Pollution Prevention Partnership
Reducing ground level ozone in Nueces and San Patricio counties since 1995
Why Care About Air Pollution?

Major Toxic Pollutants in Vehicle Exhaust:

- **VOC**—Volatile Organic Compounds, ingredients for ozone
  - Unburned Fuels in Exhaust, Evaporated Fuels and Solvents
- **NOx**—Oxides of Nitrogen, ingredient for ozone
- **PM**—Particulate Matter, lodges in the lungs
- **CO**—Carbon Monoxide, a colorless, odorless, poisonous gas
- **HCHO**—Formaldehyde, a lung irritant and carcinogen

Some Economic Costs of EPA Non-Attainment
(Ozone averages >70 ppb Oct. 2015)

- Possible loss of industry and economic development
- Possible loss of federal highway and transit funding
- Restrictive permitting requirements not applied in attainment areas
- Technical and Formula Changes for product manufacturing
Sources of Primary Pollutants

Sources of Anthropogenic NOx
- Motor Vehicles: 56%
- Utilities: 22%
- Industrial/Commercial/Residential Fuel Combustion: 17%
- All Other Sources: 5%

Sources of Anthropogenic VOC
- Motor Vehicles: 45%
- Industrial/Commercial Processes: 50%
- Consumer Solvents: 5%

From EPA brochure OZONE
Focus on Ozone

Ozone Good Up High

Ozone Bad Nearby
Ground Level Ozone Formation

\[ \text{NO}_x \quad \text{VOC} \quad \text{UV} \quad = \quad \text{Ozone} \]

Corpus Christi Region Ozone Season:
April 1 to October 31

VOC’s - Unburned Fuels in Exhaust, Evaporated Fuels, Solvents and
Health Effects

- Difficulty breathing deeply and vigorously
- Shortness of breath and pain when taking deep breaths
- Coughing and sore or scratchy throat
- Inflammation and damaged airways
- Aggravated lung diseases: asthma, emphysema, and chronic bronchitis.
- Increased the frequency of asthma attacks.
- Lungs more susceptible to infection.
- Continued lung damage even when the symptoms have disappeared.

Most at Risk

- Children
- Adults who are active outdoors.
- People with respiratory diseases, such as asthma
- People with unusual susceptibility to ozone

With airway inflammation, there is an influx of white blood cells, increased mucous production, and fluid accumulation and retention. This causes the death and shedding of cells that line the airways and has been compared to the skin caused by sunburn.

http://www3.epa.gov/ozonepollution/health.html
The Fix

Reduce Emissions!

Find and Fix Gross Polluters
✓ Check
✓ Fix
✓ Maintain

Reduce Normal Emissions
✓ Alternative Fuels
✓ Emission Controls
✓ High MPG Vehicles

Change Habits
✓ Ozone Actions
✓ Cycling, walking
✓ Mass transit
✓ Carpool
✓ Combine trips
Alternative Fuels: Moving Forward
Choosing a Fuel Technology for Health, Ecology and Economy
Common Alternative Fuel Vehicles (AFV)

- CNG - Compressed Natural Gas
- E85 - 85% ethanol and 15% gasoline
- LPG - Propane
- HEV - Gasoline Hybrid Electric Vehicle
- PHEV - Gasoline Plug-in Hybrid Electric Vehicle
- EREV - Gasoline Extended Range Electric Vehicle
- EV - All Electric Vehicle

2016 Chevrolet VOLT - electric vehicle with gasoline powered range-extending capability (EREV).

https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=34918
Alternative Fueling Station Locator

Find alternative fueling stations near an address or ZIP code or along a route in the United States. Enter a state to see a station count.

http://www.afdc.energy.gov/locator/stations/
Average Retail Fuel Prices in the U.S.

http://www.afdc.energy.gov/fuels/prices.html
U.S. HEV Sales by Model

Source: HybridCars.com

Notes: Vehicles are listed in order of introduction into the market.

http://afdc.energy.gov/data/10301
Emissions Charts

POLLUTION COMPARISON BY FUEL TECHNOLOGY
Annual Pounds of NO\textsubscript{x} & Total VOC
1 Passenger Truck
Local Vehicle Stock

