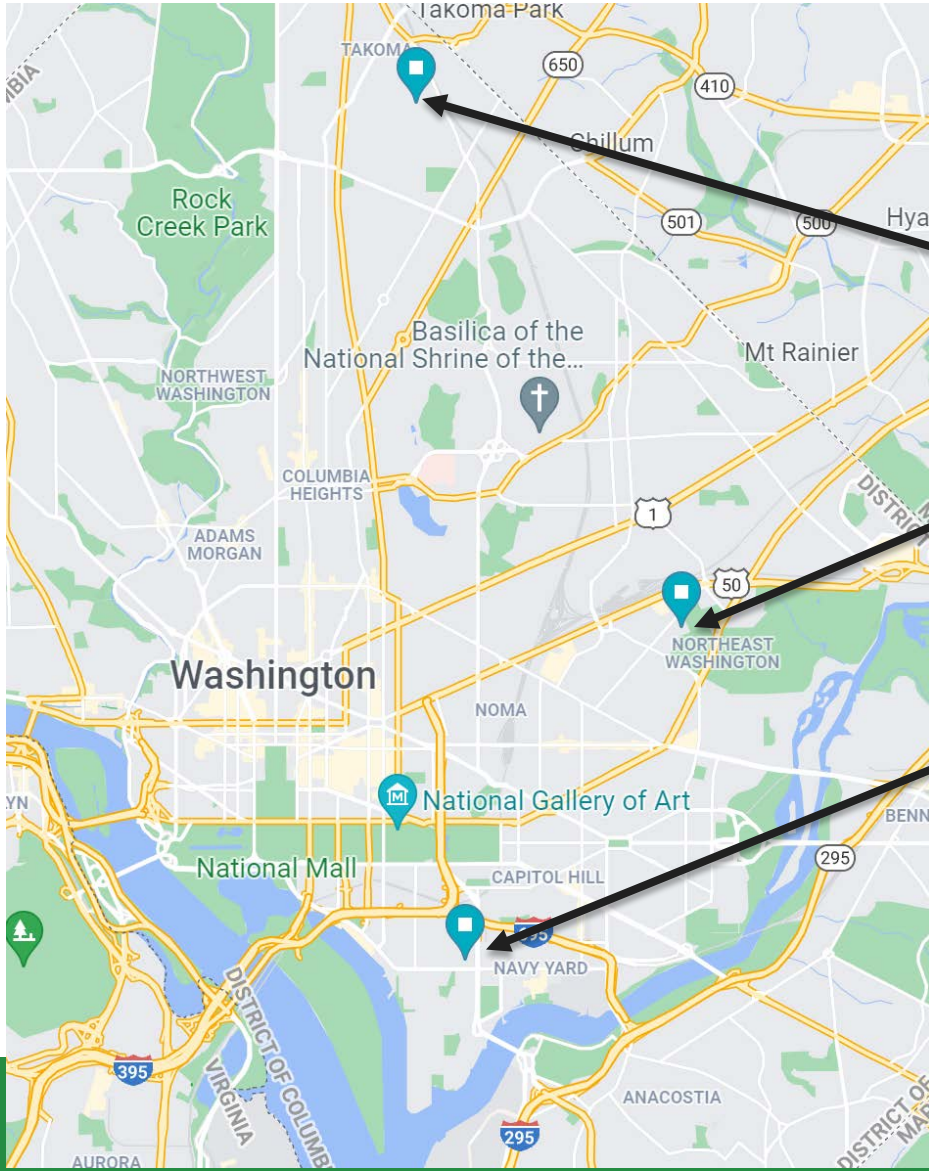
The Three Way Catalytic Converter: A case study

Expanding mat
Insulates, seals and provides an unbreakable enclosure for the monolith

Stainless steel housing

Ceramic monolith
Substrate for the catalytic noble metal

Lambda probe
Measures the residual oxygen content in the exhaust gas

CO
HC
NOx

CO_2
H_2O
N_2

Catalytic layer of noble metal
Washcoat
Ceramic substrate

Emission Controls Work!

