TCEQ Emissions Inventory (EI) & EPA Toxics Release Inventory (TRI)

Report by Pasadena CAC Plants

2021 Data and Trends

Full Presentation

FINAL 10.28.2022

ROEL MUNOZ

LYONDELLBASELL REFINERY

OCTOBER 25, 2022

Parts of the Emissions Report

Orientation Packet: Background information on why the CAC does emissions reports and on both emission inventories. Acronyms used in emission reporting. Sources of air pollution and how the data is collected.

Handouts: Intro with contents, how to read the report, plant changes. TCEQ Emissions Inventory (EI) section then EPA Toxics Release Inventory section have background about the inventory and a worksheet for each covered pollutant). Each pollutant worksheet has the size of plant, trends chart, plant-by-plant data for 2017-2021, totals, percentage change over 5 years, significant reasons for change. Color-coded to show significant increases and decreases in pounds and percentages. Plants exempt from reporting inventories are listed on each spreadsheet.

Highlights Page: Lists pollutants covered in the spreadsheets, pounds released in 2021 and the percentage they changed from 2020 to 2021 (**red** = increase, **green** = decrease). Lists the number of plants reporting each inventory.

"Full" Presentation: contains all the information in the format that has been used in our traditional face-to-face meetings; including main reasons for increases and decreases.

Emissions, Air Quality, & Health

- Emissions come from many sources, including industry.
- Minimizing emissions improves air quality, which is good for health and the environment.
- Tonight's report: air emissions from PCAC plants
- Other meetings focus on health data and health research.

Why Review Emissions Reports?

If you measure it, you manage it

- Learn what PCAC plants release
  - Including pollutants contributing to ozone formation
- Help public learn about chemicals in the community
- Tool for helping PCAC hold plants accountable
  - By looking at industry trends and specific plants
  - By sharing questions, concerns and suggestions
- Plants may learn from their own reports and others

How We Decided Which Plants to include on the 2021 "*Changes*" Slides?

- We looked at the top increases and decreases from 2020 by pounds for each pollutant.

- For some pollutants, only one increase or decrease is listed because of the order of magnitude difference in values. For example, Chevron Pasadena Refinery had a 515,972 lb. decrease in SOx and the next closest decrease was BASF with 1,534 lb.

- Plants were asked to supply reasons for changes of ± 10% or ± 5,000 lbs. Some plants voluntarily supplied reasons for changes that were below the values stated above.

1-Year Change in PCAC Plant Releases 2020-2021

- **3% decrease** in total TCEQ Air Emissions Inventory (EI) releases to air

- **1% increase** in total EPA Toxics Release Inventory (TRI) releases to air

Chevron Phillips and Sekisui reported decreased emissions from prolonged shutdowns and Afton Chemical, Chevron Pasadena Refinery, LyondellBasell Refinery, and Sekisui reported increased emissions from the shutdown/start up process caused by Winter Storm Uri.

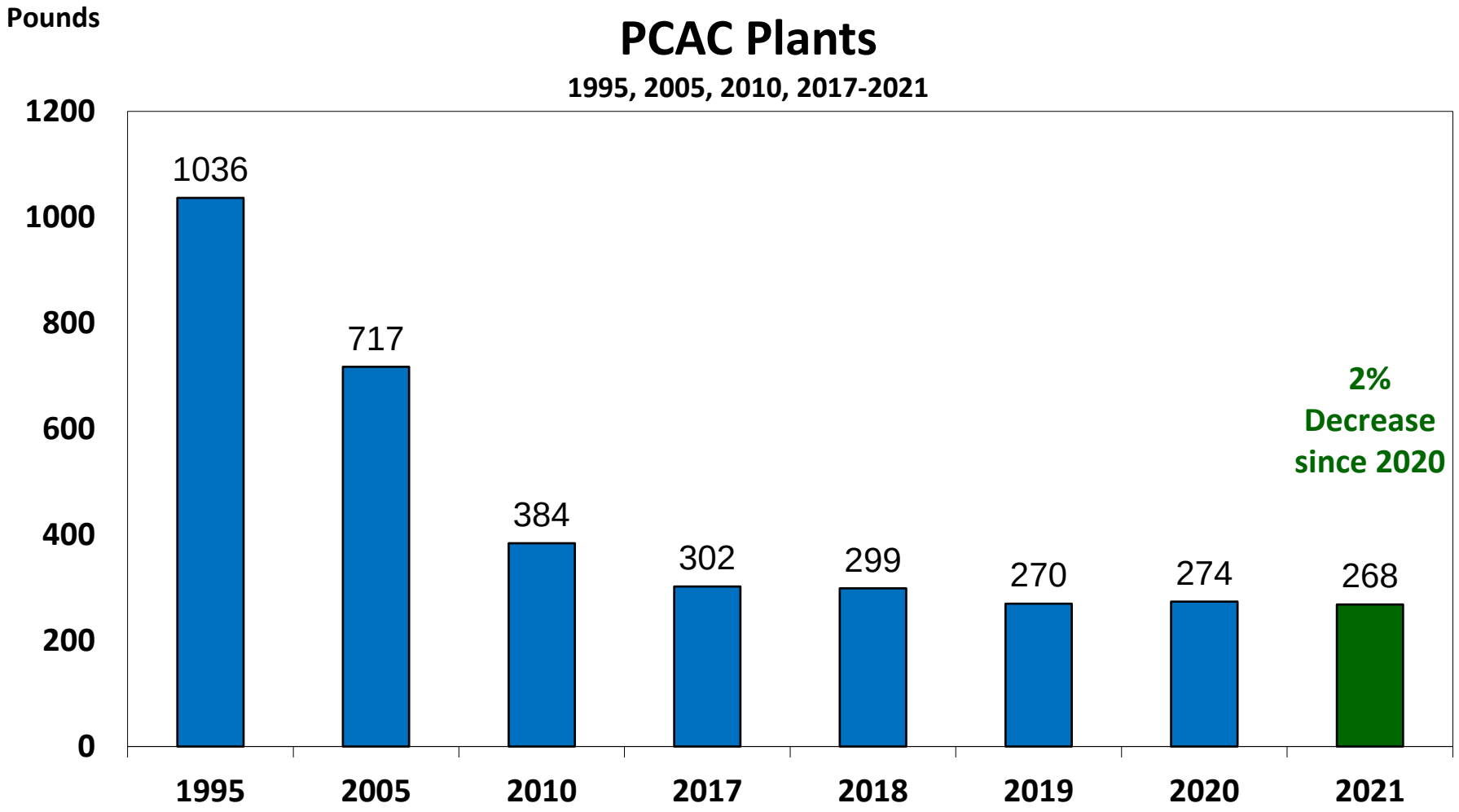
TCEQ
Air Emissions Inventory (EI) Trends in PCAC Plants

Change in PCAC Plants
TCEQ Air Emissions Inventory

	2017-2021	2020-2021
Total PCAC Air Emission Inventory	**- 21%**	**- 3%**
Nitrogen Oxides (NOx)	**- 16%**	**- 5%**
Volatile Organic Compounds (VOCs)	**- 7%**	**+ 8%**
Highly Reactive VOCs (HRVOCs)	**- 19%**	**- 1%**
Carbon Monoxide (CO)	**+ 38%**	**+ 10%**
Total Suspended Particulates (TSP)	**- 12%**	**- 10%**
Particulate Matter (PM 2.5)	**+ 1%**	**+ 3%**
Sulfur Oxides (SOx)	**- 60%**	**- 32%**

Routine Permitted Emissions	**- 19%**	**- 6%**
Maintenance Emissions	**- 23%**	**+ 465%**
Upset Emissions	**- 52%**	**+ 241%**

