5-16-19

To: Texas Commission on Environmental Quality

From: Katheryn Ackley

Re: Air quality monitoring

I am a resident of Comal County and deeply concerned about the air quality of our county, the growing number of quarry companies, and the fact that TCEQ has no air quality monitoring stations in the entire county.

The county has exceeded the safe limits for particulate matter emissions. This is urgent for the health of our citizens. Growth in the Hill Country of Texas should not equate to harmful PM emissions affecting our citizens and quality of life.

If there were stations for air quality monitoring throughout Southern and central Comal County measuring even the minimum PM (2.5 and 10 dust), we may possibly have some protection.

TCEQ should be protecting the citizens not submitting to lobbyists and corporate pressure.

Clean Air means Life. We depend on it.

Katheryn Ackley

[redacted]

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: air monitors in Comal County
Date:	Friday, May 17, 2019 9:45:06 AM

From:
Sent: Friday, May 17, 2019 9:30 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: air monitors in Comal County

To whom it may concern:

Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.

At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.

Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

Recommended locations:

Davenport High School (under construction in Garden Ridge)

Smithson Valley High School

Rim Rock Ranch Community Center

Vintage Oaks Community Center

Danville Middle School

Oak Run Middle School

Thank you!

Kathleen Banse

Find us on Facebook

"Like a good neighbor, State Farm is there"

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Friday, May 17, 2019 9:37:52 PM

Howdy,

As a resident of Comal county for nearly 30 years, the explosive population growth and development concerns me for a multitude of reasons. Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limitsfor particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Please help protect our families and the beautiful hill country!

Ali Baugh

Sent from my iPhone

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 11:22:09 AM

My name is Mike Bell. I am 70 years old and I live 1.2 miles from the proposed Vulcan Quarry site on FM 3009 and Highway 46.
Deborah, my wife and I built our home and moved in last June. We did not know Vulcan bought the White ranch with the intent of building a quarry that would adversely impact our air quality, water, roads, create dangerous traffic patterns because of tractor trailer traffic 24 hours a day 7 days a week, increase diesel fumes, "create blasting that will cover our property with life threatening dust", disrupt the wild life and beauty of the scenic hill country and lastly reduce our property values.
Sadly, the TCEQ claims they will allow a permit to be granted to Vulcan based upon what they state are sufficient monitoring at existing sites across Comal County.
Listed below are the stringent guidelines the TCEQ and EPA should mandate that Vulcan follow BEFORE a permit is even considered:
1. Comal county needs at least 6 official air quality monitors ASAP. Testing should be done before the permit is granted to establish the existing air quality versus after the site is operational. Vulcan has historically exceeded the safe limit for particulate matter emissions.
At minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust. Measure now and set the standard moving forward.
Locations should be in Central and Southern Comal county (the area between Bulverde, Canyon Lake, New Braunfels and Garden Ridge.
Recommended locations:
Davenport High School under construction in Garden Ridge
Smithson Valley High School
Rim Rock Ranch Community Center
Vintage Oaks Community Center
Danville Middle School
Oak Run Middle School

Please help us protect our air quality for our Seniors, Children, wild life, our beloved Hill Country environment.
Hold Vulcan accountable with a structured monitoring plan. They can certainly afford it if they can spend millions on lawyers that aren't concerned about us and how it will destroy all that live in and around their profit centers.
Do the right thing for the People of Comal County.

Sent from my iPhone

From:
To: MONOPS
Subject: Air Quality
Date: Monday, May 20, 2019 4:02:17 PM

We need air quality monitors in Comal County. With 11 open pit quarries, and multiple cement plants, there is no excuse for ignoring the health issues these industries force on us. We need to ensure that the county's air is safe and within PM emission limits. We need monitors that can measure down to 2.5 microns. I live here and my life matters.
David Britton

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 10:10:52 PM

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

Dear Ms. Landuyt:

I live in San Antonio and serve as Chair of the Alamo Group of the Lone Star Chapter of the Sierra Club. I have closely followed our regional air quality issues for several years. I have spoken on this issue at numerous AACOG and San Antonio City Council meetings. I have heard many reports from Steve Schmelzer, formerly of AACOG.

As a physician and retired pathologist I have a long interest in pulmonary pathology and environmental and occupational health. I fully support the lowering of the permissible ground level ozone standard to 70 ppb, and believe 65 is more medically appropriate. I am also very concerned about particulate pollution, especially the PM 2.5 which penetrates most deeply into our lungs.

Non-attainment for ozone has been applied only to Bexar County—a very unusual if not unique ruling that I believe is unfair to us, and largely based on the absence of monitoring stations in surrounding counties. Air quality issues are regional and monitoring needs to be expanded throughout our region.

The Alamo Sierra Club strongly supports the placement of several official air quality monitors in central and south Comal County where there has been a great expansion of quarry, cement, asphalt and concrete operations in recent years. These monitors should evaluate ozone, PM 2.5 and PM 10 levels in this part of our region, where resident populations are also growing rapidly.

This is an important matter of public health, and I urge you to commit the necessary funds, equipment and expertise to provide this vital monitoring. These data will help us improve air quality throughout our region.

Thank you,

Terry Burns, M.D.

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 1:17:20 PM

Please take the time to look at and listen to incoming emails, letters, and phone callers. Vulcan Quarry in Comal County is a serious undertaking that impacts so many in our area. I really believe that TCEQ will **do the right thing**.

- Comal County needs **at least six** official air quality monitors ASAP because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
  - Davenport High School (under construction in Garden Ridge)
  - Smithson Valley High School
  - Rim Rock Ranch Community Center
  - Vintage Oaks Community Center
  - Danville Middle School
  - Oak Run Middle School

Thank you for your time.

Judy Brupbacher
[redacted]

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 4:27:01 PM

To whom it may concern:
I feel very strongly that air monitors need to be located close to all rock quarry operations and at least as close as any available homes within the area. It doesn't make sense to monitor air quality many miles away when the people around the quarries are the ones that suffer. Commonsense needs to dictate.
Please consider changing the requirements, along with appropriate penalties for violations, to something that will actually benefit the people who have to live around them.
Thank you
RG Carver

Sent from my iPhone

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 4:16:41 PM

-----Original Message-----
From:
Sent: Friday, May 17, 2019 2:17 PM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Dear Legislators,

Since moving to Comal county last year, I've developed respiratory issues, related to air quality. I've never been a smoker and have lived in several states.

I was very disappointed to learn that none of my tax dollars are going to support monitoring air quality since there are so many industries here that negatively impact our air quality and environment.

No amount of money is worth jeopardizing our health and it is crucial that Comal county begin to implement air quality monitoring and legislative actions to control environmental health risks in the air we breathe!

Thank you,
Dianna Chandler

Sent from my iPhone

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:45:30 AM

From:
Sent: Friday, May 17, 2019 9:41 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: TCEQ 2019 Annual Monitoring Network Plan

Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limitsfor particulate matter (PM) emissions.

At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.

Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

Recommended locations:

Davenport High School (under construction in Garden Ridge)

Smithson Valley High School

Rim Rock Ranch Community Center

Vintage Oaks Community Center

Danville Middle School

Oak Run Middle Schoo

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From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:45:41 AM

From:
Sent: Friday, May 17, 2019 9:42 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on TCEQ 2019 Annual Monitoring Network Plan

I am writing to provide comments regarding potential additions and/or changes to the TCEQ air monitoring network plan.

As a resident of Comal County I have a specific concern for adequate and proper monitoring of local air quality, particularly levels of particulate matter. Airborne Particulate Matter (PM) is a recognized pollutant that is produced by limestone aggregate processing, e.g., quarrying, rock crushing, and cement and asphalt manufacturing. Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement manufacturing plants, and there are proposals to expand such operations. Quarry companies own over seven percent (over 25,000 acres) of all the land in the county, yet there are no monitoring stations located in the county.

To improve the level of knowledge and data available for informed decision making by the TCEQ and other regulators I offer the following specific points for consideration in preparing and implementing the TCEQ Monitoring Network Plan:

- Comal County should have at least six (6) official air quality monitors installed ASAP.
- At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.
- Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

As a member of the immediately affected public, I thank you for the opportunity to provide comments.

Sincerely;

James F. Collins

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 4:15:20 PM

From:
Sent: Friday, May 17, 2019 12:02 PM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

To Whom It May Concern,

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County. This is unacceptable.** My husband and I moved to New Braunfels from the Chicago suburbs and are very concerned about this. We moved here for the natural beauty of the Hill Country and do not want to see it destroyed. We are all stewards of the land.

Some recommendations:

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School
- Sincerely,

Amy Copps

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 11:56:03 AM

-----Original Message-----
From:
Sent: Friday, May 17, 2019 9:58 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Get the air monitors in place! The current situation in Comal County (without monitors) is unacceptable and represents irresponsible business practice at a minimum.

Steve Crawford

Sent from my iPad

From: [redacted]
To: MONOPS
Subject: Public Comment on TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 7:32:14 PM

To Whom it May concern,

I am requesting that air quality monitors be added to Comal County. Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Quarry companies own over seven percent of all the land in the county, over 25,000 acres. There are currently no air quality monitors in Comal County.

Comal County needs at least six official air quality monitors installed as soon as possible. Historically the county has exceeded the safe limits for particulate matter (PM) emissions which underscores the drastic need for air quality monitors now. The new air quality monitors should measure PM 2.5 dust and PM 10 dust. I suggest that the new monitors should be in central and southern Comal County in the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge. The following locations are appropriate: Davenport High School (under construction in Garden Ridge), Smithson Valley High School, Rim Rock Ranch Community Center, Vintage Oaks Community Center, Danville Middle School, Oak Run Middle School.

Thank you for your attention to this matter.

Catherine Croom
[redacted]

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 4:56:57 PM

We need to have air quality monitors in Comal County, particularly to check any pollution generated by the proposed Vulcan Quarry between New Braunfels and Bulverde on 46. We should at a minimum monitor particulate matter (PM) 2.5 dust and PM 10 dust., and we should have it at several places in the county around the proposed quarry sight. The health of many Comal County Texans is at risk.

I have been named an affected party because I live close to this proposed quarry and the winds could easy bring this extremely unhealthy particulate matter to my home at various times in the year. Many around me would be affected as well.

Be sure to install these monitors and make sure that if the proposed quarry does get built that it does everything possible to reduce pollution both to the air and aquifers.

Joyce Doyle
[redacted]

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 12:57:01 PM

Ms. Landuyt:

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Comal County is also the second-fastest growing county in the United States. Yet there are zero TCEQ air quality monitoring stations in Comal County.

This must change ASAP, especially considering that Comal County exceeded the WHO-established safe limit for PM 2.5 exposure in 2008 (Environmental Protection Agency (EPA) National Emissions Inventory database https://www.epa.gov/air-emissions-inventories).

Comal County needs at least six official air quality monitors. At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust. Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

Recommended locations:
Davenport High School (under construction in Garden Ridge)
Smithson Valley High School
Rim Rock Ranch Community Center
Vintage Oaks Community Center
Danville Middle School
Oak Run Middle School

Please facilitate the installation of these new air quality monitors in Comal County at the earliest possible time.

Thank you.

David A. Drewa
[redacted]

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: COMAL COUNTY - Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:48:35 AM

From:
Sent: Friday, May 17, 2019 8:45 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: COMAL COUNTY - Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limitsfor particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Your Concerned resident/tax payer of Comal County,

Joseph Smith

Sent from my iPhone. Please excuse typos.

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 8:36:46 PM

Dear TCEQ Representative,

I am sending this letter to you to request additional air quality monitors at the following locations:

- Davenport High School (under construction in Garden Ridge)
- Smithson Valley High School
- Rim Rock Ranch Community Center
- Vintage Oaks Community Center
- Danville Middle School
- Oak Run Middle School

I am very concerned about the air quality in Comal County. There has been a large increase in the amount of limestone aggregate processing without a commensurate increase in air quality monitoring by the TCEQ. Actually, there are no air quality monitors in Comal county. The detrimental health effects of airborne particulate (PM2.5) matter is well known. It is especially detrimental to asthmatics like me.The residential community has expanded tremendously and there is no zoning protection for residents. The risk to the public has increased and action is required.

Thank you for your consideration,

John Durand
[redacted]

From:
To: MONOPS
Subject: Air quality
Date: Tuesday, May 21, 2019 7:22:56 AM

I can't believe you guys aren't monitoring our air quality. Please get some air monitoring stations up immediately before allowing a new quarry.
This is obvious.
Concerned citizen,
Canyon Lake, TX.
RT Evans

Texas Commission on Environmental Quality 05/20/2019
Attn: Ms. Holly Landuyt MC - 165
P.O. Box 13087
Austin, Texas 78711-3087

monops@tceq.texas.gov

Comments on Air monitoring for 2019 consideration:

My name is Don Everingham I live in Comal County Texas at
I can be reached at or
In the past year Bexar county has been classified as non-attainment and several other countries in the region have been left unclassified, this is a disturbing trend considering public health and welfare of all citizens in the affected area as well as the entire State. I have spent a great deal of time studying air monitoring, air modeling, air dispersion and I have spoken with EPA and several Universities that study and teach these subjects. I have concluded that some current monitors located in Bexar county are not correctly positioned for PM2.5 and PM10 particle collection or for some reason the monitors are not collecting the data that should be collected, which must be considered along with Ozone components if we are to solve the problem of air pollution in the region. What I have learned is the TCEQ staff does not always reflect the true value of what the purpose of the monitor(s) at active locations are. In addition active monitors are not always collecting the air components that are required to make good decisions for our air quality.

For example we have a huge Industrial complex developing not only with the aggregate industry in Comal county and other counties close by, but we also have the Oil and Gas Industry to the south that contribute to Ozone formation under the right condition, add to this the increase in vehicles and we have a major problem that is not being properly addressed by the government agencies at any level. Governor Abbott has cut budgets and funding in 2018 and most likely will continue to do so. I have been a party to writing letters to his office and have yet to receive and competent reply. CPS picked up some costs last year for Bexar county for monitoring, but who is to say if this kind of support will or can continue.

My recommendation is to place 6 monitors in Comal County located close to the aggregate plants and check for PM2.5 and PM10 particles that can and do support Ozone components when air borne. We know that these particles are very harmful to the public as are the better-known components of Ozone.
I would suggest that TCEQ undertake a 3-year monitoring program for all air components mentioned for 24/7/365, making all monitors active for this period would meet the *Three-Year Mean Average required by EPA for the current standard* and certainly should be supported by TCEQ. In addition, because of the Industry to the South, Guadalupe and Wilson counties should be included in monitor locations in order to include wind data and seasonal changes that do affect air monitoring from the aggregate mines in Comal county and the industry to the south.

Thank you for the opportunity to submit my comments and I certainly ask that TCEQ take this matter seriously.

Respectfully submitted,

Don Everingham

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 11:56:44 AM

From:
Sent: Friday, May 17, 2019 10:08 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Hello TCEQ,

I have been informed that you are accepting public comments on the air monitoring network in Comal county and want to communicate my desire for the increase in air quality monitors. My 4 year old son has Cystic Fibrosis and we monitor the air quality index daily to determine if he can go outside without wearing a mask. I would like to see the following:

- Comal County have **at least six** official air quality monitors
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
  - Davenport High School (under construction in Garden Ridge)
  - Smithson Valley High School
  - Rim Rock Ranch Community Center
  - Vintage Oaks Community Center
  - Danville Middle School
  - Oak Run Middle School

Thank you,
Kyra

From:
To: MONOPS
Subject: Public Comments on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 11:04:54 AM

Good Morning,

I appreciate the opportunity to provide comments on the TCEQ Annual Monitoring Network Plan.

My husband and I live in south Comal County, right below the Balcones Escarpment. The scarring of the escarpment by aggregate quarrying and rock crushing operations is clearly evident when traveling IH 35 between New Braunfels and San Antonio. However, please know that there are hundreds of families that live in this area as well, such as along Rusch Lane, FM 482, Old Nacogdoches Road, Bunker Street, Wald Road, FM 2252, Coyote Run, and streets of Magnolia Springs subdivision.

On a personal note, my husband and I live on a farm that has been in our family for nearly 130 years. We share property lines with Capital Aggregates and also with Dean Word Company. We were identified as the nearest receptor to the Capital Aggregates operations. Capital Aggregates installed a seismic monitor on our property, but not an air monitor. Within 3.5 miles of our home, I believe there are currently seven (7) rock crushing facilities, with a combined production capacity approaching 35 to 40 million tons per year! These facilities include some very large operations, such as Hanson, Anderson Columbia, CEMEX, L-Hoist as well as Capital Aggregates, Dean Word and other regional operations.

Due to the number of large facilities in our immediate neighborhood, along with asphalt plants, truck yards, IH 35 traffic, and Union Pacific railways, I respectively request that air monitors be set up to capture the cumulative effects of air emissions, including PM 2.5 and PM 10 in this area. Recommended locations include:

. Near the Dry Comal Creek Flood Retarding Structure (Krueger Canyon Dam operated by Comal County), 5858 FM 482, New Braunfels, TX 78132

. Fey Property at 6028 FM 482, New Braunfels, TX 78132

. St. John Paul Catholic High School, 6720 FM 482, New Braunfels, TX 78132

. Solms Park, 445 Rusch Lane, New Braunfels, TX 78132

Please consider the locations above or some other location along FM 482. As stated before, there are hundreds of families living in this area (old farms as well as new development) together with a catholic high school, a new public middle school (with bus routes throughout the area), an historical national chapel, an historical national trail, and communities of Solms and Comal.

Thank you for your consideration.

Respectively,

Sharlene Fey

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 5:59:45 AM

Air Monitors Needed in Comal County!!!

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero** air quality monitoring stations in Comal County.

As a named "affected party" resident against the Vulcan Construction Materials LLC, Permit Number 147392L001, I am requesting that you apply common sense and protect the citizen's health by;

1. Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.

2. At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.

3. Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

4. Recommended locations:

    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Thank you in advance for your action on this matter.

David N. Fletcher
[redacted]

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 11:03:44 AM

Dear Commissioners,
Please rectify the total absence of air monitoring stations in Comal County. This county already has a problem with particulate levels that exceed safety standards. There are thousands of residents with health problems living in Comal County and many more arrive daily, since this is one of the fastest growing areas in the nation. We need at least 6 stations to monitor the air due to the extensive mining and gravel activity here.
Remember, citizens vote on these issues, and we are tired of corporate lobbyists influencing government policies.

From:
To: MONOPS
Subject: Air Monitoring in Comal County
Date: Sunday, May 19, 2019 6:12:36 AM

I live in Comal County within 2 miles of the White Ranch, which was purchased by Vulcan, who plans to put a quarry on the property. I am highly opposed to placing quarries in rural areas surrounded by housing developments. There are no working air quality monitors to measure the amount of pollution that these quarries are spewing into the air. We will be forced to breathe in particulates that are harmful to our health.

Comal County needs at least six official air quality monitors ASAP because the county has historically exceeded the safe limits for particulate matter (PM) emissions. At a minimum, these air quality monitors should measure PM 2.5 dust and PM 10 dust. Monitors should be located

be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

Vulcan cannot be trusted to self monitor. Their track record reveals that they are not as trustworthy as we would like to believe they should be. We must inspect, now expect them to comply to something that would be an extra expense to them.

Connie Gaines

Greater Edwards Aquifer Alliance

Member Organizations

Alamo, Austin, and Lone Star chapters of the Sierra Club
Aquifer Guardians in Urban Areas
Bexar Audubon Society
Bexar Green Party
Boerne Together
Bulverde Neighborhood Alliance
Cibolo Nature Center
Citizens Allied for Smart Expansion
Citizens for the Protection of Cibolo Creek
Comal County Conservation Alliance
Environment Texas
First Universalist Unitarian Church of San Antonio
Friends of Canyon Lake
Friends of Dry Comal Creek
Friends of Government Canyon
Fuerza Unida
Green Party of Austin
Headwaters at Incarnate Word
Helotes Heritage Association
Helotes Nature Center
Hill Country Planning Association
Green Society of UTSA
Guadalupe River Road Alliance
Guardians of Lick Creek
Kendall County Well Owners Association
Kinney County Ground Zero
Leon Springs Business Association
Medina County Environmental Action Association
Native Plant Society of Texas – SA
Northwest Interstate Coalition of Neighborhoods
Preserve Castroville
Preserve Lake Dunlop Association
San Antonio Audubon Society
San Antonio Conservation Society
San Geronimo Nature Center
San Geronimo Valley Alliance
San Marcos Greenbelt Alliance
San Marcos River Foundation
Save Barton Creek Association
Save Our Springs Alliance
Scenic Loop/Boerne Stage Alliance
Securing a Future Environment
SEED Coalition
Solar San Antonio
Sisters of the Divine Providence
Travis County Green Party
West Texas Springs Alliance
Water Aid – Texas State University
Wildlife Rescue & Rehabilitation
Wimberley Valley Watershed Association

May 20, 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

Dear Ms. Landuyt,

These comments are submitted on behalf of the 52 member organizations of the Greater Edwards Aquifer Alliance (GEAA). Please note that the comments come from all of the member organizations as indicated by our letterhead.

GEAA has long been concerned about the cumulative impacts of aggregate operations in Comal County and, has protested numerous air quality permits on the grounds that cumulative impacts could not be adequately assessed by TCEQ prior to granting these permits in the absence of air quality data to establish baseline conditions for the regions to host new aggregate operations.

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of zero air quality monitoring stations in Comal County.

Comal County needs at least six official air quality monitors, especially as the county has historically exceeded the safe limits for particulate matter emissions. We therefore recommend the following:

- At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.
- Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
  Recommended locations:
  - Davenport High School (under construction in Garden Ridge)
  - Smithson Valley High School
  - Rim Rock Ranch Community Center
  - Vintage Oaks Community Center
  - Danville Middle School
  - Oak Run Middle School

Given that Comal County is rapidly expanding residential development within unincorporated areas of the County, where zoning and land use restrictions are not enforceable under state law, it is incumbent upon TCEQ to insure that residents are protected from emissions of particulate matter from industrial operations. Setting up air quality monitoring as recommended above is, we feel, a good start for TCEQ to provide adequate protection of the health and quality of life of Texans living in Comal County.

P.O. Box 15618, San Antonio, Texas 78212 210-320-6294
www.AquiferAlliance.org

Thank you for the opportunity to submit these comments.

Respectfully,

Annalisa Peace
Executive Director

From:	Annalisa
To:	MONOPS
Subject:	Greater Edwards Aquifer Alliance comments re: Air Quality Monitoring in Comal County
Date:	Monday, May 20, 2019 3:17:54 PM
Attachments:	TCEQcomments-ComalAirQualityMonitoring5-20-2019-letterhead.docx.doc
Importance:	High

<<...>>

May 20, 2019

Texas Commission on Environmental Quality

P.O. Box 13087

Attention: Holly Landuyt, MC-165

Austin, Texas 78711-3087

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Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of zero air quality monitoring stations in Comal County.

Comal County needs at least six official air quality monitors, especially as the county has historically exceeded the safe limits for particulate matter emissions. We therefore recommend the following:

- At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.

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Recommended locations:

- Davenport High School (under construction in Garden Ridge)
- Smithson Valley High School
- Rim Rock Ranch Community Center
- Vintage Oaks Community Center
- Danville Middle School
- Oak Run Middle School

Given that Comal County is rapidly expanding residential development within unincorporated areas of the County, where zoning and land use restrictions are not enforceable under state law, it is incumbent upon TCEQ to insure that residents are protected from emissions of particulate matter from industrial operations. Setting up air quality monitoring as recommended above is, we feel, a good start for TCEQ to provide adequate protection of the health and quality of life of Texans living in Comal County.

Thank you for the opportunity to submit these comments.

Respectfully,

Annalisa Peace

Executive Director

Greater Edwards Aquifer Alliance

210-320-6294

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:29:37 AM

From:
Sent: Friday, May 17, 2019 9:09 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Air Monitors Needed in Comal County

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

It's time for this to change!

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Please resolve this lack of monitoring.

Regards,
Ginger Morgan
Vintage Oaks

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Air Quality Monitors
Date:	Friday, May 17, 2019 11:53:36 AM

From:
Sent: Friday, May 17, 2019 9:50 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Air Quality Monitors

Dear Commissioners of the TCEQ,

Please consider this a formal request for the addition of new air quality monitors. Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Please consider this request as soon as possible!

Respectfully,

Dr. Brent A. Hallum

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Air Quality Monitors need in Comal County
Date:	Friday, May 17, 2019 9:28:45 AM

From:
Sent: Friday, May 17, 2019 9:25 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Air Quality Monitors need in Comal County

Due to the large number of rock quarries, concrete plants, asphalt plants, and batch plants the need for more air quality monitoring is necessary. Please see the point below:

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Thank you,
Robin Burleson
New Braunfels Resident

From:
To: MONOPS
Subject: Quarry Permits: Vulcan 3009 quarry
Date: Friday, May 17, 2019 5:00:08 PM

Dear TCEQ,

I just attended your Environmental Conference and Trade Fair this week. It was a good event.

I am writing with concern about Air Quality in Comal County. Comal County needs at least six official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.
Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
Recommended locations:
Davenport High School (under construction in Garden Ridge)
Smithson Valley High School
Rim Rock Ranch Community Center
Vintage Oaks Community Center
Danville Middle School
Oak Run Middle School

There should also be downwind fenceline monitors at each quarry.

Matt Harrison

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 2:27:39 PM

It is a travesty that Comal County has nearly 30 facilities that house aggregate operations of some type and yet there are no air quality monitoring stations located in Comal County. Those of us who have concerns for our health and the welfare of our families, animals and livestock have no way to determine the quality of the air we breathe. We need to have at least 6 monitoring stations installed and located around the most populated areas, the schools, the housing developments and community centers. These monitors should be installed as soon as possible and should measure PM 2.5 and PM 10 dust.

Diane Higby

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 5:55:14 PM

Quarries and rock crushing plants occupy a substantial part of the land of Comal County yet there are no air quality monitors in the county. I am very concerned about the health and welfare of my family and all the citizens of the county. The TCEQ needs to install air monitors ASAP to monitor for PM 2.5 and PM 10 particles. I think there should be at least six, if not more, monitors in the county. Some desirable locations would be in close proximity to Smithson Valley High School,Garden Ridge area, Heritage Oaks area, and Vintage Oaks sub division

Kenneth Higby MD

Sent from my iPhone

From: [redacted]
To: MONOPS
Subject: Comments on Air Quality Monitoring
Date: Saturday, May 18, 2019 9:48:06 AM

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this is in response to the TCEQ accepting public comments on their Air Monitoring Network.

TCEQ needs to establish a series of new air quality monitoring sites in central and southern Comal County in order to properly monitor the growing presence of quarry operations which continue to exceed safe limtis for particulate matter. The additional monitoring stations should fall in the general region defined by Bulverde, Canyon Lake, New Braunfels and Garden Ridge. The monitoring stations should be capable of monitoring for PM 2.5 and PM 10 dust levels in addition to the standard TCEQ monitors.

There are multiple schools and community centers in this region which are capable of hosting a monitoring site and welcome have "local" data to determine the air quality instead of extrapolating from stations very far away.

Thank you for the opportunity to comment on your plans.

David Hoey
[redacted]

To: Texas Commission on Environmental Quality 5/17/2019
Attn: Ms. Holly Landuyt MC - 165
P.O. Box 13087
Austin, Texas 78711-3087

Ref: Air Quality Monitoring in Comal County, TX & Huge concerns over the "Proposed Vulcan Quarry"

From: Chris M. Hopmann

Attn: Ms. Holly Landuyt,

I am writing to you in sincere hopes of bringing the much required immediate attention and accountability to the overall "Air Quality Monitoring" subject plus the role TCEQ and the EPA have in this process. Much more accountability and respect for the general public's health, safety and welfare is required now! The taxpayers are saddled with your agencies financial liabilities yet the responsibilities given to the agencies are falling far short of the purpose the agencies were created to resolve.

To the best of my knowledge Comal County, TX has the following aggregate related businesses in operation today that emit numerous harmful pollutants:

> There are: 2 Cement plants, 7 batch planets, 9 asphalt plants and 11 quarries as I understand it today. It should be noted that during the Legislative Session now in progress in Austin, that there have been numerous aggregate related businesses in operation that were not permitted by TCEQ to operate. How and why could this be possible? This is more than interesting as we have google earth that shows these operations.
>
> These aggregate facilities emit: nitrogen oxide, sulfur dioxide, carbon monoxide and PM10 and PM2.5 and other harmful emissions. With NO current state of the art "Air quality monitoring" in place in Comal County. How are these emissions verified? With the technology that exists today it is irresponsible to use "best guess type models" as garbage in garbage out. The "Proposed Vulcan Quarry" permit has a 95,000 pounds limit on PM material (combination of PM10 and PM2.5 and smaller) correct? How will this be verified? Comal County and Bexar County are out of air quality standards now. Are your seriously thinking of adding more fuel to the out of control situation that exists needlessly? We now have plenty of aggregate materials readily available today. Solve the issues before making everything worse. What weight do you give people's health safety and welfare and the general environment? You are now destroying our quality of life, our general environment and putting our aquifers at addition risk and when we have water supply issues now.

After attending numerous TCEQ Public Meetings in New Braunfels, Boerne and Marble Falls, TX it is more than obvious that TCEQ is not and has not been effectively Monitoring Air Quality, specifically in regards to PM10 and PM2.5 in Comal County as no "Air monitors are in place and working today. They have been requested at every general public meeting TCEQ have held. OSHA now has "permissible exposure limits" that are now in place and should be implemented immediately and made mandatory. How are you going to do this without Air Monitoring?

The story that TCEQ has been telling for almost two years now at these public meetings, is the aggregate business says they can't afford these air monitors. Everyone knows *these operations are very profitable* and that this is only an excuse to get around following the rules and regulations. Therefore one can only assume that TACA and its members think their profits are more important that people's health and the general environment of Texas. TCEQ must agree as we have not one effective working air quality monitor in Comal County. See the attached "Top Ten Reasons to be a member of TACA (Texas, aggregate and concrete associations) look at item number 4. What do you think this means? It looks like they have you under their control and thus do as they like with immunity from both the TCEQ and EPA!

One only has to look at the Vulcan operation compliance history at the facility at Loop 1604 and Judson Road in San Antonio, TX to quickly see and realize the practice of self-regulating or monitoring is not and has not been effective. In fact, it is being grossly abused! Yet Vulcan uses this facility as an example of how they operate. In fact TCEQ states they are in "very good standing." How can that be? Even the penalties or fees for violating the rules and regulations are being overlooked, forgotten and the few violations that are pursued are being significantly reduced or discounted. *Leaving no incentive to follow the rules and regulations.* Is this being accountable? The fox is in charge of the hen house folks and that is never a good thing!

So, what needs to be done? Full effective unannounced compliance inspections and complete implementation of OSHA's new "permissible exposure limits" have to be implemented immediately. Start with the largest operations first and continue until all the facilities are in full compliance. No grandfathering type clauses should ever be allowed for any reason. Ignoring effective state of the art "air quality monitoring" 24/7/365 with live feeds is indefensible and thus should be a criminal act. We all know these emissions can and have caused great health issues and premature deaths for a long, long time. Therefore to not address these known serious health effects is willfully, knowingly and continually violating the rules and regulations.

So what actions need to be implemented quickly to bring accountability and effectiveness to this situation?

1) Be committed to the purpose and function of the agency as well as respecting the general public as government was created to protect - we the people, and thusly the environment.
2) Listen to the citizen's you are duly charged with protecting from health and environmental harm.
3) Use common sense, sound rational thinking and logic before taking action.
4) I do not think it is your responsibility to worry about the profitability of businesses, only that they comply with all the rules and regulations set forth. All businesses have to evolve and be accountable if they are to stay in business. That's the nature of being good, sound, ethical businesses.
5) Do not allow any special exemptions to any business, no grand fathering clauses. Everyone needs to be treated equally to be fair to all. Thus everyone plays by the same rules and regulations.
6) You should not be directed by or controlled by any political party or person including the governor.

Effective state of the art "Air Quality Monitors" with live feeds (24/7/365) should be of such number and set in such locations as required to properly asses the true air quality in the County. This effort should be designed by independent third party engineers normally engaged in this type work. The live feeds are required such that everyone knows what the actual air quality is at any given time and location. This enables prompt actions to be initiated to correct any abnormal situations that would adversely affect the air quality.

All the monitoring equipment must comply with EPA specifications and read various air quality readings. These reading should be certifiable by the third party (independent) engineering firm and equipment manufacturer.

Strong considerations should be given to having these Air Quality Monitors located in "secure locations" for example schools, government facilities, police stations or other secure locations. If these monitors can be effectively located at various schools, which would be a great way for students to actually see first-hand how science is being used daily to protect people health and the general environment. These type secure locations would also deter people from interfering with this equipment. It would also limit the chances of employees of regulated businesses, being tempted to alter the readings of the monitors.

TCEQ has also been trying to eliminate different types of equipment used at these aggregate related businesses from being included in the total emissions data of these facilities or operations. This is altering the true emissions of the activity or operation. All of the emissions from all of the equipment on site, including delivery trucks, should be included in the overall emissions to effectively monitor any and all of the collective emissions being generated at the operations.

TCEQ has not been considering what happens when you have multiply aggregate operations near each other as to what the combined emissions of the operations are. Example if you have three operations sitting side by side and they all produce equally allowable emissions you would potentially have three times the allowable emissions. That would far exceed the permissible exposure limits. Yet nothing has been done to address this issue. Each facility needs to be fully monitored and additional monitors would be needed to read the ambient air quality away from the immediate area of these operations.

I cannot over emphasize the great need for "independent third party" engineering firms being part of the process of getting accurate Air Quality Monitoring, as to prevent any conflicts of interests. Again, the readings from these monitors should also be able to be certified by the engineering firm and the equipment manufacturer.

Immediate actions of TCEQ and the EPA are required as Comal is now and has been exceeding known safe limits.

I also believe you are not justified, accountable, professional or ethical when you allow rock quarries move into existing residential areas of significant populations such as the "Proposed Vulcan Quarry" in Comal, County. The population in a five mile radius of this site is well over 12,000 people today with an additional 3,500 to 4,000 in the next few years. This is irresponsible!

Thank you for your time and consideration of my letter and input.

Respectfully,

Chris M. Hopmann

Please see the TACA attachment, look at #4.

Texas Aggregates and Concrete Association Member Benefits

Top 10 Reasons to Join TACA

1. TACA members represent 70% of the aggregates, 100% of the cement, and 75% of the concrete produced in Texas today.
2. TACA has a political action committee (TACPAC) that raises hundreds of thousands of dollars annually and is the largest of its kind across the industry.
3. TACA has retained the services of a highly respected governmental advocacy group to serve our member's best interests at the state capitol.
4. TACA has strong relationships with the state and federal regulatory authorities, such as Texas Commission on Environmental Quality (TCEQ), the State Comptroller's Office, Texas Department of Transportation (TxDOT), Texas Department of Public Safety (DPS), Environmental Protection Agency (EPA), etc., to insulate our members from adverse rulings in the case of an audit or inspection.
5. TACA provides marketing & technical standards to support our members with one-to-one marketing and specification assistance.
6. TACA members receive email updates such as important changes in the industry by our federal, state, or local governments.
7. TACA members receive our highly acclaimed quarterly magazine, the *TACA Conveyor*, and have access to our "member's only section" on the TACA website.
8. TACA members enjoy the benefit of knowledge-based seminars that provides them the tools to be on the cutting edge of industry standards and practices.
9. TACA provides our members with a tangible network to assist with introductory or present customer needs.
10. TACA members are leaders in their communities and industry and are prideful that they belong to an association that emphasizes the highest of standards.

From:
To: MONOPS
Subject: Air Quality Monitors in Comal County
Date: Saturday, May 18, 2019 4:44:59 PM

To: Texas Commission on Environmental Quality

The number of quarries in Comal county is continuing to rise. One is under consideration directly across the street from our residence on FM 3009. We are so very concerned about the health risks with a quarry so close to our home. To discover that TCEQ does not have any air quality monitors in Comal county is hard to understand. We need official air quality monitors, measuring particulate matter close to the quarries in the area, to include Bulverde, Canyon Lake, New Braunfels, and Garden Ridge.

Thank you,
Steve and Jane Johnson

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 9:20:28 PM

Dear Sirs:

I knew there were several open-pit quarries in Comal County.
I have learned that Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants.

That's a lot.

My home is near 3 of these and we can often see the dust moving in the air from these plants.
I found it appalling to discover that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

It is imperative that this be corrected immediately!
Given the fact that quarry companies own over seven percent of all the land in the county, it is reasonable to expect that the county would have at least six official air quality monitors .
These should monitor PM 2.5 dust and PM 10 dust and reports should be available to residents of the county.
It makes most sense to locate these monitors in central and southern Comal County where the largest population centers are.

TCEQ needs to step up its efforts to maintain air quality in our county.

Respectfully,
Wendy Junod

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:45:20 AM
Attachments:	TCEQ Air Monitoring Ltr. May 17.docx Evidence that Comal County residents are at risk for exposure to aggregate industry air pollution.pdf

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From:
Sent: Friday, May 17, 2019 9:41 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Dear Holly:
Please include my comment enclosed in your review of the TCEQ 2019 Annual Monitoring Plan.
kind regards:
Richard Keady

--
Richard Keady

May 17, 2019

Texas Commission on Environmental Quality

P.O. Box 13087

Attn: Holly Landuyt, MC-165

Austin, Texas 78711-3087

Re: 2019 Annual Monitoring Network Plan

To Whom It May Concern:

The comments below are submitted to the TCEQ in the hopes that a rational distribution of Dust Monitors 2.5 PM will be made to include specifically Comal County!

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions. At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**. Please see the enclosed white paper authored by R. Keith Randolph in regards to the existing high levels of PM 10 and 2.5 that exceed WHO exposure thresholds.

Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).Recommended locations:

- Davenport High School (under construction in Garden Ridge)
- Smithson Valley High School
- Rim Rock Ranch Community Center
- Vintage Oaks Community Center
- Danville Middle School
- Oak Run Middle School

Thank you for seeking input from citizens who wish to be protected from the cumulative effect of so much quarrying activity in Comal County!

Kind regards:

Richard Keady

Evidence that Comal County Residents Are at Risk for Exposure to $PM_{2.5}$

Airborne Particulate Matter (PM) is a recognized pollutant that is produced by limestone aggregate processing, e.g., quarrying, rock crushing, cement, concrete, and asphalt manufacture.

Exposure to airborne PM is also recognized as a serious health hazard by biomedical researchers and health authorities such as the World Health Organization (WHO).

Over the past decade or more the aggregate processing industry has undergone significant expansion in Central Texas, most notably in counties that boundary Texas Highway 46 between New Braunfels and Boerne. This expansion depends upon Air Permits issued by the Texas Commission on Environmental Quality (TCEQ), which has issued 58 air permits for Comal County alone over the past decade, and no denials.

TCEQ grants air permits based upon mathematical modeling of anticipated emissions of PM (and other pollutants) based upon assumptions, some of which come from companies applying for permits, and ***without any measurement or monitoring of PM exposure of Texas residents that could be affected by PM emissions.***

This document summarizes what is known about quarry related PM emissions, and a relatively new satellite-based method that generates estimates of PM exposure, Aerosol Optical Density.

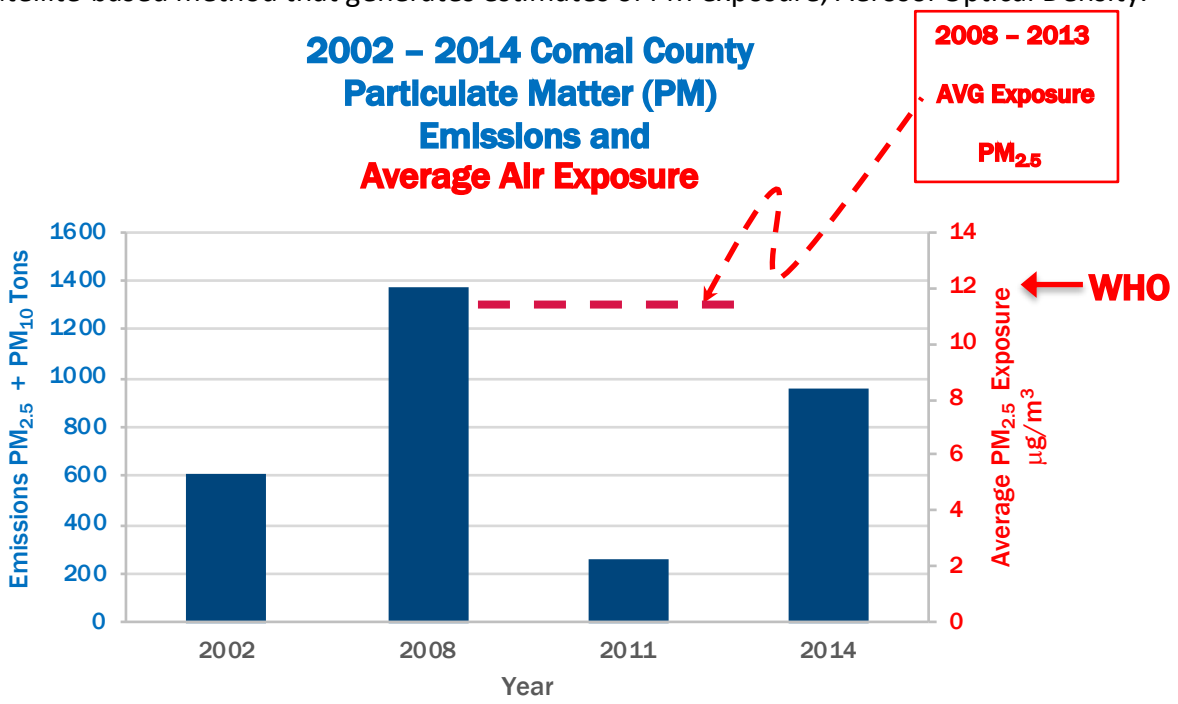

FIGURE EXPLANATION

The Left axis (blue bars) depicts aggregate industry sourced Particulate Matter (PM) emissions data obtained from the Environmental Protection Agency (EPA) National Emissions Inventory database for the years 2002 – 2014. These are the only data available.
https://www.epa.gov/air-emissions-inventories

The Right axis (red line) depicts the estimated atmospheric $PM_{2.5}$ exposure in Comal & Bexar Counties 2008 – 2013 from satellite-based aerosol optical density measurements. Data obtained from: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

The GOLD arrow right axis: World Health Organization's (WHO) health hazard exposure level threshold = 12 $\mu g/m^3$ $PM_{2.5}$.

The map of Texas shown below is the visual rendering of the 2008 - 2013 averaged satellite-based aerosol optical density measurement of $PM_{2.5}$. Bexar and Comal Counties are indicated by the dashed circle and the label.

Evidence that Comal County Residents Are at Risk for Exposure to $PM_{2.5}$

Note that the Bexar, Comal County $PM_{2.5}$ compares to that in metropolitan Austin, Houston, and the Dallas-Fort Worth areas, all exhibiting average $PM_{2.5}$ levels at or above 11.5 μg/m^3.

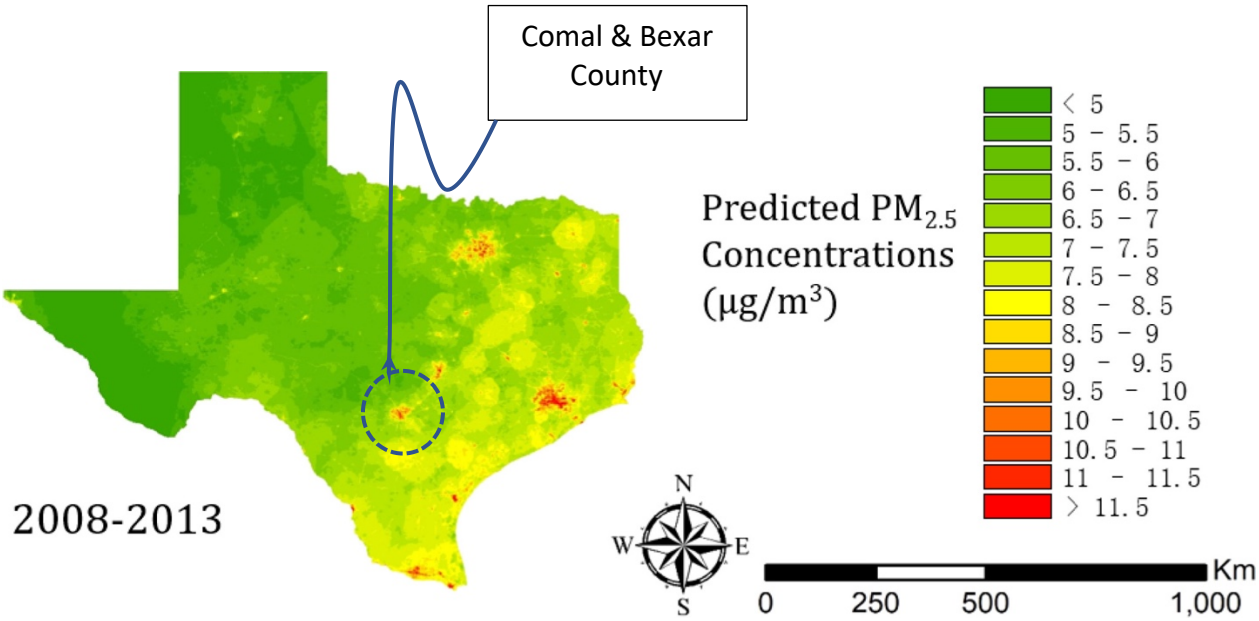

IMAGE: 2008 – 2013 Satellite-Based Aerosol Optical Density

Source: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

Recently, there has been a significant publication by researchers from the Harvard University TH Chan School of Public Health that revises the WHO health risk exposure threshold to $PM_{2.5}$ downward from ~12 μg/m^3 to less than 10 μg /m^3. This meta-analysis research, based upon results from 53 separate studies, reports significant risk for increased mortality for $PM_{2.5}$ exposures as low as 10 μg /m^3 (see Table below).

Evidence that Comal County Residents Are at Risk for Exposure to $PM_{2.5}$

Table 2, from this publication, summarizes the all cause mortality risk increase for $PM_{2.5}$ exposure at levels of 10 μg /m^3.

Estimates from meta-regression for the association between long term $PM_{2.5}$ exposure on Overall and Specific Mortality risk.

Mortality	Coefficient	SE	p-value	Percent increase at $PM_{2.5=}10$, (%)
Inverse transform of average $PM_{2.5}$ $= \frac{1}{PM_{2.5}}$	0.071	0.038	0.060	–
Intercept (All-cause mortality)[a]	0.006	0.003	0.033	1.29(1.09–1.50)
Cause specific mortality				
Cardiovascular mortality	0.002	0.001	< 0.001	1.46 (1.25–1.67)
Lung cancer mortality	0.002	0.001	0.008	1.22 (0.87–1.39)
Respiratory mortality	− 0.002	0.001	0.139	1.13 (0.85–1.41)
Cardiopulmonary mortality	0.006	0.001	< 0.001	1.92 (1.59–2.25)
Elderly studies only (yes/no)	0.003	0.001	< 0.001	1.61 (1.35–1.85)
Female studies only (yes/no)	0.0002	0.001	0.892	1.31 (1.01–1.62)

[a] All-cause, all-ages mortality represents the reference group to indicators for cause specific mortality.

Source: E Vodonos A, Awad YA, Schwartz J. Environ Res. 2018 Oct;166:677-689.

Summary

Particulate matter emissions from aggregate industry sources have varied between 2002 and 2014 in Comal County from 600 tons/year to 900 tons/year.

Average exposure of Comal County residents to $PM_{2.5}$ has been ~11. 5 μg /m^3 during the 2008 - 2013 timeframe.

The most current health risk assessment science provides evidence of increased risk for all cause mortality from average exposure to PM2.5 levels as low as 10 μg /m^3.

Available emissions data for Comal County since 2013 suggest that $PM_{2.5}$ exposure may be higher now than 2008 - 2013.

Conclusion

There is good evidence that residents of Comal County have increased health risks from exposure to $PM_{2.5}$.

This evidence is sufficient to warrant the need for $PM_{2.5}$ monitoring and a curtailment of the continued expansion of $PM_{2.5}$ producing industrial operations (such as aggregate processing).

