ORIENTATION PACKET

for those new to the
CAC Emissions Report

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Why Emissions Reports?

Learn what CAC plants release to air

- Including pollutants contributing to ozone

Help public learn about chemicals in the community

Tool for helping CAC hold plants accountable

Plants may learn from their own reports and others

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PCAC Plants Exempt from TRI Reporting and Reasons Why

Reporting not required for type of industry

- Gulf Coast Authority

Terminals that do not produce products.

- ITC
- Kinder Morgan Export Terminal
- Kinder Morgan Liquids Terminal

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Tonight's *Acronyms*

EPA – US Environmental Protection Agency
TCEQ – Texas Commission on Environmental Quality
EI – TCEQ Air Emissions Inventory
TRI – EPA Toxics Release Inventory
NOx – Oxides of Nitrogen
VOCs – Volatile Organic Compounds
HRVOC – Highly Reactive Volatile Organic Compounds
SOx – Oxides of Sulfur
TSP – Total Suspended Particulates
CO – Carbon monoxide

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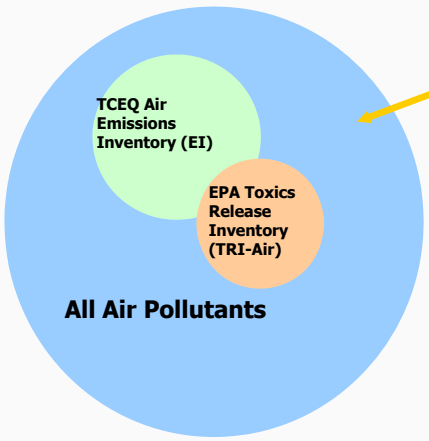
Sources of Air Pollution



Not to scale

Sources include…

- **Industry** -- Chemical, petroleum refining, electric generation
- **Transportation** -- Cars and trucks, marine, aviation and trains. Off-road vehicles (construction)
- **Other** -- Small Businesses, homes
- **Biogenic Sources** -- Vegetation, fires, dust

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Plant Sources of Air Emissions

From: boilers, heaters, cooling towers, flares, loading & unloading, process vents ,tanks, engines, vessels, wastewater treatment. . .

During: routine permitted activities, upsets, maintenance, spills. . .

Including:

- Point sources
- Fugitive emissions

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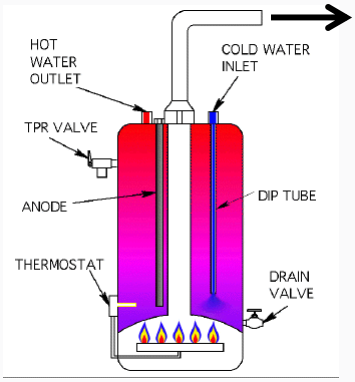
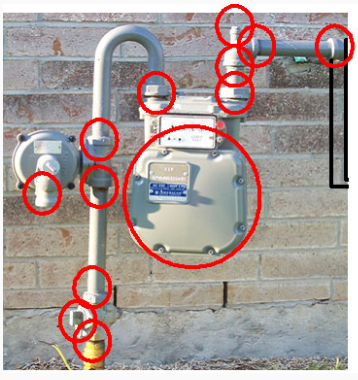
Point vs. Fugitive Emission Sources

Water Heater
Point Source



CO
NO_x
VOC
SO_x

Gas Meter
13 Fugitive Sources



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Where *Data* Come From

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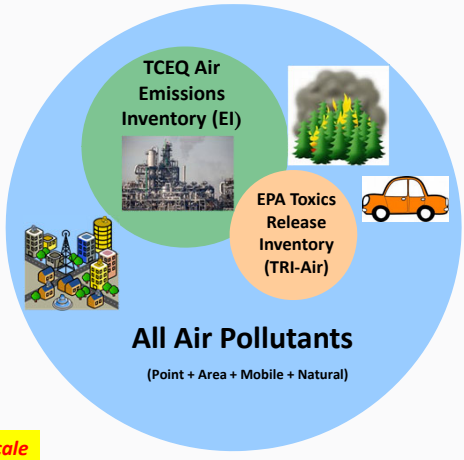
Industry Reporting of Air Emissions



EI and TRI Overlap

Not to scale

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Data from Two Inventories

TCEQ Air Emissions Inventory (EI)