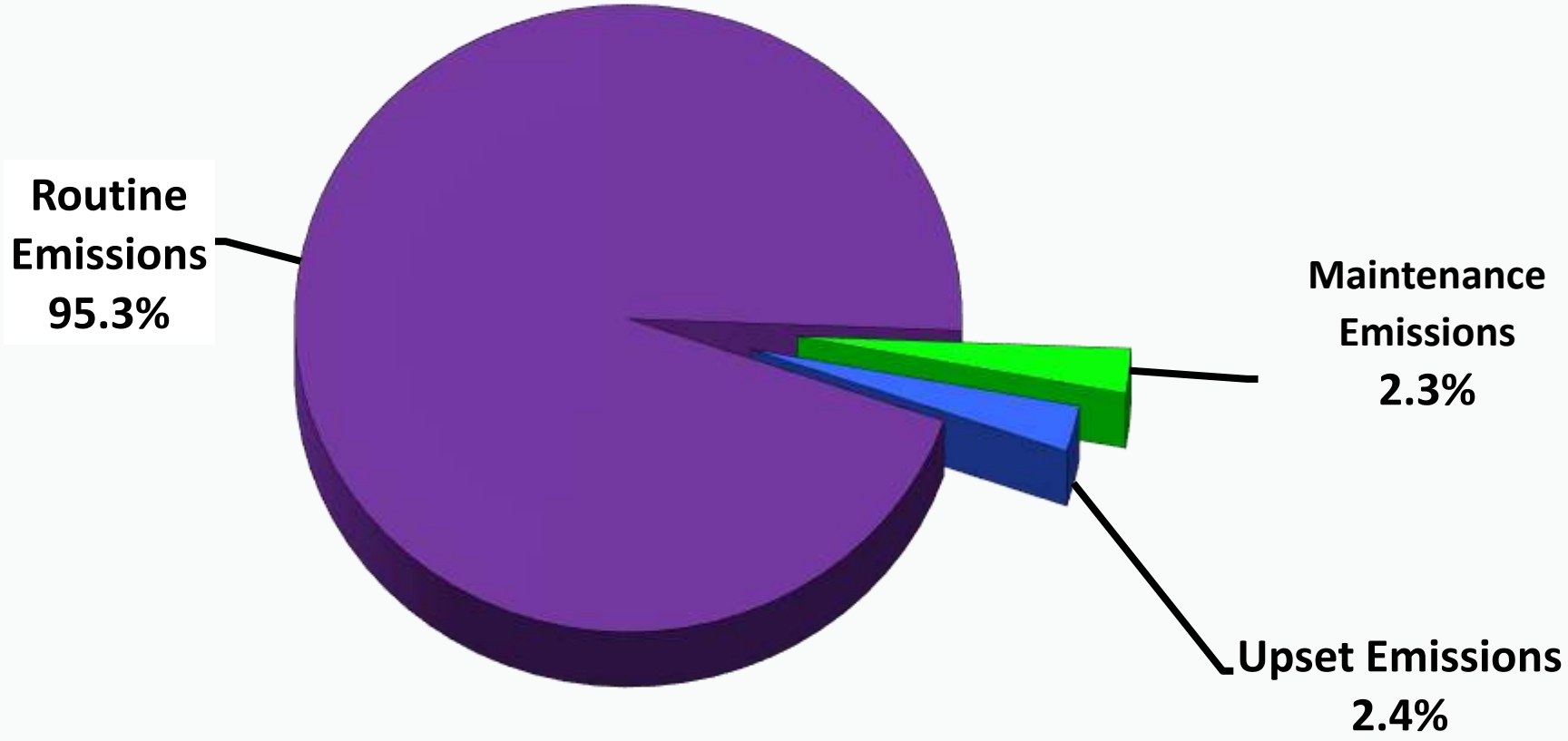
Pounds of TCEQ EI per Million Pounds of Product for PCAC Plants



1995→2021: 74% Reduction in EI Emissions per Million Pounds of Product

Since 1995, PCAC plants have produced 47-57 billion pounds of product each year.

2021 TCEQ EI Emissions *by Cause*
for PCAC Plants



Criteria Air Pollutants in EI

4 of the criteria air pollutants- subject to National Ambient Air Quality Standards (NAAQS)

- Nitrogen Oxides (NOx)- ozone precursor
- Sulfur Oxides (SOx)
- Carbon Monoxide (CO)
- Total Suspended Particulates (TSP)/PM 2.5

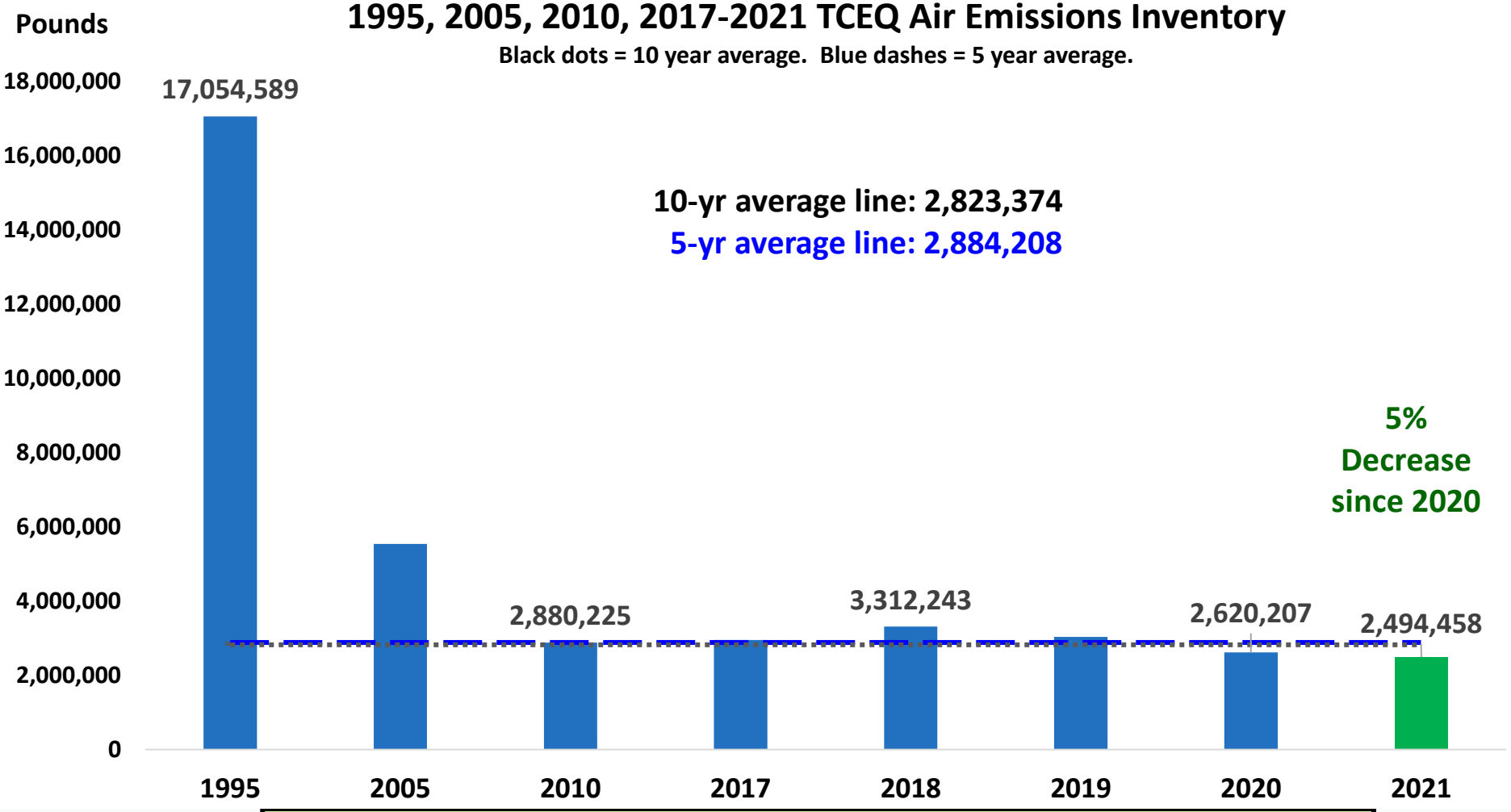
Volatile Organic Compounds (VOCs)- ozone precursors subject to other rules

- Highly Reactive VOCs (HRVOCs), a subset of VOCs, contribute more to ozone formation

Nitrogen Oxides (NOx)

1995, 2005, 2010, 2017-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



1995→2021 : 85% Reduction in NOx Emissions

Biggest change from 2020 was decrease at Chevron Pasadena Refinery:

Sustainable: Reduced fluid catalytic cracker (FCC) operating hours/rates

Nitrogen Oxides (NOx)

2021 Changes

Increases

LyondellBasell Refinery (+10,417 lbs.)

