
ORIENTATION PACKET

for those new to DPCAC emissions report
and a refresher for others

Deer Park Community Advisory Council

Fall 2021

What's in the Orientation Packet?

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Emissions, Air Quality and Health

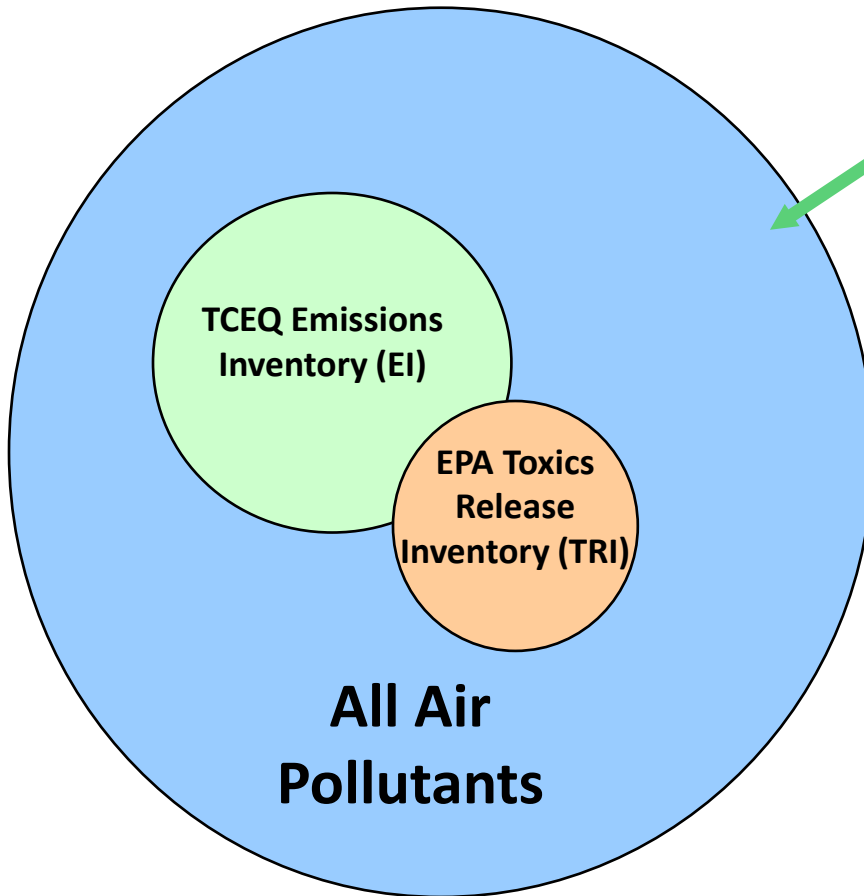
- Emissions come from many sources, including industry
- Minimizing emissions improves air quality, which is good for health and the environment
- Report focuses on emissions from DPCAC plants
- Other meetings may focus on air quality trends and on health data and research

Why Review Emissions Reports?

- Learn what DPCAC plants release to air, water, land
- Helps public learn about chemicals in community
- Plants may learn from their own reports and reports of others
- Helps hold plants accountable for emission reduction efforts
- Allows us to track trends, though trends are affected by changing circumstances
- *If you measure it, you manage it*