Average National Light-Duty Fleet Emissions by Model Year

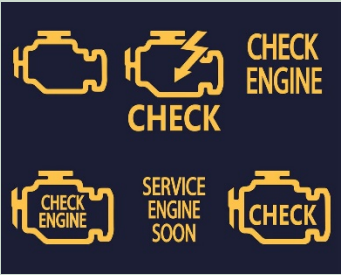@DOEE_DC

Inspection Stations

Takoma Rec Center Self Service Kiosk

DPW Inspection Station

1001 Half St SW Inspection Station

The three types of emissions tests

OBD	IM240	Idle
• Entirely computer based • Relies on the car's ECU, a computer that controls everything • If check engine light is on, the test will fail 	• Uses a dynamometer • 240 = 240 seconds of runtime on a specific speed cycle • Vehicle operated by DMV inspectors • All exhaust gas is sucked into analyzers to determine pollutant levels • NOX, VOC, CO and CO_2 are all tested	• Small probe inserted into the tailpipe • Gas sample is collected and run through an analyzer • Car is not under load during test • Only tests VOC, CO, and CO_2

Breaking down vehicle tests

Model Year	Weight (GVWR)	Test Type
1996 - 2021	≤ 8500 lbs.	OBD
1984 – 1995	≤ 8500 lbs.	IM240
1968 – 1983	≤ 8500 lbs.	Idle
1968 – 2021	> 8500 lbs.	Idle

2019 tests:

Test Type	# performed	Percent of total
OBD	152,424	94.8%
IM240	2,474	1.5%
Idle	5,884	3.7%

Demonstrating that it works

<u>MO</u>tor <u>V</u>ehicle <u>E</u>missions <u>S</u>imulator: <u>MOVES</u>

- Published by the EPA
- MOVES is an advanced simulation software that models emissions from all motor vehicles
    - Cars, trucks, semis, garbage trucks, busses, etc.
    - Highways, local roads, parking lots, construction sites
    - National level, state/county level, intersection/building level
- MOVES uses huge datasets of emissions parameters developed by EPA as well as local-specific inputs:
    - Vehicle speed
    - Road type
    - Vehicle age
    - Vehicle miles traveled (VMT)
    - Fuel type
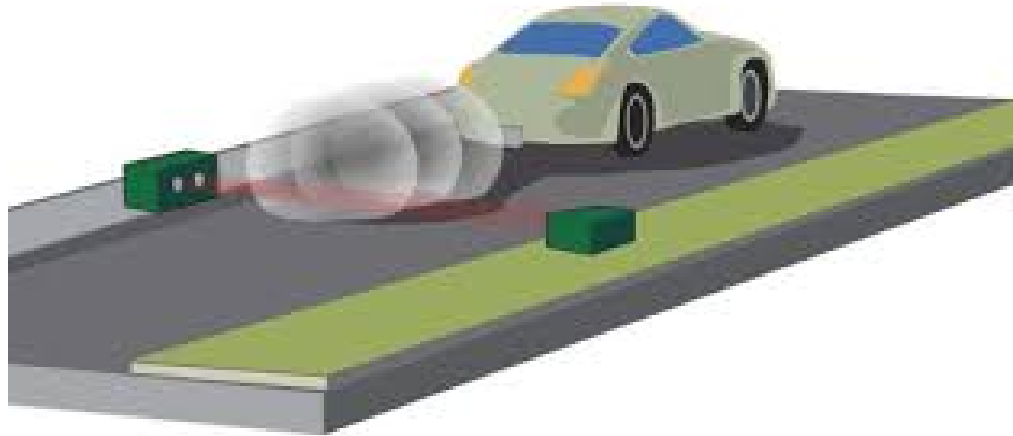   - Weather
    - Month, Day, and time

Does having an I/M program work?

MOVES3 model results for 2021 ozone season (May 1 – Sep 30)

MOVES Run Scenario	CO	NOX	VOC
No I/M	8635.14	735.27	609.81
Current Program	7335.84	659.68	525.01
Reduction	1299.3	75.59	84.8
Percent reduction	**15%**	**10.3%**	**13.9%**

All values are in Tons

What's next: Remote Emissions Sensing

- Remote Sensing uses Absorption Spectroscopy (lasers) to measure emissions from vehicles as they drive on our roads
- Vehicles cannot 'prepare' for a test, since we sample them during normal operation
- DC does not yet operate such a program however we are in the process of developing one
- Can be used to operate a Clean Screen program, identify high emitters, catch tampered vehicles in the act, and provide tons of current real world data

What's next: Tampering

- Recent data from EPA shows alarming trends in tampered vehicles
  - diesel vehicles that have been tampered with emit from 18-300 times the allowed limit of NOX
  - 10-18% of trucks are tampered with, depending on locality
- EPA initiated a nationwide enforcement effort to halt dealers and aftermarket shops from tampering with vehicles
- While diesel vehicles make up a small portion of vehicles in the District, we are working to develop a program that would identify tampered vehicles

Questions?

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