- Higher refinery rates and utilization of Fluid Catalytic Cracker Unit (FCCU)

(1% Change)

BASF (+7,016 lbs.)

- *Calculation method change*

(37% Change)

Kinder Morgan Liquids Terminal (+6,380 lbs.)

- *Temporary:* Customer demand for controlled tank landings increased in 2021 vs 2020 resulting in higher combustion emissions.

(29% Change)

Nitrogen Oxides (NOx)
2021 Changes

Decreases

Chevron Pasadena Refinery (-77,032 lbs.)

- *Sustainable:* Reduced fluid catalytic cracker (FCC) operating hours/rates
  (10% Change)

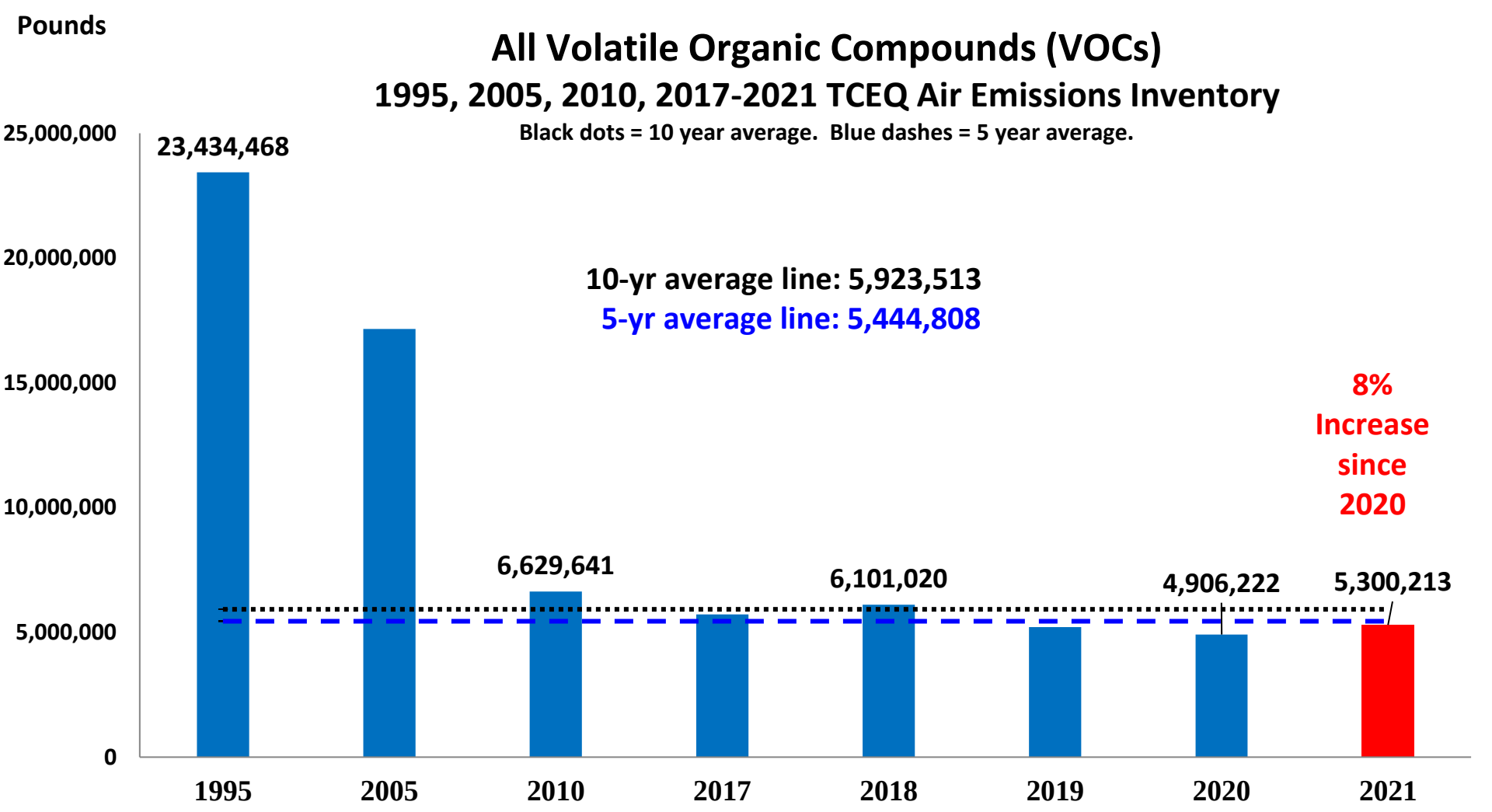
Sekisui (-25,461 lbs.)

- *Temporary:* Fewer emissions from facility unexpectedly shutdown for about a month due to the February severe winter storm event
  (53% Change)

All Volatile Organic Compounds (VOCs)

1995, 2005, 2010, 2017-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



1995→2021 : 77% Reduction in All VOC Emissions

Biggest change from 2020 was increase at Chevron Pasadena Refinery:

Temporary: Maintenance associated with a tank cleaning; emission events

All Volatile Organic Compounds (VOCs)
2021 Changes

Increases

Chevron Pasadena Refinery (+298,796 lbs.)

- *Temporary:* Maintenance associated with a tank cleaning; emission events

  (58% Change)

LyondellBasell Refinery (+123,371 lbs.)

- Higher refinery rates and increase from emission events (Winter Storm Uri)

  (9% Change)

All Volatile Organic Compounds (VOCs)
2021 Changes

Decreases

Chevron Phillips (-18,997 lbs.)

- *Temporary:* Decrease in VOC flaring due to decreased production and downtime from Winter Storm Uri

  (2% Change)