Where **Emissions** Come From

Sources of Air Pollution

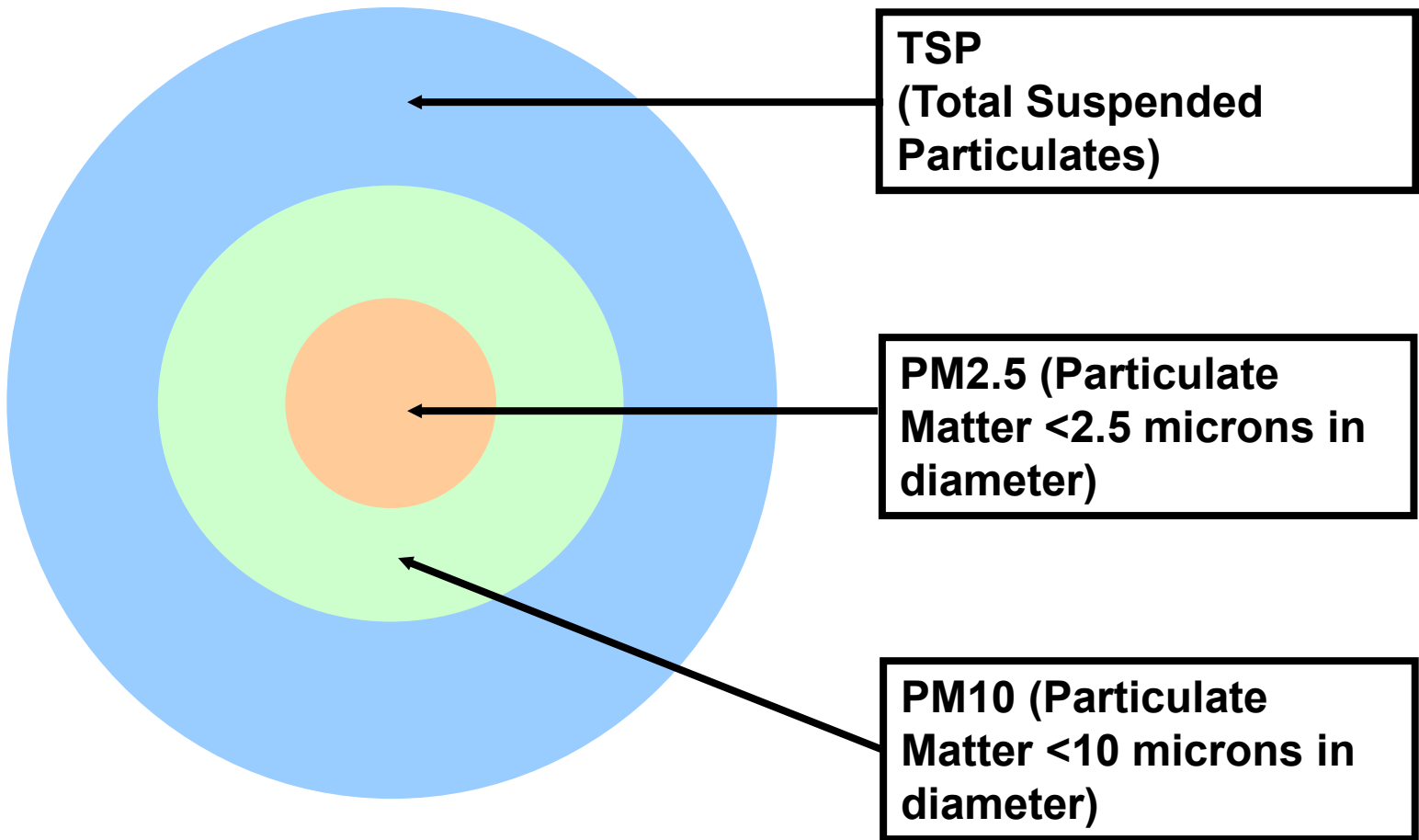


Sources include...

- Industry
 - Chemical
 - Petroleum refining
 - Electric generation
- Transportation
 - Cars and trucks
 - Marine
 - Aviation and trains
 - Off-road vehicles (construction)
- Other
 - Small Businesses
 - Home
- Biogenic Sources
 - Vegetation, fires