- Reported by major sources annually to Texas Commission on Environmental Quality (TCEQ)
- Just air -- all air releases of covered pollutants

EPA Toxics Release Inventory (TRI)

- Reported annually to Environmental Protection Agency (EPA) by plants in certain kinds of business 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.
- PCAC report includes only TRI Releases to Air

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Comparing EI vs. TRI

Air Emissions Inventory (EI)

- State requirement (TCEQ)
- *Contaminants released to Air*
- Required for permitting and compliance
- Almost all air contaminants (even small quantities)

Toxics Release Inventory (TRI)

- Federal requirement (EPA)
- Contaminants released to *air, water, and land*
- Required for Public right-to-know
- Approx 675 chemicals that exceed specific thresholds

- **Both reports**
  - **Include point source and fugitive emission values**
  - **Calculation methods including direct measurements, engineering estimates, and agency factors**
  - **Include permitted and upset emissions**
  - **Can show useful trends**
  - **Small facilities are exempted**

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Requirements for EI Reporting

A plant must submit an EI if it meets any one of the following:

- Major Source
- in Harris County emit a minimum of 10 tons per year (tpy) VOC, 25 tpy NOx, or 100 tpy of any other contaminant
- emit more than 0.5 tpy of lead (Pb)
- have the potential to emit 100 tpy or more of any contaminant
- have the potential to emit 10 tpy of a single (25 tpy aggregate) hazardous air pollutant
- be subject to a special inventory

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Requirements for TRI Reporting

Plants must report if:

- the chemicals used in their processes are covered by the TRI program (approximately 675 chemicals)
- the plant makes more than 25,000 lbs. of a TRI chemical in a year
- the plant uses more than 10,000 lbs. of the TRI chemical in a year

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TRI for EPA vs. PCAC

PCAC looks only at TRI releases to *air* To keep the report simple

Plant reports to EPA also include

- Releases to environment (air, land, water)
- Transfers off the plant site for further waste management or disposal
  - Ex: recycling or use as fuel, or landfilling
    - Internal recycling, reduction of emissions at the source, etc.
- Pollution Prevention Information

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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 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 the same

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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

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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:

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

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

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Measurement + Calculation

Fugitive VOC emissions calculation basis

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

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

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

[a]SV = Screening value in ppmv.

[b]These correlations predict total organic compound emission rates.

[c]The correlation for light liquid pumps can be applied to compressor seals, pressure relief valves, agitator seals, and heavy liquid pumps.

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Published Emission Factors

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

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Numbers Change Year to Year

Actual long-term changes in emissions

- Adding units or closing them; BASF operating for the full year 2018 vs. 2017
- Pollution prevention efforts – practices/equipment.