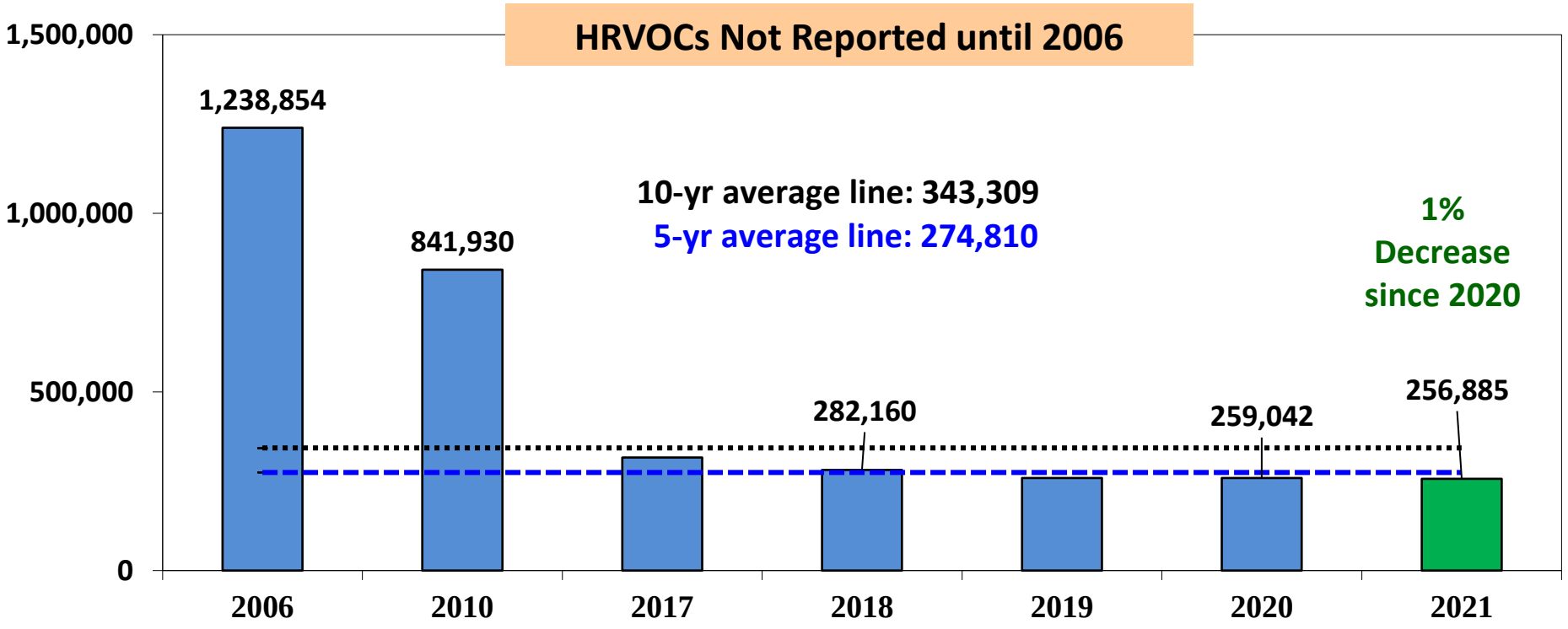
Albemarle (-5,000 lbs.)

- *Temporary:* Variability year to year in production

  (2% Change)

Highly Reactive Volatile Organic Compounds (HRVOCs)
(subset of VOCs)
2006, 2010, 2017-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



2006→2021 : 79% Reduction in HRVOC Emissions

<u>Biggest change from 2020 was decrease at Chevron Phillips:</u>

Temporary: Decrease in HRVOC flaring and process vent emissions due to decreased production and downtime from Winter Storm Uri

Highly Reactive Volatile Organic Compounds (HRVOCs) (subset of VOCs) 2021 Changes

Increases

OxyVinyls (+3,067 lbs.)

- Increase in fugitives from refrigeration skid (80% Change)

Chevron Refinery (+2,192 lbs.)

- Temporary: Primarily from an emission event (5% Change)

Highly Reactive Volatile Organic Compounds (HRVOCs) (subset of VOCs) 2021 Changes

Decreases

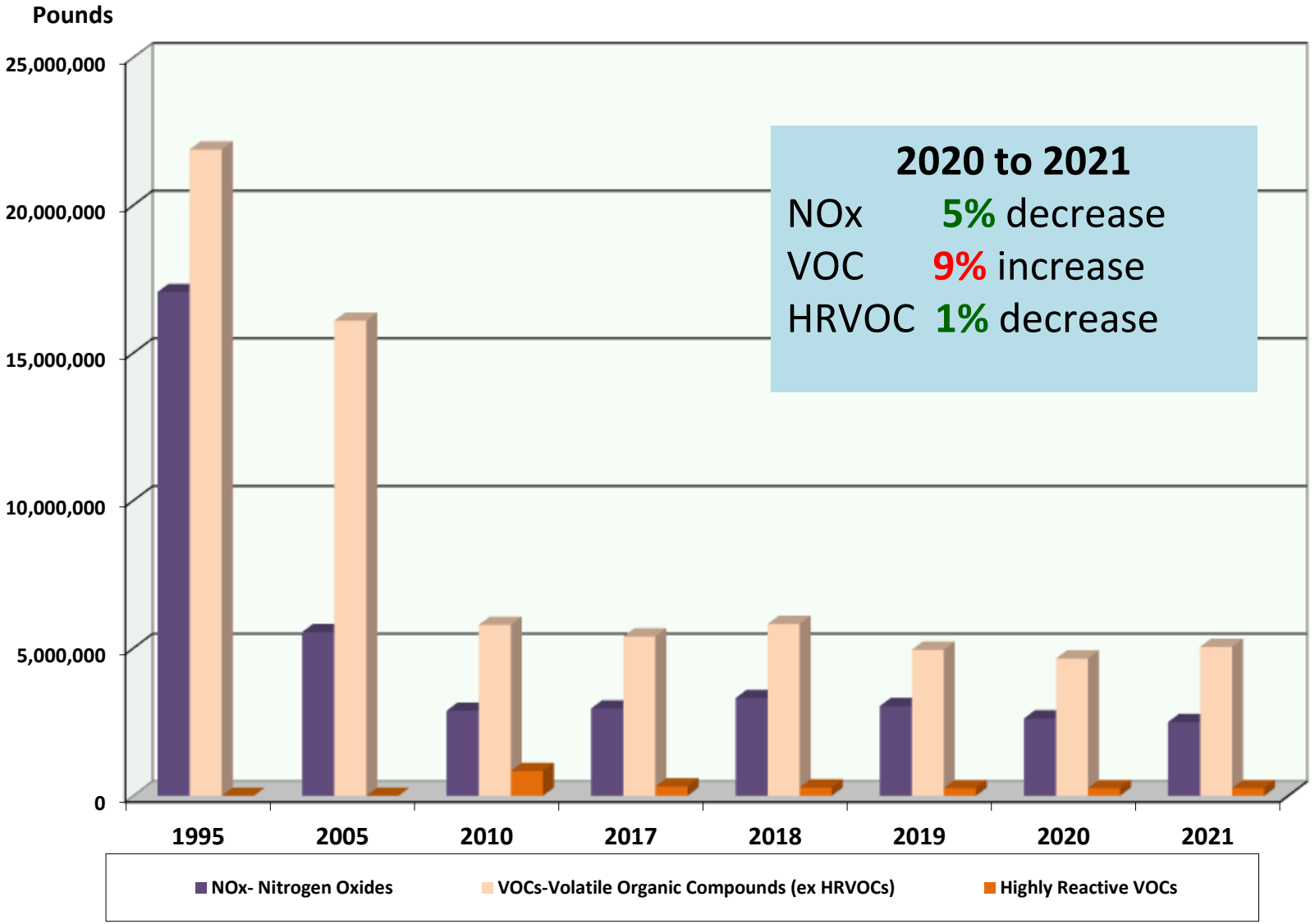
Chevron Phillips (-11,249 lbs.)

- *Temporary:* Decrease in HRVOC flaring and process vent emissions due to decreased production and downtime from Winter Storm Uri (11% Change)

Albemarle (-3,200 lbs.)

- (9% Change)