Prepared by R Keith Randolph, PhD, March 3, 2019

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 1:48:42 PM

Re: Air Monitors Urgently Needed in Comal County

As residents of Comal County, my husband and I are very concerned about the air quality in this area. I am also an affected party in the case against Vulcan's air quality permit for a rock crusher plant at 46 and 3009. During the preparation for this battle against Vulcan, we were horrified to learn that that:

--Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants.
--Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Please make these air quality monitoring stations a priority and install them asap. Thank you,

Judy and Michael Krup
[redacted]

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 4:15:57 PM

-----Original Message-----
From:
Sent: Friday, May 17, 2019 1:11 PM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Yes I agree to we need to have air monitoring Network plan in our Comal County ASAP Thanks Dona Lore

Sent from my iPhone

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 11:55:24 AM

From:
Sent: Friday, May 17, 2019 9:50 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

To:
Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

Re: 2019 TCEQ 2019 Annual Monitoring Network Plan—**Need for additional air quality monitoring stations in Comal County.**

In addition to the locations already in place in Comal County (Camp Bullis, Bulverde, and New Braunfels Airport), please add more air quality monitoring stations, **especially in the southern areas of Comal County, where most of the aggregate activity is centered.**

Here are **recommended locations:**

- Davenport High School (under construction in Garden Ridge)
- Smithson Valley High School
- Rim Rock Ranch Community Center
- Vintage Oaks Community Center
- Danville Middle School
- Oak Run Middle School

These new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.

These new locations are needed because of the high degree of aggregate activity in Comal County, especially since aggregate activity is occurring near residential areas and school buildings. According to reliable sources, Comal County contains eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Quarry companies own over seven percent (over 25,000 acres) of the land in Comal County.

Sincerely,
Jensie Madden
(Comal County)

Virus-free. www.avg.com

From:
To: MONOPS
Subject: Comal County: Need more air quality monitoring!
Date: Sunday, May 19, 2019 9:31:47 PM

Please do more to monitor air quality in Comal County. Seven percent of the county land goes towards mining, processing, or producing materials that can all affect air quality in the county. It is not just around New Braunfels it is both east and west parts of the county.

We have a lot to protect here and we need more air quality monitoring. Please do more and thank you for listening!

Best Always,

Daniel

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 5:04:06 PM
Importance: High

To who it may concern,

I just found out there are absolutely no air quality monitors in Comal county. This begs the question "who has been bought off the stop this?" NO air quality monitors? Not even one?? Something stinks but I'm not sure an air quality monitor could detect the smell of corruption.

For a county this size with the amount of air polluting industry, which by the way owns 25,000 acres of the county, this is truly unacceptable. As a property owner and citizen of the county I'd first like to know why this condition exists. Then I'd like to know when you are going to do the proper thing and install the monitors.

Sincerely,

Charles R Mann
[redacted]

From: [redacted]
To: MONOPS
Subject: Comal County Air Monitors
Date: Sunday, May 19, 2019 10:54:57 AM

Dear TCEQ,

I have lived in or near Comal County for over 30 years. We have such an abundance of quarries and aggregate plants that our air is being compromised. I do not see how you can do your job of monitoring our air without monitors???? Monitors need to be set up immediately to measure Particulate Matter before you hand out any more permits. Locations to be specifically central and South Comal County. They are needed at the Davenport and Smithson Valley High Schools, Danville and Oak Run Middle Schools, along with Rim Rock and Vintage Oaks subdivisions.

Elizabeth Luker Martin

[redacted]

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Friday, May 17, 2019 5:19:04 PM

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in**

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 2:14:53 PM
Attachments: white-paper-comal-exposure-aggregate-pollution.pdf
TCEQ Air Monitor Public Commentary 5-21-2019.pdf

[redacted]

May 21, 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

Dear Ms. Landuyt,

My name is Kira Olson. It has come to my attention that the TCEQ is accepting written public comments on their air monitoring network, including requests for new monitors and/or relocation of existing monitors.

Air Monitors are needed in Comal County. Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of zero air quality monitoring stations in Comal County.

- Comal County needs at least six official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.
- Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

My husband, two daughters, and I live adjacent to a proposed 1500 acre open pit limestone quarry owned by Vulcan Materials. With the cumulative and detrimental particulate matter that is already circulating, we do not have a method of knowing what the current air quality is in order to keep our residents of Comal County in a healthy environment. I ask that you consider the pleas of Texas

residents in keeping us safe and following the mission you set forth in the following statement: “The Texas Commission on Environmental Quality strives to protect our state's public health and natural resources consistent with sustainable economic development. Our goal is clean air, clean water, and the safe management of waste”.

Sincerely,
Kira Olson

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 4:17:54 PM

From:
Sent: Friday, May 17, 2019 3:12 PM
To: MONOPS <MONOPS@tceq.texas.gov>
Cc:
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

We live in Comal County; very concerned about the air quality since we are retired and have allergy induced asthma! As we age it gets worse!

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.

Thanks,
Sandra Petry

From:	Milann and Pru
To:	MONOPS
Subject:	Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Tuesday, May 21, 2019 4:52:48 PM
Attachments:	image002.png image004.png Paper #1 - Health Risks Associated with exposure to airborne pollutants near quarrying.pdf Paper #2 - Evidence that Comal County residence at risk.pdf

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To TCEQ and EPA Regulating Authority,

Per Title 40 Code of Federal Regulations Part 58.10 states are required to submit an annual monitoring network plan (AMNP) to the United States Environmental Protection Agency (EPA) by July 1 of each year. This monitoring plan is required to provide the implementation and maintenance framework for an air quality surveillance system, known commonly as the ambient air quality monitoring network. This document provides information on the Texas network of ambient air monitors established to meet regulatory requirements of the National Ambient Air Quality Standards and other monitors that support this effort. This document presents the current Texas air monitoring network, along with all finalized and proposed changes to the network from July 1, 2019, through December 31, 2020. However, after reading the document there are still no plans to add or transfer an air quality surveillance system into Comal County. This needs to be rectified.

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that the TCEQ has not granted any air quality monitoring stations to Comal County. What also needs to be considered is that San Antonio is in non-attainment but Comal County which is part of the Metropolitan Statistical Area (MSA) is classified as "Attainment, Non-classified" because it lacks continuous ambient air monitoring.

Comal County needs at least six official air quality monitors due to the accelerating development of the aggregate industry in this area and also because, historically, the county has met or exceeded safe limits for particulate matter (PM) emissions. See attached documents. At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust. Recommended locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge):

- Davenport High School (under construction in Garden Ridge)
- Smithson Valley High School
- Rim Rock Ranch Community Center
- Vintage Oaks Community Center
- Danville Middle School
- Oak Run Middle School

It is imperative that the AMNP be amended to include air monitoring in Comal County. Thank you in advance for your consideration.

Respectfully submitted,

Milann Guckian, President

PO Box 831414
San Antonio, Tx 78283
https://www.stop3009vulcanquarry.com/

Health Risks Associated with Exposure to Airborne Pollutants Arising From Quarrying and Aggregate Processing

Situation and Objective

A construction boom has swept into Comal County in recent years such that it is now the second fastest growing county in the US. This on-going and accelerating wave of development and construction has resulted in a high demand for limestone and limestone related products such as aggregate and cement. While limestone quarrying is not new to Comal and surrounding counties, there has been and continues to be an influx of aggregate industry business into the area. A local recent example is the purchase of 1,500 acres of pristine ranch land at the intersection of FM 3009 and TX 46 by Vulcan materials for the purpose of quarrying and crushing the limestone deposits found there.

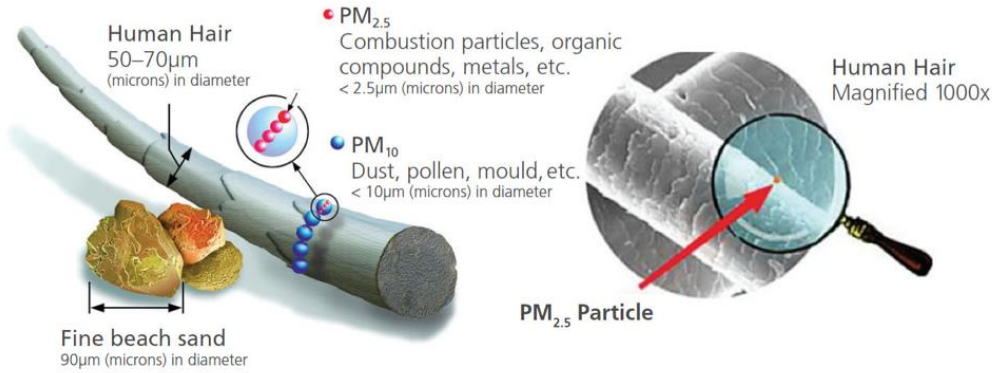
While growth is expected in this desirable region, and can bring economic benefits, limestone quarrying, crushing, and cement manufacture are well documented sources of airborne pollution called particulate matter (PM) that pose significant risks to the region, if unregulated and unmonitored.

Particulate matter is considered pollution by the World Health Organization (WHO) and the US Environmental Protection Agency (EPA) because exposure is associated with a range of serious negative health effects.

The objective of this article is to summarize the health risks of exposure to PM.

What is Particulate Matter (PM)?

Generally, PM comprises two kinds of microscopic particles, mineral (silica and other minerals from rock processing), and hydrocarbon and soot from diesel exhaust of industrial equipment and trucks that are heavily utilized in the quarrying industry. PM is classified into size ranges. The PM of interest in terms of health risks are those that are very small, invisible to the naked eye, and are referred to as $PM_{2.5}$ and PM_{10}. $PM_{2.5}$ comprises particles ~2.5 micrometers in size, PM_{10} comprises particles ~10 micrometers in size. $PM_{2.5}$ and PM_{10} are invisible to the naked eye, and are easily carried in wind currents, can remain airborne for long periods of time, and can be carried up to 30 miles (PM_{10}) or hundreds of miles ($PM_{2.5}$) from the source.
Source: [What is Particulate Matter]



Source: **EPA Particulate Matter Basics**

What are the health risks associated with exposure to PM?

PM_{10} and $PM_{2.5}$ are particles that are small enough to penetrate the delicate lining of the respiratory system following inhalation. The health effects of inhalable PM are well documented. Health risks are due to exposure over both the short term (hours, days) and long term (months, years). Short-term exposure can result in coughing, shortness of breath, tightness in the chest and irritation of the eyes. Long-term exposure can result in reduced lung function, and respiratory diseases such as asthma, chronic obstructive pulmonary

disease (COPD), lung cancer, emphysema, and aggravation of existing lung disease. Long term exposure is also associated with increased risk of allergies, cardiovascular disease and autoimmune disease. PM exposure affects health adversely such that there is increased absence from school and work, increased visits to emergency room and doctors' offices, and hospitalization. The figure below shows a more comprehensive listing of health risks from $PM_{2.5}$ exposure. Epidemiological studies also have documented a significant association between PM exposure and mortality.

Sources: WHO Health Effects of Particulate Matter

EPA Overview of Particle Air Pollution

EPA Particle Pollution and Your Health; Environmental Health Perspective Particulate Matter Air Pollution Exposure

60-Million-Strong Study Shows Clear Link Between Exposure To Air Pollution & Premature Death

A Review of Airborne Particulate Matter Effects on Young Children's Respiratory Symptoms and Diseases

Association of Short-Term Exposure to Air Pollution with Mortality in Older Adults

Brief exposure to tiny air pollution particles triggers childhood lung infections

Health effects for the population living near a cement plant: An epidemiological assessment

Health Outcomes of Exposure to Biological and Chemical Components of Inhalable and Respirable Particulate Matter

Respiratory health effects of diesel particulate matter

Expert position paper on air pollution and cardiovascular disease

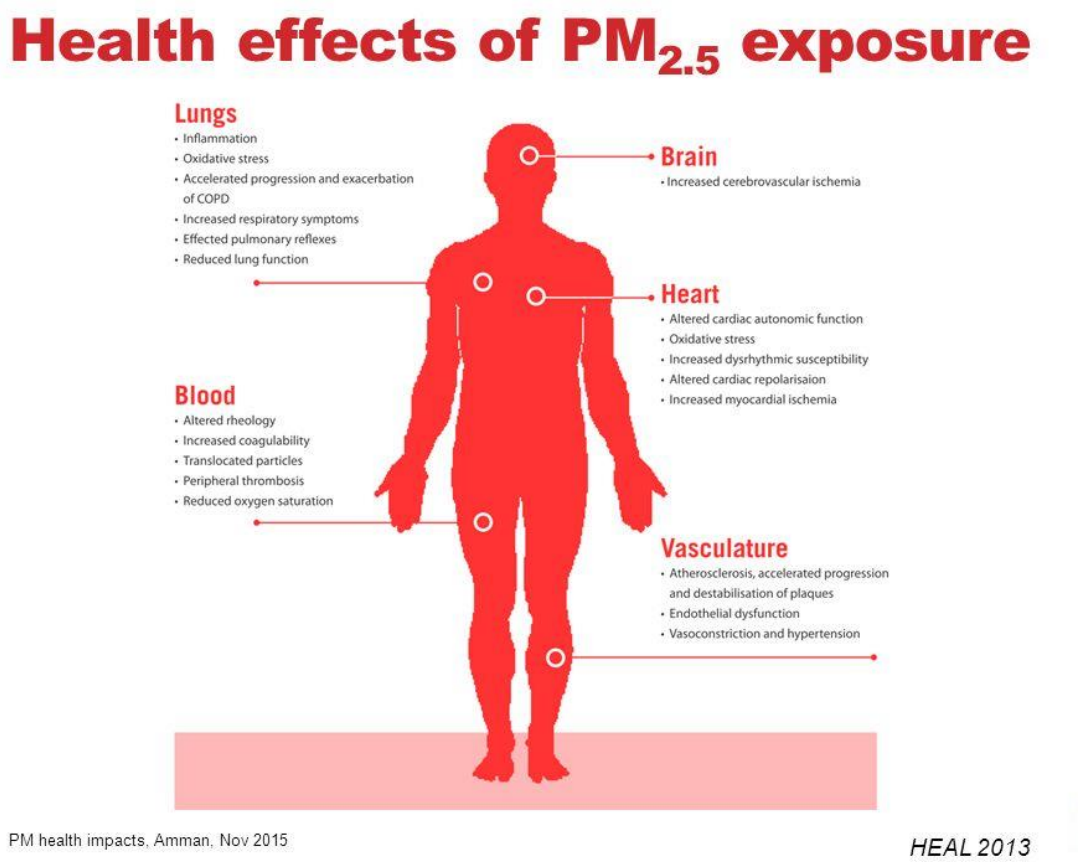
WHO Health effects of particulate matter

EPA Particulate Matter (PM) Pollution

EPA Particle Pollution and Your Health

Kings College Particulate Matter and Health

Health Risks Associated with Exposure to Airborne Pollutants Arising From Quarrying and Aggregate Processing



Source: Kings College Particulate Matter and Health

Who is at risk from exposure to PM?

Susceptible groups with pre-existing lung or heart disease, as well as children and the elderly, are particularly vulnerable.
Source: EPA Particle Pollution and Your Health

How much exposure to PM is considered potentially harmful?

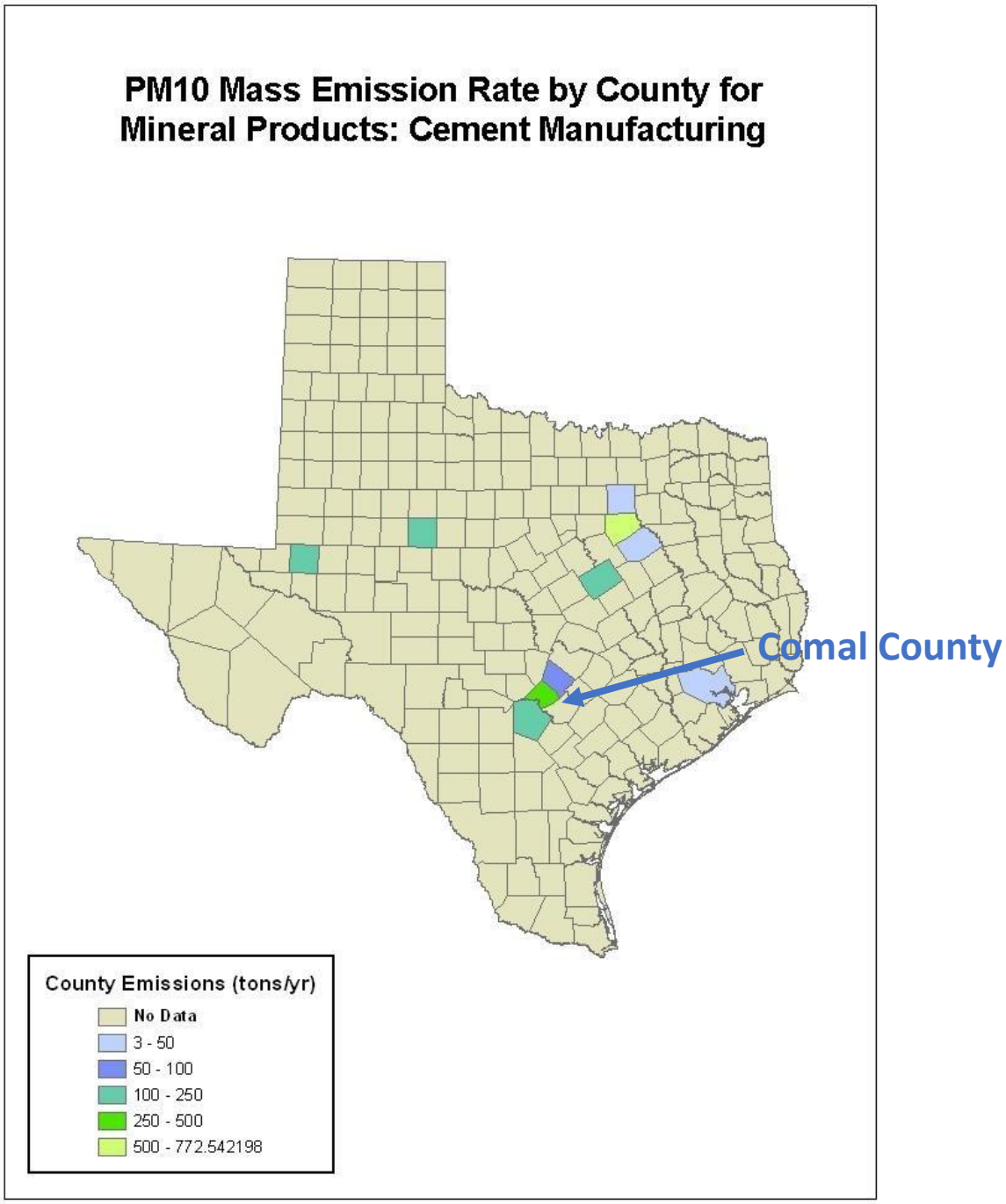
There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur. Exposure is influenced by proximity to the source, i.e., close proximity will incur higher exposure and higher risk, and by the time of exposure. Other factors include winds and weather conditions.
Source: EPA Particle Pollution and Your Health

What are the PM levels in Comal County?

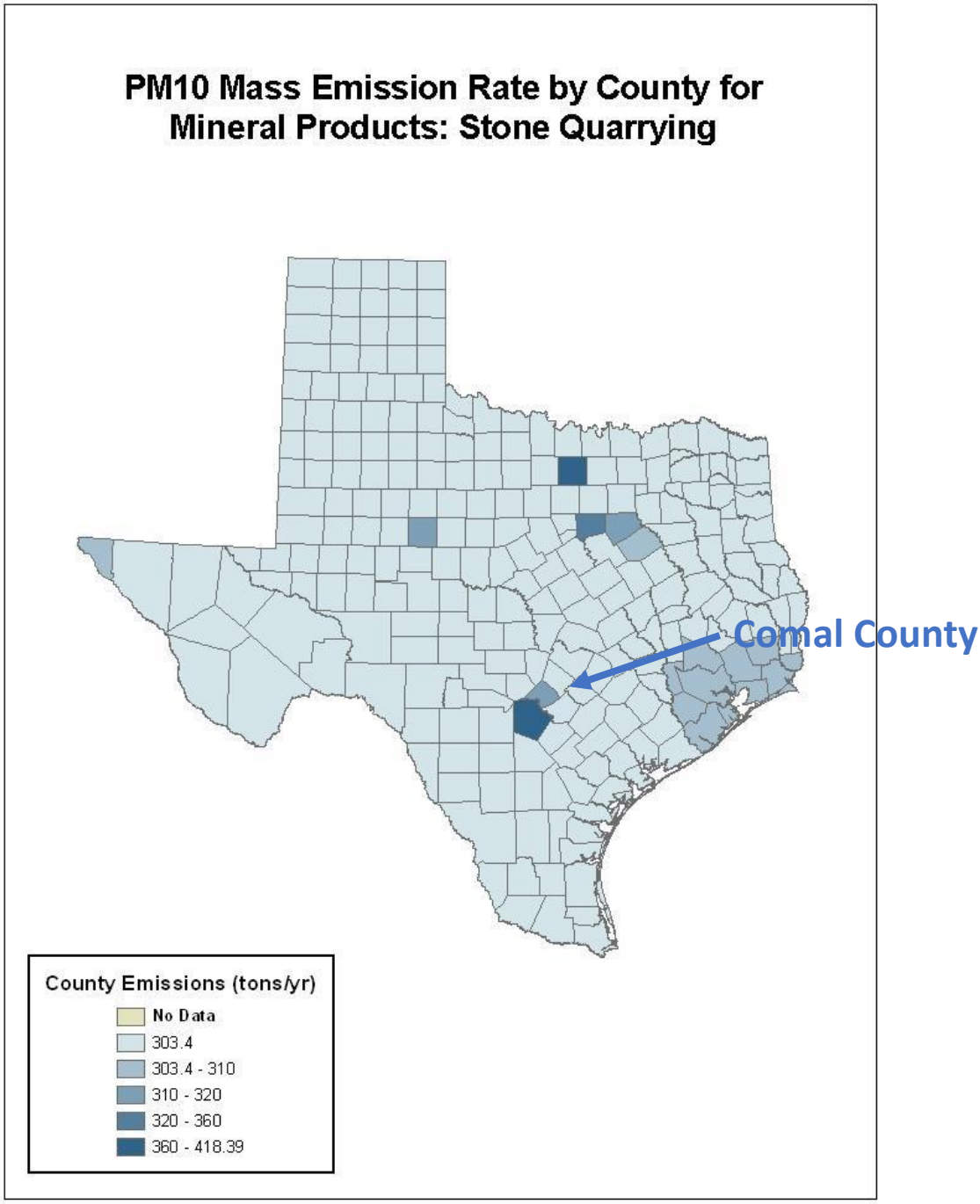
A study conducted by the University of Texas in 2002 reported the results shown in the four figures below. The first two figures show Mineral Product PM_{10}, and the second figures show Mineral Product $PM_{2.5}$. The amount of limestone quarrying has grown significantly since then, and it is clear that Comal County already represents a "hotspot" for PM pollution (see Texas county map figures below).

In 2002, the PM_{10} emissions for cement manufacturing and stone quarrying in Comal County were 250-500 tons/year (tpy) and 310-320 tons/year, respectively, or a total for Mineral Products of 560-820 tons/year. This compares to PM_{10} emissions in Bexar County for cement manufacturing and stone quarrying of 100-250 and 360-418 tpy, respectively, or a total for Mineral Products of 460-668 tpy. Considering that Bexar County

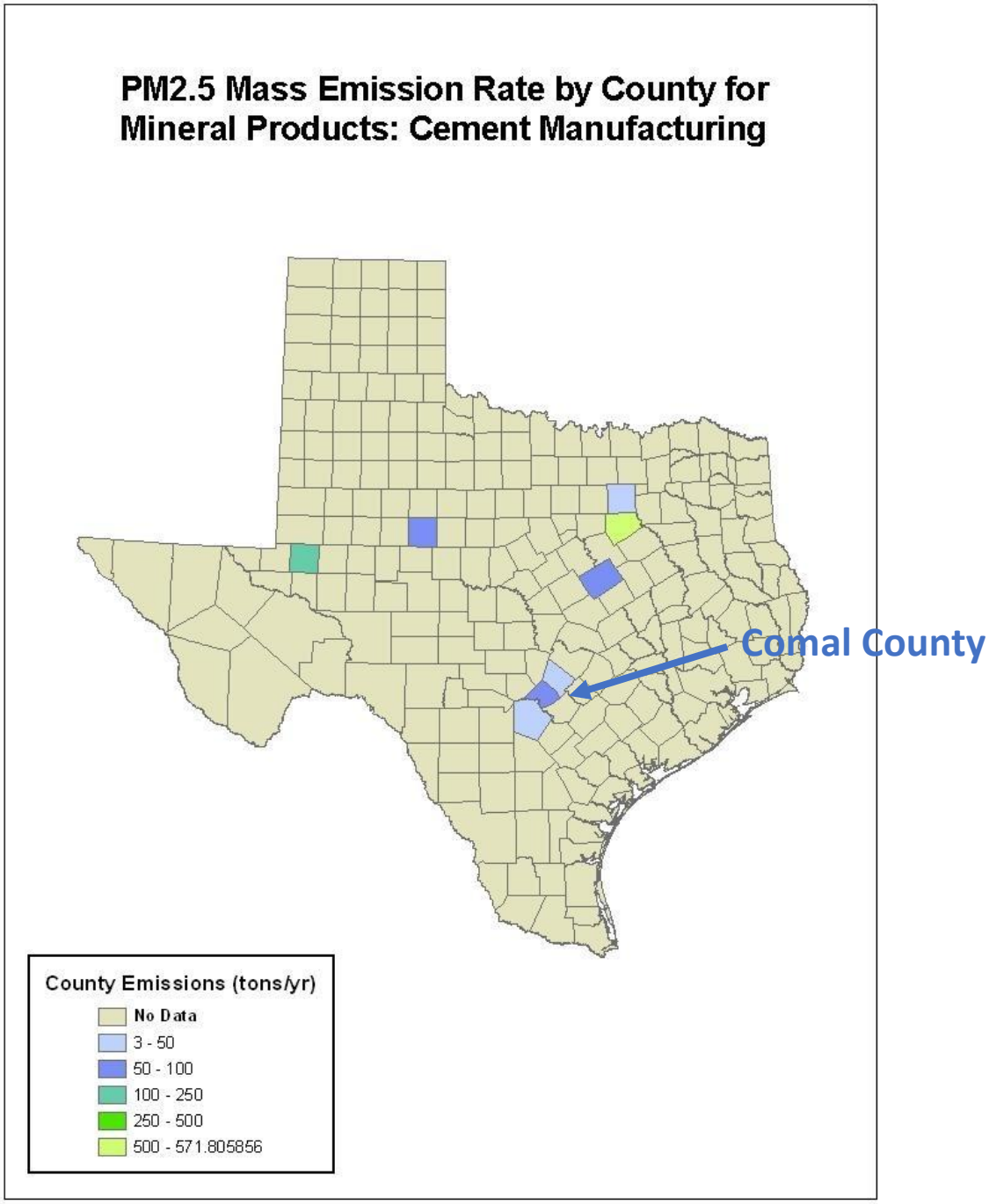
(~1,239 sq miles) is more than twice the size of Comal County (~559 sq miles), the relative exposure to Mineral PM_{10} in Comal County in 2002 was more than twice that in Bexar County. Annual exposure to Mineral Product $PM_{2.5}$ in Comal County in 2002 were also more than twice that in Bexar County. This compelling evidence clearly points to a need for more PM monitoring, data collection, and regulation.
Source: Government Census



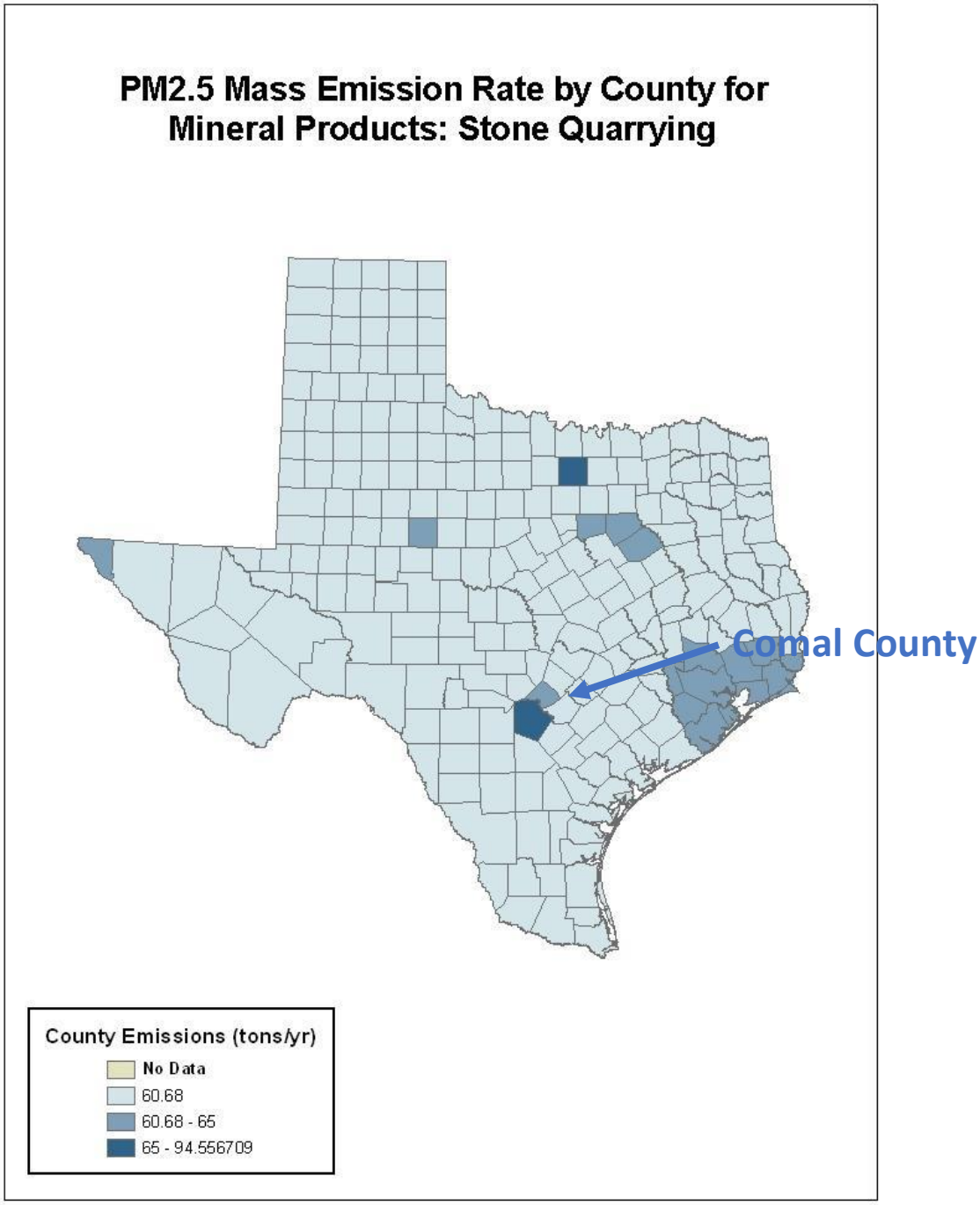
Source: Texas PM Emissions Atlas



Source: [Texas PM Emissions Atlas]



Source: [Texas PM Emissions Atlas]



Source: [Texas PM Emissions Atlas]

Health Risks Associated with Exposure to Airborne Pollutants Arising From Quarrying and Aggregate Processing

References

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WHO Health effects of particulate matter

EPA Particulate Matter (PM) Pollution

EPA Particle Pollution and Your Health

Kings College Particulate Matter and Health

Prepared by R Keith Randolph PhD, June 17, 2018

Dr. Randolph's career in biomedicine began at the Armed Forces Academy of Medical Sciences in San Antonio, Texas, U.S., where he graduated as a clinical laboratory technologist. He then graduated magna cum laude in chemistry and biology from Wayland College and earned a doctorate in experimental pathology from the School of Medicine at Wake Forest University. He has 40 years of experience in academia and industry as a basic researcher, consultant, author and speaker on topics related to human health and disease, and the factors that influence disease and health.

Evidence that Comal County Residents Are at Risk for Exposure to Air Pollution from the Aggregate Industry

Airborne Particulate Matter (PM) is a recognized pollutant that is produced by limestone aggregate processing, e.g., quarrying, rock crushing, cement, concrete, and asphalt manufacture.

Exposure to airborne PM is also recognized as a serious health hazard by biomedical researchers and health authorities such as the World Health Organization (WHO).

Over the past decade or more the aggregate processing industry has undergone significant expansion in Central Texas, most notably in counties that boundary Texas Highway 46 between New Braunfels and Boerne. This expansion depends upon Air Permits issued by the Texas Commission on Environmental Quality (TCEQ), which has issued 58 air permits for Comal County alone over the past decade, and no denials.

TCEQ grants air permits based upon mathematical modeling of anticipated emissions of PM (and other pollutants) based upon assumptions, some of which come from companies applying for permits, and ***without any measurement or monitoring of PM exposure of Texas residents that could be affected by PM emissions.***

This document summarizes what is known about quarry related PM emissions, and a relatively new satellite-based method that generates estimates of PM exposure, Aerosol Optical Density.

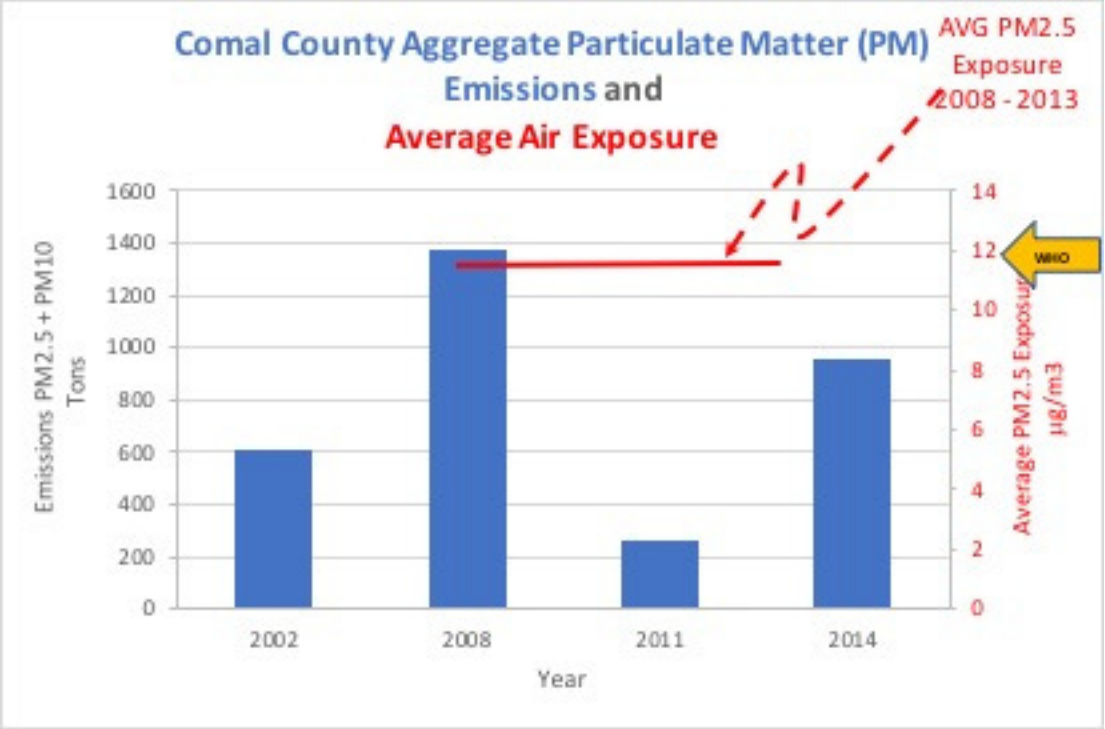

FIGURE EXPLANATION

The Left axis (blue bars) depicts aggregate industry sourced Particulate Matter (PM) emissions data obtained from the Environmental Protection Agency (EPA) National Emissions Inventory database for the years 2002 – 2014. These are the only data available.
https://www.epa.gov/air-emissions-inventories

The Right axis (red line) depicts the estimated atmospheric $PM_{2.5}$ exposure in Comal & Bexar Counties 2008 – 2013 from satellite-based aerosol optical density measurements. Data obtained from: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

The GOLD arrow right axis: World Health Organization's (WHO) health hazard exposure level threshold = 12 $\mu g/m^3$ $PM_{2.5}$.

Evidence that Comal County Residents Are at Risk for Exposure to Air Pollution from the Aggregate Industry

The map of Texas shown below is the visual rendering of the 2008 - 2013 averaged satellite-based aerosol optical density measurement of $PM_{2.5}$. Bexar and Comal Counties are indicated by the dashed circle and the label.
Note that the Bexar, Comal County PM2.5 compares to that in metropolitan Austin, Houston, and the Dallas-Fort Worth areas, all exhibiting average $PM_{2.5}$ levels at or above 11.5 µg/m^3.

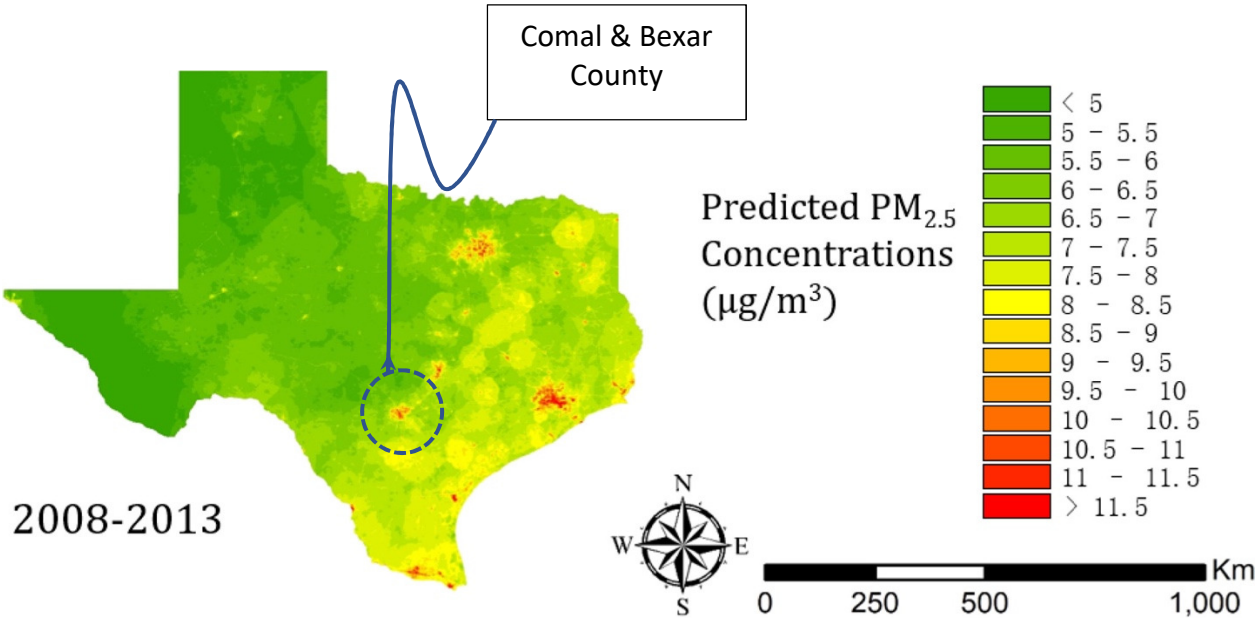

IMAGE: 2008 – 2013 Satellite-Based Aerosol Optical Density

Source: Zhang, X, Chu, Y, Wang, Y, Zhang K. Science of the Total Environment 631–632 (2018) 904–911 (UT Houston Health Science Center)

Subsequent to the initial white paper on this topic, there has been a significant publication by researchers from the Harvard University TH Chan School of Public Health that revises the WHO health risk exposure threshold to PM2.5 downward from ~12 µg/m^3 to less than 10 µg /m^3. This meta-analysis research, based upon results from 53 separate studies, reports significant risk for increased mortality for PM2.5 exposures as low as 10 µg /m^3 (see Table below).

Evidence that Comal County Residents Are at Risk for Exposure to Air Pollution from the Aggregate Industry

Table 2, from this publication, summarizes the all cause mortality risk increase for PM2.5 exposure at levels of 10 µg /m^3.

Estimates from meta-regression for the association between long term $PM_{2.5}$ exposure on Overall and Specific Mortality risk.

Mortality	Coefficient	SE	p-value	Percent increase at $PM_{2.5} = 10$, (%)
Inverse transform of average $PM_{2.5}$ $= \frac{1}{PM_{2.5}}$	0.071	0.038	0.060	–
Intercept (All-cause mortality)[a]	0.006	0.003	0.033	1.29(1.09–1.50)
Cause specific mortality				
Cardiovascular mortality	0.002	0.001	< 0.001	1.46 (1.25–1.67)
Lung cancer mortality	0.002	0.001	0.008	1.22 (0.87–1.39)
Respiratory mortality	− 0.002	0.001	0.139	1.13 (0.85–1.41)
Cardiopulmonary mortality	0.006	0.001	< 0.001	1.92 (1.59–2.25)
Elderly studies only (yes/no)	0.003	0.001	< 0.001	1.61 (1.35–1.85)
Female studies only (yes/no)	0.0002	0.001	0.892	1.31 (1.01–1.62)

[a] All-cause, all-ages mortality represents the reference group to indicators for cause specific mortality.

Source: E Vodonos A, Awad YA, Schwartz J. Environ Res. 2018 Oct;166:677-689.

Summary

Particulate matter emissions from aggregate industry sources have increased between 2002 and 2014 in Comal County from 600 tons/year to 900 tons/year.

Average exposure of Comal County residents to PM2.5 has been ~11. 5 µg /m^3 during the 2008 - 2013 timeframe.

The most current health risk assessment science provides evidence of increased risk for all cause mortality from average exposure to PM2.5 levels as low as 10 µg /m^3.

Available emissions data for Comal County since 2013 suggest that PM2.5 exposure may be higher now than 2008 - 2013.

Conclusion

There is good evidence that residents of Comal County have increased health risks from exposure to PM2.5.

This evidence is sufficient to warrant the need for PM2.5 monitoring and a curtailment of the continued expansion of PM2.5 producing industrial operations (such as aggregate processing).

Prepared by R Keith Randolph, PhD, January 27, 2019

From: [redacted]
To: MONOPS
Subject: Request for Comal County air quality monitors
Date: Friday, May 17, 2019 4:33:53 PM

Dear TCEQ,

I am writing in favor of air quality monitors for Comal county. I am a resident of Hays, which is next door, and I shop and play in Comal. Air quality is crucial for health of everyone in and near the county and it is cheaper to prevent problems than it is to fix them later.

It is especially crucial considering the power of the plant lobbyists in the area.

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
  - Davenport High School (under construction in Garden Ridge)
  - Smithson Valley High School
  - Rim Rock Ranch Community Center
  - Vintage Oaks Community Center
  - Danville Middle School
  - Oak Run Middle School

Thank you for your time.
Maria Price
[redacted]

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 10:53:55 AM

TCEQ:

I am writing to strongly recommend that you amend your air monitoring plan to include PM2.5 and PM10 monitoring in south central Comal County, along the TX 46 corridor where there are so many aggregate processing plants, and where there are numerous schools and semi-rural residents.

Sincerely,

R Keith Randolph, PhD
[redacted]

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 9:57:21 PM

This is a request to place air monitoring devices (placed and data obtained by TCEQ or a third party expert--not the quarry operators) at several strategic locations downwind from existing and proposed quarries (particularly the Vulcan quarry planned at the intersection of SH46 and FM3009), all in Comal County. The absence of proper quarry air pollution monitoring is unbelievable given the extent of quarrying operations in Comal County. The health of existing and future citizens need to be protected---if the quarries say they don't pollute, they should welcome third party monitoring to verify their claims. If they are polluting, TCEQ is our line of defense against the health risks resulting. Thanks

Joan and Robert Reeh
Owners of property located about one mile North of the proposed Vulcan quarry

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 11:54:30 AM

-----Original Message-----
From:
Sent: Friday, May 17, 2019 9:49 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

We must have air quality control monitors! The quarry is going to be a disaster for Comal County. Not just the air, but the cracking of slabs and windows from the blasting. I also believe a huge unintended consequence is the large trucks on our roads. We have many young drivers and I fear the possible death and injury with these extra trucks in our county.

Thank you for listening

Lindi Roberts

Sent from my iPhone

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Comal County Air Monitoring
Date:	Friday, May 17, 2019 11:58:12 AM

From:
Sent: Friday, May 17, 2019 11:11 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Comal County Air Monitoring

Since Comal County has historically exceeded safe limits for particulate matter (PM) emissions we need new air quality monitors that should measure **PM 2.5 dust and PM 10 dust**.

Stop putting profits above our health. If you kill us off how can you tax us?

Teresa Rodriguez

"The world is my country, all mankind are my brethren, and to do good is my religion."
- Thomas Paine

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 4:17:19 PM

From:
Sent: Friday, May 17, 2019 2:20 PM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

New Braunfels is primarily a tourist and retiree city. The air quality is paramount to keeping our citizens safe. The liability to the city and commercial excavation companies from lawsuits stemming from worsening COPD and allergies and other breathing problems of our residents is exacerbated by the lack of air quality control. We must have better air quality monitors or limit these businesses if we want to guarantee the growth of New Braunfels and surrounding areas.

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Saturday, May 18, 2019 1:46:44 PM

For the folks of Comal County Texas...please do the right thing!

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Thank you,
Michele Sobeck

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:29:14 AM

From:
Sent: Friday, May 17, 2019 9:02 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

TCEQ:

I have always wondered why we do not have air quality monitoring stations in Comal County, especially given the large industrial operations and the known federal air quality issues already in Bexar, our neighboring county to the south. Residents deserve to know how industry and growth is impacting our health! Is big industry paying you to keep us in the dark?

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County.**

- I would like to see **at least six** official air quality monitors in Comal County ASAP because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Regards,
John Sullivan

From:
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Monday, May 20, 2019 11:12:10 AM

Air Monitors Needed in Comal County
My family and I will live within 3.5 miles of Vulcan's proposed rock crusher site on the White Ranch. The fact that Comal County has 0 air quality monitors in Comal County is a travesty. How can TCEQ fulfill its purpose without a direct means to ensure these corporations actually comply with the regulations?

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of zero air quality monitoring stations in Comal County.

Comal County needs at least six official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.

•At a minimum, all new air quality monitors should measure PM 2.5 dust and PM 10 dust.

•Locations should be in central and southern Comal County (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).

God Bless and Semper Fi,
Steve

"May God himself, the God of peace, sanctify you through and through. May your whole spirit, soul and body be kept blameless at the coming of our Lord Jesus Christ. The one who calls you is faithful, and He will do it." - 1 Thessalonians 5:23-24

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:29:04 AM

From: [redacted]
Sent: Friday, May 17, 2019 8:54 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

As an over 50 Native Texan, I am ashamed that our politicians have not addressed the air pollution caused by these companies before now. It's time you do something to protect the greatest state in this nation by implementing the above items and limiting the destruction to our land, air and water by these companies.

Thank you, in advance, for listening and acting.

Gina Tharp
[redacted]
Sent from my iPad

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 11:57:25 AM

From:
Sent: Friday, May 17, 2019 10:14 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Cc:
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Good morning. I am writing in concern about air quality in our area. We are avid outdoorsman and run, swim, hunt, fish, do extracurricular activities and sports in. Comal County. We moved out here 17 years ago to move away from all of this and have a safe and quality filled life. Both my kids will be attending SVHS together next year and we do a wide variety of activities in the area. My kids are driving and safety is of upmost concern on 46/Smithson Valley Rd and all corridors of the county.

I feel and am on board with the rest fighting this battle. We need the following:
Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limitsfor particulate matter (PM) emissions.
At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
Recommended locations:
Davenport High School (under construction in Garden Ridge)
Smithson Valley High School
Rim Rock Ranch Community Center
Vintage Oaks Community Center
Danville Middle School
Oak Run Middle School

My main concern is in the area that I live, but I am also plugging for everyone else's health and safety too.