Not to scale

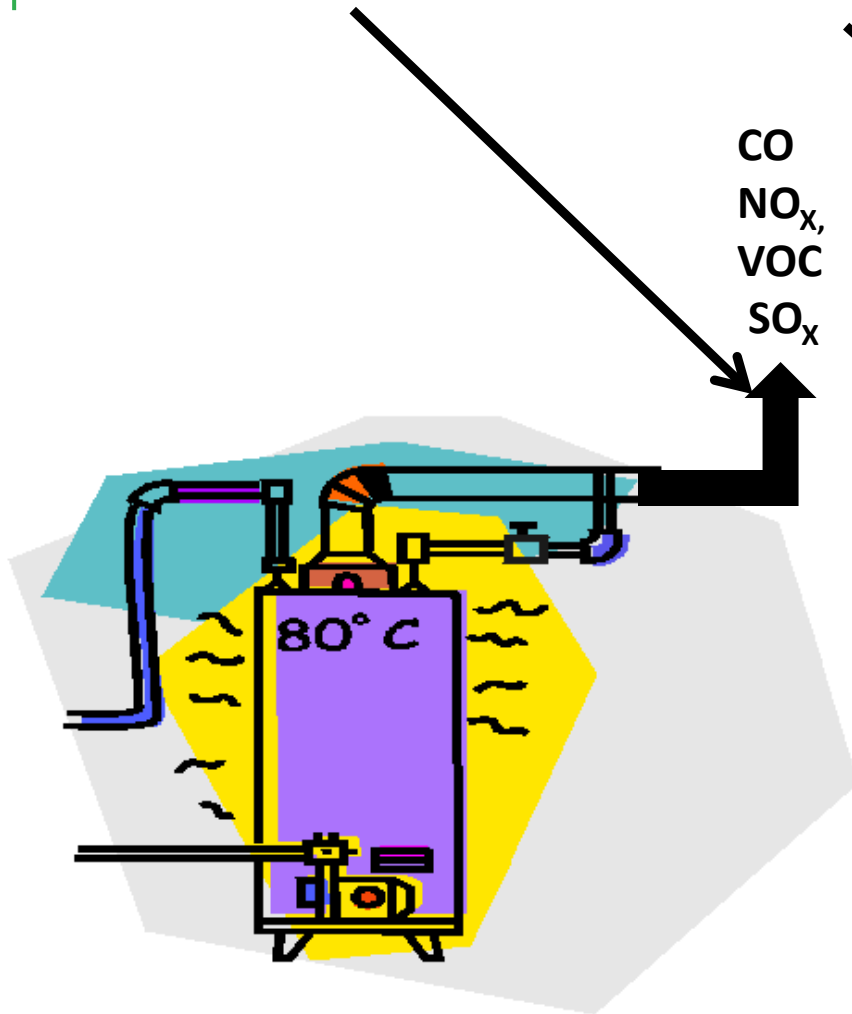
Particle Pollution



Two Kinds of Air Emission Sources

- Point sources
- Fugitive sources

Point Source Emissions



Point Sources: Hot Water Heater and Vent



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Fugitive Emissions May Occur at *Connections*



Plant Sources of Air Emissions

- **From:** boilers, furnaces, cooling towers, flares, vents, tanks, loading and unloading vehicles and vessels, wastewater treatment...
- **During:** routine permitted activities, upsets, spills, or maintenance...
- **Including:** point sources and fugitive sources
 - Like the hot water heater and gas meter

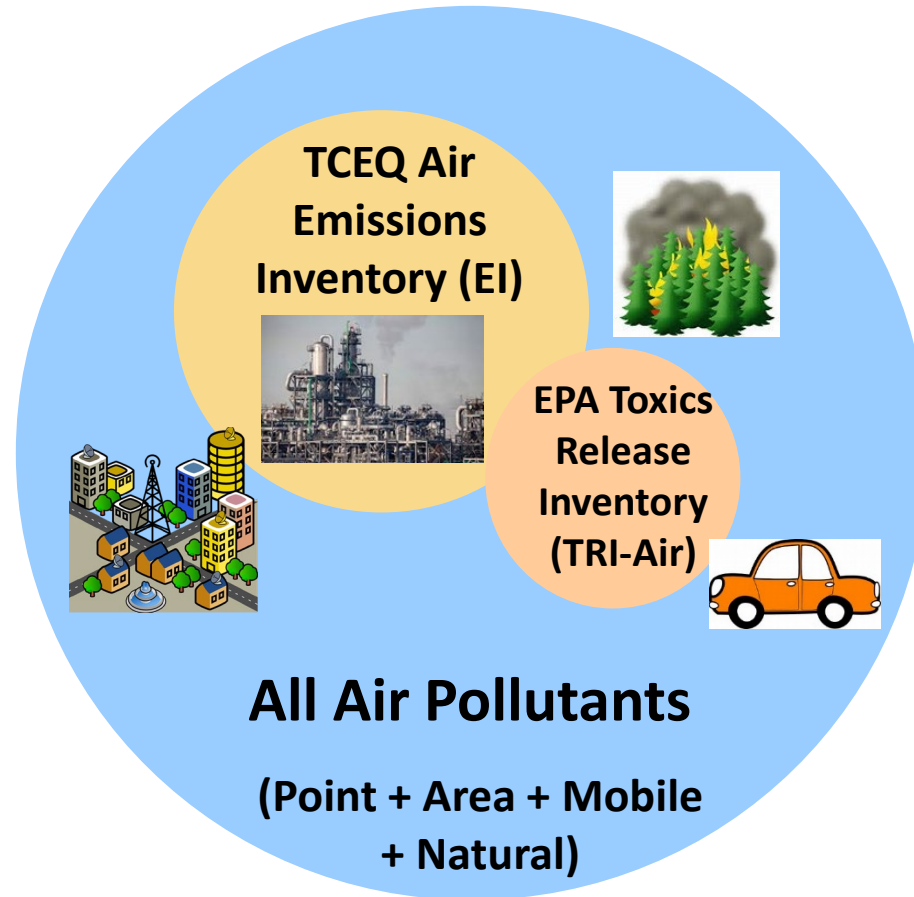
NO_x comes mostly from combustion in heaters and boilers. **VOCs** come from many sources.