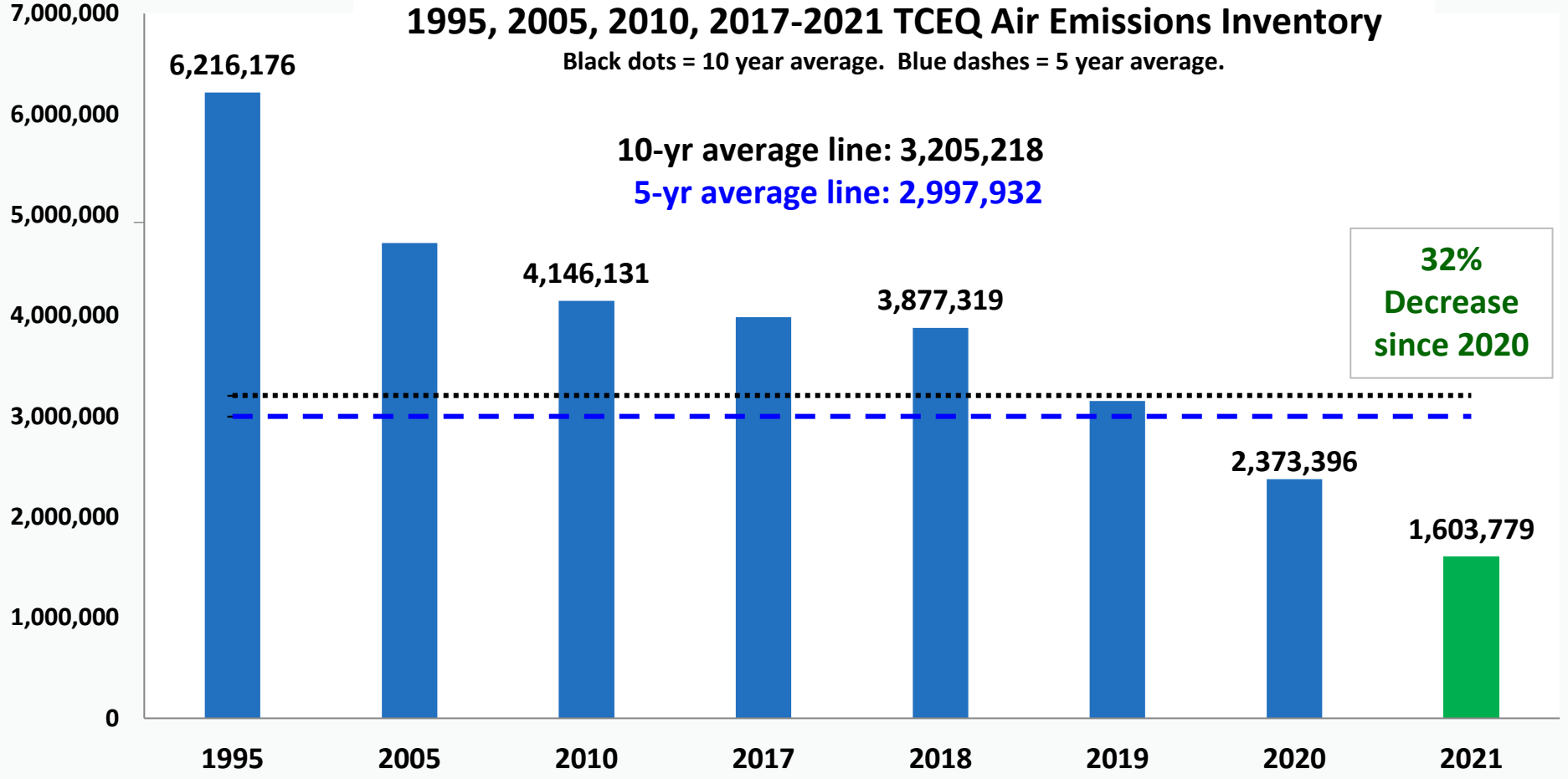
Summary of Contributors to Ozone Formation
NOx, VOCs (excluding HRVOCs) & HRVOCs
1995, 2005, 2010, 2017-2021



Sulfur Oxides (SOx)

1995, 2005, 2010, 2017-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



1995→2021: 74% Reduction in SOx Emissions

Biggest change from 2020 was decrease at Chevron Pasadena Refinery:
Sustainable: Reduced fluid catalytic cracker (FCC) operating hours/rates

Sulfur Oxides (SOx)
2021 Changes

Increases

LyondellBasell Refinery (+40,834 lbs.)

- Higher refinery rates and increase from emission events (Winter Storm Uri) (4% Change)

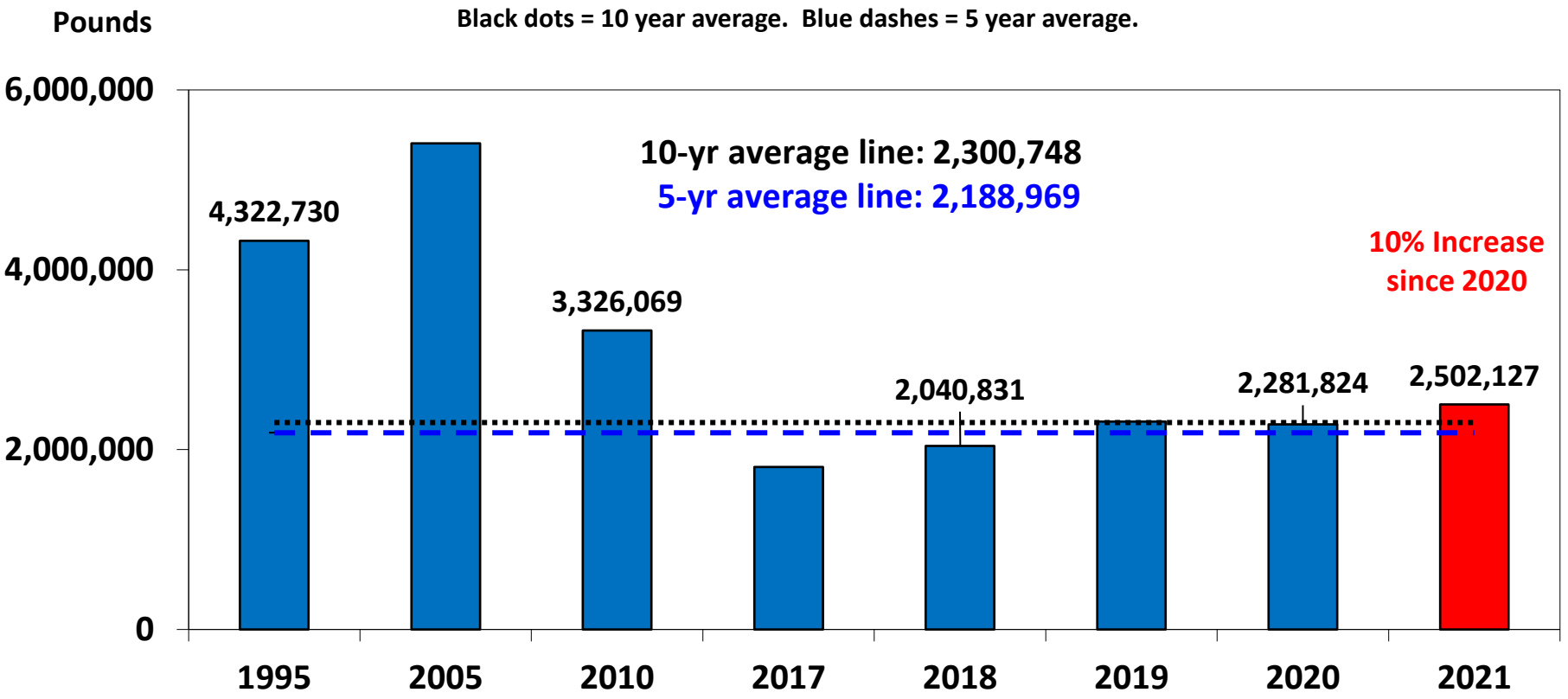
Decreases

Chevron Pasadena Refinery (-515,972 lbs.)

- *Sustainable:* Reduced fluid catalytic cracker (FCC) operating hours/rates (51% Change)

Carbon Monoxide (CO)

1995, 2005, 2010, 2017-2021 TCEQ Air Emissions Inventory



1995→2021: 42% Reduction in CO Emissions

Biggest change from 2020 was increase at LyondellBasell Refinery:

Higher refinery rates and increase from emission events (Winter Storm Uri)

Carbon Monoxide (CO)
2021 Changes

Increases

LyondellBasell Refinery (+249,578 lbs.)

- Higher refinery rates and increase from emission events (Winter Storm Uri)

  (40% Change)

BASF (+120,565 lbs.)

- *Calculation method change*

  (144% Change)

Carbon Monoxide (CO)
2021 Changes

Decreases

Chevron Pasadena Refinery (-52,463 lbs.)