Thank you,

Susan Thorpe

From:	MONOPS
To:	Holly Landuyt
Cc:	Sally Klein
Subject:	FW: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date:	Friday, May 17, 2019 9:29:25 AM

From:
Sent: Friday, May 17, 2019 9:04 AM
To: MONOPS <MONOPS@tceq.texas.gov>
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County!**

- Comal County needs **at least six** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

Thank you,
Jennie

Sent from my iPhone

From: [redacted]
To: MONOPS
Cc: [redacted]
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Saturday, May 18, 2019 4:43:10 PM

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county. With this being stated, it is most important that that there is an Air Quality Monitoring Station. It is sad that TCEQ has a total of ZERO Air Quality Monitoring Station.

With the growth in this area and with building of schools and the existence of schools, there should be at least 6 Official Air Quality Monitors, **ASAP, as the county has exceeded the safe limit!**

Each new air quality monitor should; measure **PM 2.5 dust and PM 10 dust.** This includes areas between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge.

Suggested Locations are listed:
~ Davenport High School (under construction in Garden Ridge)
~ Smithson Valley High School
~ Rim Rock Ranch Community Center
~ Vintage Oaks Community Center
~ Danville Middle School
~ Oak Run Middle School

Thank you for your consideration! It is important to protect our Environment!

Cheryl Walthour
[redacted]

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Tuesday, May 21, 2019 8:35:17 AM

To Whom this may concern:

My husband and I are writing to you to voice our comments and concerns that "Air Monitors are NEEDED in Comal County.

Comal County must have at least SIX official air quality monitors as soon as possible. The county has EXCEEDED the SAFE LIMITS for the PM matter emmissions. These monitores MUST measure PM 2.5 dust and PM 10 dust.

These monitors MUST be in Central & Southern Comal County. This area should include the cities of Bulverde, Canyon Lake, New Braunfels and Garden Ridge. Also, the locations of Davenport High School, Smithson Valley High School, Rim Rock Ranch Community Center, Vintage Oaks Community Center and Danville Middle School and Oak Run Middle School.

We are concerned for the air quality of our families, the communities we live in, our future and would appreciate your company placing air quality monitors in places mentioned above, that will register the PM matter emmissions.

Thank you for your attention on this very serious matter,

Jean Williams

Harold Williams

[redacted]

From:
To: MONOPS
Subject: Air & Water Quality Monitoring Comments - Comal County
Date: Tuesday, May 21, 2019 8:15:42 AM

Hello,

I am responding to the TCEQ request for comments regarding air (surface water should be included) quality monitoring in Comal county. As stewards of environmental quality for Texas, I would hope TCEQ is aware of the numerous quarries, concrete, cement, and asphalt plants in Comal and Northern Bexar counties. Comal county is also experiencing an extremely high rate of new development, as well as a proposed new quarry at the junction of FM 3099 and SH 46. Additionally, a significant amount of road and heavy equipment traffic requires consideration. Each of these factors alone impacts air and water quality in Comal county, and the combined effects are significant. The prevailing winds are from the South for 10 months of the year, and from the North the remaining 2 months. With another couple of plants just to the North of Canyon Lake, it would seem the town of Startzville has a bull's-eye on it for particulate matter from the above mentioned facilities, and other known particulate matter generators to the South of Comal county. With the overall environmental impact in mind, it is imperative that air and surface water quality monitoring stations be included in the TCEQ 2019 Annual Monitoring Network Plan due to be submitted to the U.S. EPA by July 1st.

To quote another party, "PLEASE take care of Texas - it's the only one we've got!

The citizens and resources which you represent are counting on you for their environmental future. Thank you for your consideration and responsible actions of conscience in this matter.

Kind regards,

Hank Willis
Canyon Lake, TX

From: [redacted]
To: MONOPS
Subject: FW: Public Comment Re: Air Monitors in Comal County
Date: Tuesday, May 21, 2019 10:20:32 AM

This is a written Public Comment on the TCEQ air monitoring network, requesting new monitors and/or relocation of existing monitors.

Comal County is currently home to eleven open-pit quarries, nine asphalt plants, seven concrete batch plants, and two cement plants. Considering that quarry companies own over seven percent (over 25,000 acres) of all the land in the county, it's incredible that TCEQ has a total of **zero air quality monitoring stations in Comal County. There are even more quarries trying to come into this area.**

- Comal County needs **at least seven** official air quality monitors ASAP due to the reasons above and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School
    - Corner of FM 3009 and State Hwy 46

We apricate your consideration on this matter. Much of the time, appears that the TCEQ is more aligned with the large aggregate companies, rather than the citizens that live in the area, and have to breathe contaminates in the air and deal with the blasting.

Thank you,

Renee Wilson
[redacted]

From: [redacted]
To: MONOPS
Subject: Public Comment on 2019 TCEQ 2019 Annual Monitoring Network Plan
Date: Saturday, May 18, 2019 1:46:57 PM

I am a concerned citizen of Comal County. Both my wife and daughter have a genetic lung disorder called Alpha-1 Anti-trypsin deficiency. Air quality is directly proportional to their quality of life and longivity. Therefore:

- Comal County needs **at least six** official air quality monitors ASAP due to the many limestone surface mines and because the county has historically exceeded the safe limits for particulate matter (PM) emissions.
- At a minimum, all new air quality monitors should measure **PM 2.5 dust and PM 10 dust**.
- Locations should be in **central and southern Comal County** (the area between Bulverde, Canyon Lake, New Braunfels, and Garden Ridge).
- Recommended locations:
    - Davenport High School (under construction in Garden Ridge)
    - Smithson Valley High School
    - Rim Rock Ranch Community Center
    - Vintage Oaks Community Center
    - Danville Middle School
    - Oak Run Middle School

The real-time output of the monitors should be made available via the TECQ website.

--
John V. Young Enterprises, LLC
[redacted]

From:	[redacted]
To:	MONOPS
Subject:	from deer park
Date:	Tuesday, May 21, 2019 5:13:10 PM
Attachments:	image001.png

PLEASE do not decommission an air monitor in or near Deer park with what we have dealt with since the ITC fire. WE NEED MORE AIR MONITORS NOT LESS PLEASE.

Best Regards,

Lupe Gonzalez
[redacted]

From: [redacted]
To: MONOPS
Date: Tuesday, May 21, 2019 10:47:33 AM

Gentlemen:

Thank you for allowing the citizens of Jefferson County to comment on the application of Oxbow Carbon LLC to exceed the limits for Sulfur Dioxide and Lead into the atmosphere in and around Jefferson County, Texas. I ask that you consider seriously limiting the quantities of these materials which Oxbow has been allowed to put into our atmosphere.

It is my understanding that Oxbow's previous allowed pollution is restricting the growth of other industry who are or may be interested in locating or expanding in Jefferson County. It is also my understanding that this inability for growth directly impacts the economic development of our area and affects job growth causing further loss of our citizens who seek opportunity elsewhere. As our area is already contending with higher incidents of illness, particularly respiratory, our communities are paying high personal prices for Oxbow Carbon LLC to have the privilege of doing business in Port Arthur. I personally hope you will help in curtailing this and other pollution excess incidents.

I have also become aware that an effort to bring more clean energy operations to Port Arthur is being thwarted by activity that I consider potentially fraudulent. It is my understanding that an effort to force Port Arthur Steam Energy Company out of business is directly related to the need for Oxbow to avoid detection of its pollutants by allowing the heat in its operation to carry its pollutants high enough into the atmosphere to be blown over the TCEQ monitor designed to measure Oxbow's emissions. If public officials were used by Oxbow and/or its employees or contractors to in anyway thwart the operation of Port Arthur Steam Energy Company causing it to shut down and lay off employees, I would plead for you to investigate and take any findings into consideration for punitive action.

The citizens of Jefferson and area want industry to reside here and we are appreciative of the economic benefit all bring to us. We do not, however, appreciate those who choose to take unfair advantage of our goodness. We resent having to fight for clean air when we can show a higher incidence of adverse health among our citizens. We want and will support good neighbors and expect each and every one to respect the lives and health of each of our citizens. When any of those neighbors goes beyond a sense of fair play to gain an advantage over a competitor or to prevent others from competing, we expect our government agencies such as TCEQ to stand up for those of us whose voices are not strong enough to stand up against the big money of industries such as Oxbow Carbon LLC.

Please severely curtail or stop the emissions of Oxbow Carbon LLC.

Thank you for your consideration for this matter.

Nick Lampson
Former Member of Congress
[redacted]

From:
To: MONOPS
Subject: Comments on Oxbow Calcine
Date: Tuesday, May 21, 2019 4:59:55 PM

My name is Roger McGuire. I was an employee of Port Arthur Steam Energy for 12 years. Before that I was an employee of Dynegy Energy at Port Arthur. both companies were hindered by Great Lakes Carbon. Later Oxbow Calcine with problems of sulphuric dioxide. Oxbow would supply heat to us at about 2000 degrees and after going through our boiler the exhaust stack temperature would be 400 degrees. We captured about 1600 degrees of heat producing 750 pounds of steam at 750 degrees temperature.
I am sure that Oxbow was trying to disrupt P.A.S.E. Operations, thus driving P.A.S.E. Out of business. I have witnessed Oxbow be a “bad neighbor” to P.A.S.E. On many Occasions. P.A.S.E. was a Green Energy facility with a great safety record. I think It is a crime for Oxbow to get away with polluting our air and hurting the employees Of P.A.S.E. Means of making a living. Oxbow and Great Lakes Carbon have gotten away with this since 1936.

Roger Dale McGuire Maintence technician Retired

Sent from my iPad

From:
To: MONOPS
Subject: Oxbow Calcine
Date: Wednesday, May 22, 2019 12:38:43 AM

.Hello and thank you for giving the people of Jefferson County a voice to discuss the problems with Oxbow.I am a former outside operator for Port Arthur Steam Energy. I lost my job back in January of this year due to the problems they have dealt my company and the citizens of Jefferson County. It has been a brutal partnership from the beginning. Oxbow is not a team players in this partnership. We had three Delteck boilers running and started to notice they would just call and say you have to shut a specific boiler down. They say they had some specific test they had to run. So we at P.A.S.E would shut the boiler down there request . Mainly at first it was the #4 boiler. My board operator logs every move made by Oxbow Or By PASE. Very Detailed LOG!! After Months Of THIS HAPPENING we started to TREND why this was happening. Months go into Year or More they refuse to give us flue gas back to the number #4 boiler without a reason. Would not let us bring it back online! A short bit later they shut flue gas from out #3 boiler. (Number 3 boiler is in the middle of the plant) They would only provide the 2000 degree Fahrenheit gas to the number 5 boiler. Number 5 boiler is located on the ship channel furthest from the tecq monitor. It wasn't a short time later Oxbow was calling our board operators and making excuses and diverting heat from #5, causing us to have to shut down our steam turbine(because anything less than 100kpph will damage it) Well the Trend started to show that anytime the wind blew out of the south the boilers suffered and the hot stacks were utilized(Diverting Heat Away From Our Boilers). On one boiler we would go from 120kpph as low as 50kpph when we had a southern wind. After long extensive trends were ran and through several sets of eyes, it was obvious there was no testing, they were simply just bypassing our green system and running the hot stacks. The hot stacks are much taller and the exhaust gasses are not only hotter, but the velocity's are truly not comparable. The gases are released hotter and faster, which means they run farther up into the atmosphere and able to pass over the monitor in place. So they think because there getting away with it that's its within the air quality permit. NO FOR A FACT ITS NOT! DEFEATING THE MONITOR IS NOT IN COMPLIANCE!!!!! When those gases are ran through the P.A.S.E System that high temp gas is Captured!!!!!! It then run though the boiler leaving heavy residues, and when it leaves the boiler it then enters what is called a MULITICLONE at a bear 400 decrees Fahrenheit It is a special system unto which pulls Over 800lbs or more of a corrosive ash per 12 hours run time. I personally have had to change these catch bags twice in my 12 hour shift. So that's up to 1600lbs of corrosive ash in a 12 hour period!! Thats just out of one boiler!! They also wash this corrosive black ash into catch ponds at the rear of this plant which is less than 100 yards from the Sabine Ship Channel. I have personally seen paint jobs on brand new vehicles be eaten smooth up by the use of the hot stacks. So if they can shut P.A.S.E. down and do as they please, What Do You Think The People Of Jefferson County Are Breathing Everyday! This Cant Continue.

Thank You
Roger Dwayne McGuire (Former Outside Operator)

From:
To: MONOPS
Subject: comments on TCEQ 2019 Annual Monitoring Network Plan
Date: Sunday, May 19, 2019 1:43:32 PM

Overall it appears TCEQ did not do a lessons learned session after Shell, ITC, or KMCO, and consider where they needed to put monitors so they could make claims the air was non-toxic. All comments should reflect recent and current events that revealed flaws in the system as built and operating, including the lack of understandable reporting.

WIth DoD, DOE, lessons learned were mandatory. One lesson should have been don't make claims you can't support, as no one provided absolute proof of their opinions.

TCEQ should work backwards from the geographic locations of those that reported for medical attention following the plumes to the extinction location downwind install monitors there.

TCEQ should analyze for those elements and compounds related to the conditions they were suffering. Recollection is I saw a Mercury chart on a wall during ITC and during Texaqs.

Do they have any lead on site at ITC or KMCO? Do they blend aviation gasoline at those sites? do they supply octane improver to small bottlers?Does their document correspond to a reduction in funding? They might claim money saved, but public health damaged costs more.

As I recall, there was no Carbon Dioxide monitor in all of Texas, add those all around for source identification and path. CO2 emitters cause and have lower cognitive performance.

Personally I have two carbon dioxide monitors, one inside, one outside. Texas can do better than zero, unless there are executive orders.

Release, report and chart, for easy understanding, all the data acquired and accumulated from all the monitors detailed through the report and appendices.

Kingwood had C0309, particulate monitor, and C0555, ozone monitor, taken away to other locations, put those back, and add the metrological package that was requested years ago.

Report all monitoring data in real time and 5 minute averages in addition to the worthless 1 hour average reported an hour and a half late.

Recollection is that the system was sold on the basis of 15 minute data, but fact is there are 5 minute averages, and better networks now than when this system was pitched and sold.

Measure all emission sources and report with detailed and complete health effects so the public knows who is poisoning them.

Calculate the health effect potential for all of the hardware, sampling, testing elimination itemized in the report.

Install more GCs, for all the comment of how instrumented Houston is, Houston has less GCs

than Dallas. Houston has nine reporting, Dallas has fifteen reporting today.

How much of the world refining capacity is in Dallas? Nearly zero, ratio up and factor from that and add more GC, PM2.5 monitors all around Houston from point sources to far suburbs. PM2.5 monitors are completely inadequate for the 4th largest city in the nation with more petroleum processing than any other single geographic location.

Don't reduce monitoring, increase monitoring throughout Houston and Texas to be able to exactly identify the source location and flow rate to the minimum limit of measurement far away.

Perform elemental, component, mineral analysis of all TEOM filters using MS-ICP, XRF, XRD, and particle sizing equipment.

DIAL LIDAR all pollutant emitter fence lines. Current methods allow Shell to release 326,166 pounds of carcinogenic 1,3-butadiene without detection.

Flush all reference to the deceptive AQI, Air Quality Index that perpetuates the deception that any level of PM2.5 particulate is good.
10 ug/m3 is 10 times worse than 1 ug/m3, but acceptable to TCEQ, well documented 10 ug/m3 will shorten lives as shown when analyzing deaths of 20 million in a 60 million cohort.

The toxicity of PM2.5s depends on associated elements/compounds including neurotoxins lead, mercury, manganese, as well as the other Hazardous Air Pollutants, etc..

There is no acceptable level of PM2.5 use real numbers not AQI fraud. PM2.5s of 1 ug/m3 damages virtually all human, animal, and plant systems. Ozone is not good for living things.

The thousands of papers and studies performed on millions of humans did not use a calculated AQI, they used microgram per cubic meter. Using AQI is deadly misrepresentation.

Fact is there is cancer in Houston, stop the wussy science chat of 'could, might, etc.' put in monitoring to match the locations of those poisoned and their upwind and downwind paths.

Acquire, tie in and report in all the industry 'self' monitors. The industry reps report everything is good during events without proof or support, prove it.

Stop showing and counting the metrological stations as pollution monitors, they aren't. Do provide real time wind direction and speed with every monitor. Use wunderground equipment, it's cheap.

Install particle size analyzers at all TEOM locations. In meantime retain all the filters and analyze particle size distribution, see previous.

PM2.5s are deadly, smaller particulates are even more deadly. Install equipment to measure Ultrafine Particles and report real time, 5 minute average, 15 minute average and hourly.

Acquire, install and real time report instrumentation and calculation that match pollutant reality better than demonstrated at ITC and KMCO

Government, regulator, industry proclaimed the air was good at ITC and KMCO while the public saw the dense black clouds of toxins rising and going downwind, how much landed where?

Massive emissions from ITC, KMCO and Shell prove the need for current measurement systems such as remote sensing, drones, DIAL LIDAR and Solar Occultation.

Those ITC toxins covered Bellaire according to colleagues in that location, but were never reported on news or web, put in enough monitoring to represent reality of downwind distribution.

Install monitoring systems that are appropriate to the hundreds and thousands that are on downwind paths from industrial point sources, not just those across the fence.
I
nstall monitoring systems that reflect the locations of the sources and those poisoned in previous emission events: ITC, Shell, KMCO, Texas City, etc

Considering the ITC and KMCO ignorance as they appeared not to know what or how much was in tanks; hire tank measurement companies that remotely measure tankage, like crude tanks at Cushing.

Could argue more important to generate graphics that communicate to all, rather than more hardware. Show all numbers, not green dots, humans and animals are affected at lower levels than used.
I
mplement pollutant real time data kriging and mapping for all pollutants from source release to landing destination for each individual pollutant and all pollutants combined.

Implement pollutant 5 minute average data kriging and mapping for all pollutants from source release to landing destination for each individual pollutant and all pollutants combined.

Implement pollutant 15 minute average data kriging and mapping for all pollutants from source release to landing destination for each individual pollutant and all pollutants combined.

Implement pollutant 1 hour average data kriging and mapping for all pollutants from source release to landing destination for each individual pollutant and all pollutants combined.

Publish all elemental and particle analyses that have been performed using Texas funds. A vast amount of data does not get reported to the public. Don't like the emission, don't report it.

Thanks.

Lucy Randel
[redacted]
21 May 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

RE: Comments to Texas Commission on Environmental Quality 2019 Annual Monitoring Network Plan

In light of recent emissions events where placement of existing monitors left many residents with incomplete information on their exposure to pollutants, it saddens me that this report focuses on meeting regulatory requirements for criteria pollutants without taking the opportunity to improve information related to public health monitoring. The monitoring network is based mainly on population but it should take into account pollution sources as well.

TCEQ should take this opportunity to reassess the network with respect to known deficiencies observed. Monitors should be placed in areas where emissions are likely to be detected. Since wind is variable, monitors should be located in multiple directions around major sources. If the argument is that these monitors are to be used for long term averaging for federal compliance, then additional monitors capable of measuring acute releases should be included in a separate network.

PM2.5 particulate matter

Add particulate monitors in west Houston.

Even though we have twice the required PM-2.5 monitors in Houston, as we saw with ITC Fire, they are clustered on the east side of Houston. The wind typically blows from SE toward congested traffic corridors that will add to industrial or other releases being transported. A monitor is proposed for Houston West End, but has only NOx and ozone, no PM. Considering the lack of PM monitors in the area, a collocated PM-2.5 monitor for Houston West End would provide valuable data for the region.

Sulfur Dioxide

Add Sulfur Dioxide monitors in Permian Basin

A recent report by Environmental Integrity Project
http://www.environmentalintegrity.org/wp-content/uploads/2019/05/West-Texas-Air-Pollution-Report-5.9.19.pdf
on sulfur emissions in the Permian Basin highlights the need for additional monitors. Data in the report identify several sources that exceed 2000 tons SO_2 emissions. Your report specifies that the Data Requirements Rule "requires air agencies to characterize air quality around sources emitting 2,000 tons per year (tpy) or more of SO_2 not located in a previously designated nonattainment area." Data for this determination should not be limited to permitted sources only since large quantities of unpermitted emissions are being released through flaring and other activities.

Sincerely,
Lucy Randel, MSChE

From:
To: MONOPS
Subject: Comments on 2019 Monitoring Plan
Date: Tuesday, May 21, 2019 11:49:00 AM

Hi,
I want to comment on the air monitoring plan. The plan is not strong enough on following EPA guidance for locating air quality monitors to protect the public. We need stronger monitors for SO2 and smog going into the ozone. Houston's air quality is already terrible most days we need stronger regulations NOW.

Thanks,
Chloe Roman

From:	Garcia, Adrian (Commissioner Precinct 2)
To:	MONOPS
Cc:	Banks, Kris (Commissioner Precinct 2); Lee, Kristen (Commissioner Precinct 2); Lykes, Mike (Commissioner Precinct 2)
Subject:	2019 Annual Monitoring Network Plan Comments
Date:	Tuesday, May 21, 2019 4:27:31 PM
Attachments:	image006.png image003.png image005.png image008.png TCEQ 2019 Annual Monitoring Network Plan Comments.PDF

To Whom it May Concern:

Please find the attached comments in regards to the TCEQ's 2019 Annual Monitoring Network Plan. I have copied the letter in the body of my email below, and a physical copy of this statement has also been mailed from my office.

Please confirm receipt of these comments, and do not hesitate to reach out to my office should you have any questions.

Thank you for your consideration.

May 21, 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087
monops@tceq.texas.gov

Re: Comments regarding the Texas Commission on Environmental Quality 2019 Annual Monitoring Network Plan

Ms. Landuyt:

In recent months, Harris County Precinct 2 has endured numerous, frequent, large-scale pollution events that, among other consequences, have significantly negatively impacted the air quality in our region. I hope that you will take into account these events when considering the concerns I express here regarding the draft 2019 Annual Monitoring Network Plan.

Primarily, I encourage the TCEQ to consider placing monitors in locations that not only fulfill the federal guidelines, but also aid and inform first responders and the public during emergency emission events. I understand that this network's intended use is to monitor regional ambient air quality. However, the residents of Precinct 2 necessarily rely on the network as an emergency response tool because there is no other data of this nature available to communities nearest our industrial neighbors. Therefore, a more comprehensive network of stationary monitors that is designed with the purpose of informing and protecting vulnerable communities – one that provides real-time and easily accessible information to residents – is desperately needed. Additional monitors would also help to alleviate the concerns that arose in the wake of the Intercontinental Terminal Company fire in Deer Park when it became apparent that there was a gap in the information collected because, as noted by TCEQ Chairman Niermann in his March 28 letter to me, a monitor was out of service

because it was undergoing routine maintenance at the time.

In addition, while I understand the stated reason for moving the Speciated PM 2.5 monitor from Aldine to Clinton, I would like to emphasize that *both* communities deserve access to this type of monitoring because *both* communities bear a significant and disproportionate air quality burden. I strongly encourage the TCEQ to advocate for additional monitoring in this network rather than moving monitors away from communities that have come to rely on the information provided by those monitors. To that end, I encourage the TCEQ to explore the possibility of adding a near-road monitor to the east side of Harris County – Highway 225 or Interstate 10 – to gather a better understanding of the impact of significant heavy truck traffic to nearby communities.

Finally, I would like to encourage the TCEQ to participate in more robust outreach to encourage community input during this notice and comment period in the future. Air quality is a top priority for Precinct 2 communities and I believe the plan would greatly benefit from consideration of residents' concerns.

Thank you for considering my comments.

Respectfully,

Adrian Garcia
Harris County Commissioner, Precinct 2

Adrian Garcia

Harris County Commissioner, Precinct 2

Office: 713.755.6220

ADRIAN GARCIA
COMMISSIONER

May 21, 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087
monops@tceq.texas.gov

Re: Comments regarding the Texas Commission on Environmental Quality 2019 Annual Monitoring Network Plan

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Thank you for considering my comments.

Respectfully,

Adrian Garcia
Harris County Commissioner, Precinct 2

Capital Area Council of Governments Clean Air Coalition

6800 Burleson Road, Building 310, Suite 165, Austin, Texas 78744
(p) 512-916-6000 (f) 512-916-6001
www.capcog.org

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City of Bee Cave

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Council Member Tammy Young
City of Round Rock

Judge Sarah Eckhardt
Travis County

Commissioner Terry Cook
Williamson County

May 21, 2019

Ms. Holly Landuyt
Texas Commission on Environmental Quality (TCEQ)
P.O. Box 13087, MC-165
Austin-TX 78711-3087

Subject: Comments on *2019 Annual Monitoring Network Plan*

Dear Ms. Landuyt:

The Clean Air Coalition (CAC) appreciates this opportunity to comment on the Texas Commission on Environmental Quality's (TCEQ's) 2019 Annual Monitoring Network Plan. Our chief comment is on the proposed relocation of the Austin Northwest monitor (CAMS 3), which we are aware is prompted by Austin Independent School District's (AISD's) planned construction at the location starting in the summer of 2019. This monitor is currently recording the region's highest ground-level ozone (O_3) measurements, and we are concerned that relocating this monitor too far away from its current location could result in a loss of data continuity and therefore make it harder for the region to remain designated "attainment" for federal ozone quality standards. This site is one of the oldest sites still operated by TCEQ, and therefore provides an invaluable reference point for tracking air pollution trends over time for the Austin metro area and the state as a whole.

It is our understanding that EPA allows a relocated monitoring station to be treated as essentially the same site if stays within 1 mile of the existing location, and we are encouraged that TCEQ may be able to relocate the monitoring station to another location at Murchison Middle School. We strongly encourage TCEQ to keep the station at the Middle School if possible or try to find another location within 1 mile if that is not possible. If neither of these options works, we request that TCEQ consult with CAPCOG and the CAC on where to relocate the station. It is also important that any relocation of the monitor enable as much data collection during the 2019 ozone season as possible. We request that the final version of this plan include as many details about the relocation this station as possible and information about implications for meeting federal monitoring requirements and the designation process for any revised 2020 O_3 NAAQS if CAMS 3 again records high O_3 in 2019 and a suitable site nearby cannot be secured.

Sincerely,

Monty Parker

Bee Cave Mayor Monty Parker
Chair

Jane Hughson

San Marcos Mayor Jane Hughson
Vice Chair

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

RE: Comments to Texas Commission on Environmental Quality 2019 Annual Monitoring Network Plan

Air Alliance Houston (AAH) believes that everyone has a right to breathe clean air and that where you live should not determine your health. Our organization's goal is to improve air quality in the Houston area through research, education, and advocacy. We appreciate the opportunity to submit comments regarding the 2019 Air Monitoring Network Plan (AMNP).

In terms of the proposed AMNP's adherence to the standards set forth in Title 40 Part 58.10 of the Code of Federal Regulations (CFR), our organization assumes the plan meets the standards for approval by the Environmental Protection Agency. We also acknowledge that the regional AMNP appears to exceed the monitoring requirement guidelines described in the CFR.

However, our objection to the AMNP is not confined to the adherence of the plan to the regulatory goals of determining ambient air quality values. Rather, Air Alliance Houston takes issue with the utility of the network to provide meaningful information for Houston communities when, too often, the practical use of the Houston-area air monitoring network is as an unofficial emergency response tool.

Since mid-March of this year, the Houston area has endured one significant air emission event after another. The most significant of these events is arguably the ITC fire in Deer Park. The ominous black cloud resulting from the event reminded residents from one end of the county to the other about the persistent threat from industrial pollution our region faces. In addition to the catastrophe at ITC, in the last two months we've seen fires at Exxon and Chevron in Baytown, KMCO in Crosby, and – most recently – a large release of reformate from an accident in the Houston Ship Channel near Seabrook.

In each of these events, desperate Houston-area residents have sought guidance from their State environmental agency in making decisions to protect their family and loved ones and have received only vague reassurances regarding the air quality. Many who have sought access to the data from the stationary air monitoring network have been discouraged by the technical difficulty of accessing the information and the irrelevance of the data to nearby pollutant sources.

Although the ITC fire and other recent events have brought renewed awareness of the confluence of public health and industrial safety, the events of the last few months are not uncommon in the Houston area. A 2016 *Houston Chronicle* investigation found that the Houston area experiences a chemical fire, explosion, or chemical release an average of every six weeks, and a recent working-paper by researchers at the University of Indiana found that the damages to public health caused by excess emissions from Texas industries amounted to a monetary cost of approximately $241 million per year.

Houston area fenceline communities – that is, those that live in close proximity to hazardous industrial facilities – are most at risk from these events and need an air monitoring network with the capability to inform them when they are being exposed to adverse air quality conditions. The information they need to make informed decisions regarding the precautions necessary to protect the health and safety of their families must be easily accessible, have clearly defined actionable exposure thresholds, be easily interpreted, and relevant to the chemical risk profile of the community. Community stakeholders should be engaged across the Houston area to identify the concerns residents have about the local air quality, and the implementation of the regional monitoring network should better reflect those concerns.

While AAH is aware that the current ambient air quality monitoring network isn't designed to assess the risk from acute exposures, we also know that that is precisely what many Houston-area communities say they need most. We maintain that recent and historical events call for a reassessment of the purpose of the regional air monitoring network, and a refocusing of that purpose that is more consistent with TCEQ's mission to protect public health. Of course, we believe that ambient air quality monitoring is a crucial component to determining regional air quality, but we also believe a co-benefit of the monitoring network should be to provide vital information about adverse air quality conditions to at-risk communities.

Thank you for your time,

Corey Williams
Policy and Research Director, Air Alliance Houston

Pollution Control Services Department
101 S. Richey, Suite H
Pasadena, Texas 77506
FAX: 713-274-6475 713-920-2831

May 21, 2019

Texas Commission on Environmental Quality
P.O. Box 13087
Attention: Holly Landuyt, MC-165
Austin, Texas 78711-3087

RE: 2019 Texas Commission on Environmental Quality Annual Monitoring Network Plan

Dear Ms. Landuyt:

Thank you for the opportunity to submit comments regarding the 2019 Texas Commission on Environmental Quality (TCEQ) Annual Monitoring Network Plan. Harris County Pollution Control Services Department (PCS) is the local regulatory enforcement authority for air, water, and solid waste issues in Harris County, Texas. We understand that TCEQ has solicited comments regarding the above plan.

PCS understands that TCEQ proposes decommissioning or moving certain monitors for particulate matter of 2.5 microns or less ($PM_{2.5}$). Specifically, the plan proposes replacing the Houston Aldine continuous tapered element oscillating microbalance sampler (TEOM) with a newer federal equivalent method (FEM) $PM_{2.5}$ monitor, decommissioning the Deer Park 2 TEOM while continuing to operate a FEM $PM_{2.5}$ monitor, and proposes moving a speciated $PM_{2.5}$ monitor from Houston Aldine to the Clinton Drive monitoring site. $PM_{2.5}$ monitoring data at these sites has been of great interest to local governments and the public and was very useful in monitoring the smoke plume from the recent Intercontinental Terminals fire. PCS urges TCEQ to ensure that 1-hour $PM_{2.5}$ monitoring data from these sites will continue to be publicly available.

PCS appreciates this opportunity to offer comments. Should you have any questions, please contact Matt Van Vleck, Air Specialist - Harris County Pollution Control Services Department at 713-920-2831 or by e-mail at matt.vanvleck@pcs.hctx.net.

Sincerely,

Dr. Latrice Babin
Interim Director

cc: Ronnie James, Harris County Judge's Office
Kristen Lee, Harris County Precinct Two
Rock Owens, Harris County Attorney's Office
Nicole Bealle, TCEQ Region 12

MVV

William Carl McClain
General Manager, El Paso Refinery Operations

212 N. Clark St.
El Paso, Texas 79905
Tel: 915.775.3300
Western Refining Company, L.P.
A subsidiary of Marathon Petroleum Corporation

VIA EMAIL to monops@tceq.texas.gov

May 21, 2019

Ms. Holly Landuyt, MC-165
Monitoring Operations
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Re: Marathon El Paso Refinery Comments on TCEQ Proposed 2019 Annual Air Monitoring Network Plan

Dear Ms. Landuyt:

The Marathon El Paso Refinery respectfully offers the following comments on the Texas Commission on Environmental Quality's ("TCEQ's") proposed 2019 Annual Air Monitoring Network Plan (AAMNP) with respect to the established monitoring, planned changes, and possible additional changes for El Paso.

Western Refining Company, L.P. d/b/a Marathon El Paso Refinery is a wholly owned indirect subsidiary of Marathon Petroleum Corporation ("MPC") and owns the petroleum refinery located in El Paso, Texas. MPC is a leading, integrated, downstream energy company headquartered in Findlay, Ohio. The company operates the nation's largest refining system with more than 3 million barrels per day of crude oil capacity across 16 refineries. MPC's marketing system includes branded locations across the United States, including Marathon brand retail outlets. Speedway LLC, an MPC subsidiary, owns and operates retail convenience stores across the United States. MPC also owns the general partner and majority limited partner interests in two midstream companies, MPLX LP and Andeavor Logistics LP, which own and operate gathering, processing, and fractionation assets, as well as crude oil and light product transportation and logistics infrastructure.

Western Refining fully supports TCEQ's planned changes to the AAMNP for El Paso. TCEQ's planned changes incorporate a good balance of enhancing monitoring to provide critical information to better understand ambient ozone and particulate concentrations in El Paso while eliminating other less critical monitoring such as semi-volatile organic compounds and reducing the frequency of or number of certain collocated monitors. We support the addition of ozone and $PM_{2.5}$ continuous monitoring at the Ojo de Agua monitoring location to enhance the understanding of ozone, $PM_{2.5}$, and possible wildfire contributions to ozone.

Regarding the "proof of concept" brown carbon monitoring at UTEP using the tricolor absorption photometer, if this concept results in reliable monitoring for brown carbon, we recommend continuing this monitoring or installing some other type of monitoring to assess brown carbon concentrations during the months of May through September in future years to help support TCEQ determinations of wildfire impacts on ozone concentrations in El Paso. Since this monitoring would not be required by EPA, it may be done outside of the AAMNP.

We also recommend that TCEQ consider the following additional monitoring changes for El Paso either for the 2019 plan or in the future:

- Continuous $PM_{2.5}$ monitoring at Skyline and/or Chamizal
- Additional speciation of $PM_{2.5}$ at UTEP and/or Skyline
- Additional ceilometers to provide mixing height at various monitors

These monitoring additions would be useful for analyzing potential wildfire-impacted dates for El Paso. With the NAAQS for ozone at 70 ppb, the potential impacts of wildfires in the hot, dry desert southwest has become a critical issue that must be fully understood to continue to support an attainment designation for El Paso. TCEQ may want to consider this additional monitoring as a research project rather than as part of the AAMNP. Conducting the additional monitoring outside of the AAMNP would allow TCEQ to obtain this potentially critically important monitoring information during the wildfire months of May through September will allowing the monitors to be shutdown for cost savings during other months. Due to the nature of the $PM_{2.5}$ 24-hour standard relying on the 98th percentile value, we would not support partial year $PM_{2.5}$ monitoring if the monitoring results must be considered when determining the design value.

To provide cost savings that might be applied to implement additional monitors, TCEQ may want to consider decommissioning the PAMS GC monitor at Chamizal. This monitor may not be providing useful information at this time.

We appreciate TCEQ's consideration of our comments. For further information, please contact me at 915-474-7897 or MLTextor@MarathonPetroleum.com.

Sincerely,

Marise Lada Textor

Marise Textor
Manager, Regulatory Affairs

8-Hour Ozone SIP Coalition

May 21, 2019

Texas Commission on Environmental Quality
Monitoring Operations Division
P.O. Box 13087
Austin, TX 78711-3087
Attn: **monops@tceq.texas.gov**

RE: Proposed 2019 Draft Annual Monitoring Network Plan

The 8-Hour Ozone SIP Coalition (Coalition) appreciates the opportunity to provide comments to the Texas Commission on Environmental Quality (TCEQ) on its draft Annual Monitoring Network Plan (AMNP). Title 40 Code of Federal Regulations (CFR) §58.10 requires states to submit an annual monitoring network plan to the United States (U.S.) Environmental Protection Agency (EPA) by July 1 of each year. This monitoring plan is required to provide the implementation and maintenance framework for an air quality surveillance system, known commonly as the ambient air quality monitoring network.

The Coalition's members are energy and petrochemical companies with the common goal of achieving clean air and a strong economy for Texas. The Coalition uses science to understand the underlying drivers of ozone formation, and our members have invested billions of dollars in state-of-the-art emissions controls since 2001. These measures have achieved unprecedented ozone precursor emission reductions in the Houston-Galveston-Brazoria (HGB) ozone nonattainment area and contributed to a substantial reduction in statewide ozone levels. Of note, from 2000 to 2016, the HGB population increased by 44%, while the eight-hour ozone design value decreased by 29%. In addition, the HGB area is measuring attainment of the one-hour ozone standard, which has decreased by 40% since 2000, and is at all-time low concentrations.

The Coalition concurs with the priorities and network changes articulated in the proposed AMNP. However, the Coalition recommends additional changes to certain monitors in key nonattainment areas like HGB to capture compounds that are commonly considered tracers for a variety of ozone precursor emissions from wildfires. At times, these emissions can cause ozone levels to exceed the National Ambient Air Quality Standard. The Clean Air Act provides statutory relief for areas that have experienced these exceptional events, and provides guidance to states about how to demonstrate that an ozone exceedance was caused by emissions from wildfires, and that that exceedance would not have occurred but for those emissions. However, making this demonstration without the directly observed presence of wildfire tracer compounds is challenging and time-consuming for states, and demonstrations are not always approved by EPA. The ability of a state to submit a demonstration that includes observed wildfire tracers present in the region could greatly bolster a state's ability to prove wildfire influence.

There are several options available to states to obtain wildfire tracer data. The oxygenated VOCs like acetaldehyde, acetone, etc. can be measured at existing monitoring stations using automated

cartridge samplers or active sorbent media and off-line analysis, similar to the benzene fence line monitoring program. These methods concentrate the analytes onto an adsorbent, thus detection limits can be sub-part per billion (ppb) range for some compounds. The sorbent methods could be carried out at a wide range of monitoring sites at reasonable cost and agencies would have the option to carry out the off-line analysis or not, depending on the need for the data. However, used in this way, the data will be in the form of a several hour average, making it more difficult to show a correlation with hourly or sub-hourly carbon monoxide (CO), ozone (O3) and/or particulate matter (PM).

To get higher time resolution data for identifying wildfire influences, more advanced analytical methods will produce more useful results. For example, it is possible to calibrate a commercially available chemical ionization mass spectrometry (CIMS) or proton transfer mass spectrometry (PTRMS) to measure a suite of VOCs including acetonitrile, formic acid, acetone, acetaldehyde, or some combination of those on an at least an hourly basis if not faster and at levels in the sub-part per billion (ppb) range. The CIMS data can be paired with hourly (or faster) CO/O3/PM data to show convincingly the presence of wildfire tracers along with concurrent increases in ozone during an individual day. However, the PTRM methodology is significantly more expensive than sorbent methods, thus limiting the number of sites that could be sampled. Ideally, a study could be conducted involving a careful PTRMS campaign simultaneously with the sorbent methods, allowing for an improved understanding of the utility of both methods for identifying wildfire influence.

The Coalition recognizes that the addition of advanced sampling equipment and techniques, and the staff needed to operate them, comes with additional costs. However, in several areas across the state of Texas, emission reductions from local sources have reduced ozone to such a degree that these wildfire-caused exceptional event days have dramatic policy relevance. The ability to directly measure wildfire tracers in real time could lend much-needed data to exceptional event demonstrations, which could mean the difference between attaining the standard or not, or placing an area into a lower classification. The ability to accurately measure tracers and develop a high-quality exceptional event demonstration also allows the State to focus State Implementation Plan activities on emissions that the State can control.

In conclusion, the Coalition supports the AMNP provisions as written, and requests that the TCEQ evaluate the feasibility of adding wildfire tracers to this or future network plans or in any other manner/program that the TCEQ deems appropriate. We appreciate your consideration of these comments. If you have any questions, please contact me.

Sincerely,

Elizabeth Hendler
Project Coordinator
Ehendler42@att.net
512-257-7322

From:	Sharon Wilson
To:	MONOPS
Cc:	emilylindley@tceq.texas.gov; jonniermann@tceq.texas.gov; tobybaker@tceq.texas.gov
Subject:	Comments: 2019 Annual Monitoring Network Plan
Date:	Tuesday, May 21, 2019 7:18:04 AM
Attachments:	Earthworks' comments on TCEQ's 2019 Annual Monitoring Network Plan.pdf

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Attached are Earthworks' comments on TCEQ's 2019 Annual Monitoring Network Plan.

Please reply to confirm receipt of these comments.

Thank you,
Sharon Wilson

=== EARTHWORKS: Protecting Communities and the Environment

Sharon Wilson, Senior Organizer
EARTHWORKS' Oil and Gas Accountability Project
Certified Optical Gas Imaging Thermographer
Certification #79568
940-389-1622
swilson@earthworksaction.org
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twitter: earthworks, txsharon
blog: http://www.texassharon.com/

Watch invisible oil & gas pollution become visible through infrared videos created for the Community Empowerment Project.

Read about the very real health risks of oil & gas development in our reports Reckless Endangerment, Gas Patch Roulette and Flowback.

May 20, 2019

Texas Commission of Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Attention: Ms. Holly Landuyt
Monitoring Division
Sent via electronic email

Re: Earthworks' comments on TCEQ's 2019 Annual Monitoring Network Plan

Background

Thank you for the opportunity to comment on the Texas Commission on Environmental Quality (TCEQ) 2019 Annual Monitoring Network Plan. Title 40 Code of Federal Regulations Part 58.10 requires states to submit an annual monitoring network plan to the United States Environmental Protection Agency (EPA) by July 1 of each calendar year. As stated on tceq.texas.gov, this monitoring plan is required to provide the implementation and maintenance framework for an air quality surveillance system, known commonly as the ambient air quality monitoring network. As you know, this document provides information on the State of Texas network of ambient air monitors established to meet regulatory requirements of the National Ambient Air Quality Standards and other supporting monitors.

Earthworks is a nonprofit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions. We promote clean air, water and land, healthy communities, and corporate accountability. We work for solutions that protect both the Earth's resources and our communities. We fulfill our mission by working with communities and grassroots groups to reform government policies and improve corporate practices. We expose the health, environmental, economic, social and cultural impacts of mining and energy extraction through work based on sound science.

Earthworks evolved from the work of two organizations – Mineral Policy Center and the Oil and Gas Accountability Project. In 1999, the Oil and Gas Accountability Project was founded to work with people in rural, tribal, and urban communities to protect their homes and environment from the devastating impacts of oil and gas development – bringing together such diverse partners as Native Americans, ranchers, sportsmen, and environmentalists. In 2005, these two founding organizations joined forces for the benefit of both our supporters and the planet.

Observations

Earthworks' staff conduct environmental assessments by analyzing air monitoring data that is generated by state and federal regulatory agencies, field investigators, and various monitoring networks. Our employees are trained and certified on a variety of air monitoring instruments including but not limited to FLIR GF320 optical gas imaging (OGI) cameras. As a result of our

technical expertise, we spend a significant amount of time conducting field sampling of a variety of air emission sources both in Texas and around the country.

As a result of our personal field observations and findings, as well as those of private citizens that we have interacted with, Earthworks has grave concerns about the lack of a robust air monitoring network in and around the Permian Basin in both Texas and New Mexico. As listed on the electronic links that were provided on TCEQ's website, TCEQ Region 7 currently possesses three monitoring stations including the Odessa-Hays Elementary School (C47/A160), Odessa Gonzalez (C1014), and Big Spring Midway (C1072). Considering the amount of hydrocarbon and sulfurous compounds that are emitted in the Permian Basin, these three stations are not sufficient for the quantity of emissions that are emitted in the Odessa-Midland, Texas area and the Permian Basin as a whole.

The Odessa-Hays Elementary School monitoring station was established on February 2, 1993, in response to the public's growing alarm at the large industrial and chemical complex that was located south of Odessa-Hays Elementary School. Years ago, now shifting populations and company philosophies resulted in these companies leaving the Odessa-Midland complex area. As a result, its gas chromatograph was not replaced in approximately 2015, and thus the station only currently collects meteorological data and 24-hour automated single canister samples for some 84 target compounds. This site is now surrounded by a residential area, as opposed to the heavy industry that it was originally intended to characterize.

The Odessa Gonzalez site was established on June 6, 2002 and collects particulate matter equal to or less than 2.5 micrometers ($PM_{2.5}$) and meteorological samples, while the Big Spring Midway station was established at 1218 North Midway Road on December 3, 2016, for EPA-mandated sulfur dioxide (SO_2) monitoring. This site is located northeast of the Alon Refinery in Big Spring, Texas and has frequently measured elevated SO_2, concentrations, as recently emphasized by the Texas Observer's May 2019, article titled "Report: Oil and Gas Producers May Be Pushing the Permian Basin Past Federal Air Quality Limits."

Despite having these three monitoring stations, the Permian Basin in West Texas appears to be woefully under monitored and assessed by the environmental regulatory authorities responsible for that effort. First, it is our understanding that the EPA requires at least one ozone monitor for any metropolitan statistical area that has more than 350,000 people. Since the Odessa-Midland area was listed as two of the 10 fastest-growing metro areas in 2018 by the United States Census Bureau information that was released on April 18, 2019, including Midland (first) with a growth rate of 4.3% and Odessa (fifth) with a growth rate of 3.2%, the 350,000 person threshold is expected to be exceeded by July 2019.

Despite the population growth rate in the Odessa-Midland area, it is curious to learn that the TCEQ's Metropolitan Statistical Area information does not list these two cities together in estimating population growth - despite doing so for the following combined Texas metropolitan areas: Dallas-Fort Worth-Arlington, Houston-The Woodlands-Sugar Land, San Antonio-New Braunfels, Austin-Round Rock, McAllen-Edinburg-Mission, Killeen-Temple, Brownsville-Harlingen, Beaumont-Harlingen, Beaumont-Port Arthur, College Station-Bryan, and Sherman-

Denison. It is also more than a bit curious that TCEQ is apparently not considering an update to its monitoring network in the Odessa-Midland and Permian Basin area as listed in its Appendix A: 2019 Summary of Proposed Network Changes, despite having listed Midland's and Odessa's 2017 population estimates as 170,675 and 157,087, respectively. It seems that the statistical split of the Odessa-Midland areas is done simply out of convenience, as these two geographic areas have historically been considered one.

Secondly, as listed on the TCEQ's website, in Volume 63 (2013) – Issue 5 of the Journal of the Air and Waste Management Association, the article titled "Impact of three interactive Texas state regulatory programs to decrease ambient air toxic levels," (contributed to by then TCEQ Chief Engineer Susana M. Hildebrand and then and now TCEQ Toxicology Division Director Michael Honeycutt amongst others) states "Texas recognized through the collection of ambient air monitoring data that additional measures beyond federal regulations must be taken to ensure that public health is protected. Texas integrates comprehensive air permitting, extensive ambient air monitoring, and the Air Pollutant Watch List (APWL) to protect the public from hazardous air toxics. Texas issues air permits that are protective of public health and also assesses ambient air to verify that concentrations remain below levels of concern in heavily industrialized areas. Texas developed the APWL to improve air quality in those areas where monitoring indicates a potential concern."

This article also states that "the Federal Clean Air Act framework also envisions a federal-state partnership whereby the development of regulations may be at the federal level or state level with federal oversight. The U.S. EPA establishes National Ambient Air Quality Standards to describe "safe" ambient levels of criteria pollutants…but does not establish ambient standards for hazardous air pollutants or other air toxics. Thus, states must ensure that ambient concentrations are not at harmful levels. The Texas Clean Air Act authorizes the TCEQ, the Texas state environmental agency, to control air pollution and protect public health and welfare." After reading this article, it thus, appears that Texas has apparently fallen short of its responsibilities in the Permian Basin area.

This Journal of the Air and Waste Management Association article lists three parts to the TCEQ's three tier integrated process, including its comprehensive permitting program. This is more than a bit concerning, as many oil and natural gas sites are permitted based on the honor system by a permit-by-rule (PBR) that uses the 25 tons per year emission rate as a cut off. As you know, there is no actual testing of emissions to verify these figures, and thus the State of Texas is dependent upon each individual company to accurately represent its emissions.