Making or storing a different mix of products

- For example, more or less volatile materials

Production/customer demand -- up or down

Maintenance and related shutdowns and startups

Changing number of plants in PCAC

Emission events: upsets, leaks and spills

Changing calculation methods & emission factors

Audits – continuous improvement

Agency interactions – identify deficiencies

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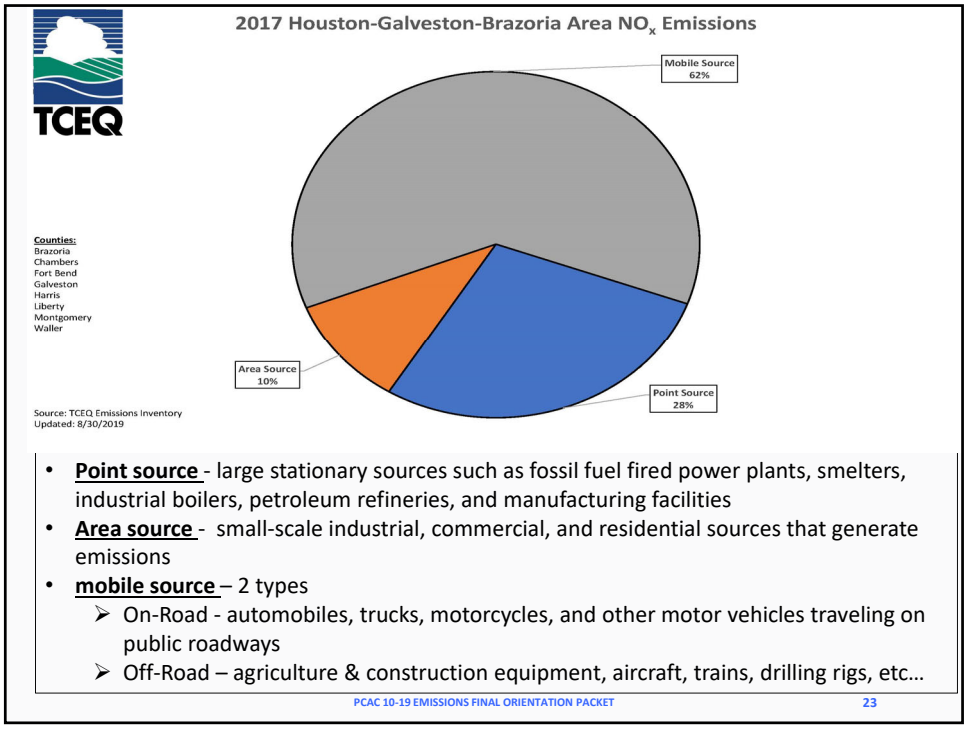
2017 Houston-Galveston-Brazoria Area NO_x Emissions
Mobile Source 62%
Point Source 28%
Area Source 10%
Counties:
Brazoria
Chambers
Fort Bend
Galveston
Harris
Liberty
Montgomery
Waller
Source: TCEQ Emissions Inventory
Updated: 8/30/2019
• Point source - large stationary sources such as fossil fuel fired power plants, smelters, industrial boilers, petroleum refineries, and manufacturing facilities
• Area source - small-scale industrial, commercial, and residential sources that generate emissions
• mobile source – 2 types
➢ On-Road - automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways
➢ Off-Road – agriculture & construction equipment, aircraft, trains, drilling rigs, etc…
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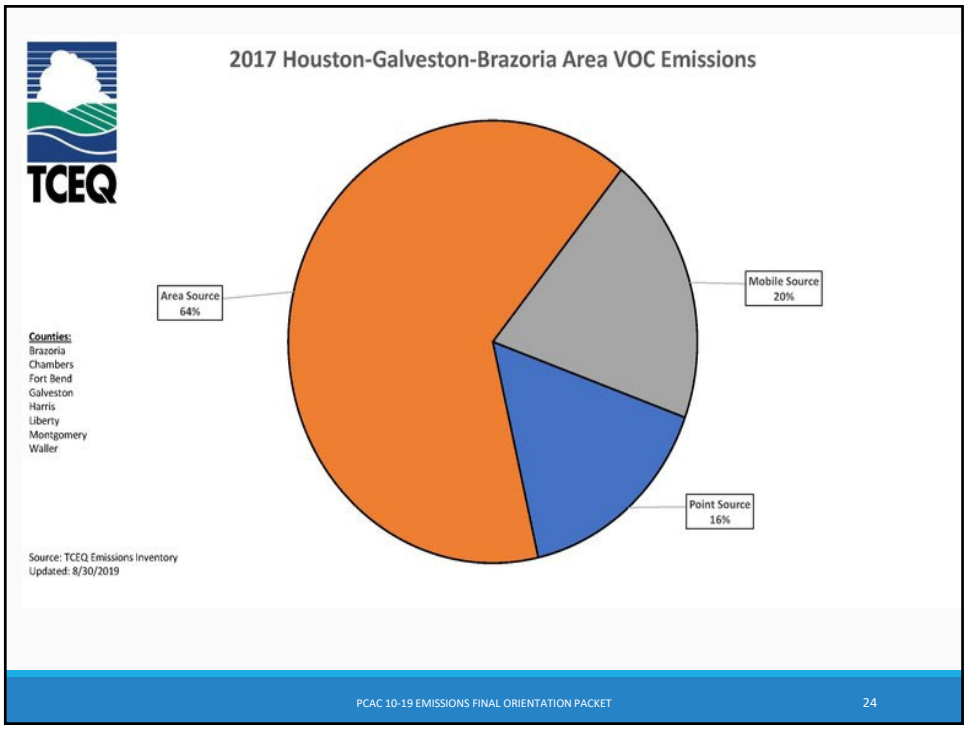
2017 Houston-Galveston-Brazoria Area VOC Emissions
Area Source 64%
Mobile Source 20%
Point Source 16%
Counties:
Brazoria
Chambers
Fort Bend
Galveston
Harris
Liberty
Montgomery
Waller
Source: TCEQ Emissions Inventory
Updated: 8/30/2019
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If You Want to Know More