- *Sustainable:* Reduced fluid catalytic cracker (FCC) operating hours/rates

  (12% Change)

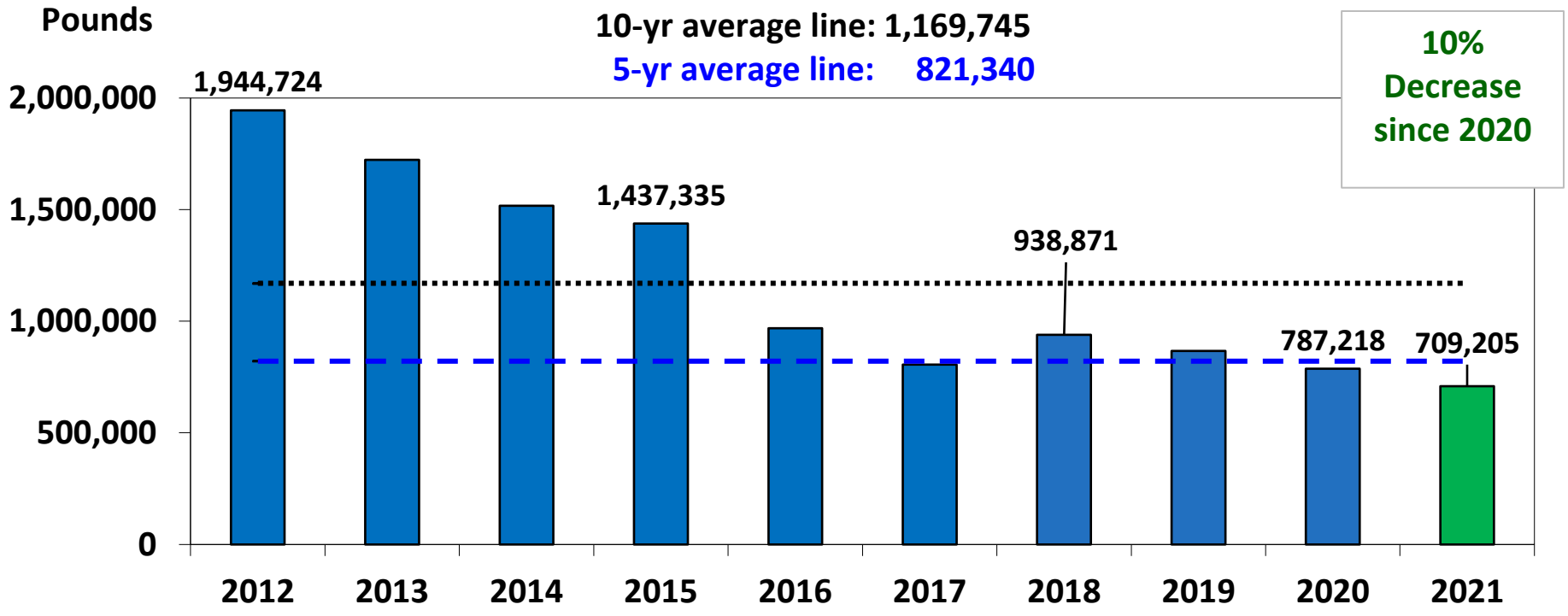
Chevron Phillips (-21,099 lbs.)

- *Temporary:* Decrease in CO from flares due to decreased production and downtime from Winter Storm Uri

  (3% Change)

Total Suspended Particulates (TSP)
2012-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



2012→2021 : 64% Reduction in TSP Emissions

Biggest change from 2020 was increase at LyondellBasell Refinery:
Higher refinery rates and utilization of Fluid Catalytic Cracking Unit (FCCU)

Total Suspended Particulates (TSP)
2021 Changes

Increases

LyondellBasell Refinery (+38,148 lbs.)

- Higher refinery rates and utilization of Fluid Catalytic Cracking Unit (FCCU)

  (13% Change)

Chevron Pasadena Refinery (+14,082 lbs.)

- *Temporary:* Primarily from Fluid Catalytic Cracker (FCC) start up attempts after Winter Storm Uri and emission events

  (9% Change)

Total Suspended Particulates (TSP)
2021 Changes

Decreases

BASF (-10,804 lbs.)

- *Calculation Method Change*

  (57% Change)

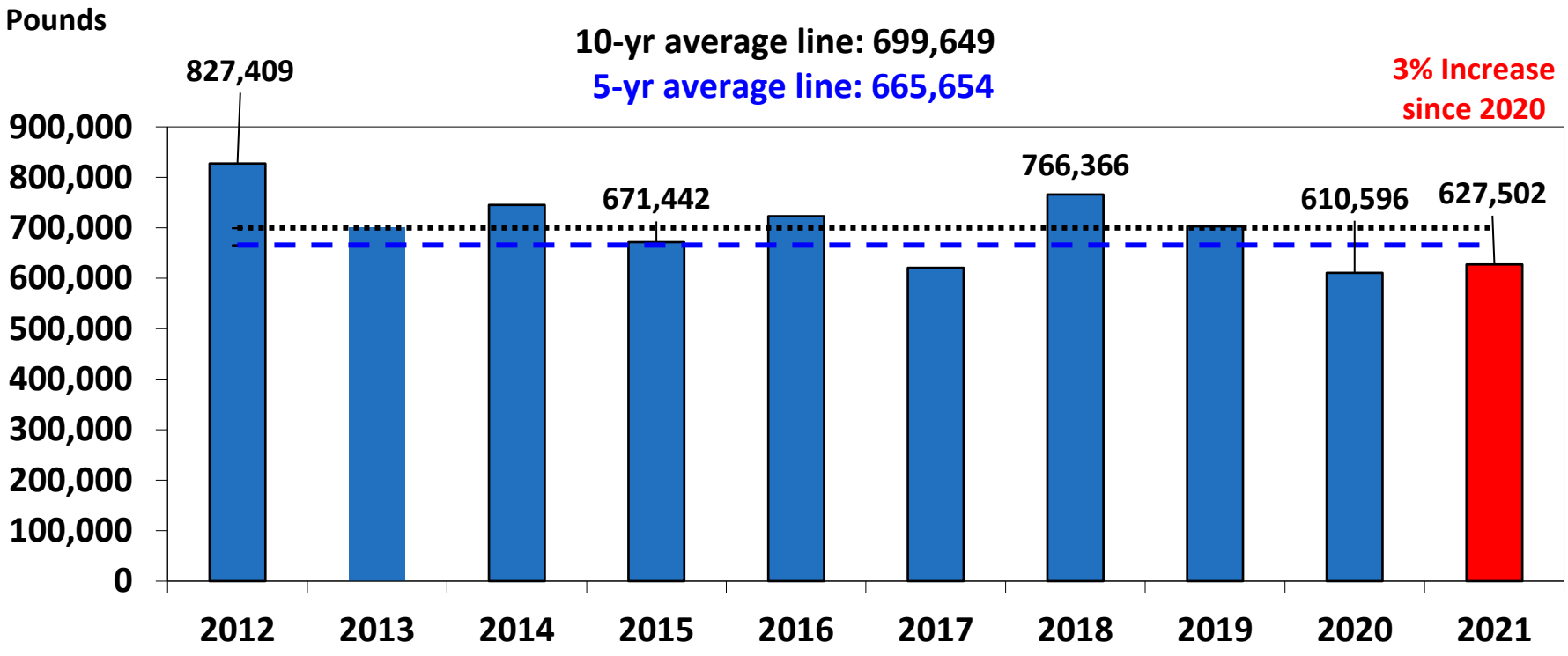
Kinder Morgan Liquids Terminal (-4,708 lbs.)

- *Sustainable:* Change in Calculation Method.

  (69% Change)

Total Suspended Particulates Reported as PM 2.5
2012-2021 TCEQ Air Emissions Inventory

Black dots = 10 year average. Blue dashes = 5 year average.



2012→2021: 24% Reduction in PM 2.5 Emissions

Biggest change from 2020 was increase at LyondellBasell Refinery:

Higher refinery rates and utilization of Fluid Catalytic Cracking Unit (FCCU)

PM 2.5 Portion of TSP
2021 Changes

Increases

LyondellBasell Refinery (+41,549 lbs.)