Secondly, the TCEQ does not actively update its APWL areas anymore, as it has been years since any companies have been added to the list. In fact, the truth is quite the opposite, as the TCEQ has actively worked to remove all companies and geographic areas from the List rather than to add new companies to the List. It is again curious to see that the technical information from the most recent findings by limited mobile monitoring efforts downwind of both the International Paper and MeadWestvaco Papermill near Texarkana and Evadale, Texas, respectively, have not been updated online to indicate that elevated hydrogen sulfide (H_2S) concentrations were measured in the last 1-2 year period at both facilities. These facts have not

been updated on the TCEQ's website - lending credence to the idea that the Agency is not being completely forthcoming when documenting elevated pollutant concentrations downwind of industrial sites.

Moreover, though the TCEQ does have the regulatory authority to encourage companies to come into compliance, the Agency does not actively use its authority to do so. There is no enforcement of 30 Texas Administrative Code (TAC) Chapter 112 that allows regulation of sulfurous emissions including, but not limited to, SO_2 and H_2S. In fact, it outwardly appears that TCEQ rarely, if ever, conducts simultaneous upwind and downwind monitoring that would make such compliance and enforcement matters possible, though it regularly did so in years past. Additionally, the TCEQ rarely, if ever, uses its Executive Director flexibility to enact 30 TAC Chapter 70 that allows enforcement action using information provided by private individuals.

And lastly, there have been no extensive ambient air monitoring efforts in the Odessa-Midland and Permian Basin area for years. After mostly decentralizing the TCEQ's Mobile Monitoring Team's capabilities and assets several years ago, few mobile monitoring sampling trips have been conducted until recently, when there was a sudden resurgence after pictures of non-deployed monitoring vans were shown parked at TCEQ Central Headquarters in Austin, Texas during Hurricane Harvey relief efforts.

As with other TCEQ regional offices, Midland regional investigators seem to work in a reactive mode, rather than a proactive mode, when conducting air investigations. Investigators do conduct OGI surveys, but canister samples that can speciate and quantify volatile organic compounds are being collected in historically low numbers outside of the ones that are collected by the automated 24-hour canister samplers both at the Midland regional office and around the state.

In the recent past, Earthworks has filed some 38 complaints with the Midland regional office, and only 24 of those have resulted in site inspections. Minimal compliance actions have resulted from Earthworks' field and OGI assessments that apparently exceed those of the TCEQ Region 7 office. Unlit flares, improperly combusting flares, and apparent faulty/open storage tank hatches and Leonardo (or similar pressure relief) valves are typical findings in the approximately 132 OGI videos that have been recorded in the Texas Permian Basin by Earthworks to date.

Also, of note, the TCEQ advertises its current Agency policy on the Track Status of Complaints (WACI Tracker) online. As stated, "we (the TCEQ) will provide you with a report on the outcome of our investigation." Though outwardly this policy sounds user friendly, the TCEQ typically does not share this information unless a Public Information Request (PIR) is filed to get the information. The Agency's online information is either incorrect or regional offices are not complying with this policy, making the Agency look uncooperative when members of the public engage in the investigative and complaint process.

Suggestions

Earthworks respectfully requests that the EPA and/or the TCEQ use federal and/or state funds to build a robust Permian Basin ambient air monitoring network to protect its citizens and to accurately characterize the air emissions that affect them. We believe that accurately counting the increasing populations of both the Odessa and Midland areas justifies the inclusion of at least

one ozone monitor in the area, especially since the nearest one is in the Hobbs, New Mexico area. Earthworks also believes that it would be prudent to construct and manage two upwind and two downwind monitoring stations to more fully and continuously characterize emissions in the Odessa-Midland corridor that could protect the residents of the surrounding area from hydrocarbon emissions including, but not limited to, volatile organic and sulfurous compounds. Specific siting for these monitors should be based on historical wind-rose information that tends to indicate a more southwesterly wind flow pattern in the winter and spring months, as compared to a more southeasterly wind flow pattern during the summer months. Moreover, we believe it prudent to conduct this same characterization by building and managing monitoring stations at three locations in the Permian Basin along the Texas and New Mexico border so that interstate cooperation can better protect residents of each state from both potential health effects and climate change.

Because of documented emissions and observations, it would also seem wise to increase and improve mobile monitoring efforts in the Odessa-Midland area and in the Permian Basin, in general. Past agency assessment efforts in the Barnett Shale and Eagle Ford Formation areas were more intensive than those currently in TCEQ Region 7. In addition, Earthworks also respectfully requests that the TCEQ use the current tools that are available to more fully characterize emissions in this geographic area. This would include proactive use of scientific instruments and sampling media including, but not limited to, OGI cameras, continuous emission monitors, gas chromatographs, and passivated stainless-steel canisters.

Earthworks also believes that it is prudent to continue to actively assess environmental conditions in the Odessa-Midland area. TCEQ Regional Geographic Area Toxicology Assessments were completed from 2003 through 2016, though no additional assessments have been uploaded for the public to view since that time. Finally, Earthworks also requests the TCEQ actively use the enforcement tools that it has at hand to improve the current air quality in the Permian Basin, including but not limited to 30 TAC Chapter 112 and Chapter 70.

Thank you for your attention to these matters and the opportunity to comment. We look forward to your feedback in the near future, and we stand ready to provide more technical insights as requested.

Sharon Wilson

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May 21, 2019

Texas Commission on Environmental Quality
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Attention: Holly Landuyt, MC-165
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monops@tceq.texas.gov *Via E-Mail*

Re: Comments on the TCEQ's 2*019 Annual Monitoring Network Plan*

Dear Ms. Landuyt:

Thank you for the opportunity to submit these comments on the TCEQ's 2019 Annual Monitoring Network Plan. We urge the TCEQ to revise the Plan to include sulfur dioxide monitoring in the Permian Basin. The Permian Basin region is experiencing rapid population growth[1] at the same time that unauthorized industrial emissions (Emission Events) are at record-high levels, all due to rapid expansion of oil and gas production. The proposed Plan fails to protect air quality in the Permian Basin. Specifically, the Plan fails to account for the large volumes of sulfur dioxide releases that are a fact of life and are expected to continue in the Permian Basin for the foreseeable future.

[1] The multi-county Permian Basin is home to roughly 1.4 million residents, according to U.S. Census estimates. See, https://www.tsl.texas.gov/ref/abouttx/popcnty2010-11.html. However, U.S. Census-based estimates do not account for the recent growth, nor the massive laborer population residing in the Permian Basin. See, "Welcome to the 'Man Camps' of West Texas; Thousands of oil workers are living in dormitory-like compounds in the Permian Basin," By Rachel Adams-Heard, August 7, 2018. https://www.bloomberg.com/news/articles/2018-08-07/welcome-to-the-man-camps-of-west-texas ; See, "Midland-Odessa CSA leads the nation in population growth, " by Trevor Hawes, March 29, 2016, https://www.mrt.com/business/article/Midland-Odessa-CSA-leads-the-nation-in-population-7405540.php. Previous TCEQ Air Monitoring Network Plans incorrectly relied on deflated population values for the Midland-Odessa census based statistical area (see, e.g., the 2018 Plan, in which TCEQ erroneously considered Midland and Odessa as two distinct statistical areas. In fact, Midland and Odessa (Ector) counties are considered to be a single census based statistical area, according to the US Census Bureau.) However, it is not enough to assess emissions for only the Midland-Odessa area, because for purposes of protecting the public welfare and monitoring air quality, the TCEQ should consider the entire multi-county Permian Basin a single region.

By 2023, the industry expects oil production to double from 2017 levels.[2] According to the International Energy Agency, U.S. crude oil will account for 80 percent of the growth in global oil supply over the next seven years, and most of that oil will come from the Permian.[3]

Studies Demonstrate that Sulfur Dioxide Emissions in the Permian Basin Are Causing Adverse Health Impacts, and May be Violating Ambient Standards

We are enclosing a May 9, 2019, report, entitled *Sour Wind in West Texas*, showing that there is a serious sulfur dioxide air pollution problem in Ector County. In addition, please find enclosed a 2018, *Environmental Science and Technology* journal article entitled, "Understanding Excess Emissions from Industrial Facilities: Evidence from Texas," by Nikolaos Zirogiannis, Alex J. Hollingsworth, and David M. Konisky (*Environmental Science and Technology* 52 (5): 2482-2490 (2018)). Please consider these enclosures to be incorporated for all purposes and adopted as part of our comments. Taken together, these studies demonstrate that large and sustained (multi-years) unauthorized sulfur dioxide emissions from oil and gas production and processing facilities have serious health implications for residents of the Permian Basin.

TCEQ's Reliance on the EPA Population Weighted Emissions Index, and Data Requirement Rule (for Sources Over 2,000 Tons) Does Not Reflect the Reality in the Permian

We wish to point out errors and shortfalls in the TCEQ's reliance on the EPA's population weighted emissions index (PWEI) formula, and the Data Requirement Rule that triggers required sulfur dioxide monitoring near single large emitters over 2,000 tons per year. AMNP, page 10-11 (Sulfur Dioxide). See, Title 40 CFR §58, Appendix D, Section 4.4.2. While the strict use of these formulas indicates where TCEQ *must* establish monitors, they do not preclude additional monitors where the evidence suggests monitoring is needed. For the 2019 Plan, the TCEQ used 2017 U.S. Census Bureau population estimates for individual county-level determinations. By conducting the PWEI calculation on a county-by-county basis, the TCEQ pre-ordains that no monitors will be required in the Permian, based entirely on the low population of Permian counties when viewed on a single-county basis. However, the multi-county Permian Basin is really a unified geographic, economic, and cultural region of Texas, with a single driving industrial base – oil and gas

[2] New IHS Markit Outlook – "Stunning" Permian Basin Oil Production to More than Double from 2017-2023, Exceeding Expectations. BusinessWire, June 13, 2018. https://www.businesswire.com/news/home/20180613005357/en/New-IHS-Markit-Outlook-–-"Stunning"-Permian.

[3] "As oil and gas exports surge, West Texas becomes the world's 'extraction colony,'" by Kiah Collier, The Texas Tribune and Jamie Smith Hopkins and Rachel Leven, Center for Public Integrity, published Oct. 11, 2018, available at: https://www.texastribune.org/2018/10/11/west-texas-becomes-worlds-extraction-colony-oil-gas-exports-surge/

production. Therefore, TCEQ should adjust its approach when calculating the PWEI formula for the Permian Basin, simply by treating the region as a single, large, multi-county area.

Another shortcoming of the TCEQ's exclusive reliance on the EPA's formulas for determining the required monitoring locations is the reliance on the 2014 National Emissions Inventory data. The problem is that only stationary industrial sources subject to Title V of the Clean Air Act must submit Emissions Inventories. Yet, the oil and gas production industry is unique in the sheer numbers of "minor sources" that are not Title V sources. Many of these sources, typically authorized via Permit-By-Rule, emit large volumes of sulfur dioxide, often far in excess of minor or *de minimus* levels. Therefore, the National emissions Inventory excludes many oil and gas (and other non_title V sources) emissions. TCEQ has full access to all of these reported emissions, as they are filed with the TCEQ's STEERS system.

A third shortcoming of TCEQ's reliance on the EPA formulas for *required* SO_2 monitoring is the use of EPA's threshold for required monitoring triggered by a *single* stationary source: EPA's threshold is 2,000 tons per year. But, as the data demonstrate, the Permian Basin is plagued not by one or two large smokestacks, but rather by hundreds of small sources that, cumulatively, emit thousands of tons of SO_2.

In both 2017 and 2018, according to TCEQ's most recent STEERS data, industries in the Permian Basin reported releasing roughly two coal-fired power plants' worth of sulfur dioxide emissions. According to TCEQ's STEERS database, in 2018, Permian facilities reported a total of 11,342 tons (22,684,926 lbs) of sulfur dioxide from emission events.[4] This marks a slight drop from 2017 levels, when a total of 258 Permian Basin facilities reported releasing 27 million pounds of unauthorized SO_2 (see, table below).

[4] Source: http://www2.tceq.texas.gov/oce/eer/

Unauthorized SO_2 Emissions Reported in Permian Basin Counties, 2017

County	2017 Population Estimate	# Facilities that Reported Unpermitted SO2 Releases	# of Events Reported	Total Unauthorized SO2 Releases (lbs)
Ward	11,472	7	64	8,281,725
Ector	157,087	109	782	5,335,754
Andrews	17,722	26	299	4,234,912
Gaines	20,638	18	212	3,161,380
Crane	4,740	36	320	3,041,220
Yoakum	8,568	10	77	862,064
Howard	36,040	10	99	706,390
Hockley	23,088	3	29	532,136
Pecos	15,634	4	86	331,249
Reagan	3,710	3	38	271,003
Winkler	7,574	5	47	154,422
Reeves	15,281	2	41	146,052
Scurry	17,050	4	6	73,700
Dawson	12,813	3	31	51,950
Kent	763	2	13	36,504
Glasscock	1,348	2	9	21,915
Mitchell	8,468	4	12	10,137
Cochran	2,851	1	7	6,716
Martin	5,626	3	4	4,013
Crockett	3,564	1	4	3,852
Garza	6,528	1	3	2,444
Coke	3,306	1	1	798
Upton	3,663	3	10	126
Total:	**387,534**	**258**	**2194**	**27,270,462**

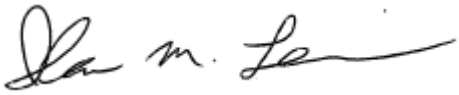
In conclusion, we urge TCEQ to exercise its discretion, and to acknowledge the unique nature of the Permian Basin, both in terms of its geographic and economic uniqueness, and also the sources of the area's air pollution. Among these facts are the following:

- The Permian Basin is the largest oil and natural gas-producing basin in the U.S., and is home to about 1.4 million people, according to 2017 U.S. Census estimates.
- Census-based statistical areas, such as the Midland-Odessa metropolitan statistical area, do not adequately represent the Permian Basin. Instead, the Permian Basin is a large, multi-county geographic area unique in and of itself.
- Census-based population estimates undercount the Permian population because they do not capture the ongoing growth in population, nor the the oil and gas "man camps" and transient labor that adds to the area's rapidly growing population.
- Sulfur dioxide emissions from Texas facilities in the Permian are equivalent to about two baseload coal-fired power plants in 2017 and in 2018, and the industry forecasts a doubling of production over the next few years.
- The only sulfur dioxide monitor in the Permian Basin is located in Big Spring, and it has recorded at least 30 hourly readings over 75 ppb (sulfur dioxide) since 2016.

The TCEQ owes residents of the oil patch the same level of protection as people living in Houston, Dallas, and San Antonio. The establishment of a network of continuous sulfur dioxide air monitoring stations in the Permian Basin would not only give Permian residents helpful information, but would also provide important baseline air quality information for TCEQ, would aid the TCEQ in permitting, and could aid in enforcement.

Thank you for considering these Comments.

Respectfully submitted,



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Sour Wind in West Texas

Air Pollution From Surging Oil and Gas Industry Exceeds Health Standards

ENVIRONMENTAL INTEGRITY PROJECT

THURSDAY, MAY 9, 2019

ACKNOWLEDGEMENTS

Written by Ilan Levin, Courtney Bernhardt, and Ari Phillips of the Environmental Integrity Project.

THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

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PHOTO CREDITS: Cover image: Gas flaring; Shutterstock. Pumpjack located south of Midland, Texas; Wikimedia Commons. Big Spring monitoring station; Texas Commission on Environmental Quality.

Sour Wind in West Texas

Air Pollution from Surging Oil and Gas Industry Exceeds Health Standards

The Permian Basin oil producing region encompasses about 63,834 square miles in western Texas and southeastern New Mexico, extending to 29,000 feet underground, making it one of the thickest hydrocarbon producing regions in the world.[1] Oil companies have been drilling in the Permian since the 1920s, but horizontal drilling and hydraulic fracturing brought a new boom to the region in the past decade. In 2015, Congress lifted the U.S. ban on the export of crude oil, further boosting domestic production. Industry insiders predict that by 2021, Permian Basin oil will account for about 40 percent of all U.S. production.[2] By 2023, the industry expects oil production to double from 2017 levels.[3] According to the International Energy Agency, U.S. crude oil will account for 80 percent of the growth in global oil supply over the next seven years, and most of that oil will come from the Permian.[4]

With that oil comes record-breaking production of natural gas and natural gas liquids, along with the processing, storage, and transportation that these products require. This requires a massive buildout of plants, tanks, pipes, and other infrastructure – most of which release air pollution.

Despite excessive levels of unauthorized pollution in the Permian Basin, the region lacks enough air quality monitors to protect public health.

According to industry reports filed with the Texas Commission on Environmental Quality (TCEQ), Permian Basin oil and gas facilities release more illegal air pollution during equipment failures, shutdowns, and other non-routine "emission events" than in any other part of the state.[5]

A 2018 study, published in the American Chemistry Society's *Environmental Science and Technology*, found that health costs in Odessa (Ector County) attributable to unpermitted air pollution are greater than many of Texas' heavily industrialized Gulf Coast counties.[6] This research strongly suggests that residents of sparsely populated West Texas bear a disproportionate share of health burdens from air pollution. A 2019 study of TCEQ data by the non-profit Environment Texas also concluded that the Permian Basin region leads the state of Texas in illegal (unpermitted) air pollution emissions.[7] These studies are remarkable

given that the Texas Gulf Coast, including the Houston Ship Channel, is home to the largest concentration of oil refineries and petrochemical plants in the nation.

Despite the excessive levels of unauthorized emissions in the Permian Basin, the region lacks enough air quality monitors to determine if the air is safe to breathe. The TCEQ's Houston region has approximately 60 active air quality monitoring stations, while the Midland-Odessa region has three.[8] Of these three monitors, only one measures sulfur dioxide, which is the most prevalent air pollutant in the Permian Basin. The lone sulfur dioxide air monitor in this region, which is located in Big Spring (about 60 miles east of Odessa) was activated in 2016.[9] It shows there is cause for concern. On at least 30 occasions between December 2016 and April 2019, hourly sulfur dioxide pollution levels measured at Big Spring exceeded the national health-based standard.[10] In March 2018, the Big Spring air monitor recorded 460 parts per billion of sulfur dioxide – more than six times higher than the 75 parts per billion air quality standard for one hour.

The TCEQ Air monitoring station in Big Spring began operating Dec. 3, 2016. Sulfur dioxide air pollution levels there are frequently above federal health standards.

Because there is only one functioning air monitoring station measuring sulfur dioxide in the Permian Basin, the Environmental Integrity Project studied the regional air quality, based on industry self-reported unauthorized releases of air pollution, which occurred mainly from flaring.

Using the Environmental Protection Agency (EPA)-approved air quality model known as AERMOD (the American Meteorological Society/Environmental Protection Agency Regulatory Model), we demonstrated the air quality impacts in Ector County resulting from the oil and gas industry's self-reported emissions of sulfur dioxide, matching them with actual weather conditions at the time and place of the emissions incidents. We chose Ector County due to the relatively large (for West Texas) population of about 156,000 residents, including 117,000 in the county seat, Odessa.

According to the modeling results, excessive flaring from the oil and gas industry is causing dangerous levels of sulfur dioxide air pollution in and around Odessa. Pollution levels in much of Ector County exceed the hourly health-based standard set by EPA. More broadly, our study suggests that across the Permian Basin, residents, workers, and visitors are exposed to excessive air pollution as a result of excessive flaring.

Summary of Findings:

- Oil and gas operators in and around Ector County self-reported 2,564 unauthorized releases of air pollution in a four-year period from 2014-2017.
- The worst sulfur dioxide pollution for all four years studied was 3,644 micrograms per cubic meter, in 2014, near Goldsmith, northwest of Odessa. That pollution level was 18 times higher than the EPA's health-based National Ambient Air Quality Standard of 75 parts per billion.[11]
- The one functioning sulfur dioxide monitoring station in the Permian Basin, in Big Spring, frequently measures sulfur dioxide concentrations at levels above 75 parts per billion.
- Residents of the Permian Basin are breathing air with excessive levels of sulfur dioxide pollution, resulting from the widespread flaring of "sour gas" (gas that contains significant amounts of hydrogen sulfide).
- According to computer modeling, excessive flaring at oil and gas operations in and around Ector County result in pollution levels exceeding the national health based standard for sulfur dioxide.

Recommendations:

There is a serious and ongoing air pollution problem in the Permian Basin. Residents of the Permian Basin are bearing a heavy burden when it comes to health impacts from air pollution. Federal and state leaders should do more to protect health and safety in West Texas, where illegal pollution from oil and gas production is reaching levels of serious concern based on the federal health-based standard for sulfur dioxide.

Federal and state regulators have an important obligation to control this pollution. The EPA should investigate whether air quality in the Permian Basin meets the federal health-based National Ambient Air Quality Standards. If the most reliable available data (including air dispersion model results where monitoring does not yet exist) indicates air pollution in violation of federal standards, then EPA should designate the area as being in nonattainment for sulfur dioxide. This would trigger stricter environmental and health protections in the Permian, which would improve both air quality and human health.

Texas has laws in place that, if enforced, would help reduce this air pollution.

- The Texas Commission on Environmental Quality and the Railroad Commission of Texas (which regulates oil and gas operations) should more strictly enforce their permitting rules. These state agencies should only approve permits for facilities that can demonstrate their emissions will comply with state and federal standards.
- TCEQ should more closely scrutinize permit applications to ensure they are not authorizing dangerous levels of sulfur dioxide. The agency should not issue permits that allow flaring in violation of any federal ambient air standards.
- Texas should ramp up its enforcement in the Permian Basin by penalizing oil and gas companies for flaring emissions over permitted levels. Both the TCEQ and the Railroad Commission should assess fines at levels sufficient to create an incentive for

companies to comply with anti-waste, flare-minimazation, and clean air laws. In addition to penalties, the TCEQ should order the largest emitters to establish monitoring networks upwind and downwind of their facilities.

- Texas should make a modest investment in the health of Permian Basin residents by establishing a regional air quality monitoring network to measure air quality in Midland-Odessa. Monitoring stations should measure multiple pollutants and meteorological conditions, and should be located to measure baseline and worst-case conditions.

West Texas communities that are paying the steepest price – in terms of air quality and health – should not be left at the mercy of polluters. State and federal regulators have an obligation to step in and protect the public from harmful emissions.

Air Pollution in the Texas Permian Basin

The Permian Basin is the largest oil and natural gas-producing basin in the U.S., and is home to about 1.4 million people, according to 2017 U.S. Census estimates. As stated in the introduction, oil companies have been drilling and extracting oil from the Permian since the 1920s, but horizontal drilling and hydraulic fracturing brought a new boom to the region starting around 2010. This trend was accelerated in 2015 by Congress' approval of crude oil exports. Oil and gas producers in the Permian are now extracting more than ever.[12]

Oil and gas production relies on a system of interconnected infrastructure. Most of the components of this system (wells, tank batteries, pipelines, compressor stations, gas processing plants, oil refineries, petrochemical plants, and power plants) are also sources of air pollution. For that reason, oil and gas production facilities are required to have air pollution permits that comply with the federal Clean Air Act.

But, according to industry reports filed with TCEQ, Permian Basin oil and gas facilities also release a large amount of *unpermitted* pollution during equipment breakdowns, maintenance, and other non-routine so-called "emission events." Because many oil and gas production facilities are interconnected to other similar facilities and to pipelines, a breakdown at one site often sparks a chain reaction, causing simultaneous releases of pollution up and down the supply chain.

In recent years, a new and disturbing trend has become evident: oil and gas production facilities, which have historically been considered to be relatively small sources of air pollution, are emitting more air pollution during unpermitted "emission events" than during routine operations, and more than their Clean Air Act permits allow.[13]

However, controlling air pollution in West Texas has not been a priority for the state, as evidenced by the scarcity of air pollution monitoring stations in the Permian Basin. And yet, the type of air pollution in the Permian Basin – dominated by excessive emissions of sulfur dioxide and hydrogen sulfide – is known to have serious environmental and public health consequences.

Health Impacts of Sulfur Dioxide and Hydrogen Sulfide

Sulfur dioxide (SO_2) forms when substances containing sulfur, including coal, oil, and gas, are burned. According to EPA, short-term exposures to sulfur dioxide can harm the human respiratory system and make breathing difficult. Children, the elderly, and those who suffer from asthma are particularly sensitive to sulfur dioxide. The pollutant also reacts with other compounds in the atmosphere to form dangerous soot-like fine particles (also known as particulate matter), which can penetrate deeply into sensitive parts of the lungs and cause additional health problems.[14] Studies show correlations between short-term exposure to sulfur dioxide and increased visits to hospital emergency rooms. Children, the elderly, asthmatics, and those who exercise regularly are most at risk.[15]

Historically, extremely high concentrations of sulfur dioxide caused – for example -- London's Great Smog of 1952, which killed at least 10,000 people and hospitalized 200,000. Since that era, better emission controls and decreased use of coal have done much to reduce atmospheric concentrations of SO_2.

Hydrogen sulfide is best known for a rotten egg smell that is often associated with oil and gas production. At low levels this acid can cause causes headaches, breathing problems, and irritation of the eye, nose, and throat. Long-term exposure can lead to miscarriages, poor memory, and dizziness. Very high concentrations cause coma and even death.[16]

Natural gas fields in New Mexico, Arkansas, West Texas, and north-central Wyoming are well known for having "sour gas," which is gas with high concentrations of hydrogen sulfide. Because this gas is heavier than air, it can pool in low-lying areas when the wind is not blowing. In February 1975, a hydrogen sulfide release killed eight people in a home near an oil and gas site in the West Texas town of Denver City.[17]

Environmental Impacts of Pollutants

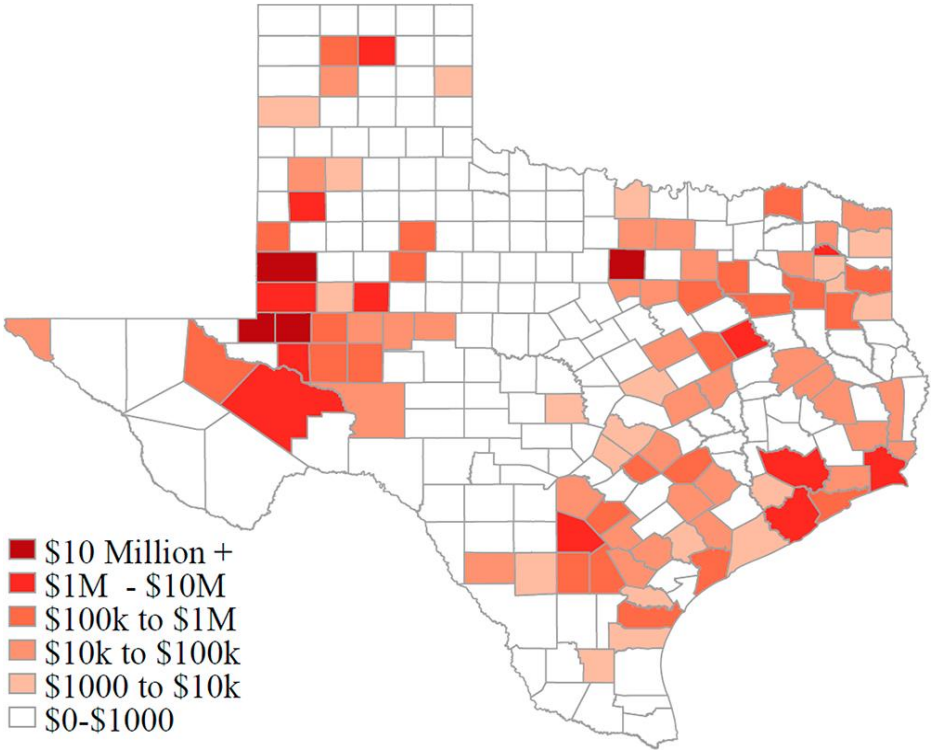
Sulfur dioxide and hydrogen sulfide are not only dangerous for people, but can also acidify soils and water. The pollutants harm trees and plants by decreasing growth and damaging foliage. Sulfur dioxide and hydrogen sulfide also react with other compounds in the air to form haze that reduces visibility in national parks and wilderness areas.[18] Sulfur dioxide is also one of the key pollutants that forms acid rain, which can leach aluminum particles from soil and clay, killing fish, insects, and plants.

Other wildlife is harmed by sulfur dioxide and hydrogen sulfide in much the same ways as people are, primarily through respiration. Hydrogen sulfide acts such the same way on all vertebrate species that breathe, such as in migratory birds, mammals, and certain reptiles and amphibians.[19]

West Texas Residents Bear a Heavy Health Burden

An article published in the *Journal of Environmental Science and Technology* on January 27, 2018, estimates that air pollution "emission events" in Texas cause $150 million per year in health costs.[20] The authors acknowledge that this cost is likely an underestimation, because it is based only on premature deaths from fine particle pollution. Figure 1 shows the distribution of the health costs, with some of the highest in the Permian Basin.

Figure 1: Distribution of Premature Death Health Costs From Unpermitted Pollution Across Texas



This map shows the distribution of estimated health costs due to premature deaths triggered by unpermitted pollution from industrial facilities based on a 2018 study in the Journal of Environmental Science and Technology. The highest concentration of dark red zones – showing highest costs – are in the Permian Basin in West Texas.

Sulfur dioxide is the most prevalent air pollutant released by facilities in the Permian Basin, according to Texas' database of unauthorized emission events.

The Clean Air Act requires EPA to protect human health from this pollutant by setting maximum limits on the amount of sulfur dioxide that can be present in outdoor air. These limits, called primary National Ambient Air Quality Standards, are based on short- and long-term exposure. The current health-based standard is 75 parts per billion (which is equivalent to 196 micrograms per cubic meter) based on the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum concentrations.[21]

A total of 258 facilities in Texas' Permian basin reported releasing 27 million pounds of unauthorized sulfur dioxide (SO_2) in 2017. See table below.

Table 1: Unauthorized SO_2 Emissions Reported in Permian Basin Counties, 2017

County	2017 Population Estimate	# Facilities that Reported Unpermitted SO2 Releases	# of Events Reported	Total Unauthorized SO2 Releases (lbs)
Ward	11,472	7	64	8,281,725
Ector	157,087	109	782	5,335,754
Andrews	17,722	26	299	4,234,912
Gaines	20,638	18	212	3,161,380
Crane	4,740	36	320	3,041,220
Yoakum	8,568	10	77	862,064
Howard	36,040	10	99	706,390
Hockley	23,088	3	29	532,136
Pecos	15,634	4	86	331,249
Reagan	3,710	3	38	271,003
Winkler	7,574	5	47	154,422
Reeves	15,281	2	41	146,052
Scurry	17,050	4	6	73,700
Dawson	12,813	3	31	51,950
Kent	763	2	13	36,504
Glasscock	1,348	2	9	21,915
Mitchell	8,468	4	12	10,137
Cochran	2,851	1	7	6,716
Martin	5,626	3	4	4,013
Crockett	3,564	1	4	3,852
Garza	6,528	1	3	2,444
Coke	3,306	1	1	798
Upton	3,663	3	10	126
Total:	**387,534**	**258**	**2194**	**27,270,462**

As the data indicate, the largest emissions occurred in Ward, Ector, Andrews, Gaines, and Crane counties. Facilities in each county reported releasing between 3 million and 8.2 million pounds of unauthorized SO_2 in 2017. Ector County, which has the highest population of these counties, had the second highest number of unauthorized releases.

A large number of facilities that reported unauthorized emissions are owned or operated by a small handful of companies, as shown in Table 2 below. For example, Occidental Permian owns 74 facilities that released 10.6 million pounds of sulfur dioxide during 500 incidents in 2017. XTO Energy (an Exxon subsidiary) owns 42 facilities that reported releasing nearly 2.4 million pounds of unauthorized sulfur dioxide during 359 incidents.

Table 2: Ten Companies Responsible for the Most Unauthorized SO_2 Releases in the Permian Basin, 2017

Company	# Facilities	# Events Reported	Unauthorized SO2 (lbs)
Occidental Permian Ltd. (CN600755086)	74	500	10,618,267
Chevron U.S.A. Inc. (CN600132484)	6	76	5,015,784
XTO Energy Inc. (CN600601348)	42	359	2,387,124
ConocoPhillips Co. (CN601674351)	37	315	1,863,664
Hess Corp. (CN600132245)	3	20	1,760,370
James Lake Midstream, LLC (CN604509893)	1	106	1,214,775
DCP Operating Co. LP (CN601229917)	11	76	923,794
OXY USA Inc. (CN604677401)	9	52	559,618
Burlington Resources Oil & Gas Co. LP (CN602989436)	18	170	531,261
Kinder Morgan Production Co. LLC (CN603227380)	4	21	412,371

Some of the companies responsible for the most unauthorized SO_2 emissions own or operate large gas processing plants and acid gas disposal wells. For example, Canyon Midstream (James Lake Midstream), operator of the James Lake Gas Plant in Ector County, reported 106 events that resulted in the release of 1.2 million pounds of sulfur dioxide. According to state reports, nearly all of these emissions were associated with flaring due to problems with the facility's acid gas injection well.

The 10 facilities that reported the most unauthorized sulfur dioxide pollution in 2017 are listed below.

Table 3: Facilities that Reported the Most Unauthorized SO_2 in the Permian Basin, 2017

Company	Site	County	# Events	Total Unauthorized SO_2 (lbs)
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 7	Ward	10	6,759,756
Chevron U.S.A. Inc.	Mabee Ranch CO_2 Plant	Andrews	29	2,925,848
Hess Corp.	Seminole Gas Processing Plant	Gaines	18	1,680,384
Chevron U.S.A. Inc.	J.T. McElroy 202 TB	Crane	17	1,483,836
James Lake Midstream LLC	James Lake Gas Plant	Ector	106	1,214,775
DCP Operating Co. LP	Goldsmith Gas Plant	Ector	36	792,238
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 3	Ward	13	538,448
Chevron U.S.A. Inc.	McElroy Section 199 Emergency Flare	Crane	14	505,427
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 8	Ward	12	478,356
XTO Energy Inc.	Goldsmith CO_2 Pilot Phase II Facility	Ector	8	468,752

Seven of these 10 facilities listed in the above chart have state air pollution control permits (called "Permits-by-Rule") that are intended for small sources that emit no more than 25

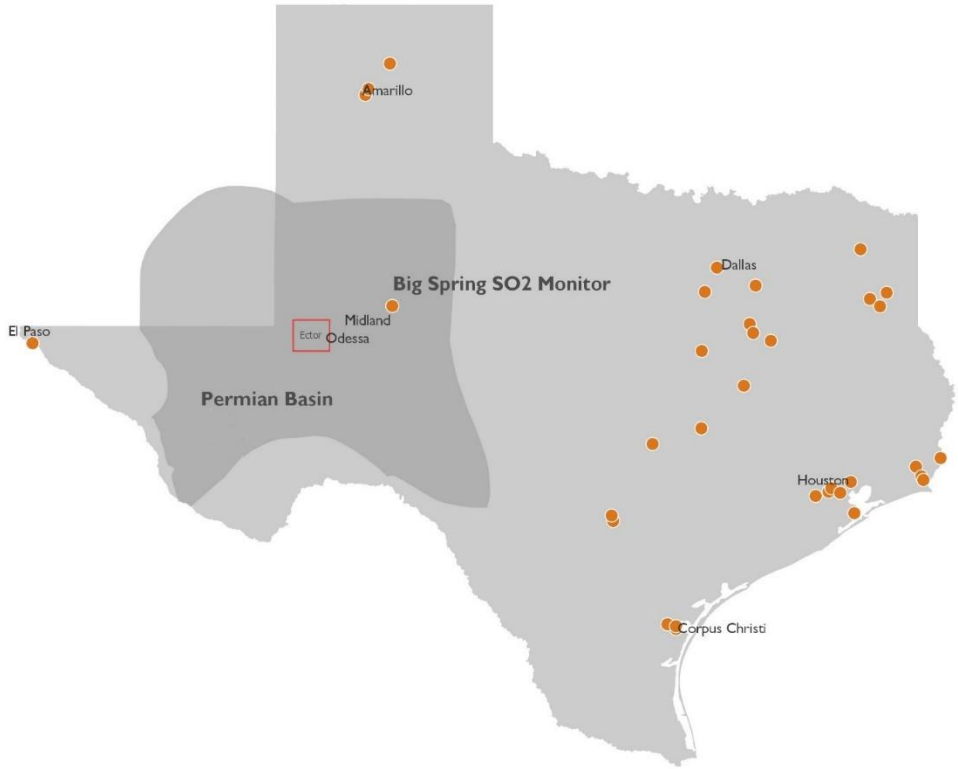
tons per year of sulfur dioxide. However, as shown in Figure 4 on page 12, these seven plants released far in excess of the 25-ton limit in 2017. This means that the emissions were illegal and that Texas should require these plants to obtain and follow stricter air pollution control permits.

Texas Lacks Adequate Air Monitors in the Permian Basin

The federal Clean Air Act requires states to monitor ambient air quality to protect public health. EPA regulations require states to monitor sulfur dioxide levels in areas that satisfy certain population and emission level requirements. Monitors are also required near large emitters (>2,000 tons per year of SO_2). Due to the small population in the Permian Basin (approximately a quarter of a million people live in Midland-Odessa), neither Texas nor EPA has seen fit to monitor sulfur dioxide levels associated with Permian Basin oil and gas production.[22]

The closest sulfur dioxide air monitor to Odessa is located in Big Spring, over 60 miles to the northeast of Odessa, and that monitor was established to measure air quality adjacent to a particular oil refinery. Even so, between December 2016 and April 2018, that monitor recorded 30 hours in which sulfur dioxide concentrations reached levels above the federal 1-hour standard of 75 ppb. Recorded concentrations during these times ranged from just over 75 ppb to as high as 460 ppb.

Figure 3: Locations of Active Sulfur Dioxide Monitoring Stations in Texas



The red dots indicate the locations of sulfur dioxide monitoring stations across Texas in December 2018. Although the oil and gas industry is booming in the Permian Basin (marked in darker gray), air quality monitoring there is sparce – with only one SO_2 monitor.

Modeling Shows Ector County is Flunking Air Quality Standard for Sulfur Dioxide

Because there are no sulfur dioxide air pollution monitors in Ector County,[23] the Environmental Integrity Project used an EPA-approved air dispersion model to determine the effects of oil and gas emissions on local air quality. We modeled industry reported emission events in Ector County between 2014 and 2017. EIP conducted the modeling in this location with the understanding that similar air quality impacts are likely in other parts of the Permian where there are large releases of SO_2.

Table 4 shows the largest sources of unauthorized sulfur dioxide emissions in Ector County in 2017. The two top facilities are large gas plants located in Goldsmith, Texas, that together reported 142 events and released over 2 million pounds of unauthorized sulfur dioxide pollution.

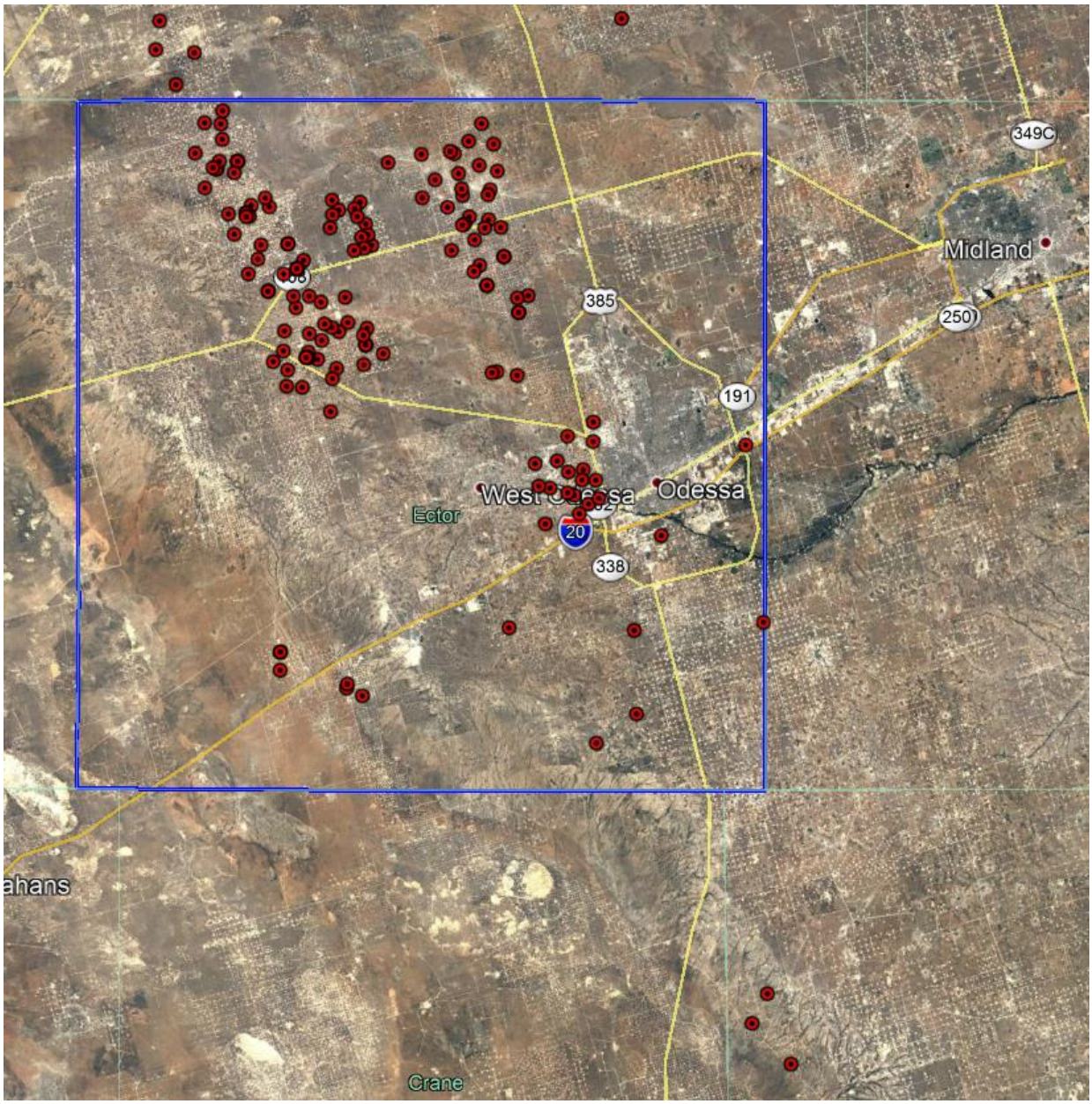
Table 4: Largest Sources of Unauthorized SO_2 Emissions in Ector County, 2017

Company	Site	County	# Events	Unauthorized SO_2 (lbs)
Canyon Midstream/James Lake Midstream LLC	James Lake Gas Plant	Ector	106	1,214,775
DCP Operating Co., LP	Goldsmith Gas Plant	Ector	36	792,238
XTO Energy Inc.	Goldsmith CO_2 Pilot Phase II Facility	Ector	8	468,752
ConocoPhillips Co.	Embar 2 - WCAB	Ector	11	222,249
XTO Energy Inc.	CAG Central Battery No 448	Ector	5	197,143
XTO Energy Inc.	GSAU 2 2 Battery	Ector	9	188,773
Occidental Permian Ltd.	North Cowden Unit South Central Tank Battery	Ector	12	149,916
Occidental Permian Ltd.	OB Holt R Lease TB 1	Ector	2	92,977
ConocoPhillips Co.	Gandu Battery 34	Ector	21	92,117
Occidental Permian Ltd.	Rhodes Cowden Unit Central Battery	Ector	4	84,895

Using the above data, we conducted air dispersion modeling using the regulatory model that EPA and the State of Texas require, called AERMOD, to estimate the air quality impacts of unauthorized SO_2 emissions in Ector County. We ran the air dispersion model, using the industry self-reported emission events for calendar years 2014 – 2017, and National Weather Service meteorological data for the days and times that the emissions events occurred. We obtained source parameters (i.e., the location, height, and other specifications) for the flares and other emission points from publicly available databases.[24] (For more on methodology, see Appendix A).

In Ector County, over the four-year study period, a total of 155 sources reported 2,564 separate emission incidents (mainly flaring events), including 495 in 2014; 669 in 2015; 568 in 2016; and 832 in 2017.

Figure 3: Locations of the Pollution Sources Included in the Modeling Study



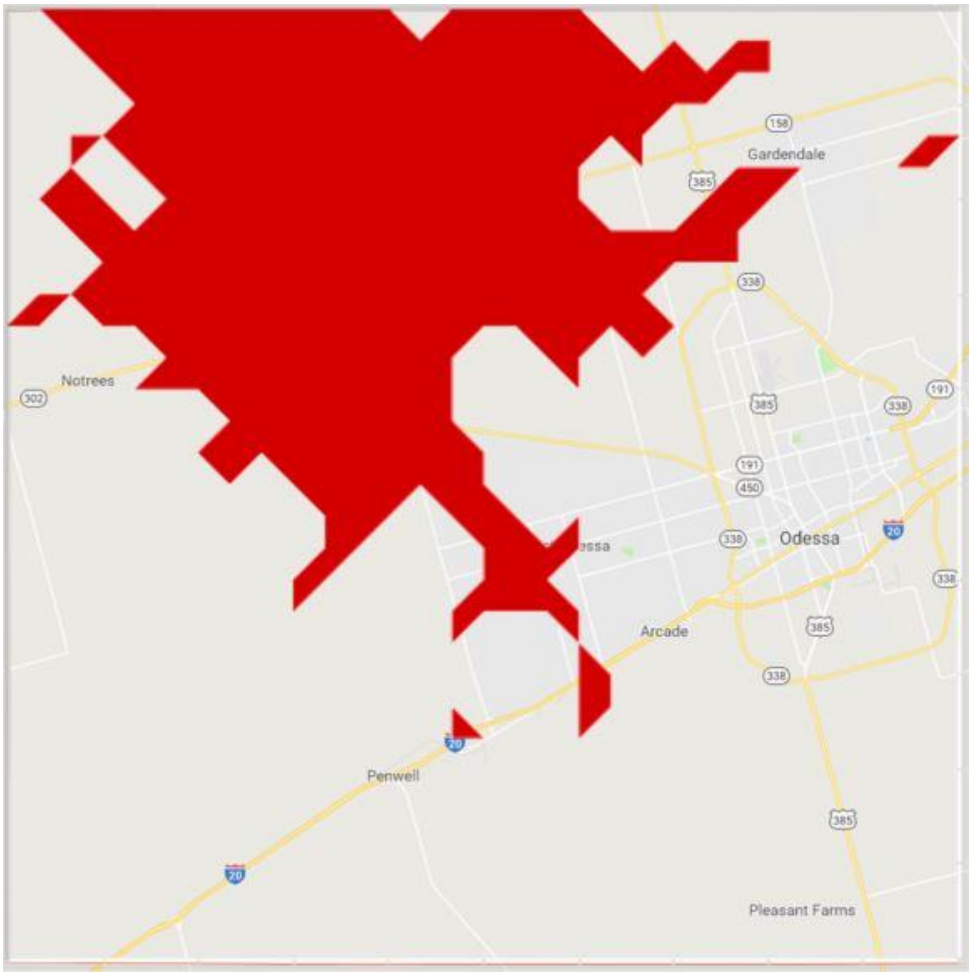
The red dots indicate the locations of the 155 sources of oil and gas industry emissions included in the EIP analysis, with the blue square depicting Ector County. The sources cluster north and west of the city of Odessa, exposing residents to potentially harmful air pollution.

The total amount of sulfur dioxide emitted from all 155 sources for all four years was 15,270 tons, or an average of 3,818 tons of unauthorized sulfur dioxide pollution per year. Overall, the average incident lasted 70.3 hours and released 11,911 lbs of sulfur dioxide. The overall average emission rate for all incidents was 169.5 lb/hr (with a wide variation). [25]

Results

Over a four-year period, from 2014 through 2017, roughly 35 percent of Ector County experienced sulfur dioxide air pollution levels in excess of the federal health-based standard, as shown in the map below. The model results indicate that in each year, oil and gas flaring resulted in hundreds of exceedences of the U.S. health-based air quality standard for sulfur dioxide.[26] In 2015, pollution levels over the national standard covered an an approximate area of 579 km^2, about 25 percent of Ector County.