Things DPCAC Plants Make or Do That Generate Emissions

- Refine crude oil – Shell Refinery
- Manufacture chemicals – Dow, Evonik, GEO, Hexion, Lubrizol, Oxy Vinyls, Shell Chemical
- Package and distribute lubricants -- Valvoline
- Store and ship other plants' products – ITC, Vopak
- Manage waste or wastewater from other plants – Clean Harbors, Texas Molecular

Where **Data** Come From and Why **Numbers** Change

Industry Reporting of Air Emissions



**EI and TRI
Overlap**

Not to scale

Data from two inventories

- TCEQ Air Emissions Inventory (EI)
 - Reported by major sources annually to Texas Commission on Environmental Quality
 - Just air – all air releases of covered pollutants
- EPA Toxics Release Inventory (TRI)
 - Reported annually to Environmental Protection Agency if plant has chemicals on TRI list above a set amount
 - Releases to environment (air, land, water) and transfers off the plant site for further waste treatment or disposal.
 - DPCAC collects TRI data on air, water, and land. Presents **TRI Releases to Air** annually & others periodically.

Comparing EI vs. TRI

Air Emissions Inventory (EI)

- ❑ State requirement (TCEQ)
- ❑ Criteria pollutants - Air only
- ❑ Almost all air contaminants (even small quantities)
- ❑ Basis for setting fees

Toxics Release Inventory (TRI)

- ❑ Federal requirement (EPA)
- ❑ Contaminants released to *air, water, and land & offsite transfers*
- ❑ A public right-to-know law
- ❑ Chemicals from list of ~800 if you meet threshold quantities

Both reports

- ❑ Include point source and fugitive emissions
- ❑ Include permitted and upset & maintenance emissions
- ❑ Based on direct measurements, engineering estimates & factors
- ❑ Small facilities are exempt from reporting

Requirements for EI Reporting

- A plant must submit an EI if it meets any one of the following:
 - major source
 - in Harris County, emits a minimum of 10 tons per year (tpy) VOC, 25 tpy NO_x, or 100 tpy of any other contaminant
 - emits more than 0.5 tpy of Lead (Pb)
 - has potential to emit 100 tpy or more of any contaminant
 - has potential to emit 10 tpy of a single (25 tpy aggregate) hazardous air pollutant
 - is subject to a special inventory

DPCAC plants that don't meet EI reporting requirements: Evonik, Texas Molecular, Valvoline. **Evonik** voluntarily reports EI to DPCAC.