- Higher refinery rates and utilization of Fluid Catalytic Cracking Unit (FCCU) (15% Change)

Chevron Pasadena Refinery (+13,595 lbs.)

- *Temporary:* Primarily from Fluid Catalytic Cracker (FCC) start up attempts after Winter Storm Uri and emission events (9% Change)

PM 2.5 Portion of TSP
2021 Changes

Decreases

OxyVinyls (-3,984 lbs.)

- (6% Change)

Air Products (-1,632 lbs.)

- (6% Change)

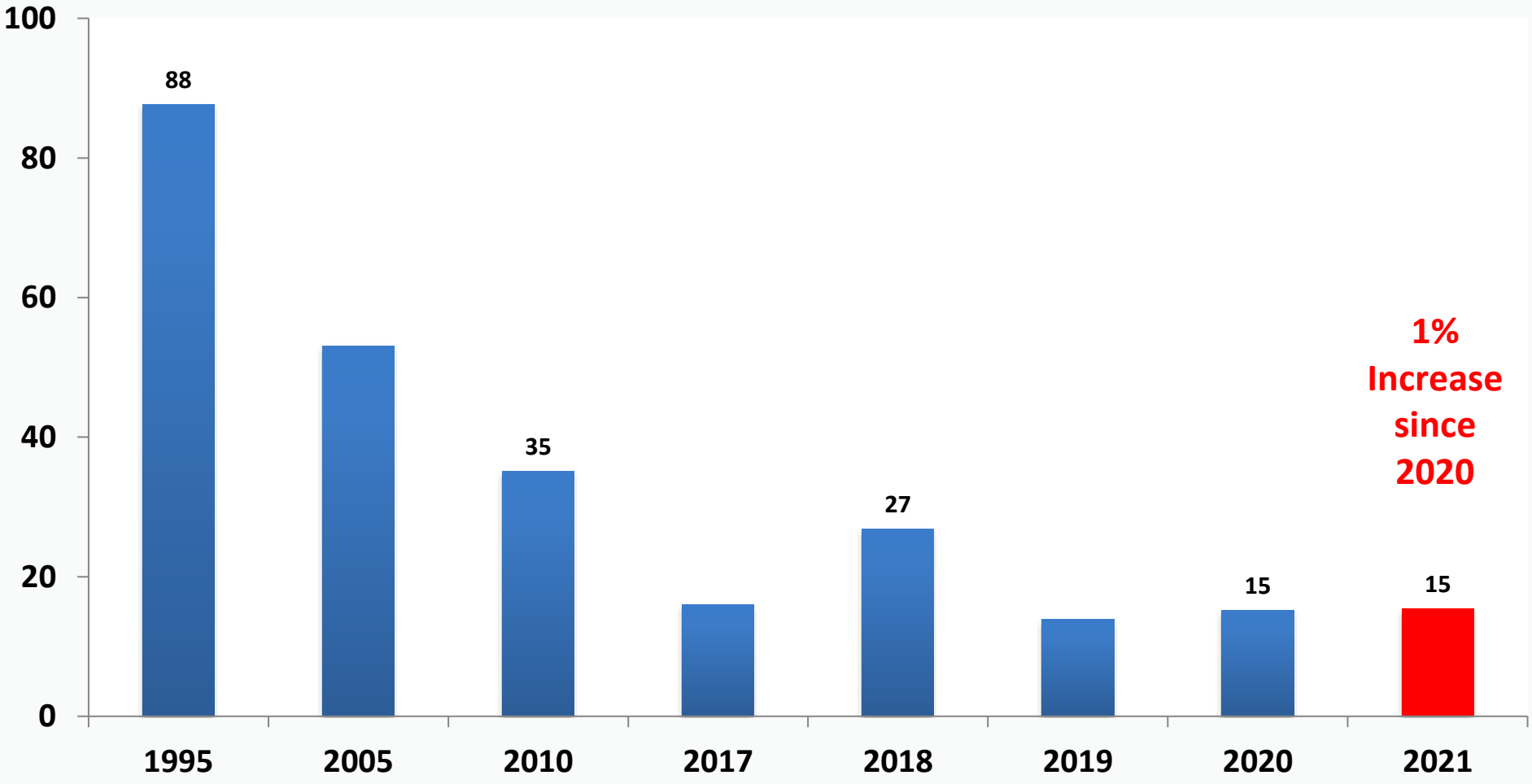
Questions?

EPA
Toxics Release Inventory (TRI)
Trends for PCAC Plants

Change in PCAC Plants
EPA Toxics Release Inventory

	2017-2021	2020-2021
Total PCAC TRI Releases to air	**- 14%**	**+ 1%**
From fugitive sources	**- 1%**	**+ 15%**
From point sources	**- 22%**	**- 8%**

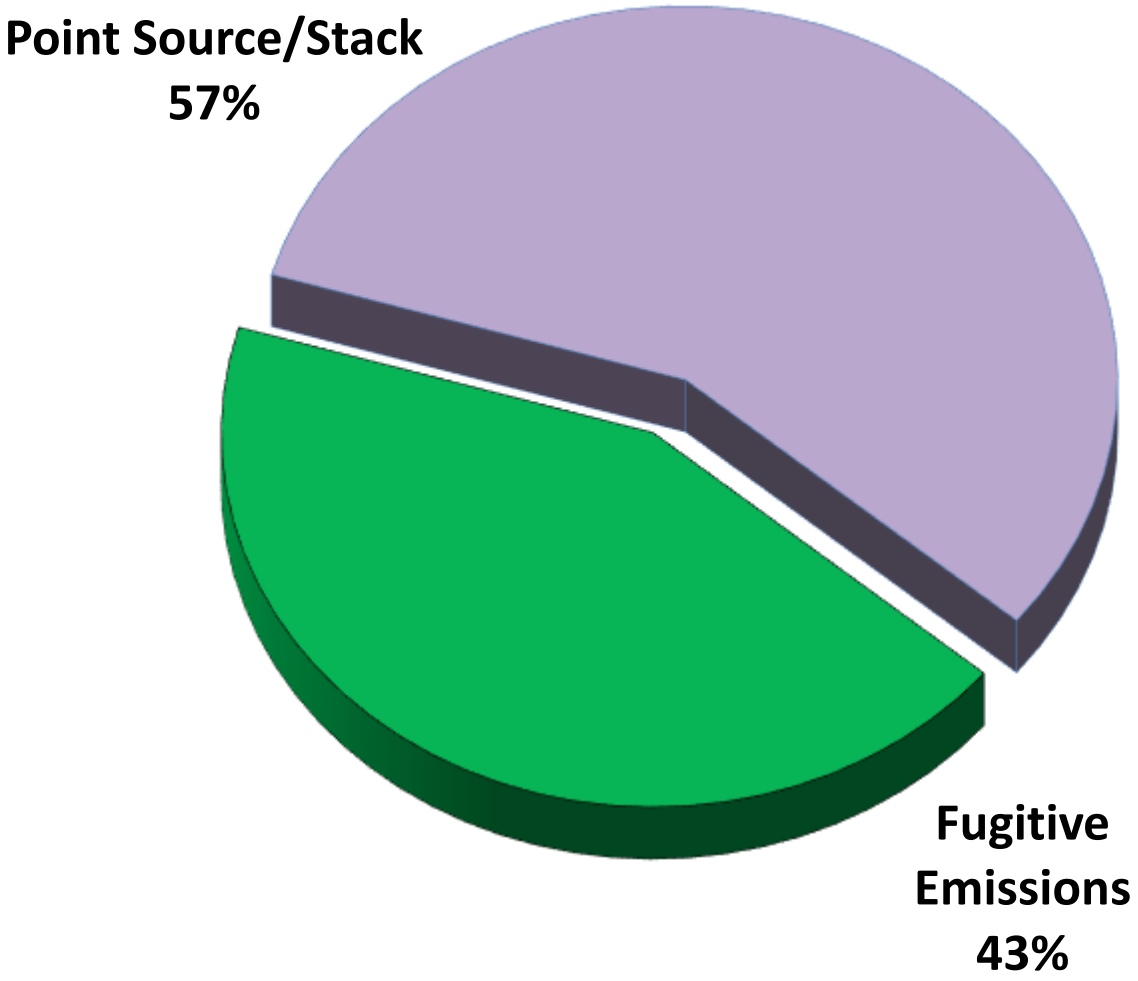
Pounds EPA TRI per Million Pounds of Product
1995, 2005, 2010, 2017-2021