NUECES AND SAN PATRICIO COUNTIES (CY 2014)
Passenger Trucks/SUV by Fuel Type

Total count 98,479

Gasoline ICE Vehicles 87.98%
Other 12.02%

Ethanol-Flex Fuel ICE 10.63%
Propane 0.50%
Gasoline(HEV) 0.43%
TDI Diesel 0.23%
Natural Gas 0.21%
All Electric 0.01%
PHEV 0.00%
% Change from Conventional Fuel Passenger Vehicles to Alternative Fuel: NO\textsubscript{x} Reductions

% of Gasoline Vehicles Replaced with AFV

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<tr>
<th>% Change</th>
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NO\textsubscript{x} Emissions

- CNG
- E85
- HEV
- EV
Total Annual Pounds of NOx Emissions
All passenger cars and trucks
San Patricio and Nueces Counties
973,676

Possible Annual Pounds of NOx Reduced
With % Change from Gasoline to Alternative Fuels

<table>
<thead>
<tr>
<th>% Change</th>
<th>CNG (lbs/year)</th>
<th>E85 (lbs/year)</th>
<th>HEV (lbs/year)</th>
<th>EV (lbs/year)</th>
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<tr>
<td>5%</td>
<td>(8,181)</td>
<td>(16,363)</td>
<td>(24,544)</td>
<td>(32,725)</td>
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<td>10%</td>
<td>(24,544)</td>
<td>(49,088)</td>
<td>(72,124)</td>
<td>(99,776)</td>
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<td>15%</td>
<td>(40,906)</td>
<td>(86,194)</td>
<td>(108,185)</td>
<td>(149,664)</td>
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<td>20%</td>
<td>(49,088)</td>
<td>(103,433)</td>
<td>(144,247)</td>
<td>(199,552)</td>
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<td>25%</td>
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<td>(180,309)</td>
<td>(180,309)</td>
<td>(249,440)</td>
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<td>30%</td>
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<td>(216,371)</td>
<td>(216,371)</td>
<td>(299,329)</td>
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% Change from Conventional Fuel Passenger Vehicles to Alternative Fuels

VOC Emissions

% of Gasoline Vehicles Replaced with AFV

<table>
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<tr>
<th>5% Change</th>
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VOC Emissions

CNG | E85 | HEV | EV

Change 25% Change 30%
Total Annual Pounds of VOC Emissions
All passenger cars and trucks
San Patricio and Nueces Counties
914,562

Possible Annual Pounds of VOC Reduced
With % Change from Gasoline to Alternative Fuels

VOC Reductions with % Change from Gasoline to Alternative Fuels

<table>
<thead>
<tr>
<th>Fuel Tech</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
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<tbody>
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<td>CNG</td>
<td>(20,630)</td>
<td>(41,260)</td>
<td>(61,890)</td>
<td>(82,521)</td>
<td>(103,151)</td>
<td>(123,781)</td>
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<td>E85</td>
<td>(4,290)</td>
<td>(8,579)</td>
<td>(12,869)</td>
<td>(17,159)</td>
<td>(21,448)</td>
<td>(25,738)</td>
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<td>HEV</td>
<td>(23,450)</td>
<td>(46,899)</td>
<td>(70,349)</td>
<td>(93,799)</td>
<td>(117,249)</td>
<td>(140,698)</td>
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<tr>
<td>EV</td>
<td>(46,382)</td>
<td>(92,764)</td>
<td>(139,146)</td>
<td>(185,529)</td>
<td>(231,911)</td>
<td>(278,293)</td>
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</table>
VW Offending Vehicles

- Cars registered locally (.1% of local cars) ➔ 313
- NO$_x$ released above certified ➔ 10X to 40X
- Exhaust equivalent of adding cars ➔ 2,817 to 12,207
- % of NO$_x$ from offending cars ➔ 2-7 % of NO$_x$ from cars
AFLEET Tool - Argonne National Laboratory
Sources and Resources

AutoCheck.cc
http://www.afdc.energy.gov/
http://www.hybridcars.com/
https://greet.es.anl.gov/afleet
http://www.eia.gov/forecasts/aeo/tables_ref.cfm