Requirements for TRI Reporting

- Plants must report if:
 - the chemicals used in their processes are covered by the TRI program (approximately 800 chemicals/chemical categories)
 - the plant manufactures, imports, or processes 25,000 lbs. or more of a TRI chemical in a year
 - the plant otherwise uses 10,000 lbs. or more of a TRI chemical in a year
 - those classified as persistent bioaccumulative toxics have lower reporting thresholds (100 or 10 lbs or 0.1 gram)

DPCAC plants that are not required to report TRI: ITC

Where **Numbers** Come From

Combination of measurements and estimates

Measurements from Continuous Emissions Monitoring Systems (CEMS), stack and vent tests, lab analysis, and other direct measurements

Estimates from calculations are based on fuel consumption, mass balance, engineering calculations, throughput formulas, flow measurements, inventory loss, production data, and field surveys

- Fugitives often estimated by EPA's AP-42 factors
- Direct measurements may be incorporated into calculations
- Accuracy improving over the years
- Changing methods to improve accuracy may result in different numbers while emissions remain about the same

Measurements

Continuous Emission Monitoring System (CEMS)



Only available for certain kinds of emissions

Most accurate way to quantify emissions

....and the most expensive to install & maintain



Emissions Measurement Example

- NOx emissions calculations basis
 - NOx and CO CEMS data (concentration, ppmvd)
 - Exhaust gas flow rate (dscfm)
 - Molecular weight (lb/lb-mol)

Boiler NOx example:

$$\frac{C_{\text{ppmvd}} * MW_{\text{lb/lb-mol}} * Q_{\text{dscfm}} * 60 \text{ min/hr}}{V_{\text{ideal gas, cf/lb-mol}} * 10^6} = \text{lb/hr}$$

$$\frac{17.86 * 46.1 * 19,150 * 60}{386.5 * 10^6} = 2.45 \text{ lb/hr NOx}$$

Measurement + Calculation

Fugitive VOC emissions calculations' basis

- EPA Test Method 21 monitoring results
- EPA/TCEQ correlation equations
- Annual Leak Report

TABLE 2-9. SOCFI LEAK RATE/SCREENING VALUE CORRELATIONS

Equipment type	Correlation ^{a,b}
Gas valves	Leak rate (kg/hr) = $1.87E-06 \times (SV)^{0.873}$
Light liquid valves	Leak rate (kg/hr) = $6.41E-06 \times (SV)^{0.797}$
Light liquid pumps ^c	Leak rate (kg/hr) = $1.90E-05 \times (SV)^{0.824}$
Connectors	Leak rate (kg/hr) = $3.05E-06 \times (SV)^{0.885}$

^aSV = Screening value in ppmv.

^bThese correlations predict total organic compound emission rates.

^cThe correlation for light liquid pumps can be applied to compressor seals, pressure relief valves, agitator seals, and heavy liquid pumps.



Published Emission Factors

Pages - Home x AP-42: Compilation of Air Emission Factors x

Secure | <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-Compilation-air-emission-factors>





Apps | Albemarle | Benefits | Financial | Fishing | News | Stuff | Google Images | Google Maps | Suggested Sites | Uni Knot | Imported From IE | Workday albemarle3 | cabins

i We've made some changes to [EPA.gov](#). If the information you are looking for is not here, you may be able to find it on the [EPA Web Archive](#) or the [January 19, 2017 Web Snapshot](#).

EPA United States Environmental Protection Agency

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Air Emissions Factors and Quantification

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Air Emissions Factors and Quantification Home

Basic Information

AP-42

Emissions Estimation Tools

WebFIRE

CHIEF Archives

AP-42: Compilation of Air Emission Factors

On This Page:

- Compilation of Air Pollutant Emission Factors (AP-42)
 - [Proposed/Revised/New Emissions Factors](#)
 - [AP-42 Proposed Factors, But Not Finalized](#)
 - [AP-42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources](#)
- Additional AP 42 Resources
 - [Historical AP-42 Information](#)
 - [AP-42 Frequent Questions](#)
 - [Older editions of AP-42, Volume 1](#)

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Compilation of Air Pollutant Emission Factors (AP-42)

AP-42, *Compilation of Air Pollutant Emission Factors*, has been published since 1972 as the primary

Emission factors are continuously revised and added!