Figure 4: 4-Year Maximum Modeled 1-Hour Average Sulfur Dioxide Levels Exceeding Health Standards



Over a four year period, roughly 35 percent of Ector County experienced sulfur dioxide air pollution levels in excess of the federal health standards (196 micrograms per cubic meter). Occuring mostly Northwest of Odessa, this elevated pollution corresponded with an area of intense oil and gas industry emissions.

Recommendations

EPA and the Texas Commission on Environmental Quality share the responsibility to protect air quality and to stop illegal pollution. While the state agency is on the frontline in terms of issuing air pollution permits and enforcing emissions limits, EPA has oversight and enforcement authority. At the state level, the Railroad Commission of Texas also bears responsibility for issuing most drilling permits. When these regulators fail to protect public health and the environment, the law allows members of the affected public to hold violators accountable and to enforce pollution limits.

The state and federal regulators should take the following steps to reduce air pollution in the Permian Basin:

- Both EPA and TCEQ should expand their air quality monitoring programs for the Permian Basin, including establishing stationary air monitors in and around Odessa.
- Because EPA's air quality determinations using information gathered from the new air quality monitors will take years to complete (according to the usual EPA regulatory process), EPA should immediately conduct its own modeling to determine whether areas in the Permian Basin meet the national ambient air quality standards. EPA should also initiate the formal, public, information-gathering request and rulemaking process to gather information from the industry and the public, and to ensure all stakeholders participate in this determination.
- EPA and TCEQ should strengthen air pollution control permits in the Permian Basin, including by reviewing Texas' reliance on the less-stringent standard permits and "permits-by-rule" in oil and gas production, processing, storage, and transportation. Texas should also ensure that all major sources of air pollution obtain appropriate major source permits. The goal is to ensure that all sources of potentially dangerous air pollution have enforceable permits that protect public health.
- TCEQ should revise its rules and policies on unpermitted air pollution incidents, such that all unauthorized emissions over a threshold level determined by the state should be subject to automatic penalties.
- EPA and the State of Texas (both the TCEQ and Railroad Commission) should exercise their enforcement authority by investigating and prosecuting those operators in the Permian Basin who routinely violate anti-pollution rules and their permit limits.
- TCEQ should review its policy allowing industrial emitters to avoid compliance simply by filing timely reports about unpermitted emissions. TCEQ should adopt a rule specifying the factors that the agency will use in exercising enforcement discretion for emission events. The rule should specify that penalties will apply for any emission event over a certain threshold and for which the root cause has occurred more than once before. For all other emission events, the TCEQ should exercise its enforcement discretion as long as the operator provides proof that the

source employs the best available control technology to control emissions, and that the incident did not contribute to an exceedance of any national ambient air standard.

With common-sense steps like these, there is no reason that oil and gas producers in the Permian Basin cannot comply with air pollution rules that ensure and safeguard the health of the people of West Texas.

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[20] "Understanding Excess Emissions from Industrial Facilities: Evidence from Texas," Nikolaos Zirogiannis, Alex J. Hollingsworth, and David M. Konisky, *Environmental Science and Technology* 52 (5): 2482-2490 (2018)

[21] The threshold of 75 parts per billion of sulfur dioxide in air can also be expressed as 196 micrograms of sulfur dioxide per cubic meter of air.

[22] TCEQ, "Annual Monitoring Networking Plan, 2018" pp. 10-11 https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2018-AMNP.pdf.

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[24] The sources were either the TCEQ's Air Permits Allowables Database, or individual permit application files.

[25] The maximum incident duration was 2,659 hrs (or 110 days). Eight incidents had a duration that exceeded 1,000 hours each. The largest incident resulted in the release of more than a million pounds of SO2 and lasted 15.5 days starting in late November 2016. Forty-six incidents had total SO2 emissions exceeding 50 tons.The highest emission rate was 39,561 pounds of sulfur dioxide per hour, which occurred during a two-hour period in December 2016. Twenty six (26) incidents resulted in emission rates that exceeded 10,000 pounds per hour; and 329 incidents resulted in emission rates that exceeded 1,000 pounds per hour.

[26] The standard was set by U.S. EPA at 196 micrograms per cubic meter, the 1-hour sulfur dioxide national ambient air quality standard

APPENDIX A: METHODOLOGY

The Environmental Integrity Project ran an EPA approved air dispersion model called AERMOD, which is also used by the state of Texas when it issues air quality permits. We ran the air dispersion model using the industry self-reported emission events for calendar years 2014 – 2017 and National Weather Service meteorological data for the days and times that the emissions events occurred as inputs. We obtained source parameters (i.e., the location, height, and other specifications) for the flares and other emission points from TCEQ via publicly available databases and a Public Information Act request.

In some cases, mainly for smaller sources, the specific source parameters were unavailable in TCEQ records. In these instances, we used conservative inputs as estimates, based on TCEQ guidance, i.e. tall stack/flare height.

The model results indicate that in each year from 2014 through 2017, oil and gas flaring resulted in hundreds of exceedences of the U.S. health-based air quality standard for sulfur dioxide (set by U.S. EPA at 196 micrograms per cubic meter or the equivalent of 75 ppb, the 1-hour sulfur dioxide national ambient air quality standard). In 2015, pollution levels over the national standard covered an an approximate area of 579 km^2, about 25 percent of the entire Ector County. In 2016, the 1-hour SO_2 design value (the modeling result that defines air quality relative to the national standards) exceeded 400 $\mu g/m^3$ at 74 receptors in 2016. The peak design value during all 4 model years was 3,644 $\mu g/m^3$ (in 2014, located about 1 km NW of the Goldsmith Gas Plant).

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Understanding Excess Emissions from Industrial Facilities: Evidence from Texas

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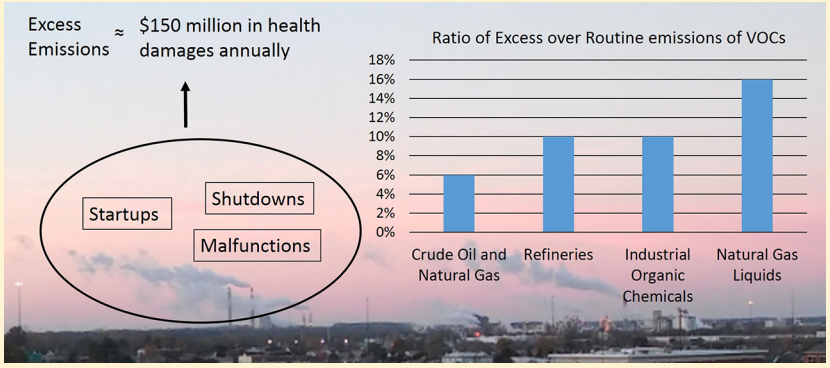
Supporting Information



ABSTRACT: We analyze excess emissions from industrial facilities in Texas using data from the Texas Commission on Environmental Quality. Emissions are characterized as excess if they are beyond a facility's permitted levels and if they occur during startups, shutdowns, or malfunctions. We provide summary data on both the pollutants most often emitted as excess emissions and the industrial sectors and facilities responsible for those emissions. Excess emissions often represent a substantial share of a facility's routine (or permitted) emissions. We find that while excess emissions events are frequent, the majority of excess emissions are emitted by the largest events. That is, the sum of emissions in the 96−100th percentile is often several orders of magnitude larger than the remaining excess emissions (i.e., the sum of emissions below the 95th percentile). Thus, the majority of events emit a small amount of pollution relative to the total amount emitted. In addition, a small group of high emitting facilities in the most polluting industrial sectors are responsible for the vast majority of excess emissions. Using an integrated assessment model, we estimate that the health damages in Texas from excess emissions are approximately $150 million annually.

1. INTRODUCTION

Hurricane Harvey made landfall in Texas on Friday, August 25, 2017. Within just a few days, some of the state received over 50 in. of rainfall, inflicting both human casualties as well as devastating infrastructure and property damages. The hurricane caused many industrial facilities in the state to shut down operations and restart them after the rain and flooding subsided. From August 23rd to September 19th, shutdowns and startups (as well as other malfunctions related to Hurricane Harvey) resulted in excess emissions of 1927 tons of criteria pollutants (616 tons of CO, 735 tons of VOCs, 435 tons of SO_2, 141 tons of NO_x) across the entire state of Texas.[1] These excess emissions represent 7% of criteria pollutant excess emissions from all Texas facilities in 2016 due to shutdowns, startups, and malfunctions. Although these emissions resulted from a singular, extreme weather event, the same types of emissions (i.e., due to startups, shutdowns, and malfunctions) occur on a regular basis during the routine operation of many industrial facilities.

The release of air pollutants is an expected byproduct of many industrial processes. In the United States, the Clean Air Act (CAA) requires that the Environmental Protection Agency (EPA) set ambient air quality standards for a variety of pollutants and emissions limits or technology-based standards for many others. Pollution sources are then required to meet source-specific targets set forth in government-issued permits. Overall, these permits aim to regulate normal operations—for example, the emissions that result from a power plant burning coal to generate electricity or a refinery processing crude oil to make gasoline. However, these types of facilities also often emit "excess emissions", defined by the EPA as emissions "*that occur during the startup, shutdown, malfunction or other modes of source operation, i.e., emissions that would be considered violations of the applicable emission limitation but for an impermissible automatic or discretionary exemption from such emission limitation*".[2]

Excess emissions can be difficult to control because they are attributed to unexpected or unavoidable circumstances. For example, when a facility has to shut down due to a power outage or natural disaster, and then restart its operations, emission levels will likely increase. This increase is because pollution control

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devices require a constant and high-temperature environment to function properly.[3] Similarly, if a control device malfunctions, emissions will increase until the device is repaired. In any case, excess emissions are violations of the CAA per EPA policy because they go beyond authorized limits delineated in a facility's permit.[2]

In this paper, we use data obtained from the Texas Commission of Environmental Quality (TCEQ) to examine the pattern of excess emissions in the state. We focus on differences across industrial sectors for emissions of criteria pollutants, volatile organic compounds (VOCs) as well as some key hazardous air pollutants (HAPs). In addition, we use topic modeling to delineate the typical causes of excess emissions events, and an integrated assessment model to approximate the monetized value of health damages from the excess emissions that cause either direct or indirect particulate matter (PM).

Between 2004 and 2015, excess emissions events in Texas resulted in releases of 104202 tons of VOCs, which are equivalent to 7.5% of routine (permitted) emissions from all facilities reporting to the state's Emissions Inventory. For CO and SO_2, the relevant figures during the same time period are 89202 tons (2.03% of routine emissions) and 123823 tons (1.84% of routine emissions), respectively. The causes of these events include, unplanned or scheduled startups and shutdowns that exceeded emissions thresholds, weather-induced power outages, and malfunctions due to poor maintenance. We estimate that the monetized value of health impacts, just from direct PM emissions and indirect PM caused by SO_2 and NO_x to be $148 million in 2015 alone.

The remainder of the paper is organized as follows. In the next section, we briefly discuss the relevant regulatory history regarding excess emissions and examine recent changes in EPA policy that affect how the agency interprets excess emissions. In section 3, we review the limited existing literature on excess emissions. Section 4 describes the excess emissions data we collected from the TCEQ, and analyzes patterns over time and across sectors, as well as the causes of excess emission events. Last, in section 5, we provide monetary estimates of health damages. We conclude with a discussion of the implications of our research for federal and state policies regarding excess emissions.

2. POLICY BACKGROUND ON EXCESS EMISSIONS

Air pollution control in the United States is a shared responsibility between the federal government (i.e., the EPA) and the states. Under the CAA, the EPA sets maximum ambient concentration levels for six criteria air pollutants—CO, lead, NO_x, ozone, PM (2.5 and 10), and SO_2—as part of the National Ambient Air Quality Standards (NAAQS) program. Based on these standards, the EPA then designates areas of the country meeting the NAAQS as in attainment and areas failing to meet the NAAQS as nonattainment. Under the CAA, every state is required to submit a State Implementation Plan (SIP) that specifies how it will meet NAAQS requirements, particularly in nonattainment areas. Once the EPA approves a SIP, the state agency begins to implement its strategy, which includes issuing permits to stationary air sources that contain specific emission limits.

Since the outset of the SIP program in the 1970s, states have incorporated policies regarding excess emissions. Initially the EPA did not consider periods of startup, shutdown, and maintenance of equipment as being part of a facility's "normal" operations. As a result, many SIPs included automatic exemptions and affirmative defense provisions that effectively shielded facilities from enforcement.[4] In a 1977 guidance, however, the EPA clarified that automatic exemptions were not allowed. Yet, even though the EPA was concerned that granting sources automatic exemptions for excess emissions would compromise the NAAQS, it did not make enforcement of the 1977 guidance a priority.[5]

The EPA issued memoranda in 1982 and 1983 clarifying its policies on excess emissions. The agency encouraged states to use an "enforcement discretion approach" to address excess emissions resulting from accidental releases,[5,6] whereby states could characterize such emissions as allowable if they were clearly due to an unavoidable malfunction. In cases where excess emissions resulted from *scheduled* startup, shutdown, and maintenance activities, the EPA memoranda made clear that these were considered part of the normal operation of a facility, since they were predictable events. Therefore, any excess emissions during scheduled events would be considered a violation of a facility's permit. This basic approach was reaffirmed and expanded upon in a 1999 memorandum in which the EPA delineated the parameters for a new "affirmative defense" approach that states could incorporate into their SIPs. If specific criteria were met, states could provide air sources with enforcement relief. There were important limitations, however. States could only apply affirmative defense provisions to requests for penalties (not requests for injunctive relief). Moreover, affirmative defense was disallowed for sources that had the potential to cause an exceedance of NAAQS, and to get around any limitations that derive from either New Source Performance Standards or National Emissions Standards for HAPs.[7,8]

2.1. Current Policy. For about two decades, the EPA did not take significant steps to systematically bring SIPs in line with its own interpretation of excess emissions regulations. In practice, this meant that many states had provisions in their SIPs that conflicted with stated EPA policy, including automatic exemptions and so-called director's discretion exemptions, which were cases where a state agency head explicitly excused what would otherwise have been a CAA violation. This changed in 2013 when the agency proposed a revision to its policy on excess emissions in response to a petition filed by the Sierra Club. The Sierra Club had argued that many states had provisions in their SIPs that did not observe EPA's guidance on automatic exemptions, including provisions endorsed by the EPA that limited the jurisdiction of federal courts to impose civil penalties. In its 2015 final ruling on the issue, the EPA found that 36 states had provisions in their SIPs with regards to excess emissions from startup, shutdown and malfunction (SSM) events that were "*substantially inadequate to meet CAA requirements*".[2] The agency requested that these states revise their SIPs to, where relevant, eliminate automatic exemptions, director's discretionary exemptions, overly broad enforcement discretion, and all affirmative defense provisions. The elimination of affirmative defense provisions was particularly significant, since the EPA previously allowed them in some circumstances in instances of malfunctions.

This regulatory history illustrates the complexity and ambiguity surrounding excess emissions. The challenge comes at distinguishing between events that a facility could have reasonably prevented through careful planning and maintenance and those that are truly unavoidable. This complexity is confounded by the lack of data, since with the exception of Texas, Louisiana, and Oklahoma, states do not systematically collect data on excess emissions in a fashion that distinguishes them

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from routine emissions or, if they do, do not make that information publicly available. Consequently, it is virtually impossible to systematically discern the magnitude of excess emissions relative to routine emissions as well as the extent to which excess emissions contribute to poor air quality and adverse health outcomes. In this paper, we explore the most comprehensive data set on excess emissions, which is based on information reported by major air sources in Texas to the TCEQ. Before turning to these data, we first review the limited existing literature on excess emissions.

3. LITERATURE REVIEW

Scholars have examined excess emission events in two different ways. First, atmospheric scientists have investigated the degree to which excess emissions of VOCs and NO_x impair air quality. Several studies conducted in the Houston−Galveston region of Texas have found that these emissions, depending on atmospheric conditions, can result in elevated concentrations of ozone.[9−11] A separate set of studies have found that excess emissions can result in higher ambient concentrations of fine PM.[12,13] Furthermore, scholars have recorded large discrepancies between the emissions documented in the Texas emissions inventory and those measured directly through observational studies. The Texas Air Quality Study (Texas AQS) of 2000, for example, found that the state emission inventory underestimated the amount of highly reactive volatile organic compounds (HRVOC) emitted from petrochemical facilities by 1−2 orders of magnitude.[14] The 2006 Texas AQS found that the emission inventory underestimated emissions for ethene and propene by a factor of 10 and 11 respectively.[14] Collectively, these studies provide evidence that excess emissions can have measurable impacts to air quality.

Most relevant to our work is a second stream of research that has explored patterns of excess emissions across states and industries. A report by the Environmental Integrity Project (2004)[15] was an early attempt to document the way states keep track of and regulate excess emissions. Of the facilities it analyzed, EIP found that CO was the highest emitted pollutant (∼48% of total excess emissions) followed by VOCs (∼24%), SO_2 (∼23%), and very low amounts of NO_x and H_2S. In addition, EIP[15] identified several natural gas plants that in 2003 released excess VOC emissions that were substantially higher than the routine emissions during the previous year. EIP reached similar conclusions in a subsequent report that analyzed data from Texas for the years 2014 and 2015.[16] In this study, EIP found that most of the excess emissions of SO_2 and VOCs deriving from malfunctions and maintenance activities were from oil and gas extraction sites, chemical manufacturing plants, oil refineries, and power plants.

Two other studies have focused their attention on excess emissions from Texas oil refineries. McCoy et al.[17] find that 96% of reported excess emissions pertained to criteria pollutants (in which they include VOCs), while 63% of the total number of emissions events were concentrated in four areas of Texas (namely Port Arthur, Corpus Christi, Houston, and Texas City). The authors also calculated the ratio of upset over total emissions, and found that 30% of the refineries they analyzed had excess SO_2 emissions that exceeded 10% of their total emissions.

Ozymy and Jarrell[18] conducted a similar analysis for 18 Texas refineries for the 2003−2008 period, pointing to the fact that a small number of large excess events released upward of 500000 lbs of SO_2, CO, propane, and isobutane. When comparing excess and routine emissions from the Toxics Release Inventory (TRI) the authors find that a single excess event can overwhelm the total annual routine emissions of a facility for some toxic pollutants.

Our paper relies on similar data as much of this prior research but provides a more comprehensive analysis. Specifically, we analyze excess emissions across sectors, facilities, multiple pollutants, and over more than a decade of time. This approach provides a more complete picture of the nature of excess emissions, in terms of the frequency of occurrence and magnitude of releases. Moreover, we use topic modeling to classify typical common causes of events, as well as an integrated assessment model to provide a monetary estimate of the health damages that can be attributed to excess emissions. We describe the data in the next section.

4. DATA

The data used in this paper come from TCEQ's Emissions Inventory (EI) and Air Emissions and Maintenance Events

Table 1. Total Amounts of Excess Emissions (in tons) from All Facilities Reporting to the Emissions Inventory of the TCEQ during the Period 2004−2015[a−c]

	contaminant	total excess emissions (tons)	total excess/ total routine (%)	emissions events/total excess emissions (%)
criteria pollutants	sulfur dioxide	123823	1.84	82.91
	volatile organic compounds	104202	7.50	72.74
	carbon monoxide	89202	2.03	57.18
	nitrogen oxides	20277	0.47	43.16
	particulate matter 10	9572	1.37	54.71
	particulate matter 2.5	6070	1.46	53.77
VOCs	propane	12,081	16.09	84.56
	propylene	6,27	19.70	83.38
	isobutane	4632	13.43	82.47
	butene	734	16.26	83.20
HAPs	hexane	2150	8.42	54.33
	toluene	840	4.53	58.65
	benzene	776	5.53	60.23
	xylene	318	2.06	56.02
	formaldehyde	70	0.22	66.40

[a]Source: table compiled by the authors using data from TCEQ.[19]. [b]Note: Between 1990 and 2003, facilities reported: (a) total excess emissions, that is, emissions events (EE) + emissions from scheduled maintenance startup and shutdown (SMSS) and (b) routine emissions. Starting in 2004, amounts were reported separately for each of the three categories of emissions (i.e., routine, EE, and SMSS emissions). We do not report data on lead because of low levels of emissions, and ozone, which is not directly emitted. The column labeled "total excess emissions (tons)" shows the total amount of EE + SMSS. The column labeled "total excess over total routine" shows the ratio of total excess emissions (EE + SMSS) over routine emissions. Finally, the column labeled "emissions events/total excess emissions" shows the ratio of emissions events (EE) over total excess emissions (EE + SMSS). [c]A more detailed version of this table is provided in Table S1 of the Supporting Information. Figures S1 and S2 of the Supporting Information, provide information on ratios of excess over routine emissions by year for criteria pollutants and important HAPs. Tables S2 and S3 of the Supporting Information provide data on excess emissions by industrial sector, while Figures S3−S8 provide time trends of excess emissions of criteria pollutants by industrial sector.

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(AEME) data sets.[1,19] The former includes annual totals for more than 2000 pollutants from major sources (i.e., CAA Title V facilities) in Texas.[20,21] Facilities report the following annual amounts in the EI data set: (1) routine emissions (i.e., permitted emissions); (2) emissions events (EE); and (3) emissions attributed to scheduled startup, shutdown or maintenance (SMSS) events. Taken together, EE and SMSS emissions constitute the total amount of excess emissions. The TCEQ defines an Emissions Event as "*any upset event or unscheduled maintenance, startup or shutdown activity...that results in unauthorized emissions*".[22] Emissions events result in releases from a stack as opposed to fugitive emissions that "*could not reasonable pass through the stack*".[22] An SMSS event is a scheduled event that is expected to exceed authorized emissions levels and for which a facility is required to provide prior notification and submit a final report to the TCEQ.[22]

The TCEQ introduced a rule in 2003 that requires all facilities in the state (not just Title V facilities) to report EE and SMSS emissions within 24 h of their occurrence provided they surpass an emissions threshold.[23] Upon receiving an initial report of an excess emission event from a facility, the TCEQ posts that information on its Web site making it immediately available to the public. The reporting facility has 2 weeks to submit a final report where it can provide updated information on the event. The compilation of those events across all years (i.e., 2002 until April of 2017) constitute the AEME data set we obtained from the TCEQ. While facilities are required to report emissions events that exceed a "reportable" quantity in the AEME data set, the same is not true for the EI data set. There, Title V facilities are required to report emissions from both "reportable" and "non-reportable" events (i.e., events below the emissions threshold). Because emissions in the EI are reported at the end of the year, facilities might update the excess emissions information they provide to the EI. As a result, at times, there can be discrepancies in the annual sum of excess emissions between the AEME and EI data sets.[24] Finally, there is no information on routine emissions in the AEME data set.

4.1. Excess Emissions from All Facilities. Table 1 captures the magnitude and severity of excess emissions in Texas compiling information on EE and SMSS emissions for criteria pollutants, VOCs, and some important HAPs for the period 2004−2015 for all Title V facilities. Excess emissions of SO_2 during this period were 123823 tons, followed by VOCs (104202 tons) CO (89202 tons), NO_x (20227 tons), PM10 (9572 tons), and PM2.5 (6070 tons). These are large amounts of pollution, accounting for the equivalent of up to 2% of routine (i.e., permitted) emissions for most pollutants, and 7.5% for VOCs. Among the VOCs with highest levels of excess emissions, propane is at the top with 12,081 tons, representing 16.1% of routine emissions. Among the 463 HAPs, hexane has the highest levels of excess emissions. For all pollutants depicted in Table 1 (with the exception of NO_x) the majority of excess emissions come from Emissions Events (as opposed to SMSS).

4.2. Excess Emissions by Industrial Sector. As of 2004, there were 3158 facilities from 231 industrial sectors reporting excess emissions in the EI data set. Figure 1 displays on the vertical axis tons of excess emissions for criteria pollutants, VOCs, and benzene (one of the most prevalent HAPs in excess emissions), while the horizontal axis captures the cumulative

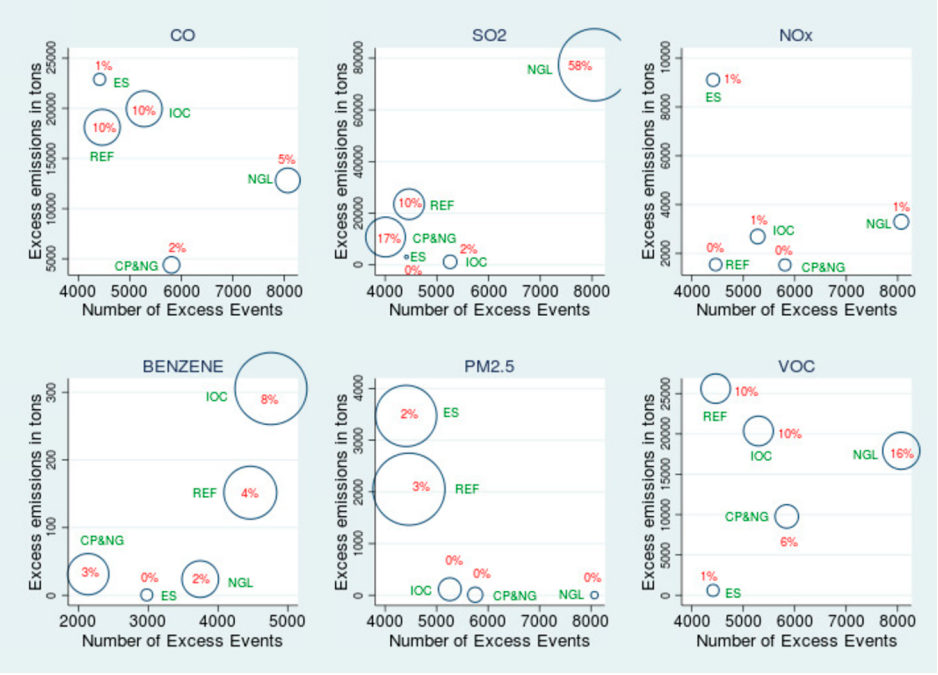

Figure 1. Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of excess emissions (on the vertical axis), and total number of excess emissions events (on the horizonral axis) from the top five polluting industries during the period 2004−2015. Source: figure compiled by the authors using data from TCEQ.[19] Note: The five industries with the highest amount of cumulative excess emissions across all pollutants (as identified in Table S2 of the Supporting Information) are highlighted in green. Those industries are (a) crude petroleum and natural gas (CP&NG), (b) natural gas liquids (NGL), (c) petroleum refining (REF), (d) industrial organic chemicals (IOC), and (e) electric services (ES). The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle, the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of the figure but are comparable within each of the six panels. The number of excess emissions events in the horizontal axis comes from the EI data set and includes both reportable and nonreportable events by facility between 2006 and 2015 (there is no information on counts of events for prior years in the EI data set).

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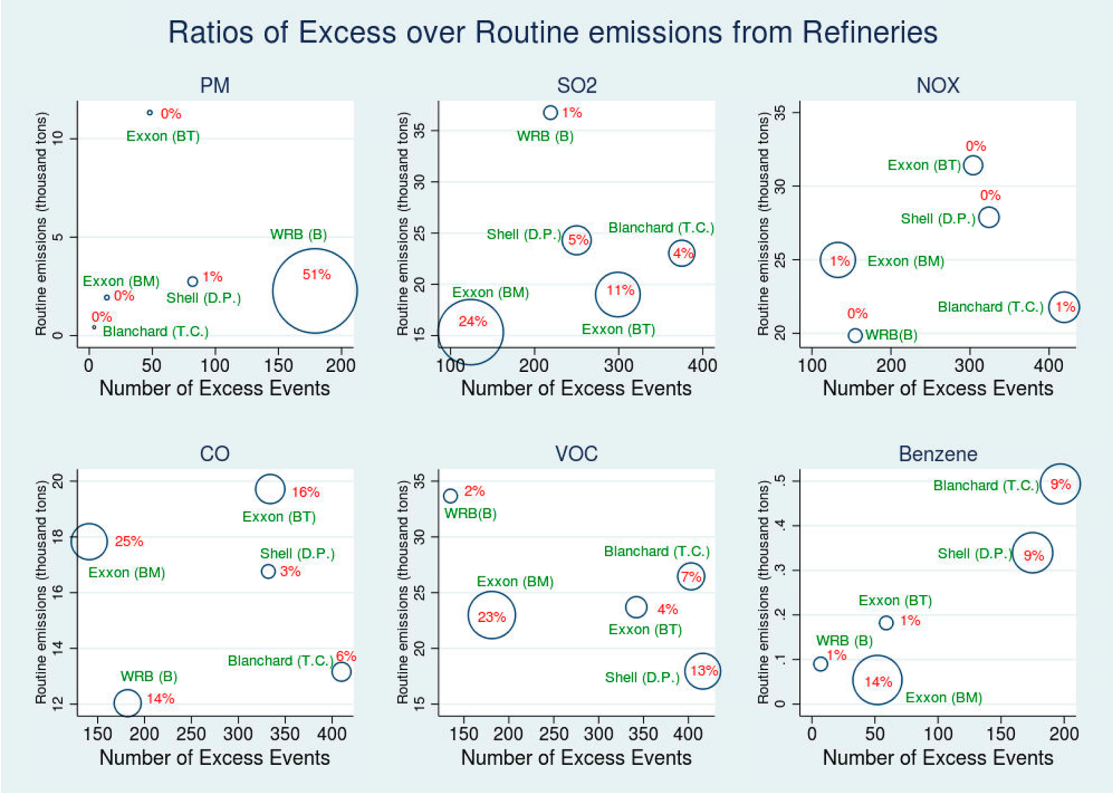

Figure 2. Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of routine emissions (vertical axis), and total number of excess emissions events (horizontal axis) from the top five polluting refineries in Texas during the period 2002−2015. Source: figure compiled by the authors using data from TCEQ.[1,19] Note: The refineries with the highest amounts of cumulative excess emissions are highlighted in green. These are (a) Shell Oil, Deer Park (D.P.), (b) Exxon Mobil, Baytown (BT), (c) Blanchard, Texas City (T.C.), (d) WRB, Borger (B), and (e) Exxon Mobil, Beaumont (BM). The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle, the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of Figure 2 but are comparable within each of the six panels. Figure S10 in the Supporting Information is a version of Figure 2 that includes all Texas refineries. Figures S11−S13 in the Supporting Information provide similar information for other key industrial sectors (namely, crude petroleum and natural gas, industrial organic chemicals, and natural gas liquids). Contrary to Figure 1, the number of excess emissions events in Figure 2 comes the AEME data set and covers the period 2002−2015.

number of excess events from all facilities in a given industry. Each circle in the six panels of Figure 1 represents a different industrial sector. The area of each circle captures the ratio of excess over routine emissions for that sector over the 2004−2015 period. The numerical value of the ratio is shown in red for the five sectors with the highest number of cumulative excess emissions across all pollutants. For example, the petroleum refining sector released 18109 tons of carbon monoxide (CO) excess emissions, which represented 10% of the sector's routine emissions during 4463 events. Of particular interest is the fact that the natural gas liquids sector emitted 77429 tons of SO_2 during 8057 events for a ratio of 58% of excess over routine emissions. The refining sector is of particular interest since a very small number of facilities (28 refineries in 2015) release large amounts of excess emissions. The refining sector is the largest emitter of excess VOCs, second largest in excess $PM_{2.5}$, benzene and SO_2, third largest in CO and fourth in NO_x.

4.2.1. Excess Emissions from Refineries. In this section, we take a closer look at excess emissions from oil refineries, an industrial sector that emits disproportionately high levels of excess emissions per facility. Figure 2 provides information similar to that of Figure 1, only this time at the facility level for the top five polluting refineries. The vertical axis in Figure 2 plots routine emissions with each circle being a specific refinery, and the horizontal axis captures the total number of excess emissions events per facility over the 2002−2015 period. The size of each circle captures the ratio of excess over routine emissions. Figure 2 identifies the top five emitting refineries and uses green labels to distinguish them. These five refineries have the highest routine emissions and, often, the largest number of excess emissions events.

4.3. Distribution of Excess Emissions. One of the unique characteristics in the pattern of excess emissions is the skewness of their distribution. Figures S14−S17 (in the Supporting Information) plot the skewness parameter of the distribution of each pollutant by industry. In all cases, the values of the skewness parameter are indicative of a distribution that has a small number of events that emit large amounts of pollutants. This fact is further substantiated in Tables S4−S8 (in the Supporting Information) which show the percentiles of the excess emissions distributions by industry. In most industries, the median events released less than 1 ton of a pollutant, while the maximum event often released over 1000 tons. Figures S18−S34 (in the Supporting Information) highlight the fact that a few extreme events dominate the excess emissions distributions. The blue bars in each of those figures show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount of excess emissions from the 96th percentile to the top of the distribution. The green bars

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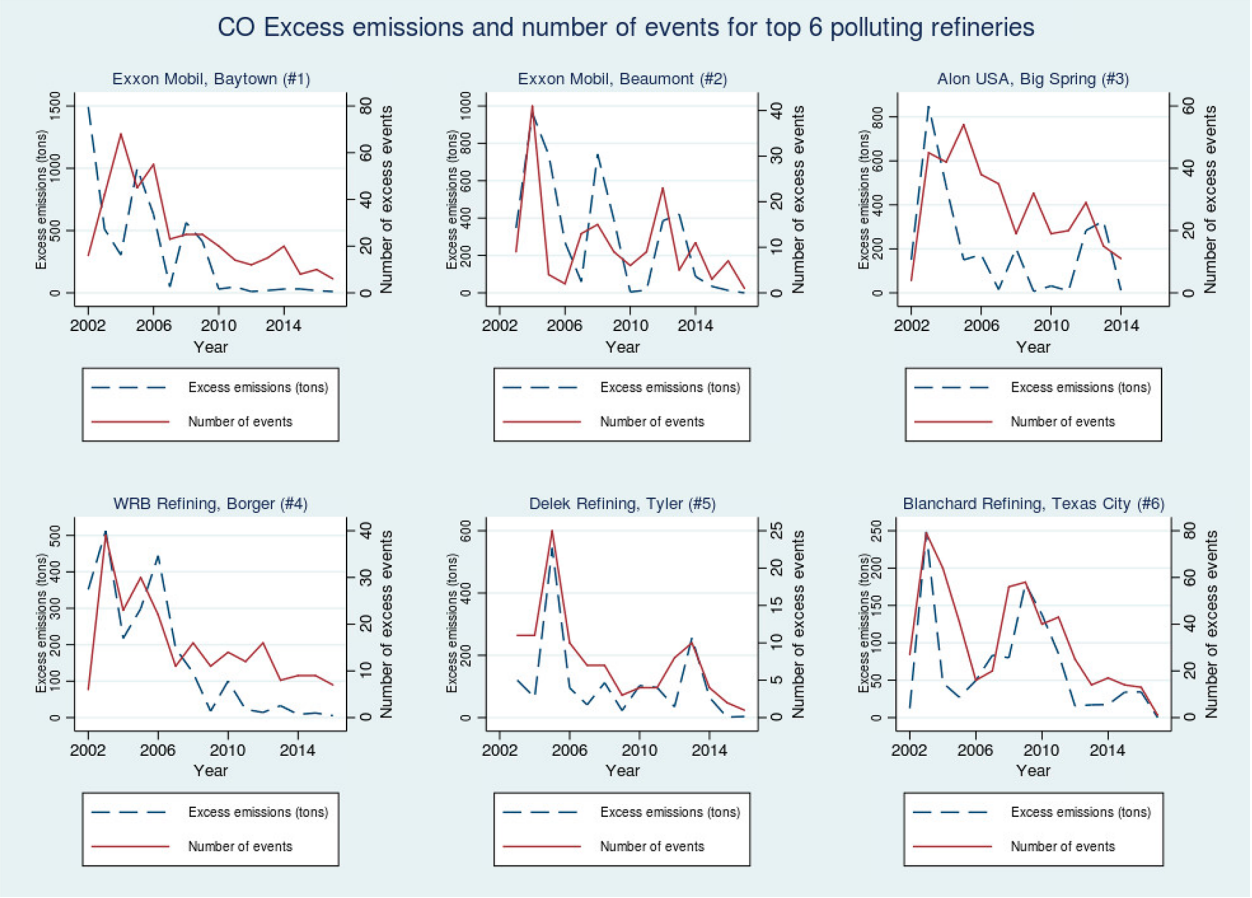

Figure 3. Excess emissions and number of excess emission events involving the release of carbon monoxide (CO) for the top six most polluting refineries. In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those six facilities released 77% of all CO excess emissions across all refineries between 2002 and 2016. The total number of excess emissions events from those six refineries represent 35% of all excess emissions events from all refineries between 2002 and 2016. Source: figure compiled by the authors using data from TCEQ.[1] Note: Figures S35−S38 in the Supporting Information present similar information as that depicted in Figure 3 for the remaining criteria pollutants on the top six polluting refineries. Figures S39−S50 in the Supporting Information have data on facilities in the most polluting sectors (namely, crude petroleum and natural gas, natural gas liquids, and industrial organic chemicals). Tables S9−S12 in the Supporting Information show summary statistics for the top six polluting facilities in each of the top four polluting sectors.

capture the amount released from the single largest event in each year. In the vast majority of cases in Figures S18−S34, the total excess emissions released from the top 5% of the distribution are *larger* than the total excess emissions released from all other events combined. This highlights the fact that several extreme events in each year dominate the distribution of excess emissions. A similar pattern has been documented by Brandt et al.[25] in the case of fugitive methane emissions from natural gas systems, where the largest 5% of leaks represent upward of 50% of the total amount of leakage.

4.4. Important Polluters. The skewness in the distribution of excess emissions can be traced to events occurring in a small number of facilities. Figure 3 shows total amounts of CO excess emissions for the six most polluting (in terms of excess CO emissions) refineries. The blue dotted line in each panel of Figure 3 traces the annual totals of CO excess emissions in each refinery, while the red solid line shows the number of excess emissions events in each refinery in each year. Those six refineries emitted 77% of the total excess CO released from all refineries in Texas between the period 2002−2016. In addition, 35% of all CO excess emissions events that occurred during the same period happened in those six refineries. Figures S35−S38 (in the Supporting Information) illustrate the top six polluting refineries for the remaining criteria pollutants. The Exxon Mobil refineries in Baytown and Beaumont are consistently among the top six most polluting refineries in four out of the five pollutants depicted in Figure 3 and Figures S35−S38. Tables S9−S12 (in the Supporting Information), indicate that in all of the top polluting industries, a few key facilities are responsible for the bulk of excess emissions. Detailed information on the top polluting facilities for other key industrial sectors is presented in Figures S39−S50 in the Supporting Information.

4.5. Causes of Excess Emissions Events. An additional piece of information in the AEME data set is a description of the cause of the excess emissions events, provided by each facility as part of their report to the TCEQ. We analyze these descriptions using a three-step approach that incorporates structural topic modeling (STM).[26] First, we find common groupings of words that organize into distinct topics. Second, we determine how well this set of topics explains the observed excess emission descriptions. Finally, we determine the topics that are most likely related to unexpected weather events. The decision to

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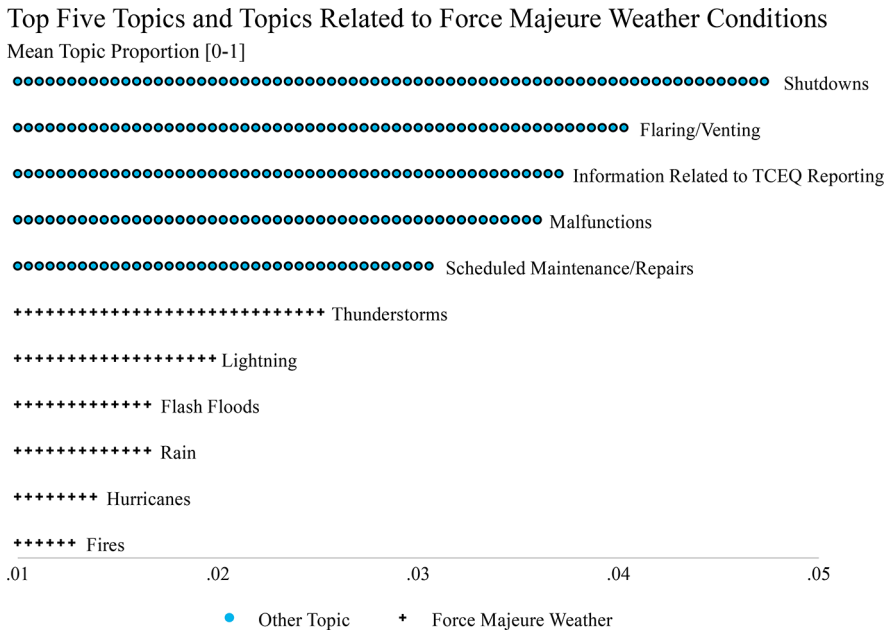

Figure 4. Results of structural topic modeling. Source: figure compiled by the authors using data from TCEQ.[1] Note: The prevalence and full set of all 50 topics estimated is available upon request.

label each topic is validated using a data driven process. Details about the three-step STM approach as well as the validation process are provided in section 1 of the Supporting Information.

Figure 4 presents the top five topics by prevalence as well as the prevalence of force majeure weather-related topics (e.g., lightning, flash floods, rain, hurricanes, thunderstorms, fires). The most common topics are related to plant shutdowns, flaring, TCEQ reporting terminology, malfunctions, and scheduled maintenance/repairs. On average, around 5% of event description text is related to shutdowns. Text related to weather induced accidents composes just over 10% of all comment text, indicating that while weather-related accidents are an important source of emissions events, they are far from the dominant source.

5. MONETARY ESTIMATES OF HEALTH DAMAGES FROM EXCESS EMISSIONS

While the adverse health effects of excess emissions are likely significant, their precise empirical estimation would require access to detailed data on mortality, morbidity, and pollution exposure. We use an integrated assessment model (IAM) to calculate a "back of the envelope" estimate of the monetary value of the health effects from excess emissions. To conduct this analysis, we first aggregate all the annual emissions of $PM_{2.5}$, SO_2, and NO_x from the EI data set to the county level for the period 2004−2015. These annual county level emissions are put into the Estimating Air Pollution Social Impact Using Regression (EASIUR)[27,28] model, which predicts the total damage from a marginal increase in pollution from any county in the continental U.S. The damage estimates provided by the EASIUR model are from the perspective of the source county, where total damage from each source county's pollution is the aggregation of damage done by that source county on all receptor counties. The EASIUR model is based on the Comprehensive Air Quality Model with Extensions (CAMx), and its damage predictions compare well with the results from other IAMs. The marginal damage estimate of the EASIUR model is based upon the impact of directly and indirectly emitted $PM_{2.5}$ on mortality. Estimates include damages that occur both locally and in downwind regions. In addition to varying across geographic space, predicted marginal damages vary with seasonal patterns in pollution transport, stack emission height, and pollutant type ($PM_{2.5}$, SO_2, NO_x, and NH_3).

We find that in 2015 excess emissions were responsible for at least $148 million in health damage annually, with approximately 10% of this damage coming from oil refineries. The EASIUR model uses a value of statistical life (VSL) estimate of $8.8 million, implying that 16.82 deaths are caused per year by excess emissions. Damages vary across the state and are concentrated in areas with more large, industrial facilities. Figure 5 displays the county-level damages estimated by EASIUR for 2015. Figures S52−S55 in the Supporting Information provide county level damages by pollutant by year. Figure S56 in the

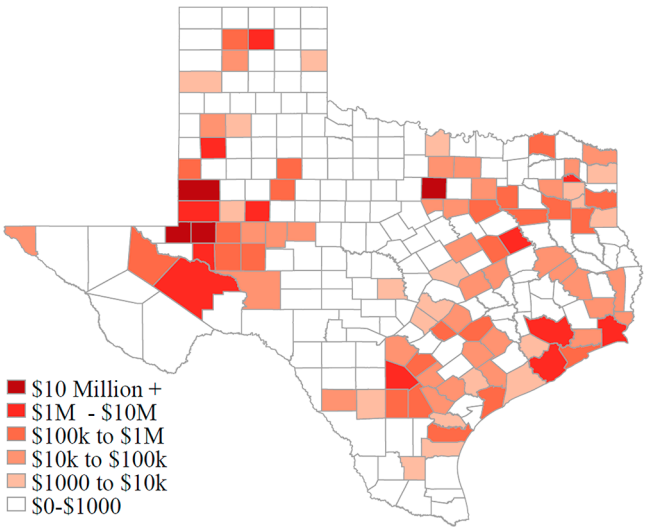

Figure 5. Damages from excess emissions in 2015, by Texas County. Source: figure compiled by the authors using data from TCEQ,[19] EASIUR,[27] QGIS,[29] and Manson et al.[30]

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Supporting Information shows aggregate annual health damages by year from all sources and from the refining sector specifically. It is important to emphasize that our damage estimates represent only those mortality impacts due to direct and indirect PM2.5 emissions. Thus, they are intended to serve as a conservative, lower bound for potential health damages. Excluded health damages include all acute health events that do not lead to mortality and all pollution induced mortality that is not related to $PM_{2.5}$.

6. CONCLUSION

This study examines the significance of excess emissions, a category of air pollution that has received little attention in the scholarly literature. Our analysis shows that excess emissions are not exceptional, outlier events, but rather a regular feature of operations at industrial facilities. The data reported to the TCEQ show that these emissions can also be substantial in magnitude, raising important questions for future research about their effects on air quality and public health. In addition, in the most polluting industries, a small group of facilities are responsible for the vast majority of criteria pollutant excess emissions. Given the significant public health impacts, which we estimate to be at least $148 million annually in Texas alone, it is imperative that all states begin to systematically track excess emissions.

Excess emissions are also important from a policy perspective. As discussed above, the EPA has recently revised its policy on how excess emissions are regulated under the CAA. The agency has always regarded these emissions as a violation of a facility's permit obligations under the statute.[2] However, enforcement has largely been left to the states, and the EPA has determined that too often states have relied on policies and procedures that inappropriately shield firms from penalties. The EPA is in the process of reviewing many states' SIPs to ensure that treatment of excess emissions is consistent with EPA's interpretation. As is the case with many EPA policies, the Trump Administration is now reviewing the policy itself, which leaves the question of how excess emissions will be handled under the CAA in the future. Given the importance of these emissions, these policy decisions will be consequential.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.est.7b04887.

Additional tables and figures. Details on the three-step structural topic modeling approach (PDF)

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The authors declare no competing financial interest.

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Supporting Information

Understanding Excess Emissions from Industrial Facilities: Evidence from Texas

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Section 1: Three step Structural Topic Modeling Approach.

The first step of our Structural Topic Modeling (STM) aims to find common groupings of words that can be combined into unique topics. To accomplish that, we first process each event description by removing all punctuation, capital letters, and other idiosyncratic grammatical constructs. We then turn each word into a stem so that similar words can be aggregated together. For example, the words pollution and polluted would each become *pollut*. We also remove common words, such as "a" and "the," as these words are unlikely to contain useful information regarding any particular topic. A topic is simply a group of words, where the set of words composing the topic shows both sufficient semantic coherence and exclusivity. A topic has greater semantic coherence when the same set of words appear together with higher frequency. A topic has more exclusivity when the set of words that compose that topic are less likely to appear in the sets of words that compose other topics. The sets of topics present in the comments are determined using a machine learning approach and implemented using the *stm* package in the statistical computing platform *R*. The estimation algorithm of the *stm* package maximizes the likelihood that the current set of topics provide the best fit for the observed comments. The models that provide the best balance between the two dimensions of semantic coherence and exclusivity are selected as candidate models. The model that has the smallest variance of all the candidate models across these two dimensions is chosen as the preferred model. Finally, the topics associated with weather related accidents are determined. For example, the topic that contains (among other words) *hurrican*, *rita*, *katrina*, *landfal*, *wastewat*, and *atmospher*, was selected to indicate a high likelihood of hurricane being involved. The word cloud for that topic is presented in Figure S29 of the Appendix.

Our decision to label each topic is validated using a data driven process. First, we create a simple indicator of a key word that should be present if the topic is correctly named (e.g., hurricane). Second, using a logistic regression we determine if the estimated topic percentage is a good predictor for the presence of this key word. For example, in the case of topic *hurricanes* a 1% increase in estimated prevalence of the topic labeled hurricane, is associated with a 28% higher likelihood of the word hurricane actually appearing in the excess emissions text description.