TCEQ: www.tceq.Texas.gov

EPA TRI Websites

TRI Program Home page: www.epa.gov/tri

TRI Explorer – by zip code, county, facility, chemical: www.epa.gov/triexplorer

Houston Regional Monitoring: http://hrm.aecom.com/

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Pasadena Citizens' Advisory Council

Emissions and Air Monitoring Acronyms and Terms

Environmental Agencies

EPA **E**nvironmental **P**rotection **A**gency

TCEQ **T**exas **C**ommission on **E**nvironmental **Q**uality

Emissions Inventory and Toxics Release Inventory Reports

EI **E**missions **I**nventory filed with TCEQ for criteria pollutants and certain hazardous air pollutants, such as benzene and 1,3-butadiene

TRI **T**oxics **R**elease **I**nventory, filed with EPA

Emission: Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts. *(EPA)*

Release: Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance. *(EPA)*

Environment: air, water, and land

LDAR **L**eak **D**etection **a**nd **R**epair. Fugitive emissions are controlled by looking for leaks and fixing them. *See gas meter (fugitives) vs. hot water heater (point sources)*. **D**elay **o**f **R**epair (**DOR**) - common cause of fugitive emission increases when leaking component cannot be repaired without shutting down plant. More emissions would result from the shutdown than from delaying repair. Components can also be placed on DOR if it would be unsafe to attempt repair with chemicals in the process piping or equipment.

Criteria Pollutants and Precursors

Ozone Respiratory irritant that may form in the atmosphere when NOx and VOCs come together on still, sunny days.

NOx **O**xides of **N**itrogen. Nitrogen dioxide and other gases made of varying mixtures of nitrogen and oxygen. Formed when fuel is burned at high temperatures *(EPA)*

VOCs **V**olatile **O**rganic **C**ompounds. *Volatiles* evaporate rapidly. *Organic Chemicals or Compounds* are naturally occurring (animal or plant-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 designated by EPA as having negligible photochemical reactivity. (*EPA*) * chemical reactions influenced or initiated by light.

HRVOCs **H**ighly **R**eactive **V**olatile **O**rganic **C**ompounds. A subset of VOCs found to be more productive than other VOCs in forming ozone. TCEQ focus is ethylene, propylene, 1,3-butadiene, and butenes.

CO **C**arbon **M**onoxide. Formed when fuel is not burned completely.

TSP **T**otal **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, they can only be detected using a microscope.

SOx **O**xides of **S**ulfur (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. SOx 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.

Air Monitoring Terms

HRM **H**ouston **R**egional **M**onitoring. Monitors air on behalf of industry members.

HGB **H**ouston – **G**alveston – **B**razoria region

NAAQS **N**ational **A**mbient **A**ir **Q**uality **S**tandards. States are required to meet these standards or bear the consequences. In the HGB area, Texas meets all but the ozone standard.

SIP **S**tate **I**mplementation **P**lan. State's plan for bringing an area into attainment of the NAAQS.

Concentration The amount of pollutant detected by the monitors is reported in parts per million by volume **(ppm-v)** or by parts per billion **(ppb-v)**

AMCVs **A**ir **M**onitoring **C**omparison **V**alues. Level of a chemical in air set to prevent short-term and long-term health effects and nuisance odor conditions. ESLs are used for evaluating air permitting models. AMCVs are used for evaluating air monitoring data

ESLs **E**ffects **S**creening **L**evels. If trends at an air monitor exceed the TCEQ ESL for a compound, the agency may place it on the Air Pollutant Watch List to determine the sources and how to bring about reductions

HAPs **H**azardous **A**ir **P**ollutants, the "air toxics" on which EPA focuses

CAMS TCEQ **C**ontinuous **A**mbient **M**onitoring **S**tation

PAMS **P**hotochemical **A**ssessment **M**onitoring **S**tation

Auto GC Automated **g**as **c**hromatograph, continuous air monitoring *equipment*

FTIR **F**ourier **T**ransform **I**nfra **R**ed spectrometer, continuous air monitoring *equipment*

BTEX **b**enzene, **t**oluene, **e**thylbenzene, **x**ylenes. Four HAPs serving as surrogates for tracking trends of HAPs

Benzene is 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 which are used to make plastics, resins, and 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. *(From the federal Agency for Toxic Substances and Disease Registration)*