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Emission Factor Example

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION^a

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO _x ^b		CO	
	Emission Factor (lb/10 ⁶ scf)	Emission Factor Rating	Emission Factor (lb/10 ⁶ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS) ^c	280	A	84	B
Uncontrolled (Post-NSPS) ^c	190	A	84	B
Controlled - Low NO _x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO _x burners	50	D	84	B
Controlled - Low NO _x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

Reasons That Numbers Change

- Changing number of plants in DPCAC that report data.
- Actual sustainable changes in emissions
 - Adding units or closing them
 - Investing in pollution prevention
- Making or storing different products than previous year; e.g. more or less volatile
- Production/customer demand -- up or down

Reasons That Numbers Change

- Maintenance and related shutdowns and startups
- Upsets, leaks, spills
- Changing calculation methods
- Major events like fires, explosions, large releases

Acronyms, Terms, Descriptions

Acronyms: Agencies & Inventories

- Environmental Agencies
 - **EPA** – US Environmental Protection Agency
 - **TCEQ** – Texas Commission on Environmental Quality
- Emissions Inventory & Toxics Release Inventory Reports
 - **EI** – Emissions Inventory filed with the TCEQ for criteria pollutants & certain hazardous air pollutants
 - **TRI** – Toxics Release Inventory filed with EPA
 - **Emission**- Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; from motor vehicle, locomotive and/or aircraft exhausts (Source: EPA).

Emissions Acronyms & Terms

- Emissions Inventory & Toxics Release Inventory Reports
 - **Environment**- Air, water, and land
 - **LDAR**- **L**eak **D**etection **a**nd **R**epair – LDAR program is how fugitive emissions are identified, repaired & prevented
 - **Speciation**- Identifying specific chemicals and the amounts in a mixture. For example, cigarette smoke contains hundreds of chemicals. Speciating them would identify the specific chemicals and how much of each is in a sample.

Pollutant Acronyms & Descriptions

Ozone- Respiratory irritant that may form in the atmosphere when NO_x and VOCs come together on still, sunny days. Tracked when we look at air quality trends rather than emissions trends.

NO_x- Nitrogen Oxides. Nitrogen dioxide and other gases made of varying mixtures of nitrogen and oxygen. Formed when fuel is burned at high temperatures (Source: EPA).

VOCs- Volatile Organic Compounds. *Volatiles* rapidly evaporate. *Organic chemicals or compounds* are naturally occurring (plant or animal produced) or synthetic substances containing mainly carbon, hydrogen, nitrogen and oxygen. Volatile Organic Compounds are any organic compounds that participate in atmospheric photochemical reactions, except those designed by EPA as having negligible photochemical reactivity (Source: EPA).

Pollutant Acronyms & Descriptions

CO - Carbon **M**onoxide. Formed when fuel is not completely burned.

SO_x - Sulfur **O**xides (including sulfur dioxide and others in the family). Sulfur is prevalent in crude oil, coal, and ore that contains common metals like aluminum, copper, zinc, lead, and iron. SO_x gases are formed when fuel containing sulfur, such as coal and oil, is burned; when gasoline is extracted from oil; or metals are extracted from ore. (Source: EPA)

TSP - Total **S**uspended **P**articulates. Mixture of solid particles and liquid drops found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small that they can only be detected using a microscope.

Pollutant Descriptions

Benzene -- a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use Benzene to make other chemicals that are used to make plastics, resins, nylon, and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of Benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. It is a known human carcinogen. (Source: Agency for Toxic Substances and Disease Registry)

Pollutant Acronyms & Descriptions

1,3-Butadiene -- a chemical made from the processing of petroleum. It is a colorless gas with a mild gasoline-like odor. About 60% of the manufactured 1,3-Butadiene is used to make synthetic rubber. Synthetic rubber is widely used for tires on cars and trucks. 1,3-Butadiene is also used to make plastics including acrylics. Small amounts are found in gasoline. It is a carcinogen. (Source: Agency for Toxic Substances and Disease Registry)

For More Information

- EPA website – Toxics Release Inventory
 - www.epa.gov/tri or www.epa.gov/triexplorer
- TCEQ website
 - www.tceq.state.tx.us
- Houston Regional Monitoring website
 - <http://hrm.aecom.com>