As an example, the following is a comment with the highest percentage of words related to the hurricane topic. It was submitted to the TCEQ as part of an emissions event report on 9/16/2007: "*pression intensified into Tropical Storm Humberto. As a small tropical cyclone, Humberto continued to quickly organize and strengthen as it gradually turned to the north-northeast. Humberto was upgraded to hurricane status just after midnight on Thursday the 13th while located about 15 miles off the coast of Texas. Hurricane Humberto made landfall around 200 AM CDT near High Island. Strong convection continued around a well defined eye, and Hurricane Hunters reported sustained winds of 85 mph about two hours after landfall. Around eight hours after landfall, Humberto weakened to a tropical storm as it crossed into southwestern Louisiana. Increasing upper-level wind shear caused the storm to weaken rapidly over land, and late on the 13th Humberto weakened to a tropical depression. Humberto continued northeastward through the southeastern United States, and on the 14th Humberto began dissipating over northwestern Georgia and degenerated into a remnant low pressure are. Smoking conditions were documented intermittently from potentially all flares identified in this report. Visible emissions were also noted intermittently from Sulfur Recovery Unit SCOT Tail Gas Incinerators I (E-01-SCOT, E-02-SCOT, E-03-SCOT, E-04-SCOT).*"[1]

Table S1: Total amounts of excess emissions (in tons) as well as the ratio of total excess (Emissions Events + Emissions due to Scheduled Startup Shutdown and Maintenance) over total routine emissions from all facilities reporting to the Emissions Inventory of the Texas Commission on Environmental Quality (TCEQ) during the period 2004-2015. The last three columns identify whether the pollutant is a Hazardous Air Pollutant (HAP), one of the Toxic pollutants in the TRI dataset (TOX) or a Volatile Organic Compound (VOC). The Table is sorted on column #2 (total excess emissions) from largest to smallest and includes contaminants that have at least 10 tons of excess emissions. Source: Table compiled by the authors using data from TCEQ [2].

Contaminant	Total Excess emissions (tons)	Total excess / Total Routine	HAP	TOX	VOC
CARBON DIOXIDE	1,365,097	0.50%	N	N	
SULFUR DIOXIDE	123,823	1.84%	N	N	
VOC-TOTAL	104,202	7.50%			
CARBON MONOXIDE	89,202	2.03%	N	N	
VOC-UNCLASSIFIED	32,544	8.34%	N	N	Y
NITROGEN OXIDES	20,277	0.47%	N	N	
TOTAL PARTICULATE	16,000	1.83%			
PART-U	15,445	2.18%	N	N	
PROPANE	12,081	16.09%	N	N	Y
N BUTANE	9,930	22.11%	N	N	Y
TOTAL PM10 PARTICULATE	9,572	1.37%			
PM10 PART-U	9,380	1.59%	N	N	
ETHYLENE	9,117	13.91%	N	Y	Y
METHANE	7,480	1.97%	N	N	
PROPYLENE	6,527	19.70%	N	Y	Y
TOTAL PM2.5 PARTICULATE	6,070	1.46%	N	N	
ISOBUTANE	4,632	13.43%	N	N	Y
GASOLINE	4,425	9.29%	N	N	Y
ETHANE	3,861	6.98%	N	N	
NITROGEN	2,791	0.04%	N	N	
CRUDE OIL	2,209	5.50%	N	N	Y
HEXANE	2,150	8.42%	Y	Y	Y
ISO PENTANE	1,872	9.48%	N	N	Y
PENTANE	1,810	8.68%	N	N	Y
HYDROGEN SULFIDE	1,698	13.13%	N	N	
NITROUS OXIDE	1,572	1.76%	N	N	
N-PENTANE	1,394	10.42%	N	N	Y
N-HEXANE	851	5.49%	Y	Y	Y
TOLUENE	840	4.53%	Y	Y	Y
CONDENSATE	831	2.74%	N	N	Y
NAPHTHA	827	7.28%	N	N	Y
1,3- BUTADIENE	803	12.87%	Y	Y	Y
VOC GAS MIXTURE-U	783	8.67%	N	N	Y
BENZENE	776	5.53%	Y	Y	Y
BUTENE	734	16.26%	N	N	Y
METHANOL	719	1.34%	Y	Y	Y
HYDROGEN	541	0.27%	N	N	
HEPTANE	516	10.12%	N	N	Y
HYDROGEN CHLORIDE	479	2.35%	Y	Y	
CYCLOHEXANE	413	5.10%	N	Y	Y

Contaminant	Total Excess emissions (tons)	Total excess / Total Routine	HAP	TOX	VOC
AMMONIA	353	0.88%	N	Y	
XYLENE-U	318	2.06%	Y	Y	Y
OCTANE	301	12.56%	N	N	Y
RAFFINATE	294	16.62%	N	N	Y
METHYL TERT-BUTYL ETHER	290	10.40%	Y	Y	Y
VINYL ACETATE	230	4.77%	Y	Y	Y
NITRIC OXIDE	218	10.90%	N	N	
PENTENE (1)	208	13.19%	N	N	Y
ACETYLENE	204	7.83%	N	N	Y
TRANS-2-BUTENE	197	14.77%	N	N	Y
HYDROGEN FLUORIDE	192	1.83%	Y	Y	
ISOPROPANOL	177	1.55%	N	Y	Y
SULFURIC ACID (VAPOR)	166	1.88%	N	Y	
OLEFINS-U	163	4.17%	N	N	Y
PETROLEUM DISTILLATE	151	2.91%	N	Y	Y
CHLORODIFLUOROMETHANE	146	24.21%	N	Y	
1-BUTENE	143	5.72%	N	N	Y
HYDROCHLORIC ACID	139	0.74%	Y	Y	
ACETIC ACID	136	4.94%	N	N	Y
ETHYL BENZENE	134	2.77%	Y	Y	Y
ISOHEXANE (AKA: 2-METHYLPENTANE)	134	3.36%	N	N	Y
ACETONE	131	0.66%	N	N	
STYRENE	124	0.65%	Y	Y	Y
ALIPHATIC PETROLEUM DISTILLATE	123	8.10%	N	N	Y
ISOBUTYLENE	113	7.04%	N	N	Y
ISOBUTENE	112	6.94%	N	N	Y
HEXENE	110	3.47%	N	N	Y
ALKYLATE	109	2.10%	N	N	Y
ETHYLENE OXIDE	98	15.69%	Y	Y	Y
ETHANOL	95	0.92%	N	N	Y
ACRYLONITRILE	95	14.02%	Y	Y	Y
CIS-2-BUTENE	95	16.21%	N	N	Y
N-BUTYL ALCOHOL	85	1.64%	N	Y	Y
TERT BUTYL ALCOHOL	82	8.50%	N	Y	Y
NITROGEN DIOXIDE	81	3.76%	N	N	
1,1,1,2-TETRAFLUOROETHANE	77	5.42%	N	N	
BUTENE (CIS-2-)	77	12.22%	N	N	Y
PROPYLENE OXIDE	75	6.26%	Y	Y	Y
FORMALDEHYDE	70	0.22%	Y	Y	Y
PROCESS FUEL GAS	70	2.31%	N	N	Y
FREONS-U	69	24.66%	N	N	
DECANE	68	9.00%	N	N	Y
METHYL PENTANE (3)	65	2.73%	N	N	Y
ISO OCTANE	63	8.46%	N	N	Y
DISTILLATE	63	1.71%	N	N	Y

Contaminant	Total Excess emissions (tons)	Total excess / Total Routine	HAP	TOX	VOC
ETHYLENE GLYCOL	63	3.13%	Y	Y	Y
PART-MINERAL-U	60	0.13%	N	N	
DIESEL	60	0.90%	N	N	Y
VINYL CHLORIDE	59	7.69%	Y	Y	Y
METHYL ETHYL KETONE	58	0.59%	N	N	Y
HYDROGEN CYANIDE GAS	56	0.99%	Y	Y	
CADMIUM AND COMPOUNDS	55	4.27%	Y	Y	
PETROLEUM DISTILLATES	54	0.85%	N	N	Y
ACETALDEHYDE	53	0.77%	Y	Y	Y
ISOPRENE	49	4.03%	N	N	Y
CUMENE	47	2.91%	Y	Y	Y
TRIMETHYL BENZENE, 1,2,4-	47	1.94%	N	Y	Y
METHYLENE CHLORIDE	44	2.45%	Y	Y	
SULFURIC ACID	44	0.26%	N	Y	
SILICA OXIDE	43	5.20%	N	N	
PM10 CARBON BLACK	42	2.42%	N	N	
ACETONITRILE	41	7.04%	Y	Y	Y
PM10 SILICA OXIDE	40	11.99%	N	N	
METHACRYLIC ACID	40	7.65%	N	N	Y
BUTYLENES - UNCLASSIFIED	40	13.86%	N	N	Y
1,2-DICHLOROETHANE	40	6.34%	Y	Y	Y
META-XYLENE	39	2.23%	Y	Y	Y
LIQUIFIED PETROLEUM GAS	39	1.11%	N	N	Y
METHYL ISOBUTYL KETONE	38	1.28%	Y	Y	Y
CARBON DISULFIDE	38	2.99%	Y	Y	Y
PARA-XYLENE	38	3.11%	Y	Y	Y
N-METHYL-2-PYRROLIDONE	38	7.41%	N	Y	Y
ALUMINM OXIDE- AL203	36	1.13%	N	Y	
PYROLYSIS GASOLINE	35	7.04%	N	N	Y
METHYL ACETATE	35	2.40%	N	N	
TETRAHYDROFURAN	34	3.90%	N	N	Y
BUTYL ACETATE	33	0.82%	N	N	Y
NONANE	32	4.66%	N	N	Y
ETHYL CHLORIDE	32	19.63%	Y	Y	Y
METHYL CHLORIDE	32	1.21%	Y	Y	Y
PINENE, ALPHA-	31	0.15%	N	N	Y
GAS OIL	31	0.50%	N	N	Y
ISOBUTANOL	30	1.53%	N	N	Y
NAPTHA,COAL-TAR	28	2.06%	N	N	Y
OCTENE	27	4.47%	N	N	Y
PHENOL	27	1.51%	Y	Y	Y
CARBONYL SULFIDE	27	0.81%	Y	Y	Y
BUTYRALDEHYDE	27	5.02%	N	Y	Y
METHYLCYCLOHEXANE	26	3.33%	N	N	Y
2,2,4-TRIMETHYLPENTANE	26	3.25%	Y	Y	Y
CARBON DISULFIDE	26	6.55%	Y	Y	
CYCLOHEXANONE	26	4.66%	N	N	Y

Contaminant	Total Excess emissions (tons)	Total excess / Total Routine	HAP	TOX	VOC
CHLOROBENZENE	25	11.44%	Y	Y	Y
ISOPROPYL ACETATE	24	4.98%	N	N	Y
FURFURAL	24	3.84%	N	Y	Y
PM10 PART-MINERAL-U	24	0.09%	N	N	
METHYLCYCLOPENTANE	23	0.70%	N	N	Y
UNDECANE	23	15.94%	N	N	Y
METHOXY-2-ACETOXYPROPANE, 1-	23	1.77%	N	N	Y
METHYL FORMATE	23	8.17%	N	N	
KEROSENE	22	0.72%	N	N	Y
METHYL MERCAPTAN	22	1.72%	N	N	Y
ORTHO-XYLENE	22	1.99%	Y	Y	Y
ACROLEIN	22	0.81%	Y	Y	Y
ALKANES-U	21	0.56%	N	N	Y
CYCLOPENTADIENE	20	7.87%	N	N	Y
JET FUEL	20	1.15%	N	N	Y
MINERAL SPIRITS	19	0.43%	N	N	Y
METHYL TERT BUTYL ETHER	19	1.41%	Y	Y	Y
METHYL METHACRYLATE	19	1.70%	Y	Y	Y
SULFUR OXIDE-U	18	0.94%	N	N	
N-PROPANOL	18	0.66%	N	N	Y
PARAFFINS-U	17	2.10%	N	N	Y
PENTENE NITRILES-U	17	2.09%	N	N	Y
ACRYLIC ACID	17	2.87%	Y	Y	Y
MALEIC ANHYDRIDE	16	16.33%	Y	Y	Y
FUEL OIL-U	16	0.66%	N	N	Y
BUTYRIC ACID	16	31.72%	N	N	Y
PINENE, BETA-	16	0.46%	N	N	Y
PLASTICS-U	16	4.23%	N	N	
BUTYL ACRYLATE	15	2.28%	N	Y	Y
CARBON-C	15	2.30%	N	N	
CARBON BLACK	15	0.65%	N	N	
2,2,4- TRIMETHYLPENTANE	15	5.20%	Y	Y	Y
PM10 ALUMINM OXIDE-AL203	15	0.54%	N	Y	
IRON 2 OXIDE - FEO	15	24.46%	N	N	
BUTENE (2-METHYL-2)	15	3.81%	N	N	Y
ISOBUTYRIC ACID	14	5.21%	N	N	Y
DODECANE	14	8.67%	N	N	Y
SULFUR TRIOXIDE	14	0.26%	N	N	
BUTYL CELLOSOLVE	13	0.88%	N	Y	Y
PM10 PLASTICS-U	13	5.91%	N	N	
PM10 CARBON-C	13	2.05%	N	N	
TERPENE	13	0.14%	N	N	Y
ETHYL ACETATE	12	0.88%	N	N	Y
LUBRICATING OIL	12	0.49%	N	N	Y
NONENE	11	8.41%	N	N	Y

Contaminant	Total Excess emissions (tons)	Total excess / Total Routine	HAP	TOX	VOC
NAPHTHA, PETROLEUM, HYDRO TREAT LT	11	0.44%	N	N	Y
REFORMATE	11	0.53%	N	N	Y
NAPHTHALENE	11	0.81%	Y	Y	Y
ISOBUTYRALDEHYDE	11	1.85%	N	Y	Y
AROMATIC PETROLEUM DISTILLATE (LIGHT)	11	0.32%	N	N	Y
CYCLOPENTANE	11	2.21%	N	N	Y
CYCLOOCTADIENE	10	25.19%	N	N	Y
ALCOHOLS-U	10	1.29%	N	N	Y

Table S2: Total excess emissions in tons for all pollutants (except CO_2) for all industries by Standard Industry Classification (SIC) codes. The Table includes industries that have at least 10 tons of excess emissions. Data pertain to all facilities reporting to the Emissions Inventory of the Texas Commission on Environmental Quality (TCEQ) during the period 2004-2015. Source: Table compiled by the authors using data from TCEQ [2].

SIC	SIC Description	Total Excess emissions (tons)
1321	NATURAL GAS LIQUIDS	130,780
2911	PETROLEUM REFINING	116,273
2869	INDUSTRIAL ORGANIC CHEMICALS, NEC	73,258
4911	ELECTRIC SERVICES	60,550
1311	CRUDE PETROLEUM & NATURAL GAS	36,587
4922	NATURAL GAS TRANSMISSION	20,209
4226	SPECIAL WAREHOUSING AND STORAGE	19,173
2895	CARBON BLACK	12,120
2821	PLASTICS MATERIALS AND SYNTHETIC RESINS	11,175
4612	CRUDE PETROLEUM PIPE LINES	10,121
3296	MINERAL WOOL	8,032
3251	BRICK AND STRUCTURAL CLAY TILE	3,644
4613	REFINED PETROLEUM PIPELINES	3,386
2819	INDUSTRIAL INORGANIC CHEMICALS	2,600
5171	PETROLEUM BULK STATIONS & TERMINALS	1,667
2011	MEAT PACKING PLANTS	1,466
2813	INDUSTRIAL GASES	1,077
4925	GAS PRODUCTION AND DISTRIBUTION	626
4931	ELECTRIC AND OTHER SERVICES COMBINED	536
2812	ALKALIES AND CHLORINE	401
2873	NITROGENOUS FERTILIZERS	387
2822	SYNTHETIC RUBBER	358
4619	PIPELINES, NEC	263
2865	CYCLIC CRUDES AND INTERMEDIATES, AND ORGANIC DYES	252
3274	LIME	230
3241	CEMENT, HYDRAULIC	213
3674	SEMICONDUCTORS AND RELATED DEVICES	207
4953	REFUSE SYSTEMS	200
4961	STEAM AND AIR CONDITIONING SUPPLY	199
2095	ROASTED COFFEE	194
3221	GLASS CONTAINERS	181
2621	PAPER MILLS	181
3821	LABORATORY APPARATUS AND FURNITURE	160
3089	PLASTICS PRODUCTS, NEC	155
9711	NATIONAL SECURITY	152
3082	UNSUPPORTED PLASTICS PROFILE SHAPE	113

SIC	SIC Description	Total Excess emissions (tons)
3411	METAL CANS	103
2952	ASPHALT FELTS AND COATINGS	102
2493	RECONSTITUTED WOOD PRODUCTS	101
2999	PETROLEUM AND COAL PRODUCTS, NEC	90
5153	GRAIN AND FIELD BEANS	87
4491	MARINE CARGO HANDLING	86
2874	PHOSPHATIC FERTILIZERS	84
3086	PLASTICS, FOAM PRODUCTS	81
3341	SECONDARY NONFERROUS METALS	81
3479	METAL COATING AND ALLIED SERVICES	81
2061	RAW CANE SUGAR EXCEPT REFINING	74
2899	CHEMICAL PREPARATIONS, NEC	71
2051	BREAD, CAKE AND RELATED PRODUCTS	68
3229	PRESSED AND BLOWN GLASS, NEC	66
4789	TRANSPORTATION SERVICES, NEC	61
3081	UNSUPPORTED PLASTICS, FILM & SHEET	55
3412	METAL BARRELS, DRUMS & PAILS	54
2631	PAPERBOARD MILLS	52
3321	GRAY & DUCTILE IRON FOUNDRIES	48
3331	PRIMARY COPPER	41
4952	SEWERAGE SYSTEMS	40
2074	COTTONSEED OIL MILLS	37
2436	SOFTWOOD VENEER AND PLYWOOD	37
2434	WOOD KITCHEN CABINETS	34
3334	PRIMARY ALUMINUM	30
4581	AIRPORTS, FLYING FIELDS, SERVICE	29
3533	OIL AND GAS FIELD MACHINERY	27
3351	COPPER ROLLING AND DRAWING	27
3053	GASKETS, PACKING AND SEALING DEVICES	22
2035	PICKLES SAUCES AND SALAD DRESS	22
2879	AGRICULTURAL CHEMICALS, NEC	22
2834	PHARMACEUTICAL PREPARATIONS	21
3441	FABRICATED STRUCTURAL METAL	20
3084	PLASTICS, PIPE	19
4923	GAS TRANSMISSION AND DISTRIBUTION	18
2752	COMMERCIAL PRINTING LITHOGRAPH	17
9661	SPACE RESEARCH AND TECHNOLOGY	15
3312	BLAST FURNACES AND STEEL MILLS	13
3275	GYPSUM PRODUCTS	12
3211	FLAT GLASS	10

SIC	SIC Description	Total Excess emissions (tons)
2844	TOILET PREPARATIONS	10
3088	PLASTICS, PLUMBING FIXTURES	10

Table S3: Top five pollutants for the top five polluting industries, based on the information reported to the TCEQ Emissions Inventory dataset (2004-2015). Column #3 reports total amounts of excess emissions for 2004-2015. Column #4 captures the ration of excess over routine emissions for a specific pollutant within a given SIC across 2004-2015. The last column captures the ratio of excess emissions for a given pollutant within an SIC over the excess emissions for the same pollutant across all SICs. Source: Table compiled by the authors using data from TCEQ[2].

Pollutant	SIC Description	Total excess emissions in tons	(Total excess / Total Routine) for a given SIC	Total excess emissions of a given SIC / Total excess emissions across all SICs
SO_2	CRUDE PETROLEUM & NATURAL GAS (1311)	10,772	17.17%	8.70%
VOC		9,774	5.95%	9.38%
CO		4,393	1.95%	4.93%
NOx		1,528	0.45%	7.54%
PROPANE		843	3.14%	6.98%
SO_2	NATURAL GAS LIQUIDS (1321)	77,429	58.47%	62.53%
VOC		17,911	15.57%	17.19%
CO		12,820	4.60%	14.37%
PROPANE		3,419	22.80%	28.30%
NOx		3,296	0.72%	16.26%
VOC	INDUSTRIAL ORGANIC CHEMICALS, NEC (2869)	20,366	9.83%	19.54%
CO		19,955	10.10%	22.37%
ETHYLENE		6,571	17.93%	72.08%
PROPYLENE		3,492	20.41%	53.49%
NOx		2,689	0.69%	13.26%
VOC	PETROLEUM REFINING (2911)	25,619	9.61%	24.59%
SO_2		23,499	10.02%	18.98%
CO		18,109	10.10%	20.30%
N BUTANE		5,611	60.25%	56.50%
Total PM		4,812	4.80%	30.07%
CO	ELECTRIC SERVICES (4911)	22,888	0.95%	25.66%
NOx		9,107	0.52%	44.92%
Total PM		5,592	1.68%	34.95%
SO_2		3,079	0.06%	2.49%
VOC		611	1.36%	0.59%

Table S4: Descriptive statistics of excess emissions from 30 Refineries during 2002-2017. Source: Table compiled by the authors using data from TCEQ [1]

	Min	25th percentile	Median	75th percentile	95th percentile	99th percentile	Max	Number of events
Duration of event (in hours)	0	2	8	34.8	291	801	8951	8,715
Excess emissions (in tons)								
All Criteria Pollutants	0	0.01	0.13	0.85	10.7	59.5	3162	8,715
CO	0	0.02	0.15	0.86	13.5	82.7	1093	5,118
Lead	0	0	0	0	0	0.01	0.012	66
NO_x	0	0	0.02	0.09	0.86	4.5	241	5,142
PM	0	0	0.02	0.25	9.2	78	203	1,123
SO2	0	0.16	0.7	2.7	24	83	2176	5,448
VOCs	0	0.03	0.18	0.87	8.2	46	3162	5,884

Table S5: Descriptive statistics of excess emissions from 1,071 Crude Petroleum and Natural Gas (CP&NG) facilities during 2002-2017. Source: Table compiled by the authors using data from TCEQ [1].

	Min	25th percentile	Median	75th percentile	95th percentile	99th percentile	Max	Number of events
Duration of event (in hours)	0	5	17	65	304	764	11,976	16,821
Excess emissions (in tons)								
All Criteria Pollutants	0	0.04	0.2	0.93	8	34	3,753	16,821
CO	0	0.04	0.13	0.42	2	8	393	14,780
NO_x	0	0.01	0.05	0.15	0.9	3	197	15,180
PM	0	0	0	0	0.04	7	8	153
SO2	0	0.45	1	3	20	67	3,753	15,261
VOCs	0	0.03	0.2	1	11	46	702	7,049

Table S6: Descriptive statistics of excess emissions from 174 Natural Gas Liquids (NGL) facilities during 2002-2017. Source: Source: Table compiled by the authors using data from TCEQ [1]

	Min	25th percentile	Median	75th percentile	95th percentile	99th percentile	Max	Number of events
Duration of event (in hours)	0	2.1	6	21	168	556	8,760	7,499
Excess emissions (in tons)								
All Criteria Pollutants	0	0.03	0.27	1	12	57	5,800	7,499
CO	0	0.03	0.19	1	6	20	714	5,838
NO_x	0	0.01	0.08	0.3	2	5	604	5,560
PM	0	0	0	0	0.14	0.14	0.14	159
SO2	0	0.4	1.2	4	32	200	5,800	5,310
VOCs	0	0.03	0.22	2	16	49	1,632	3,373

Table S7: Descriptive statistics of excess emissions from 157 Industrial Organic Chemicals facilities during 2002-2017. Source: Table compiled by the authors using data from TCEQ [1]

	Min	25th percentile	Median	75th percentile	95th percentile	99th percentile	Max	Number of events
Duration of event (in hours)	0	1.42	8	34	290	1152	9,525	10,544
Excess emissions (in tons)								
All Criteria Pollutants	0	0.02	0.16	1	10	50	16,140	10,544
CO	0	0.06	0.3	2	16	84	16,140	5,761
NO_x	0	0	0.05	0.23	2	7	75	5,959
PM	0	0	0.03	0.14	1	5	27	636
SO2	0	0.01	0.6	3.4	38	124	1,140	1,671
VOCs	0	0.04	0.2	1	10	40	767	8,151

Table S8: Descriptive statistics of excess emissions from 37 Electric Services (ES) facilities during 2002-2017. Source: Table compiled by the authors using data from TCEQ[1]. Note that the very low number of excess emissions events from utilities recorded in the AEME dataset does not allow for the compilation of frequency histograms by pollutant.

	Min	25th percentile	Median	75th percentile	95th percentile	99th percentile	Max	Number of events
Duration of event (in hours)	0	2	11	19	35	144	1,105	436
Excess emissions (in tons)								
All Criteria Pollutants	0	0.1	0.2	0.4	2	5	250	436
CO	0	0.2	0.3	0.5	1	20	67	294
NO_x	0	0.1	0.4	0.8	2	5	250	372
PM	0	0.1	0.1	0.2	0.2	0.2	2	250
SO2	0	0.1	0.1	0.2	0.2	1.5	3	244
VOCs	0	0.2	1	2	5	5	5	18

Table S9: Summary statistics for top 6 polluting refineries (out of a total of 30 refineries reporting to the AEME dataset of the TCEQ) by pollutant. Source: Table compiled by the authors using data from TCEQ [1]. Column (1) shows the ratio of the total excess emissions in the top six polluting refineries (by pollutant) over the total excess emissions in all refineries between 2002-2016. Column (2) shows the ratio of the total number of excess emissions events that occurred in the top six polluting refineries (by pollutant) over the total number of excess emissions events that occurred in all refineries over the period 2002-2016.

	(1)	(2)
Pollutant	Share of total excess emissions amounts for the top 6 polluting refineries	Share of total number of excess emissions events for the top 6 polluting refineries
CO	77%	35%
NO_x	62%	41%
PM	98%	64%
SO_2	70%	41%
VOC	64%	35%

Table S10: Summary statistics for top 6 polluting Natural Gas Liquids (NGL) facilities (out of a total of 174 NGL facilities reporting to the AEME dataset of the TCEQ) by pollutant. Source: Table compiled by the authors using data from TCEQ [1]. Column (1) shows the ratio of the total excess emissions in the top six polluting NGL facilities (by pollutant) over the total excess emissions in all NGL facilities between 2002-2016. Column (2) shows the ratio of the total number of excess emissions events that occurred in the top six polluting NGL facilities (by pollutant) over the total number of excess emissions events that occurred in all NGL facilities over the period 2002-2016.

	(1)	(2)
Pollutant	Share of total excess emissions amounts for the top 6 polluting NGL facilities	Share of total number of excess emissions events for the top 6 polluting NGL facilities
CO	72%	39%
NO_x	73%	39%
SO_2	86%	55%
VOC	69%	23%

Table S11: Summary statistics for top 6 polluting Industrial Organic Chemicals (IOC) facilities (out of a total of 157 IOC facilities reporting to the AEME dataset of the TCEQ) by pollutant. Source: Table compiled by the authors using data from TCEQ [1]. Column (1) shows the ratio of the total excess emissions in the top six polluting IOC facilities (by pollutant) over the total excess emissions in all IOC facilities between 2002-2016. Column (2) shows the ratio of the total number of excess emissions events that occurred in the top six polluting IOC facilities (by pollutant) over the total number of excess emissions events that occurred in all IOC facilities over the period 2002-2016.

	(1)	(2)
Pollutant	Share of total excess emissions amounts for the top 6 polluting IOC facilities	Share of total number of excess emissions events for the top 6 polluting IOC facilities
CO	83%	25%
NO_X	46%	31%
SO_2	98%	60%
VOC	44%	24%

Table S12: Summary statistics for top 6 polluting Crude Petroleum and Natural Gas (CPNG) facilities (out of a total of 1,071 CPNG facilities reporting to the AEME dataset of the TCEQ) by pollutant. Source: Table compiled by the authors using data from TCEQ [1]. Column (1) shows the ratio of the total excess emissions in the top six polluting CPNG facilities (by pollutant) over the total excess emissions in all CPNG facilities between 2002-2016. Column (2) shows the ratio of the total number of excess emissions events that occurred in the top six polluting CPNG facilities (by pollutant) over the total number of excess emissions events that occurred in all CPNG facilities over the period 2002-2016.

	(1)	(2)
Pollutant	Share of total excess emissions amounts for the top 6 polluting CPNG facilities	Share of total number of excess emissions events for the top 6 polluting CPNG facilities
CO	31%	9%
NO_X	23%	8%
SO_2	28%	11%
VOC	28%	5%

Figure S1: Ratio of excess emissions of criteria pollutants over routine emissions for all facilities reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

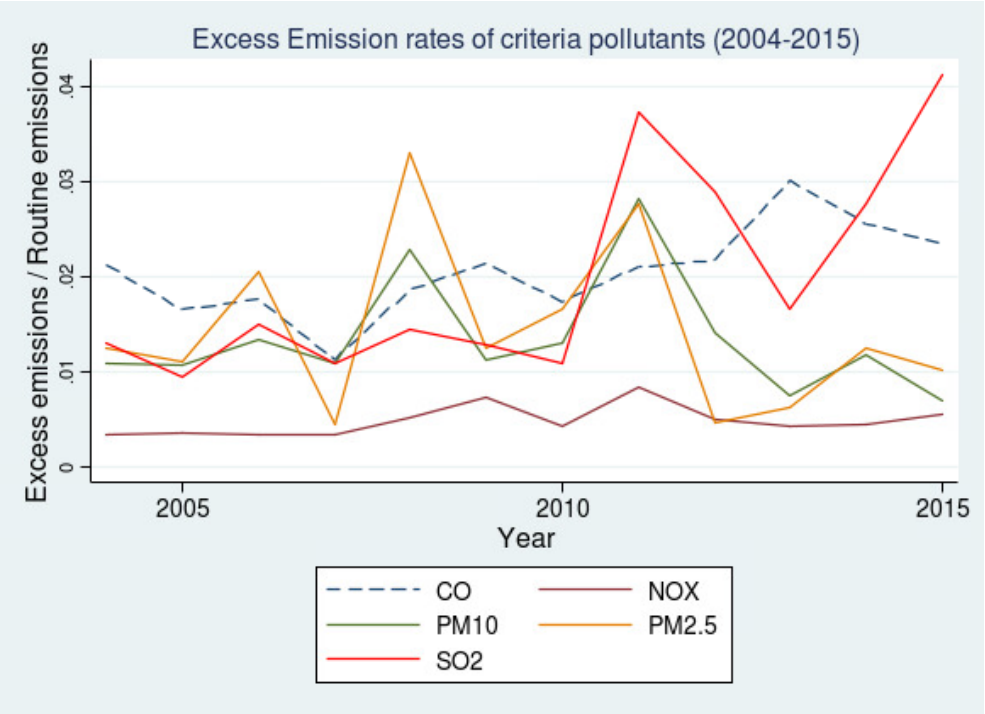


Figure S2: Ratio of excess emissions of highest emitted HAPs and VOCs over routine emissions for all facilities reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

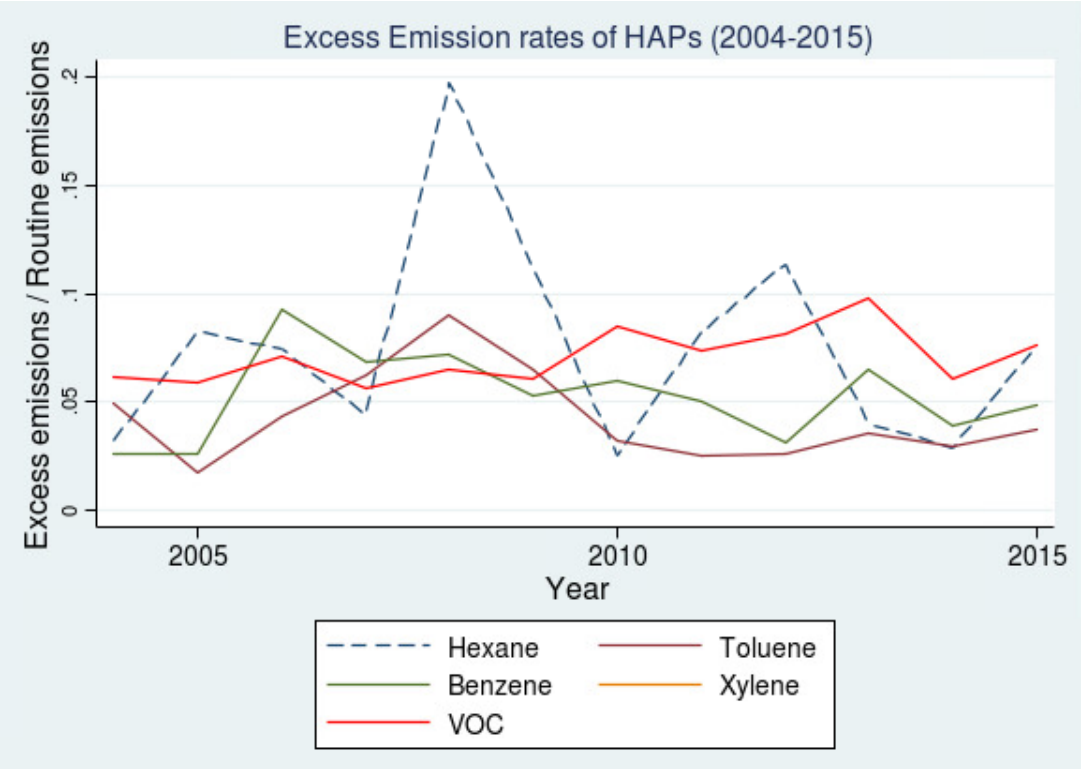


Figure S3: Total amount of excess emissions of VOCs for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

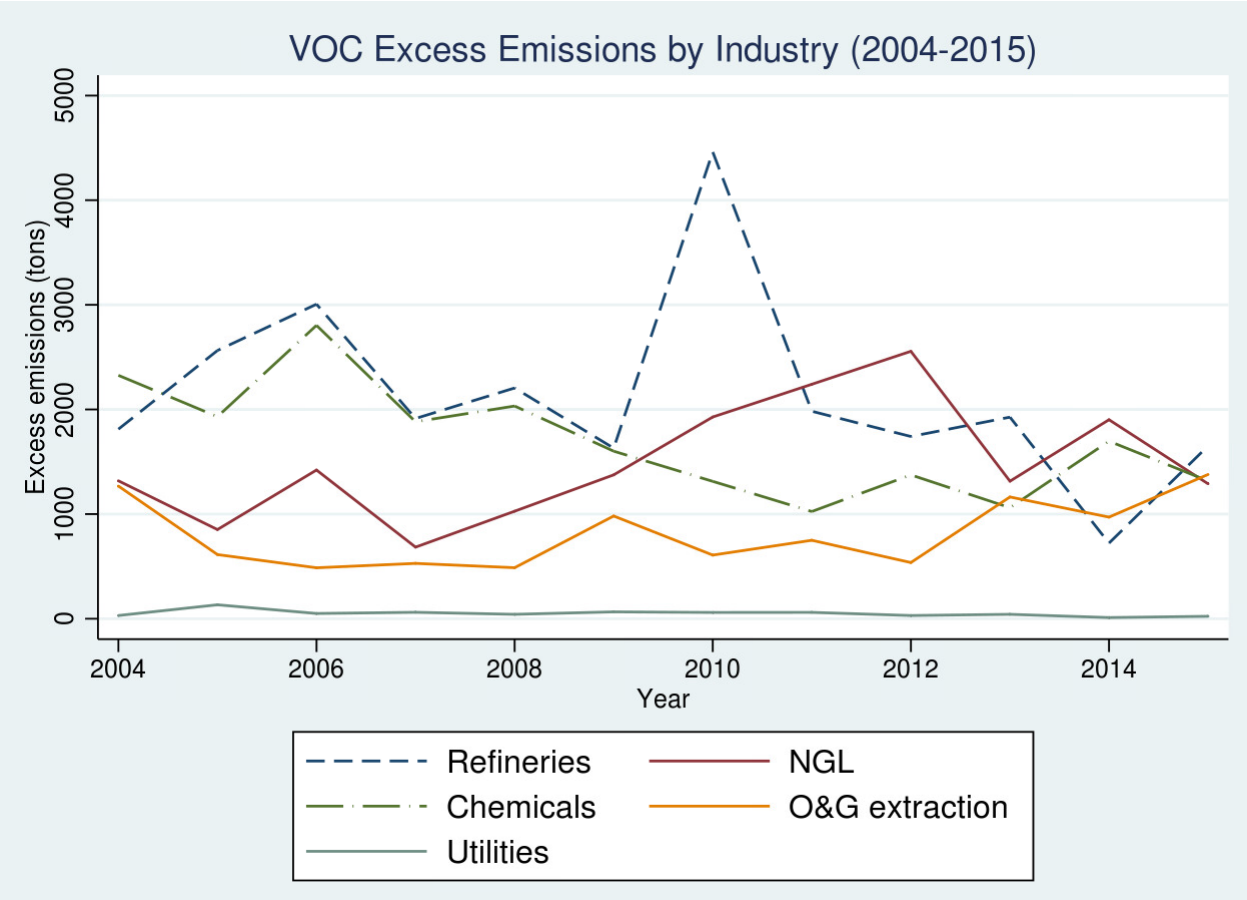


Figure S4: Total amount of excess emissions of CO for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

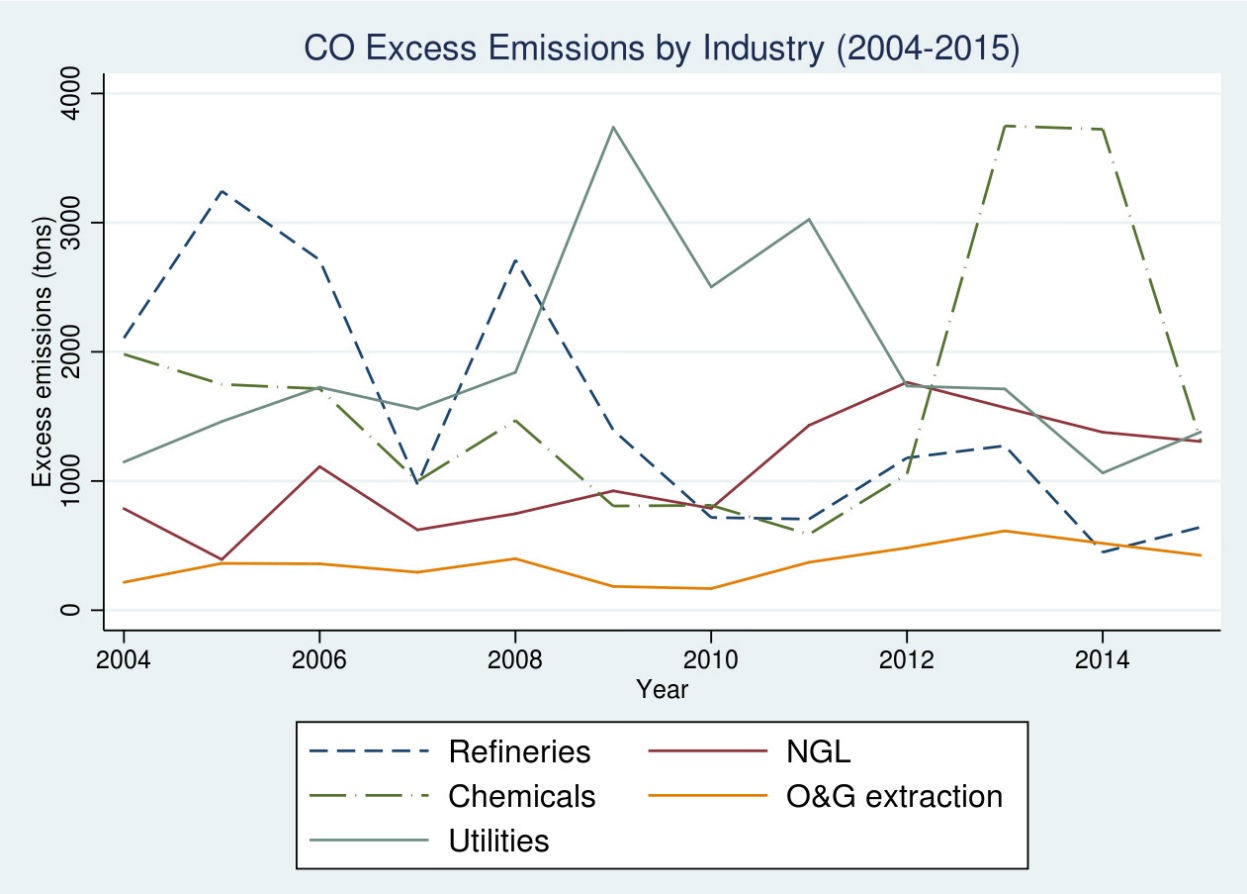


Figure S5: Total amount of excess emissions of NOx for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

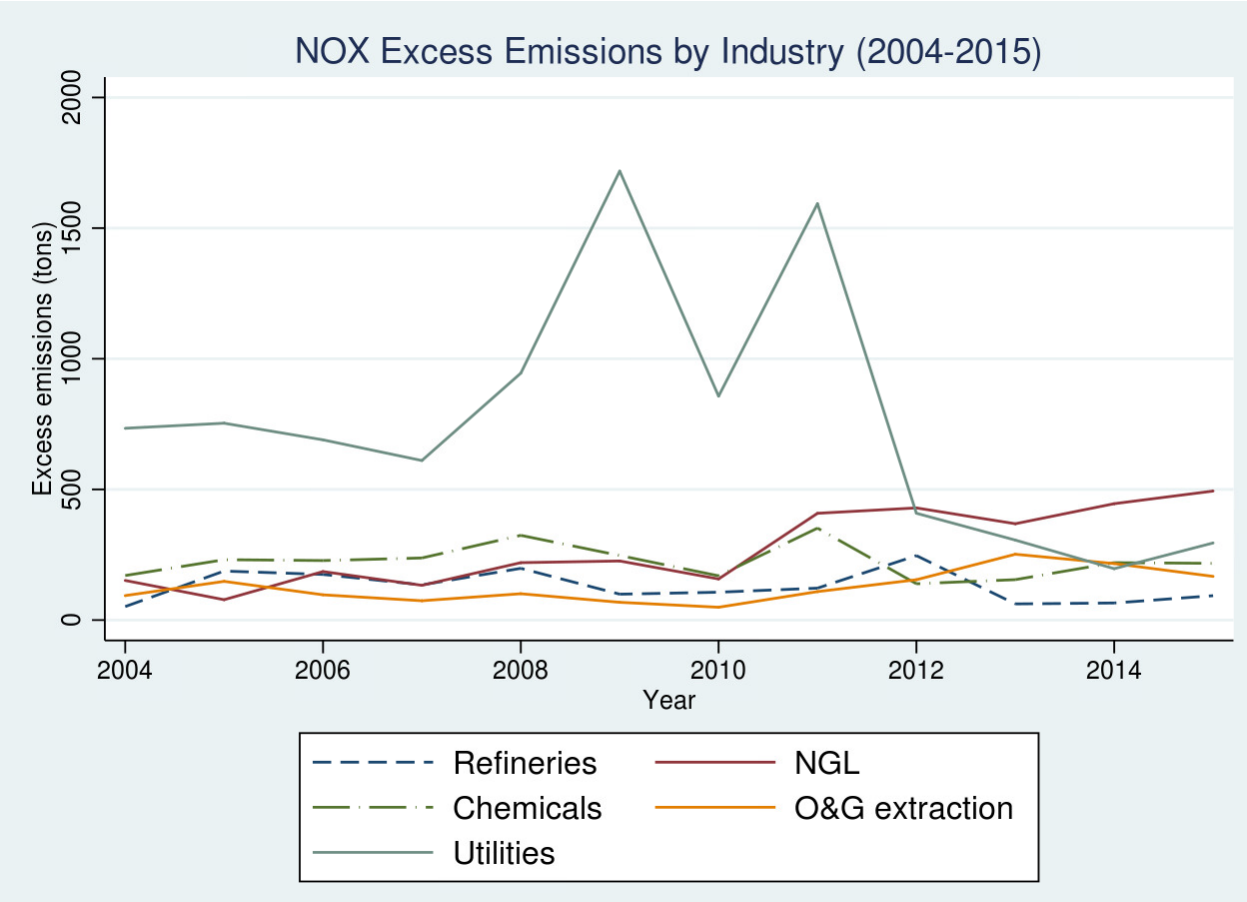


Figure S6: Total amount of excess emissions of PM 2.5 for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

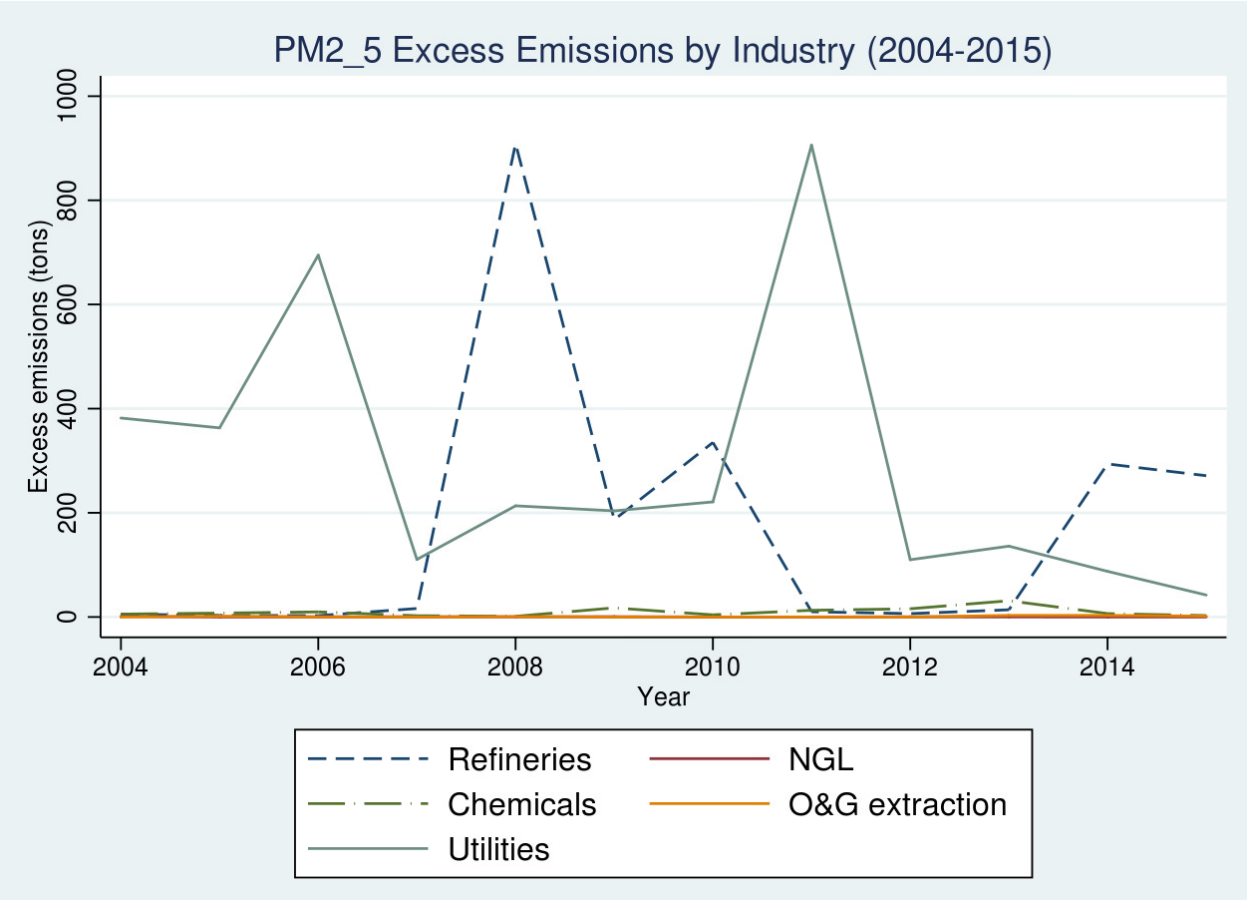


Figure S7: Total amount of excess emissions of PM10 for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

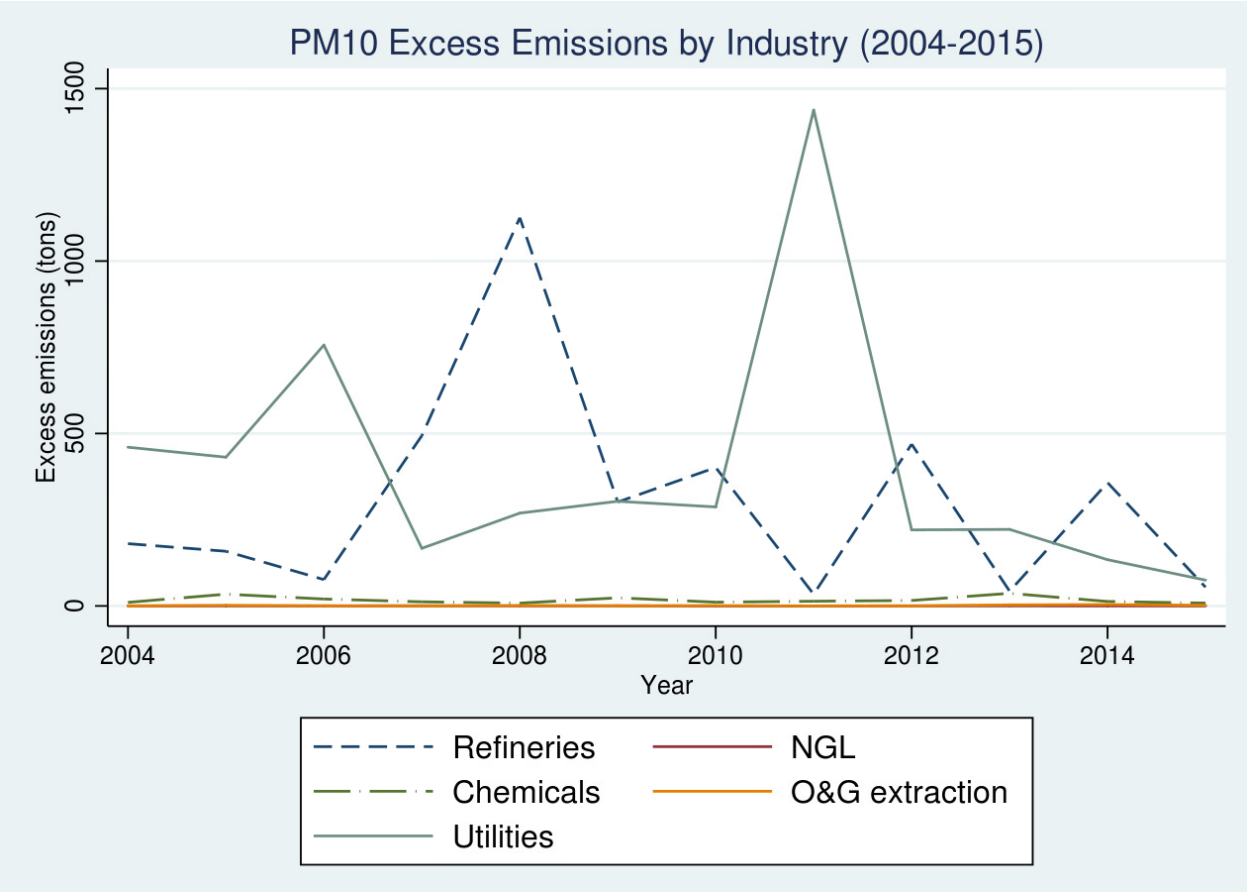


Figure S8: Total amount of excess emissions of SO_2 for all facilities in the top five polluting industries reporting to the Emissions Inventory of the TCEQ (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

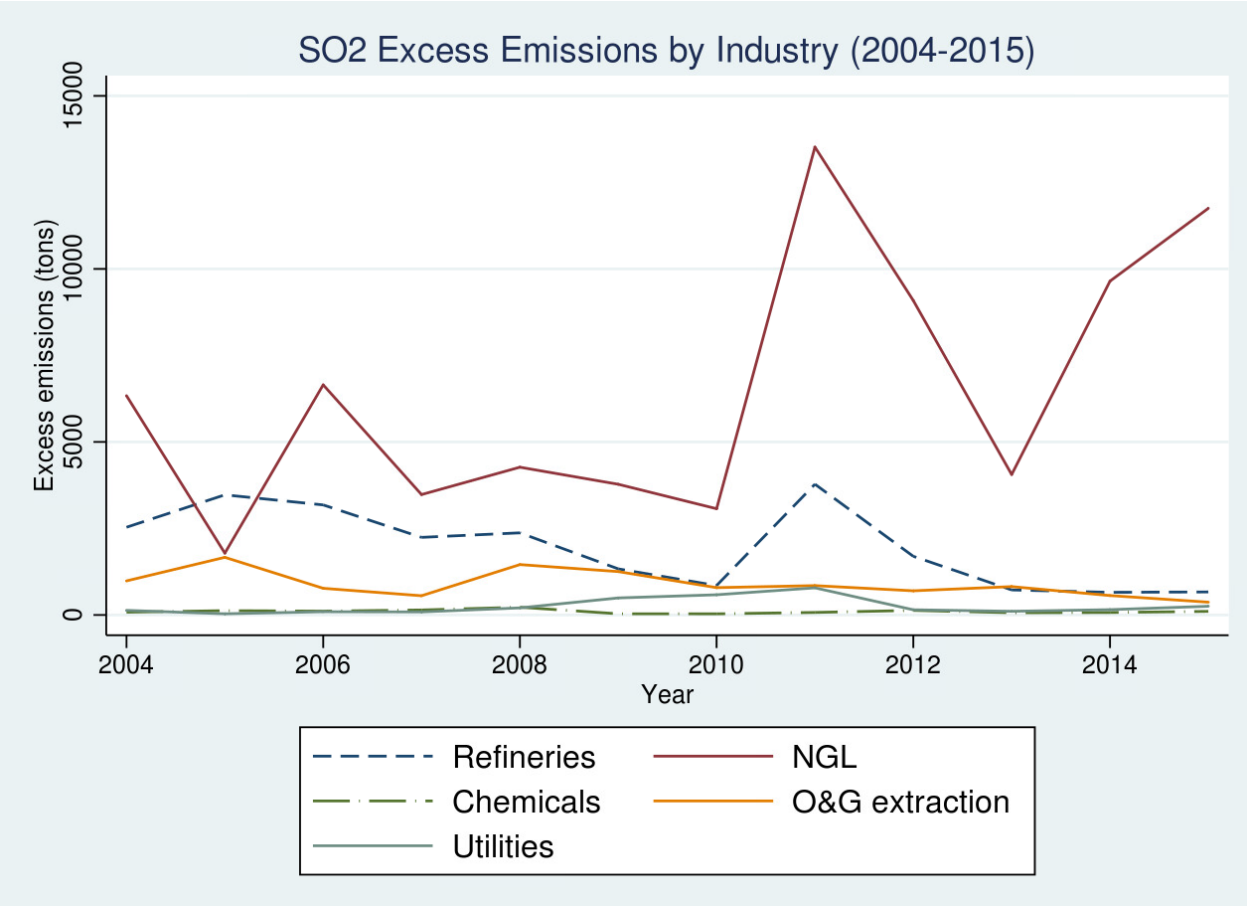


Figure S9: Number of facilities reporting to the Emissions Inventory of the TCEQ by industry (2004-2015). Source: Figure compiled by the authors using data from TCEQ [2].