1995→2021: 82% Reduction in Pounds of TRI Releases per Million Pounds of Product

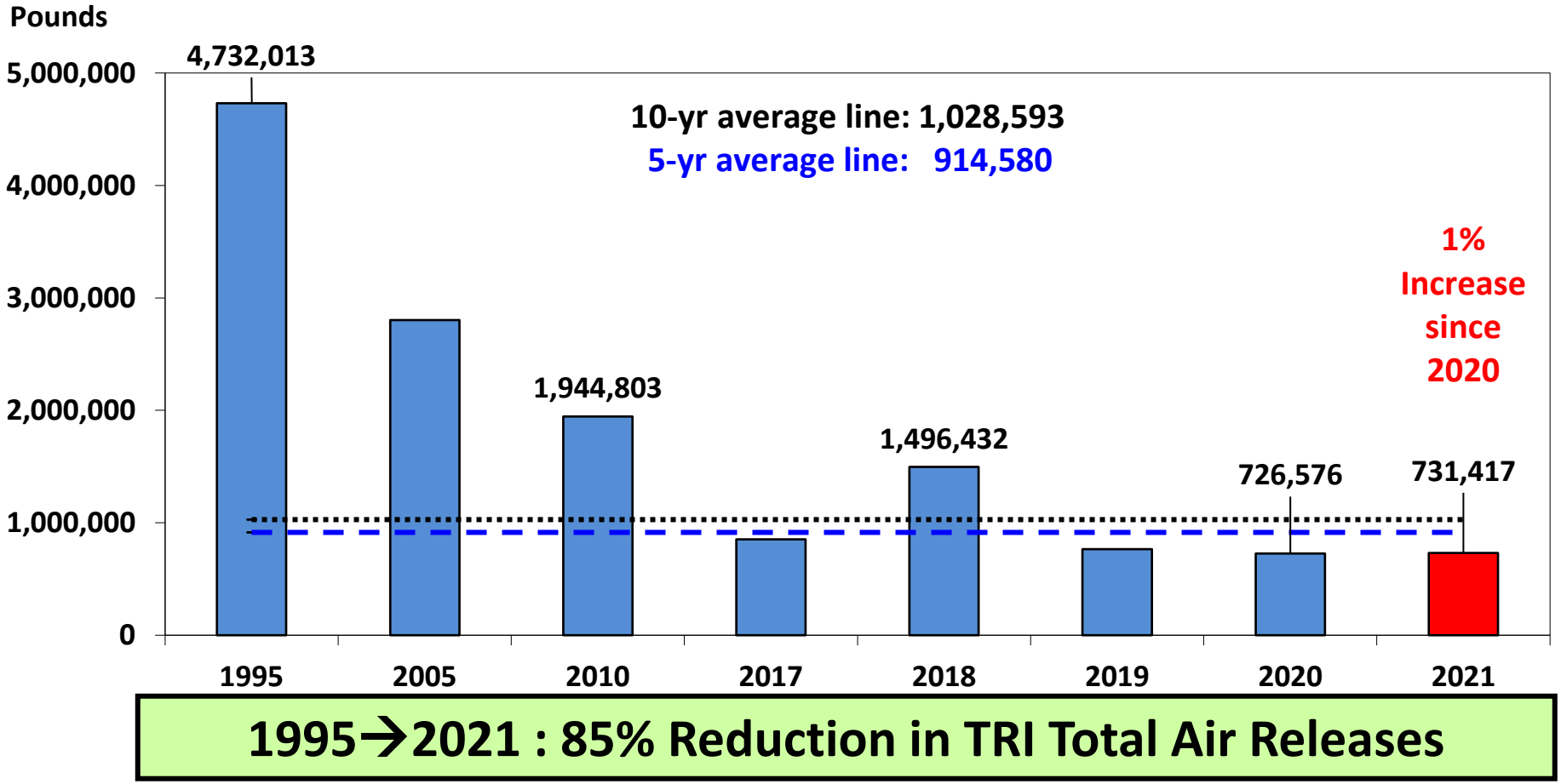
Since 1995, PCAC plants have produced 47-57 billion pounds of product each year.

2021 EPA TRI Releases by Source



EPA TRI Total Air Releases
1995, 2005, 2010, 2017-2021

Black dots = 10 year average. Blue dashes = 5 year average.



1995→2021 : 85% Reduction in TRI Total Air Releases

Biggest change from 2020 was increase at LyondellBasell Refinery:

Higher refinery rates; increase from emission events in 2021 (Winter Storm Uri)

Total TRI Air Releases
2021 Changes

Increases

LyondellBasell Refinery (+42,012 lbs.)

- **Fugitive:** Increase from emission events in 2021 (Winter Storm Uri)
- **Point Source:** Higher refinery rates

(22% Change)

Sekisui (+41,502 lbs.)

- **Fugitive:** *Temporary* – experienced more power outages that led to reportable quantity emission events

(266% Change)

Total TRI Air Releases
2021 Changes

Decreases

Chevron Phillips (-24,535 lbs.)

- **Fugitive:** *Sustainable*- Began monitoring unmonitored Leak Detection and Repair (LDAR) connectors, which had used higher emission factors.
- **Point Source:** *Temporary*- Decrease in flaring due to decreased production and downtime from Winter Storm Uri. (16% Change)

OxyVinyls (-4,696 lbs.)

- **Fugitive:** Decrease in fugitives from LDAR monitoring. (8% Change)

2021 at a Glance

DECREASES

Total Air EI	-3%
NOx	-5%
Total HRVOCs	-1%
TSP	-10%
SOx	-32%
Criteria Air Pollutants (SOx, NOx, VOC, CO, & TSP)	-3%
Routine Permitted Emissions	-6%
TRI- Point Source	-8%

INCREASES

VOCs	+8%
VOCs other than HRVOCS	+9%
CO	+10%
PM 2.5	+3%
Maintenance Emissions	+465%
Upset Emissions	+241%
Total Air TRI	+1%
TRI- Fugitive	+15%

Is 5-yr higher or lower than 10-yr Averages?

5-YR HIGHER

- NOx +2 %

5-YR LOWER

- All VOCs -8%
- HRVOCS -20%
- SOx -6%
- CO -5%
- TSP -30%
- PM 2.5 -5%
- TRI Total Air -11%

Comparison With Other CACs 2010 – 2020

	BAYCAP (25 plants)	**Deer Park CAC** (13 plants)	**La Porte CAC** (47 Reports)	**Pasadena CAC** (18 plants)
TRI Air	**- 44%**	**- 37%**	**- 28%**	**- 64%**
NOx	**+2%**	**- 22%**	**- 4%**	**+ 9%**
VOCs	**- 41%**	**- 43%**	**-6%**	**- 27%**

2020 Texas and Harris County Comparisons

	Number of Facilities reporting EI in 2020	VOCs	NOx
Texas	1917	176,000,000 lbs.	434,000,000 lbs.
Harris County	268	30,300,000 lbs.	31,700,000 lbs.
PCAC	17	4,906,222 lbs.	2,620,207 lbs.

PCAC portion of Emissions Inventory

	VOCs	NOx
Texas	3%	0.6%
Harris County	16%	8%

Questions?