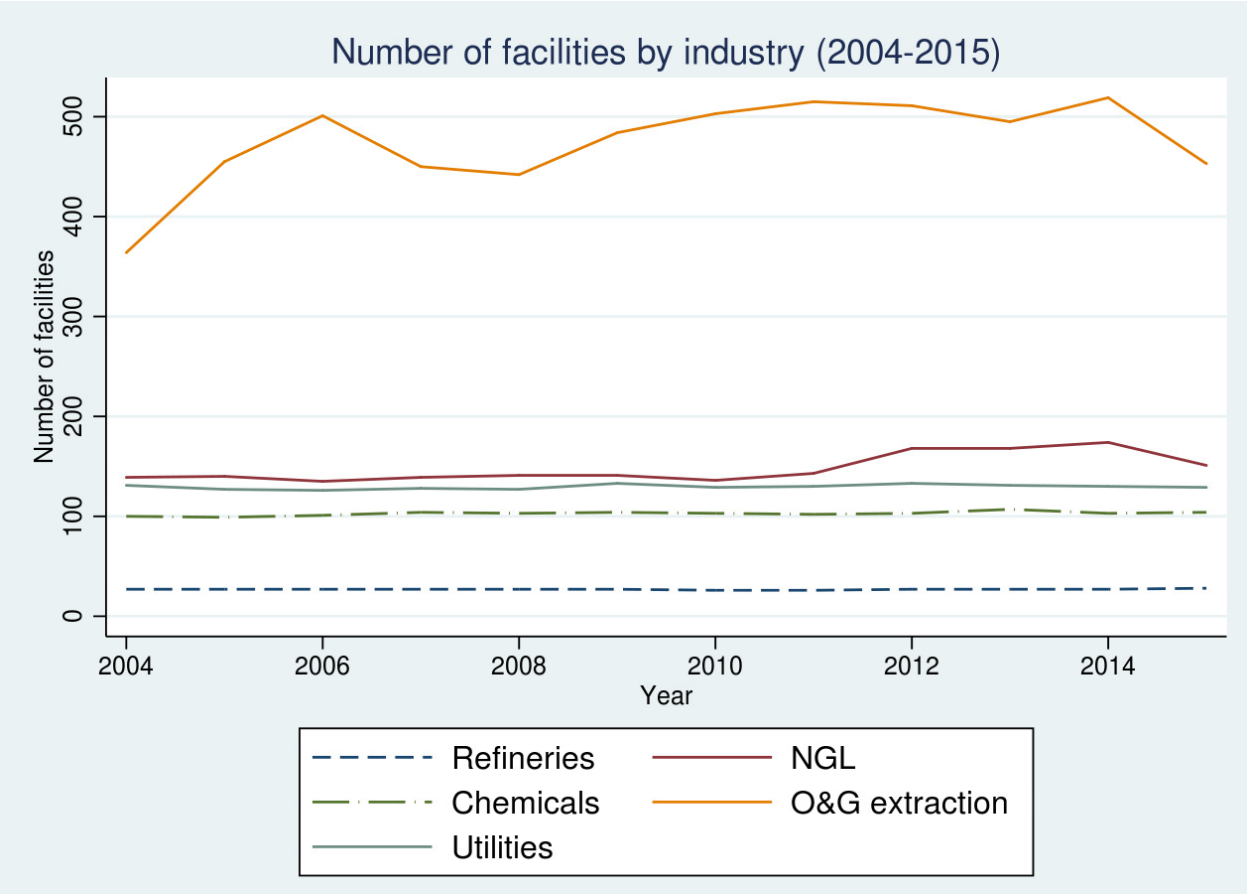


Figure S10: Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of routine emissions (vertical axis), and total number of excess emissions events (horizontal axis) from 26 refineries in Texas, during the period 2002-2015. Source: Figure compiled by the authors using data from TCEQ[1,2]. The refineries with the highest amounts of cumulative excess emissions are highlighted in green. These are: a) Shell Oil, Deer Park (label #5), b) Exxon Mobil, Baytown (label #25), c) Blanchard, Texas City (label #23), d) WRB, Borger (label # 21), e) Exxon Mobil, Beaumont (label # 19). The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of the Figure, but are comparable within each of the six panels.

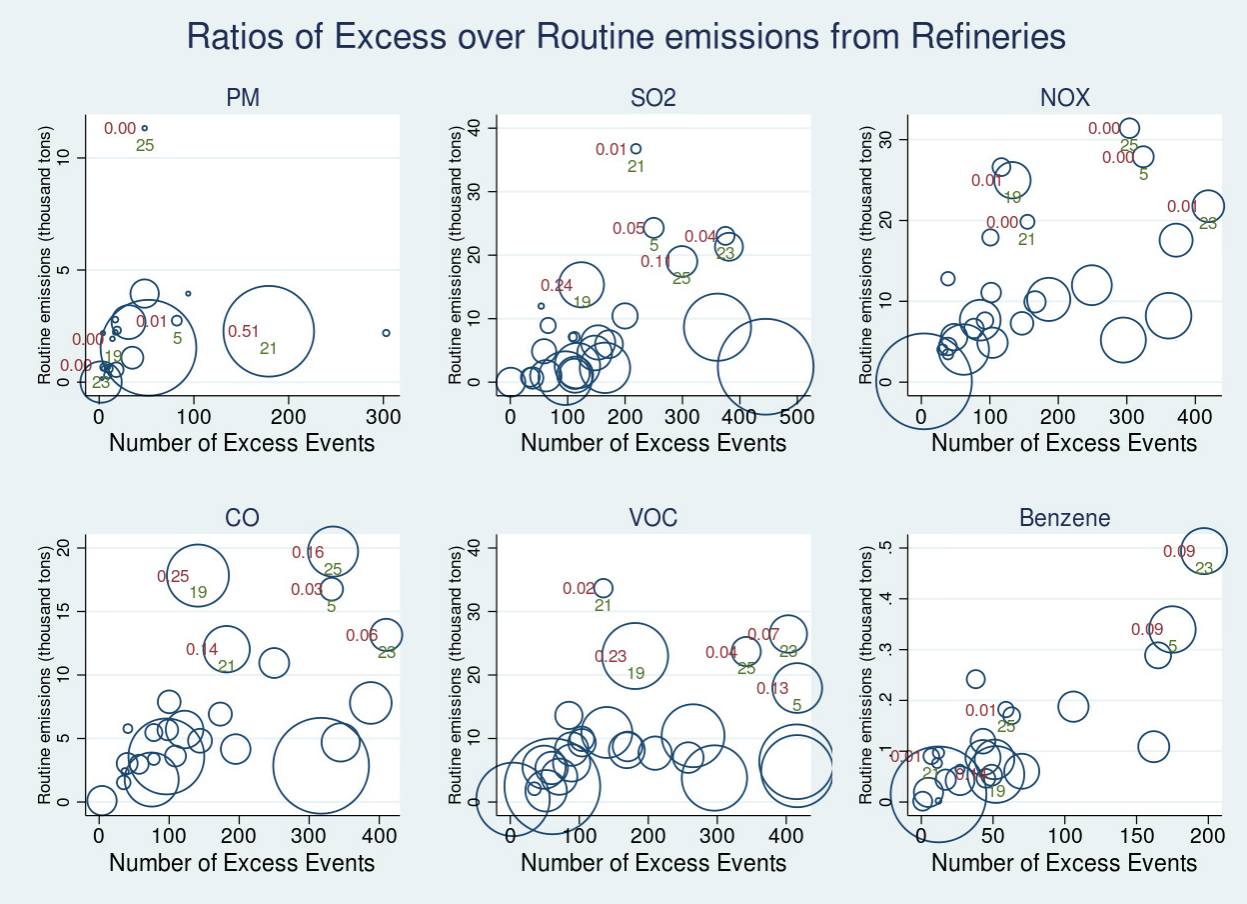


Figure S11: Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of routine emissions (vertical axis), and total number of excess emissions events (horizontal axis) from 93 Industrial Organic Chemical (IOC) facilities in Texas during 2002-2015. Source: Figure compiled by the authors using data from TCEQ[1,2]. The facilities with the highest amounts of cumulative excess emissions are highlighted in green. The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of the Figure, but are comparable within each of the six panels.

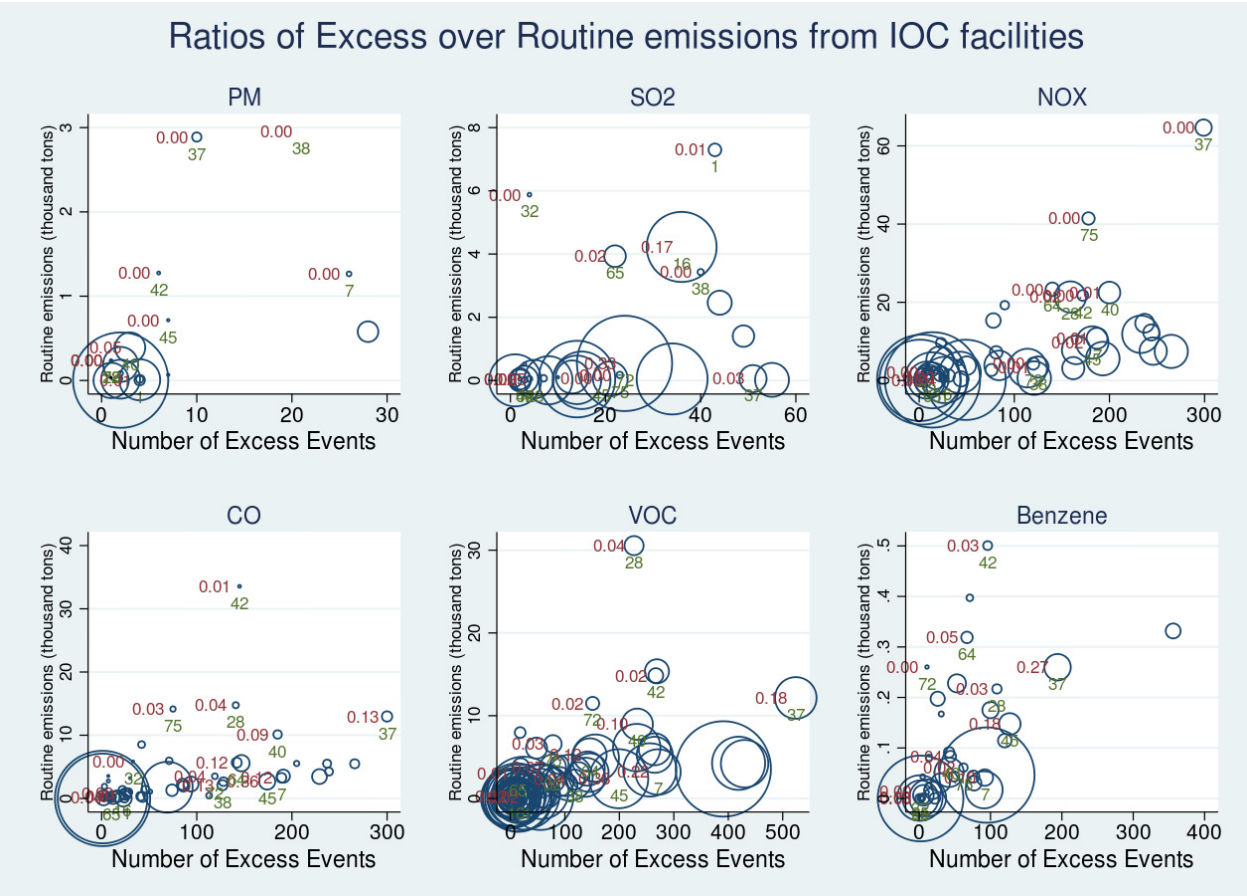


Figure S12: Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of routine emissions (vertical axis), and total number of excess emissions events (horizontal axis) from 119 Natural Gas Liquids (NGL) facilities in Texas during 2002-2015. Source: Figure compiled by the authors using data from TCEQ[1,2]. The facilities with the highest amounts of cumulative excess emissions are highlighted in green. The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of the Figure, but are comparable within each of the six panels.

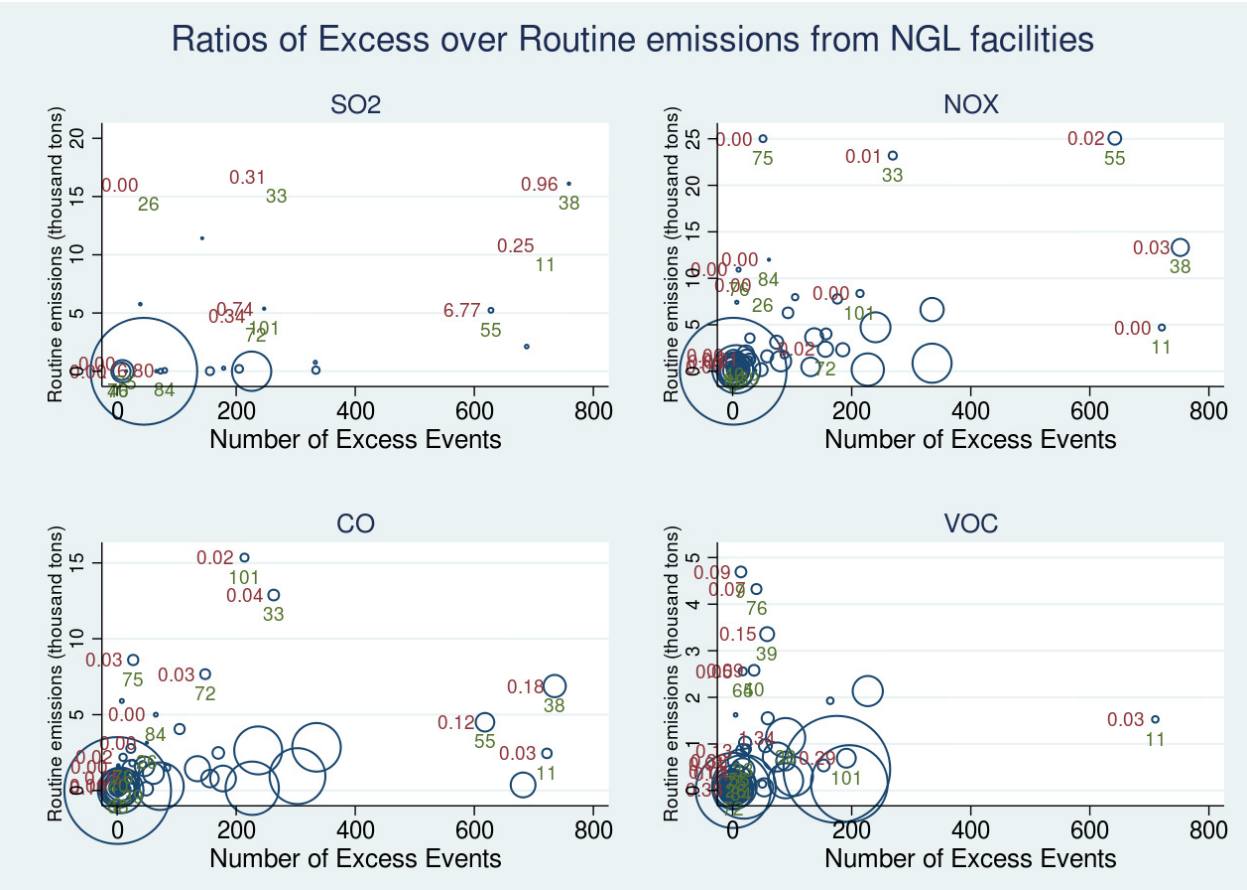


Figure S13: Ratio of excess emissions over routine (permitted) emissions (captured in red), total amount of routine emissions (vertical axis), and total number of excess emissions events (horizontal axis) from 122 Crude Petroleum and Natural Gas (CPNG) facilities in Texas during 2002-2015. Source: Figure compiled by the authors using data from TCEQ[1,2]. The facilities with the highest amounts of cumulative excess emissions are highlighted in green. The ratio of excess over routine emissions is captured in red and is also depicted by the area of each circle (the larger the circle the higher the ratio of excess over routine emissions). Note that the areas of each circle are not comparable across the six panels of the Figure, but are comparable within each of the six panels.

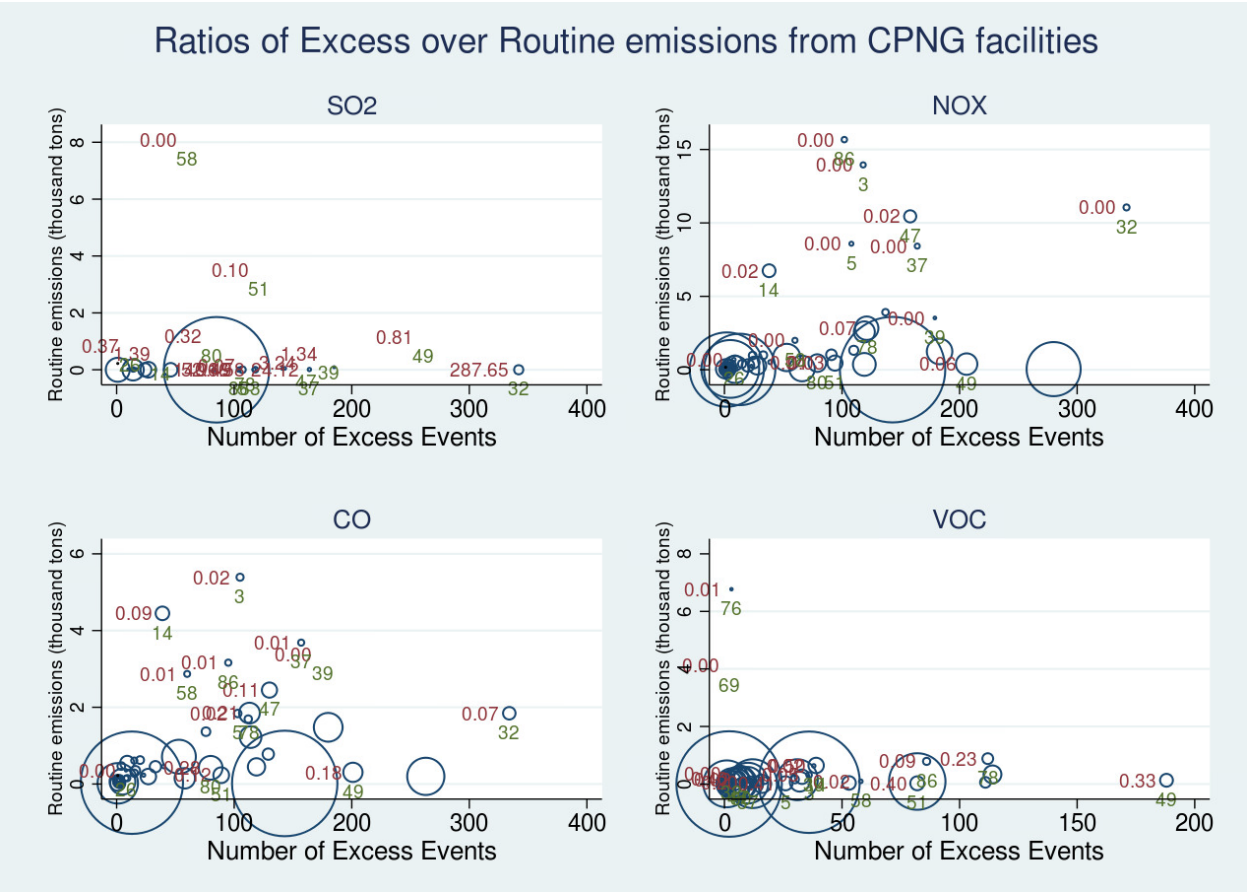


Figure S14: Skewness parameter for the distributions of criteria excess emissions for all Refineries by year. Source: Figure compiled by the authors using data from TCEQ [1].

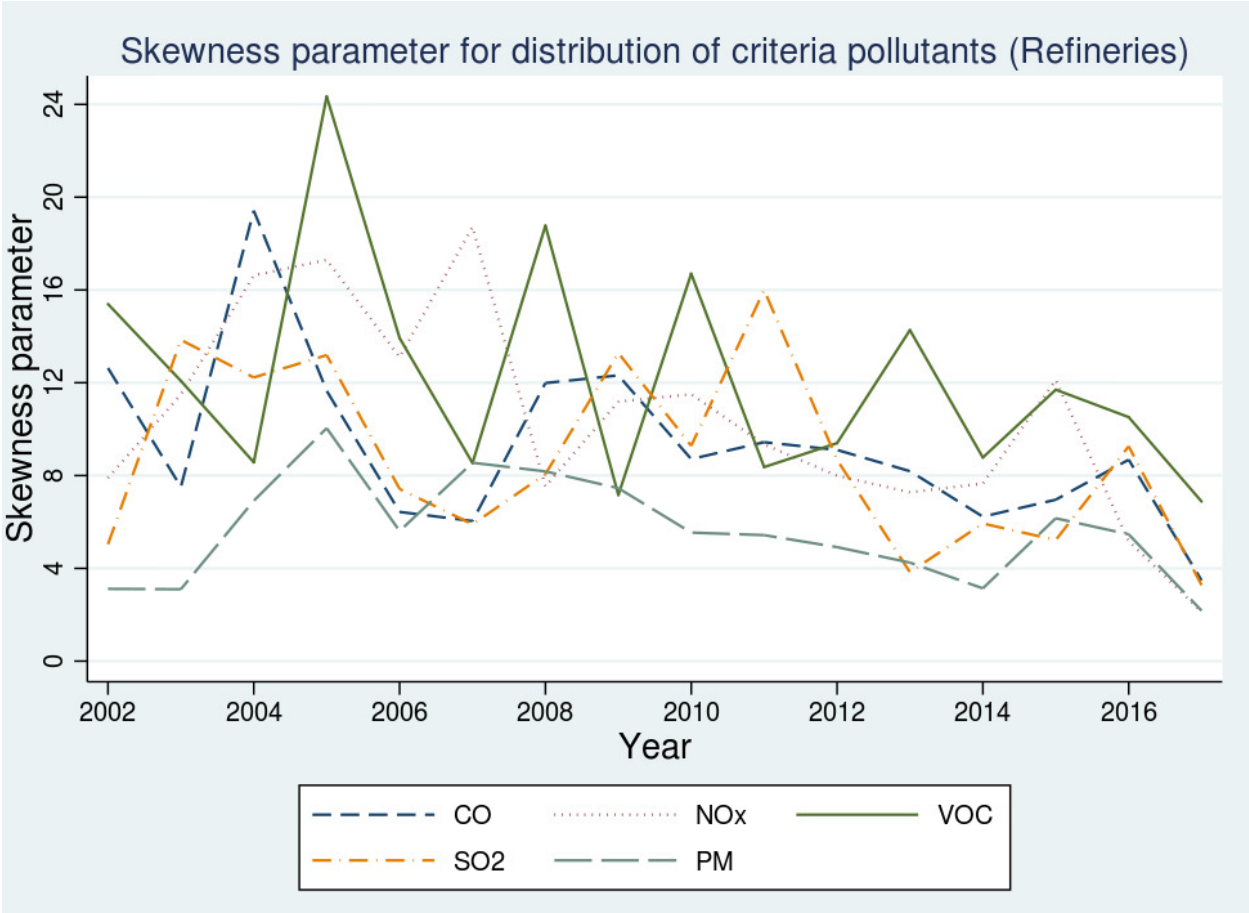


Figure S15: Skewness parameter for the distributions of criteria excess emissions for Crude Petroleum and Natural Gas (CPNG) facilities by year. Source: Figure compiled by the authors using data from TCEQ [1].

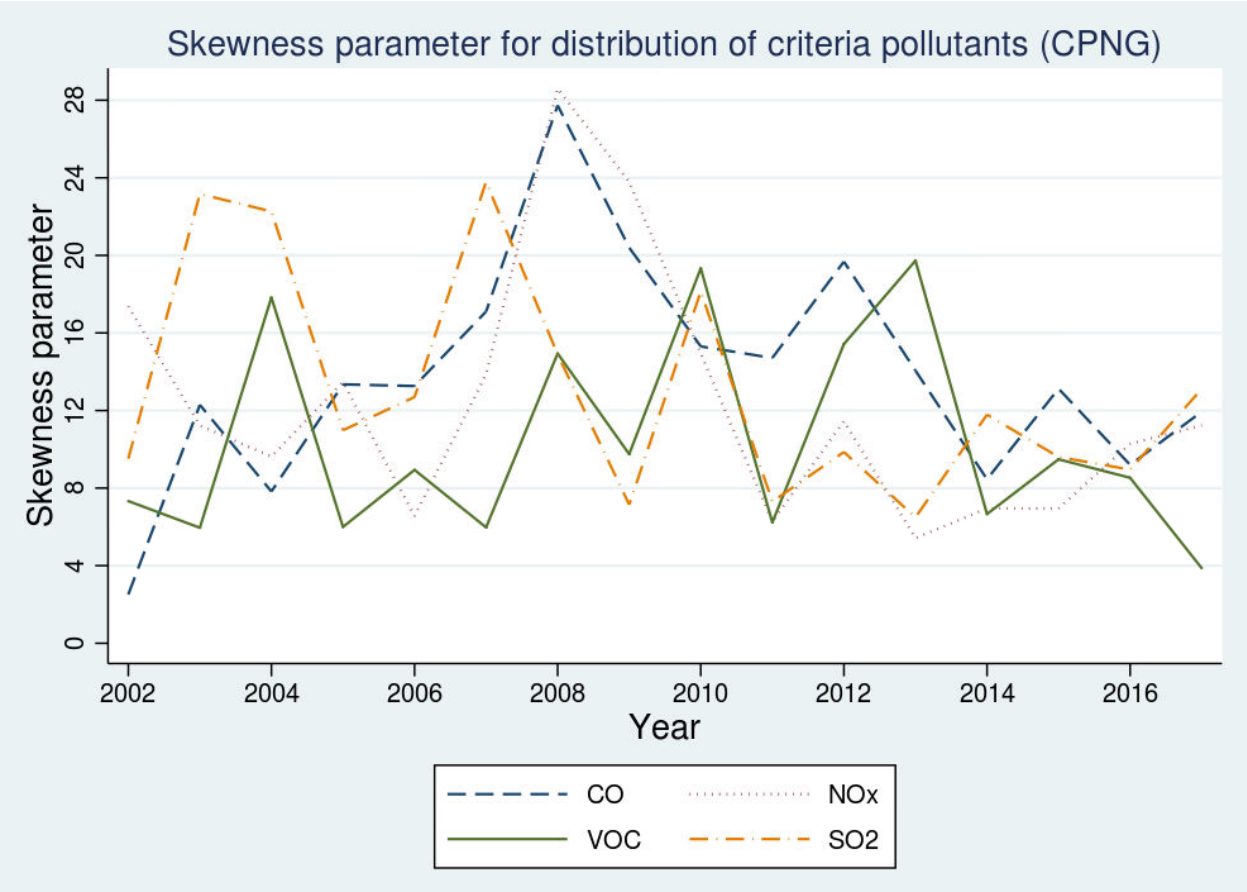


Figure S16: Skewness parameter for the distributions of criteria excess emissions for all Natural Gas Liquids (NGL) facilities by year. Source: Figure compiled by the authors using data from TCEQ [1].

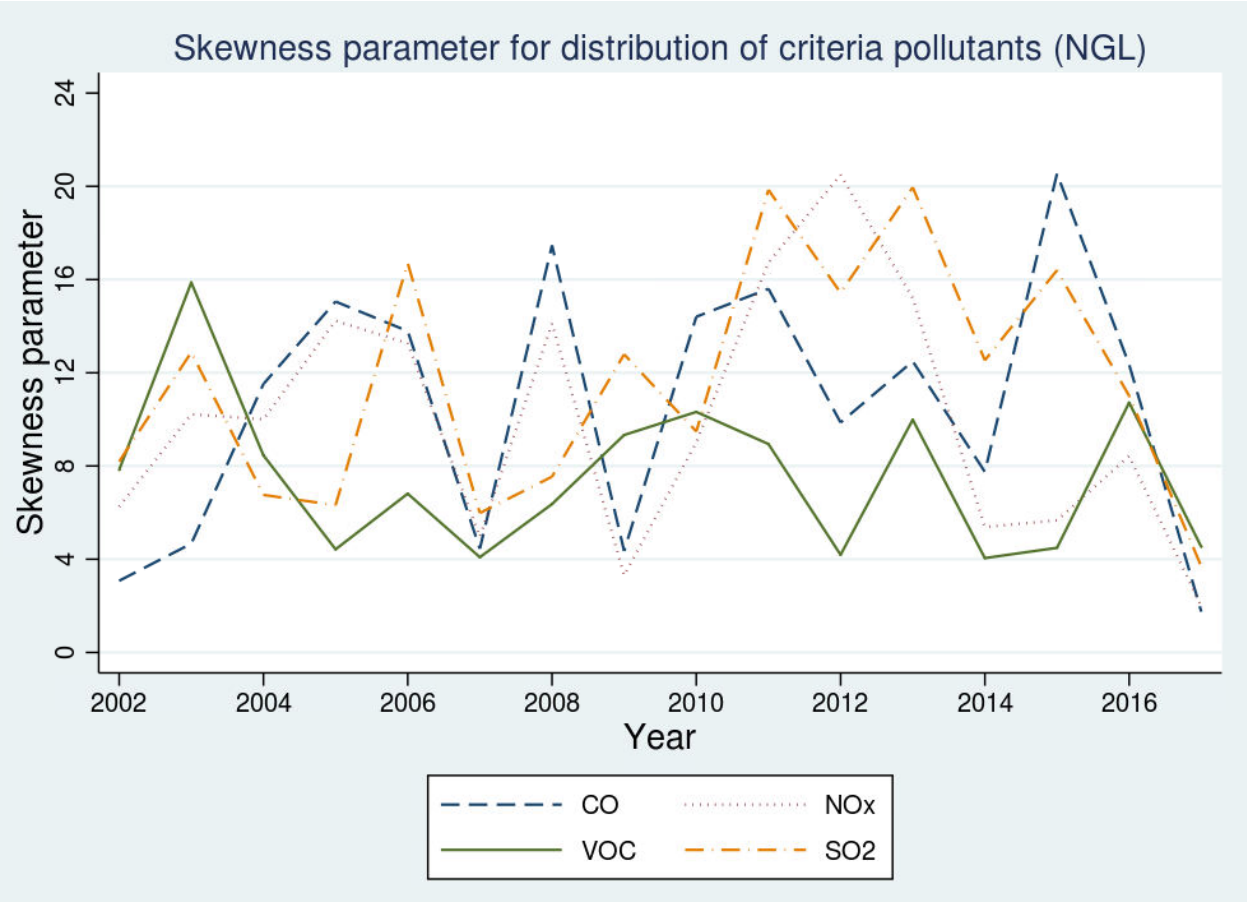


Figure S17: Skewness parameter for the distributions of criteria excess emissions for Industrial Organic Chemicals (IOC) facilities by year. Source: Figure compiled by the authors using data from TCEQ [1].

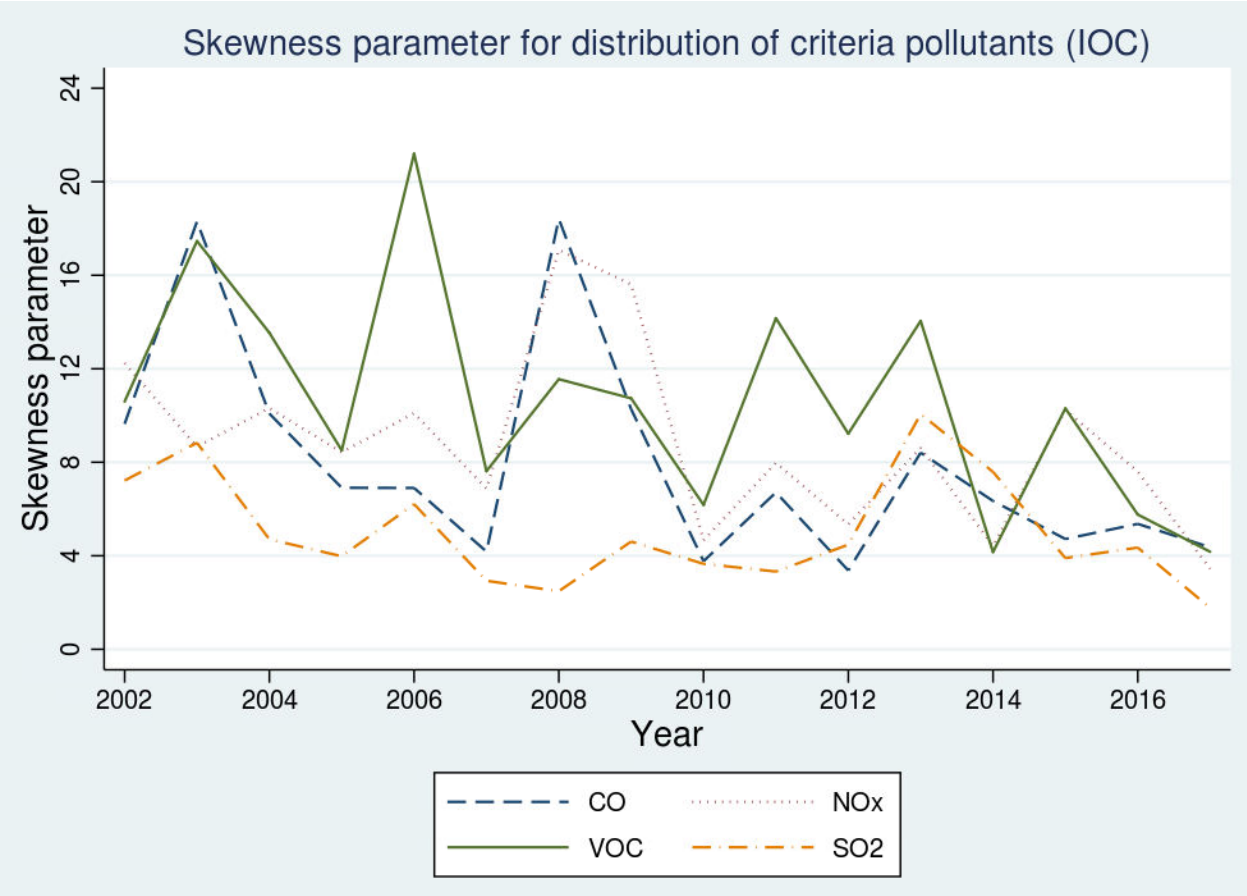


Figure S18: Distribution of SO_2 excess emissions by year (2002-2017) for 30 refineries in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

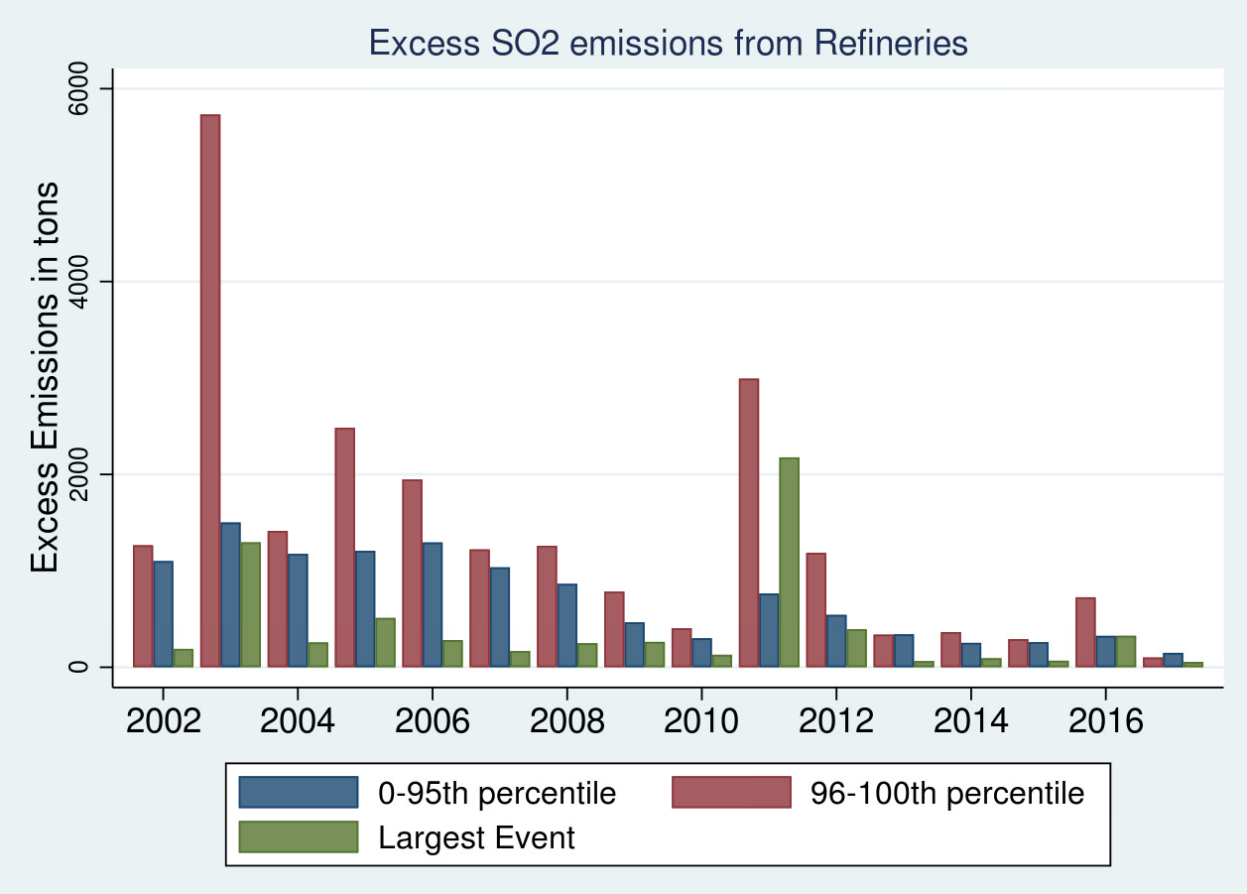


Figure S19: Distribution of PM excess emissions by year (2002-2017) for 30 refineries in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

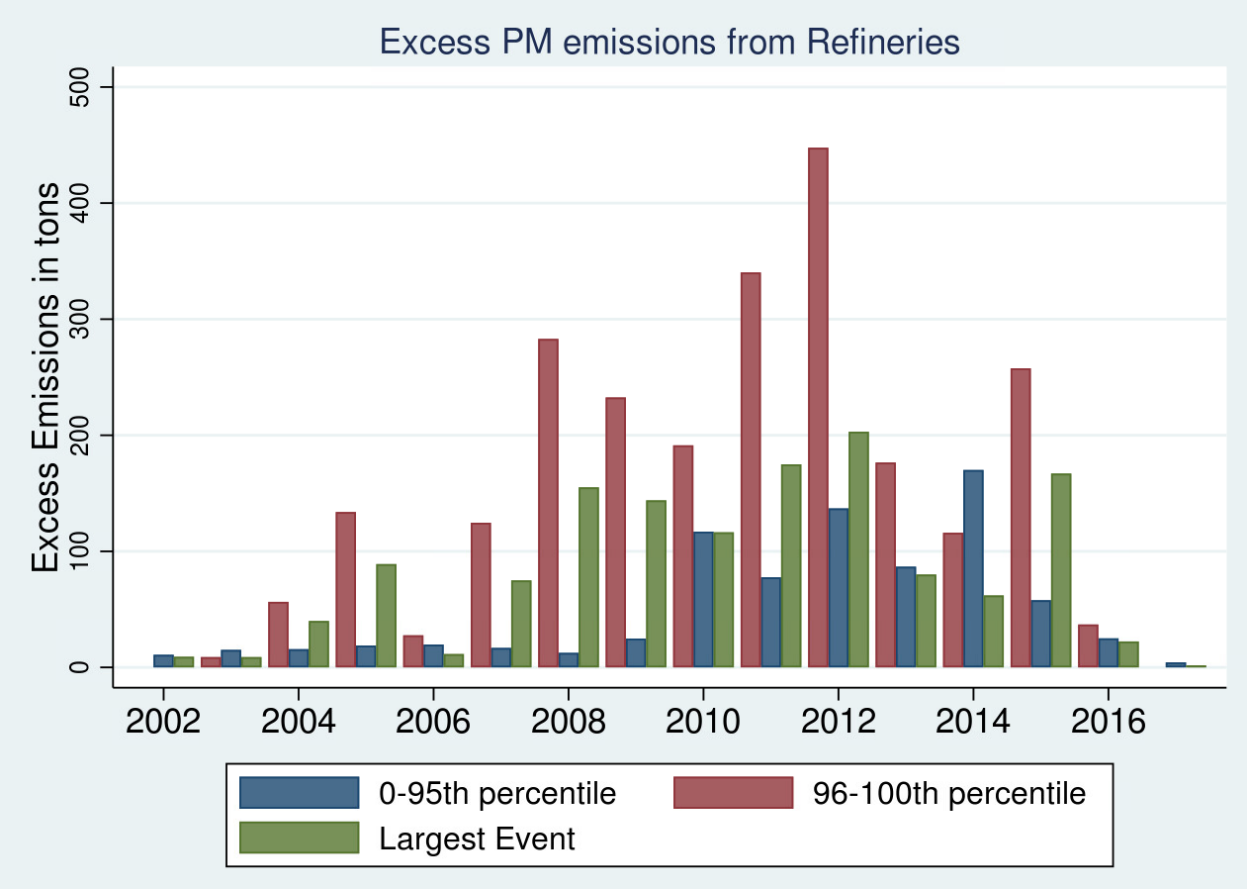


Figure S20: Distribution of CO excess emissions by year (2002-2017) for 30 refineries in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

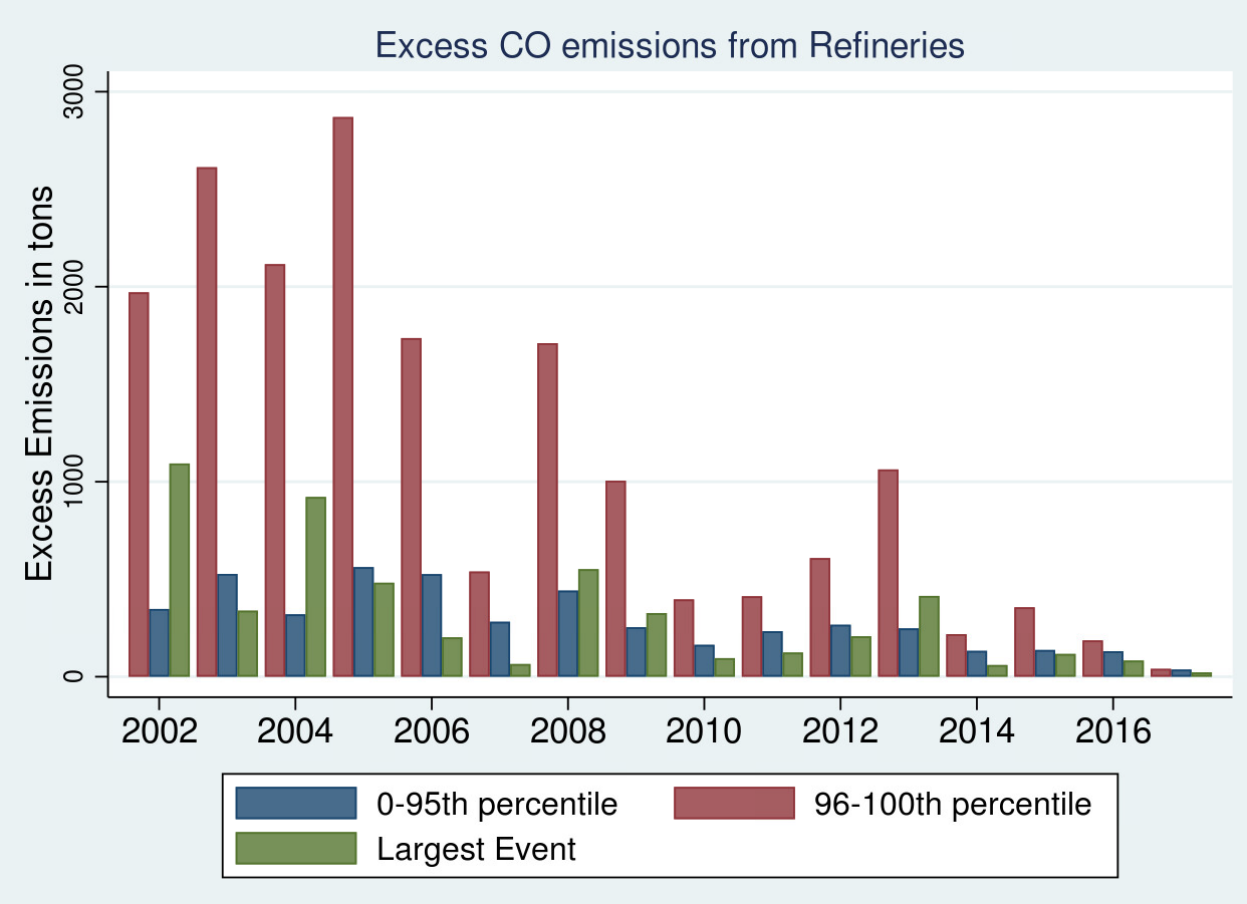


Figure S21: Distribution of NOx excess emissions by year (2002-2017) for 30 refineries in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

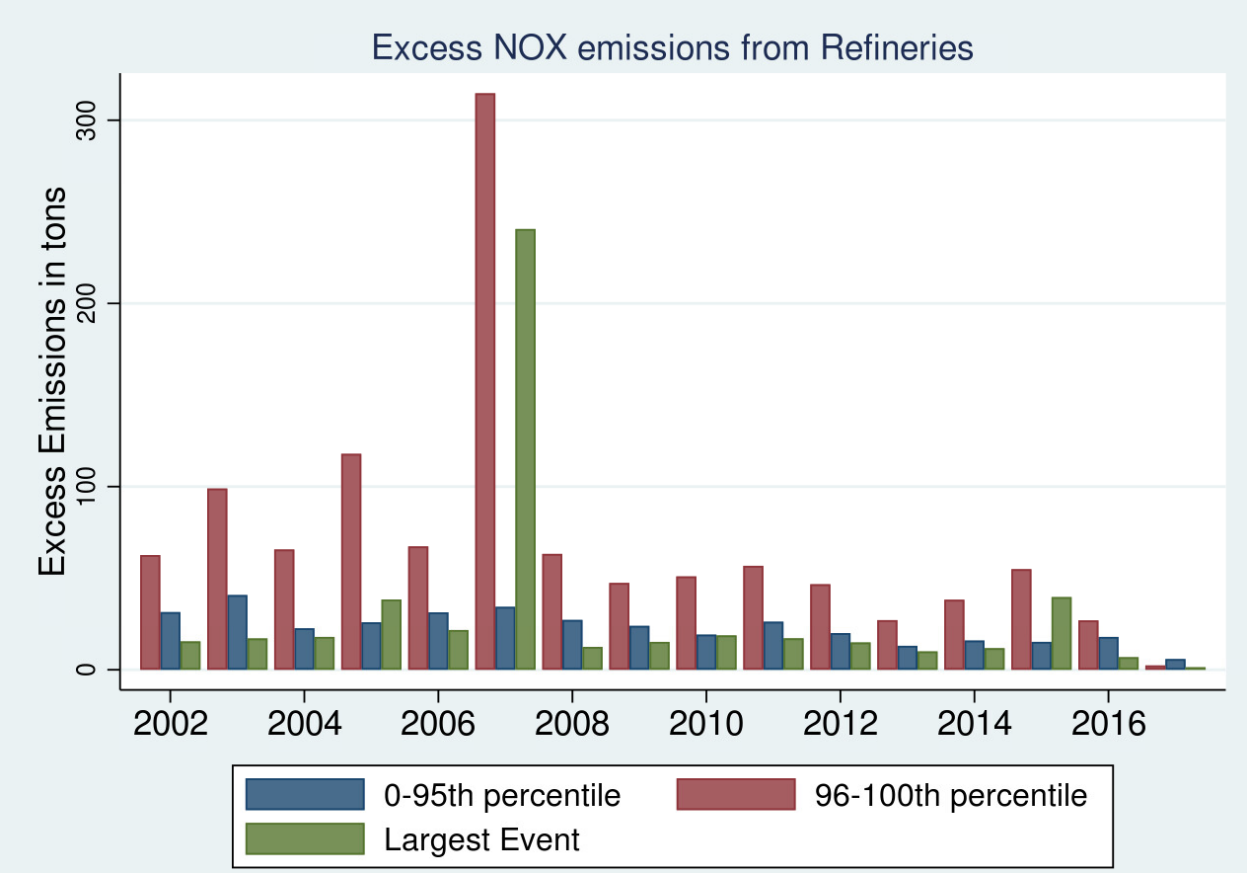


Figure S22: Distribution of VOC excess emissions by year (2002-2017) for 30 refineries in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

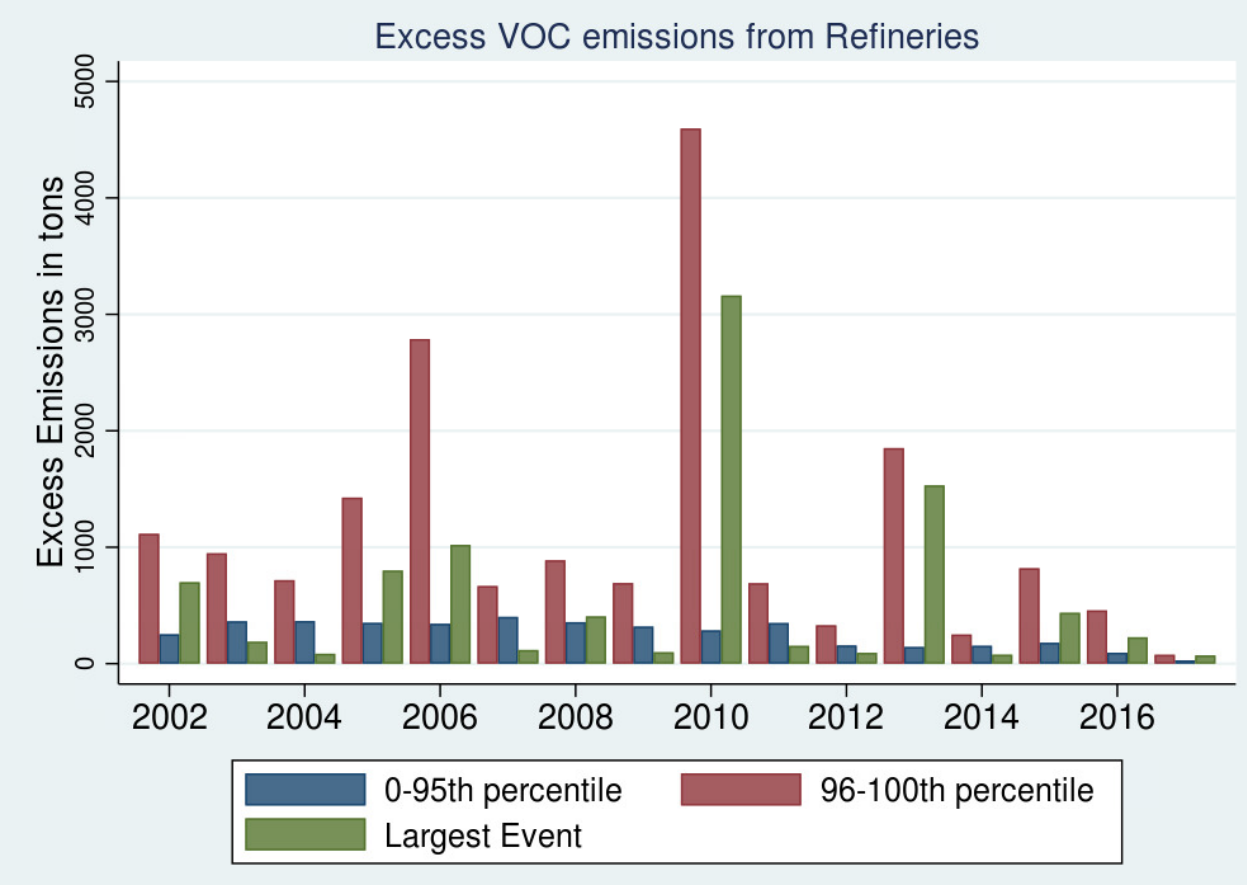


Figure S23: Distribution of VOC excess emissions by year (2002-2017) for 1,071 Crude Petroleum and Natural Gas (CPNG) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

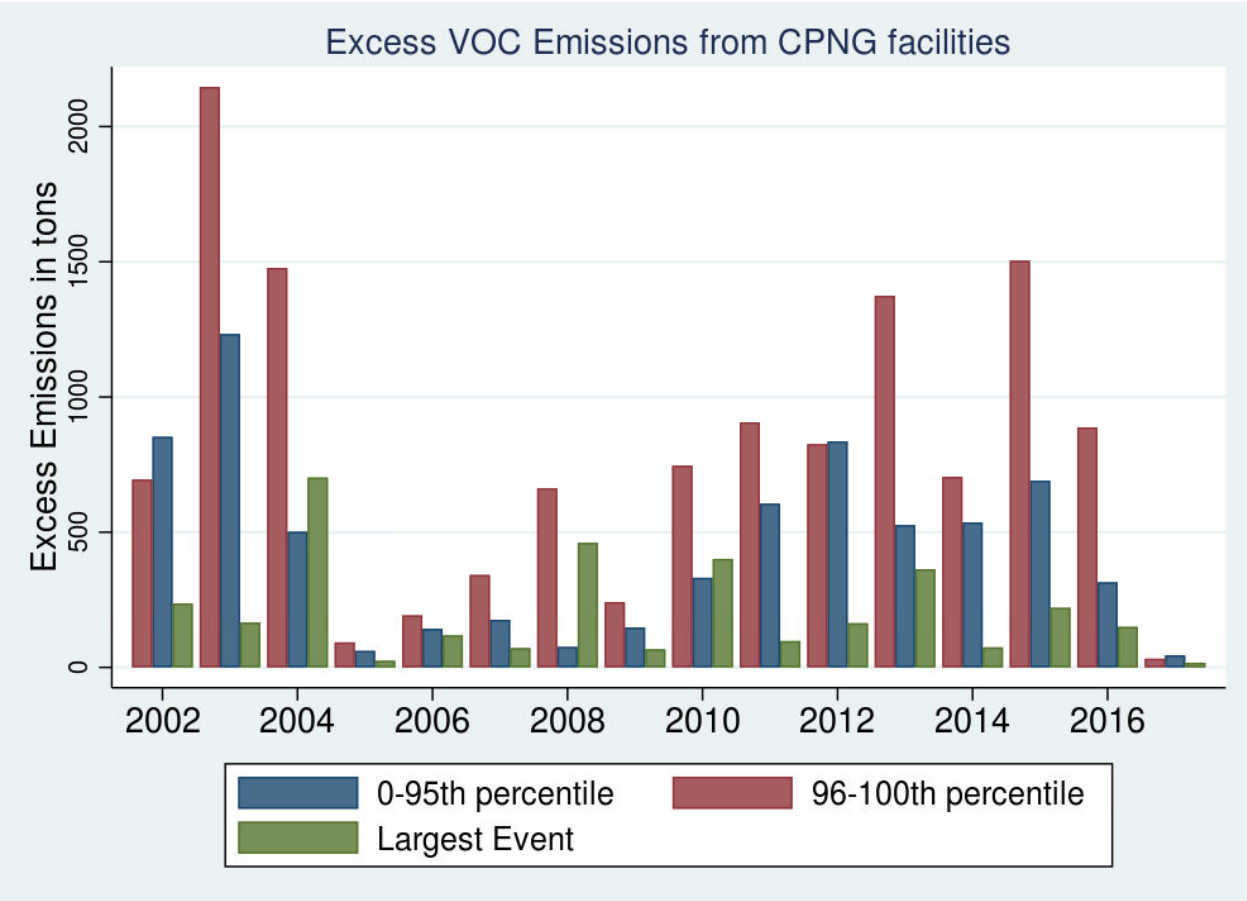


Figure S24: Distribution of CO excess emissions by year (2002-2017) for 1,071 Crude Petroleum and Natural Gas (CPNG) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

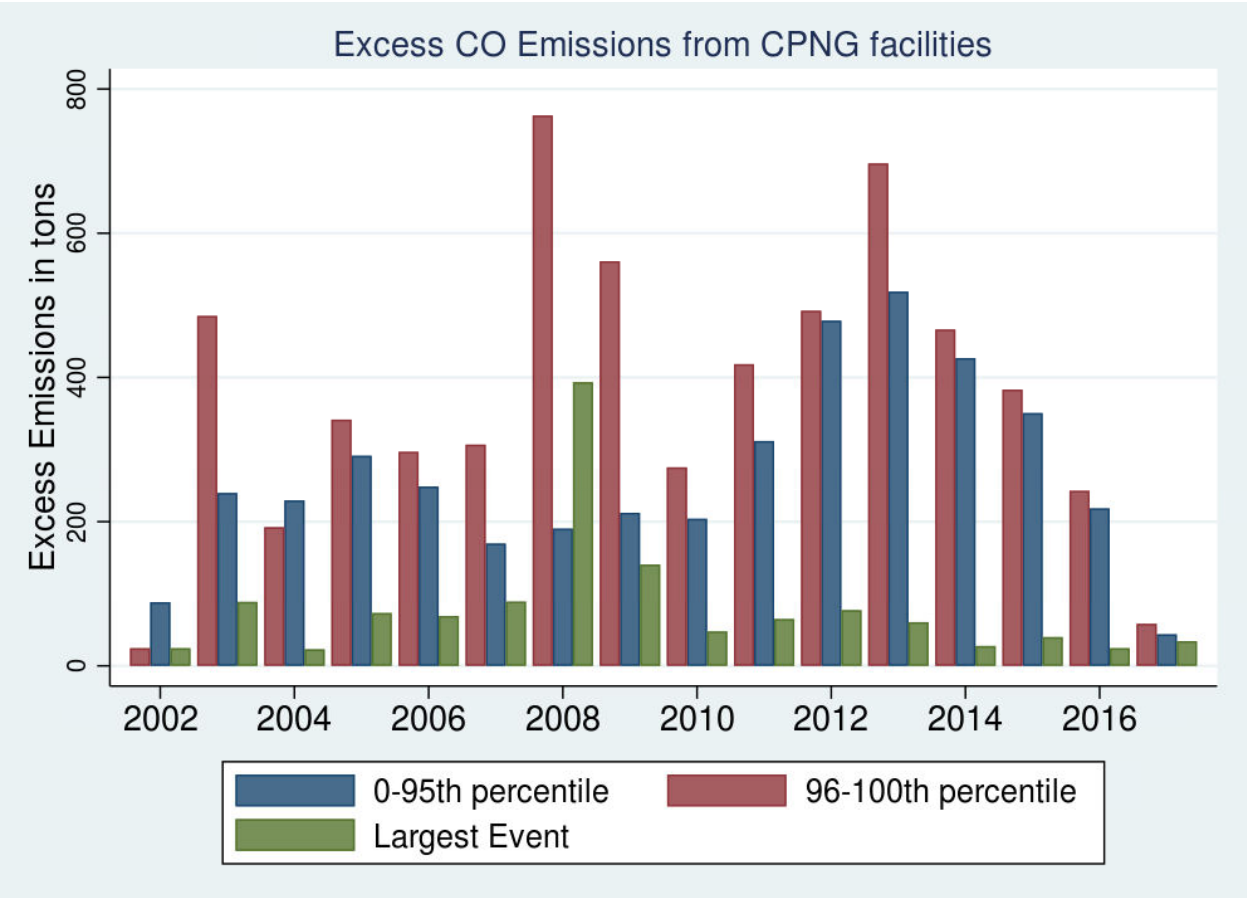


Figure S25: Distribution of SO_2 excess emissions by year (2002-2017) for 1,071 Crude Petroleum and Natural Gas (CPNG) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

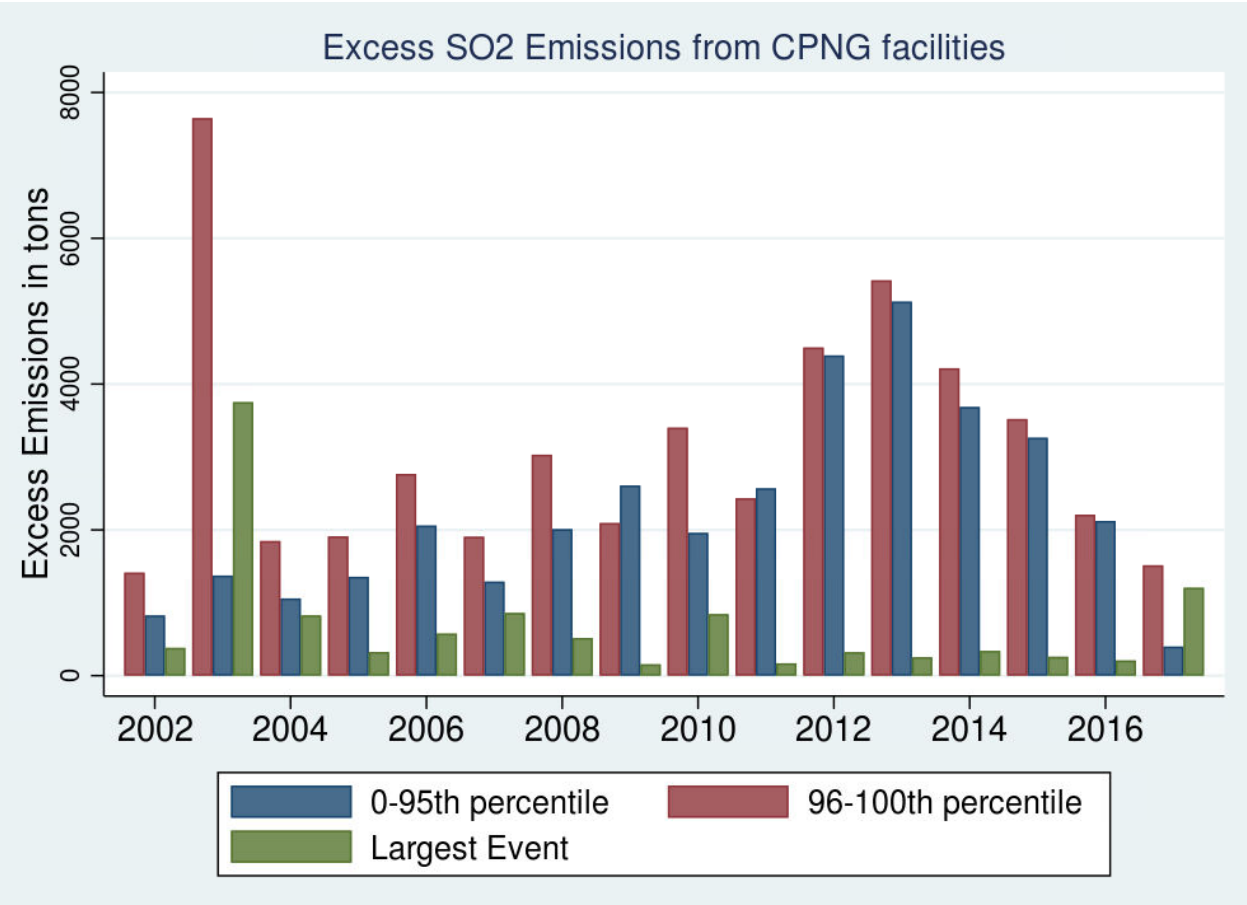


Figure S26: Distribution of NO_x excess emissions by year (2002-2017) for 1,071 Crude Petroleum and Natural Gas (CPNG) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

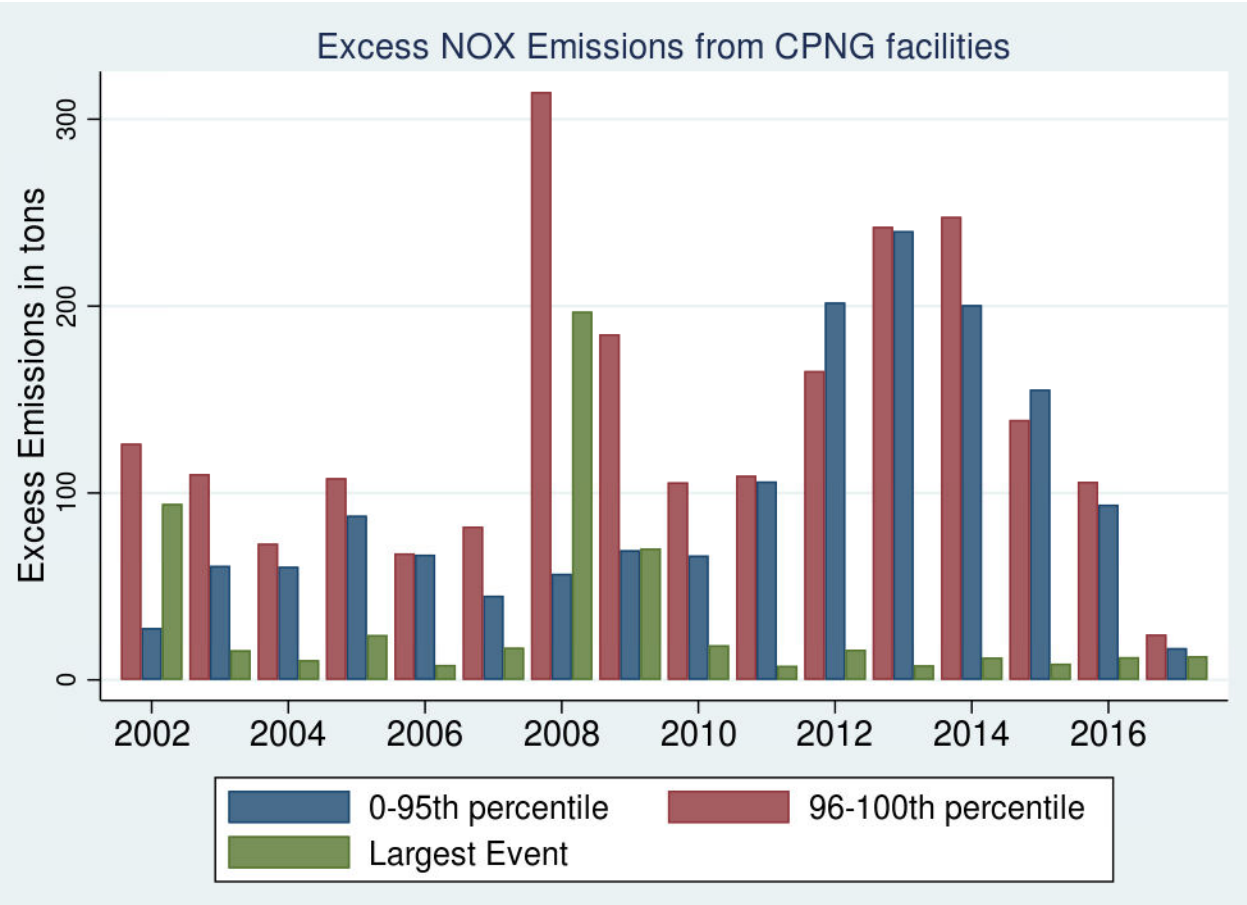


Figure S27: Distribution of VOC excess emissions by year (2002-2017) for 174 Natural Gas Liquids (NGL) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

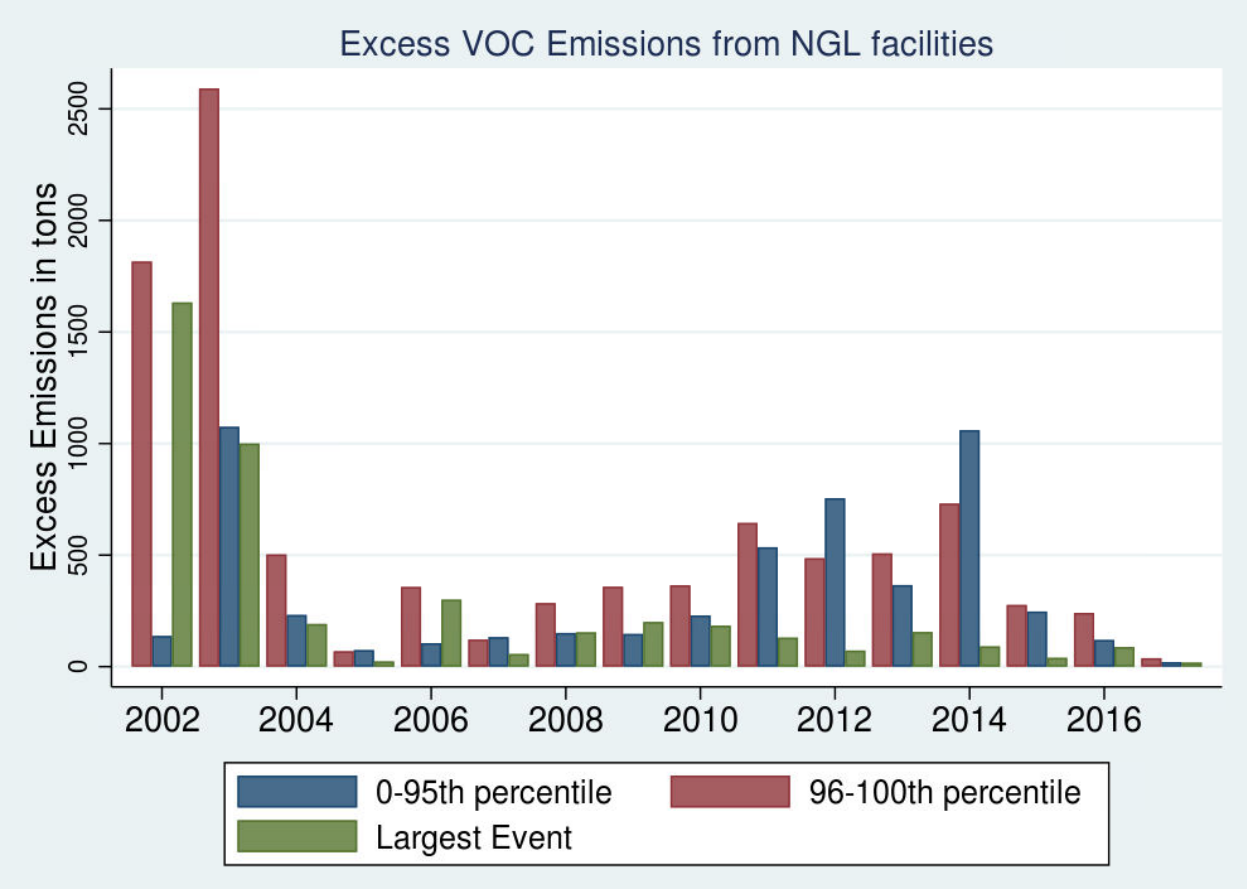


Figure S28: Distribution of NO_x excess emissions by year (2002-2017) for 174 Natural Gas Liquids (NGL) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

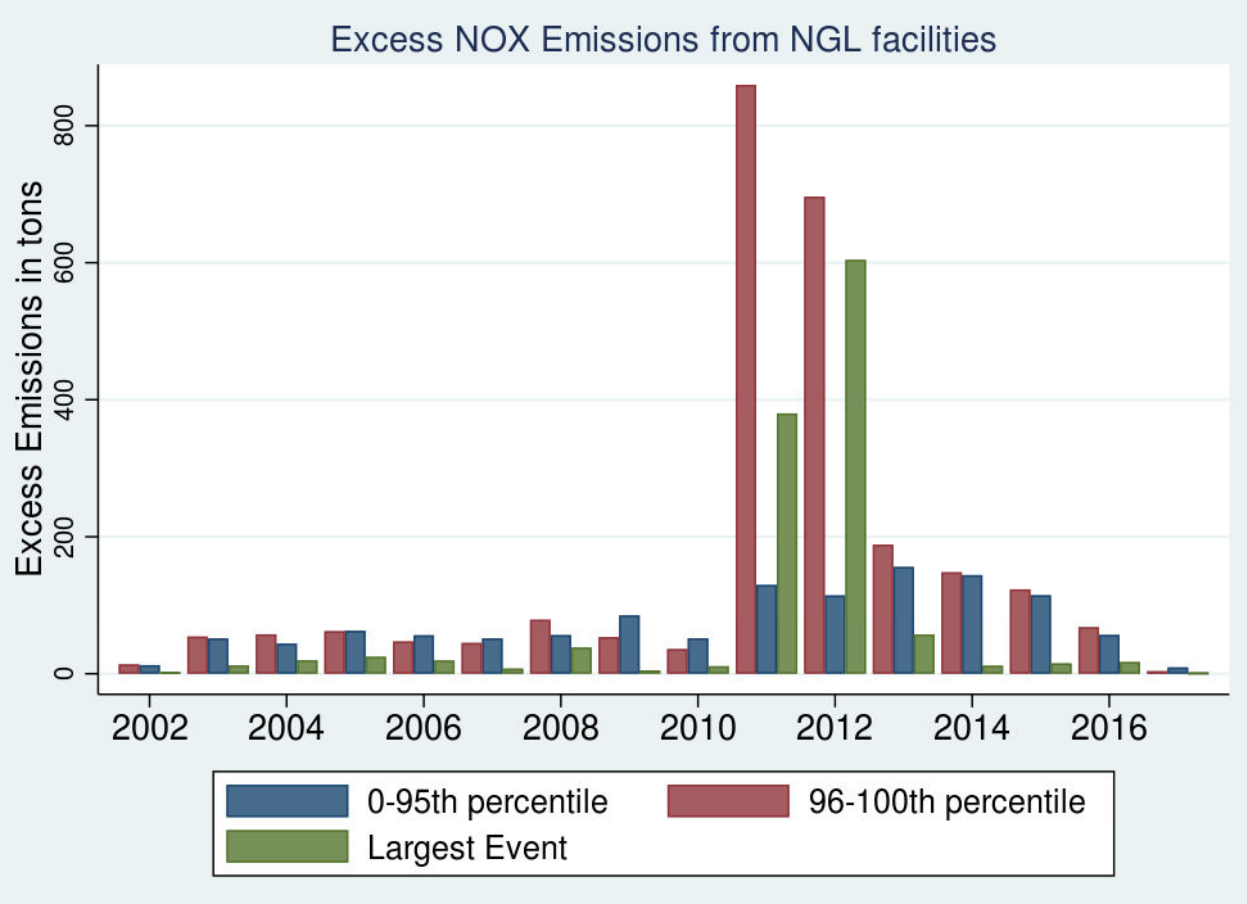


Figure S29: Distribution of CO excess emissions by year (2002-2017) for 174 Natural Gas Liquids (NGL) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

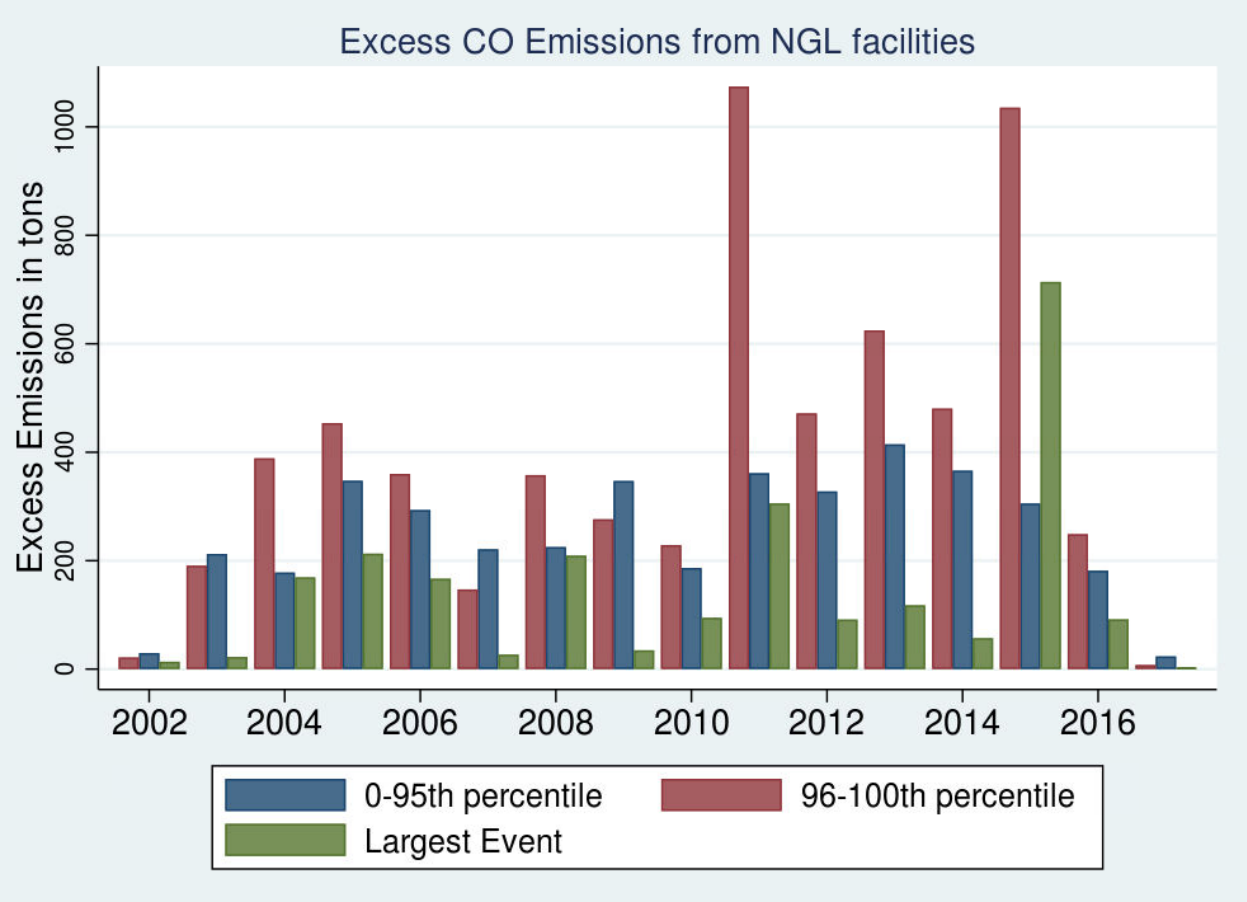


Figure S30: Distribution of SO_2 excess emissions by year (2002-2017) for 174 Natural Gas Liquids (NGL) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

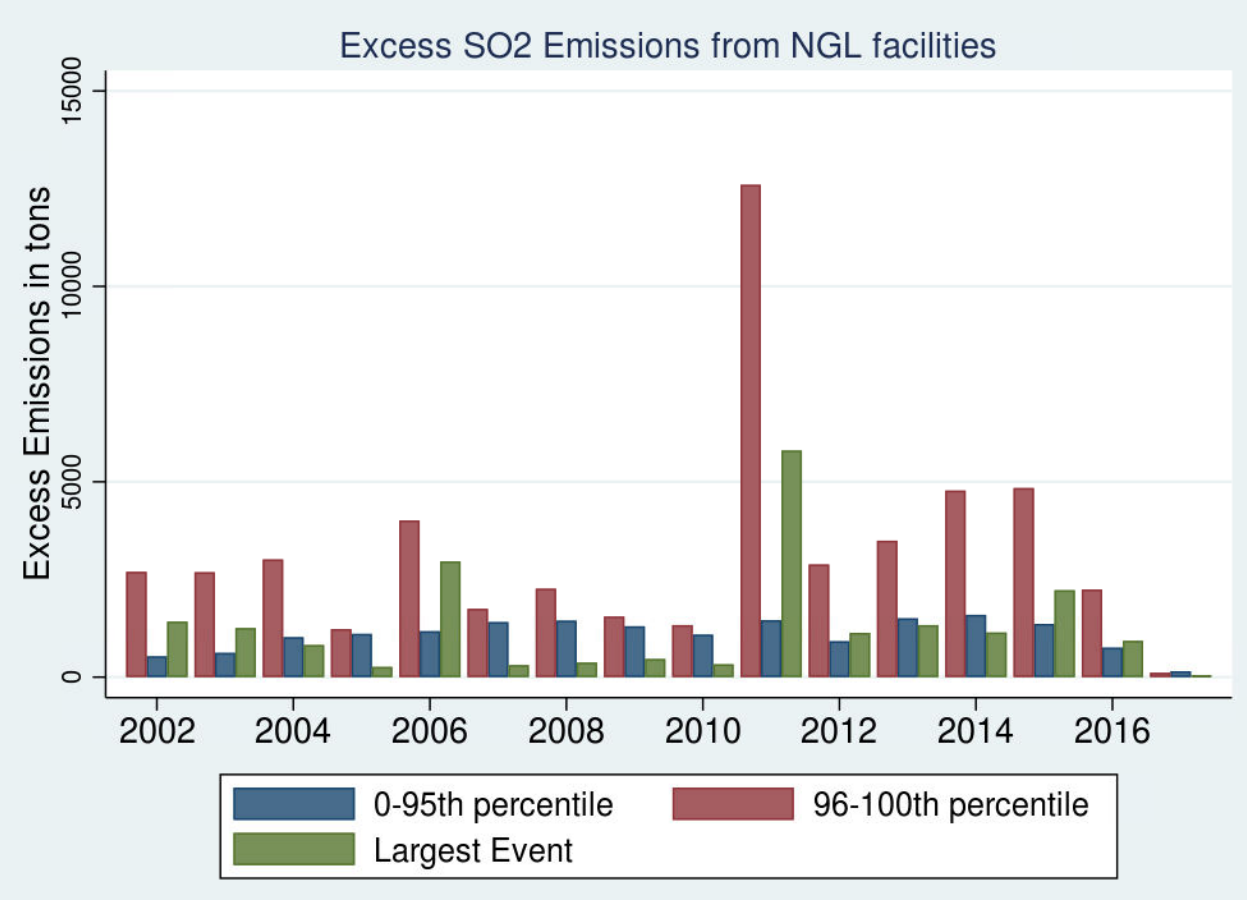


Figure S31: Distribution of VOC excess emissions by year (2002-2017) for 157 Industrial Organic Chemical (IOC) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

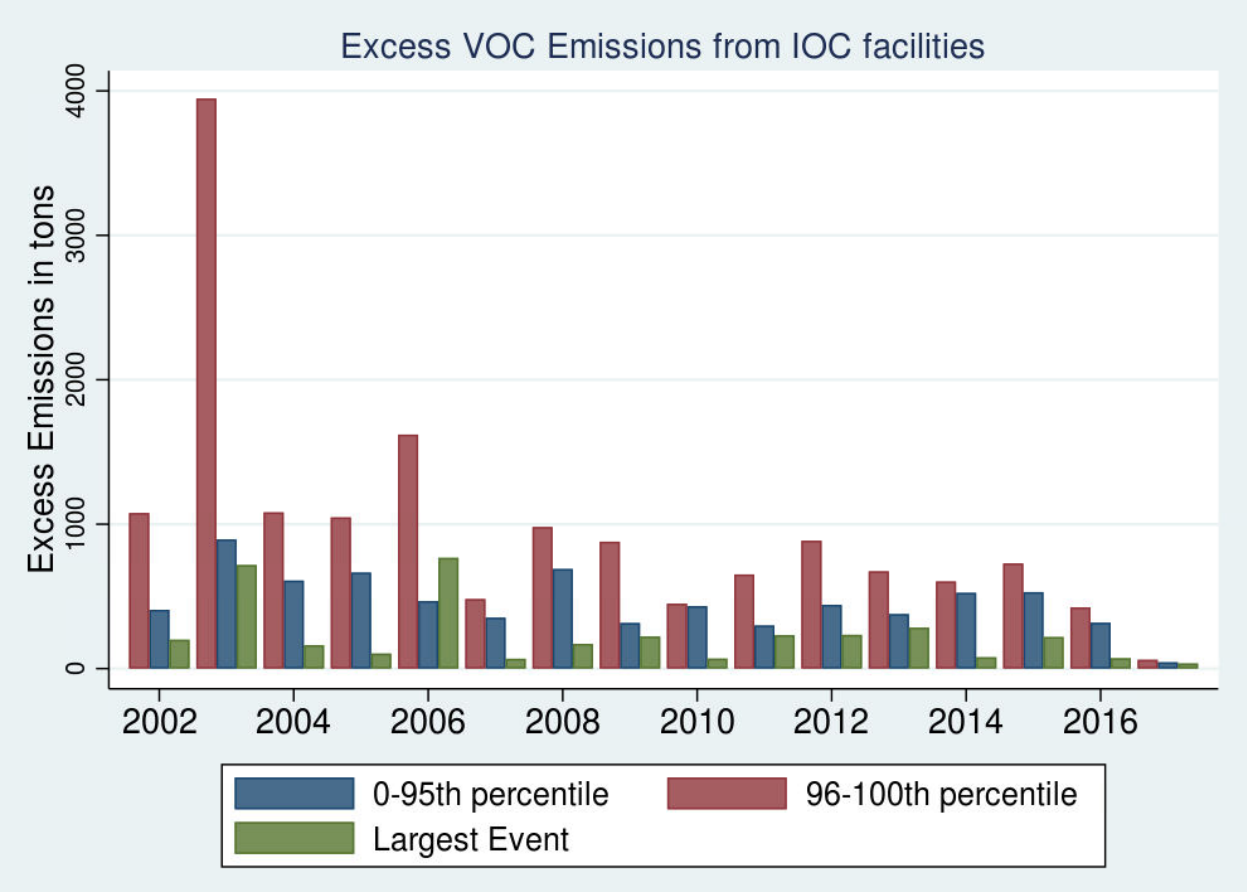


Figure S32: Distribution of NO_x excess emissions by year (2002-2017) for 157 Industrial Organic Chemical (IOC) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

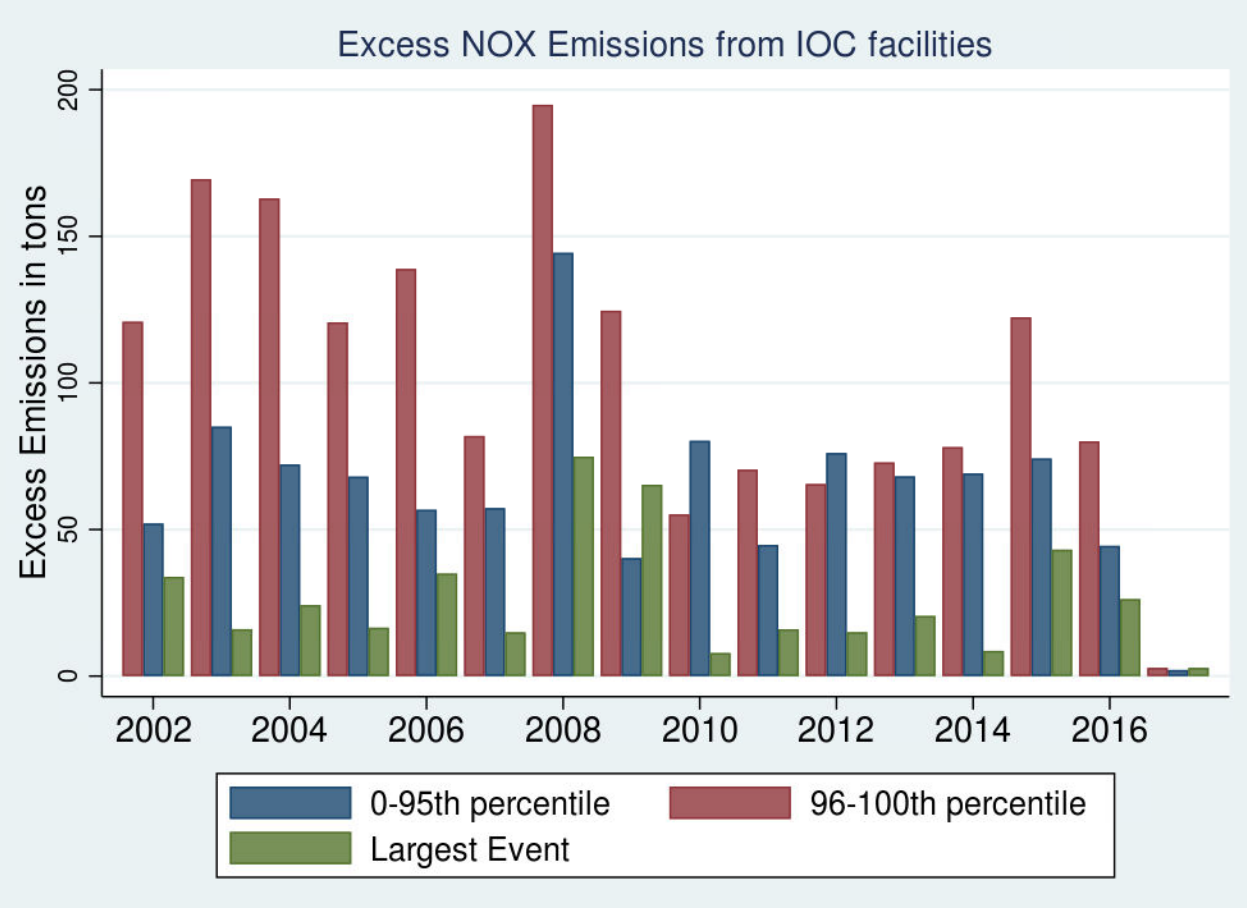


Figure S33: Distribution of CO excess emissions by year (2002-2017) for 157 Industrial Organic Chemical (IOC) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

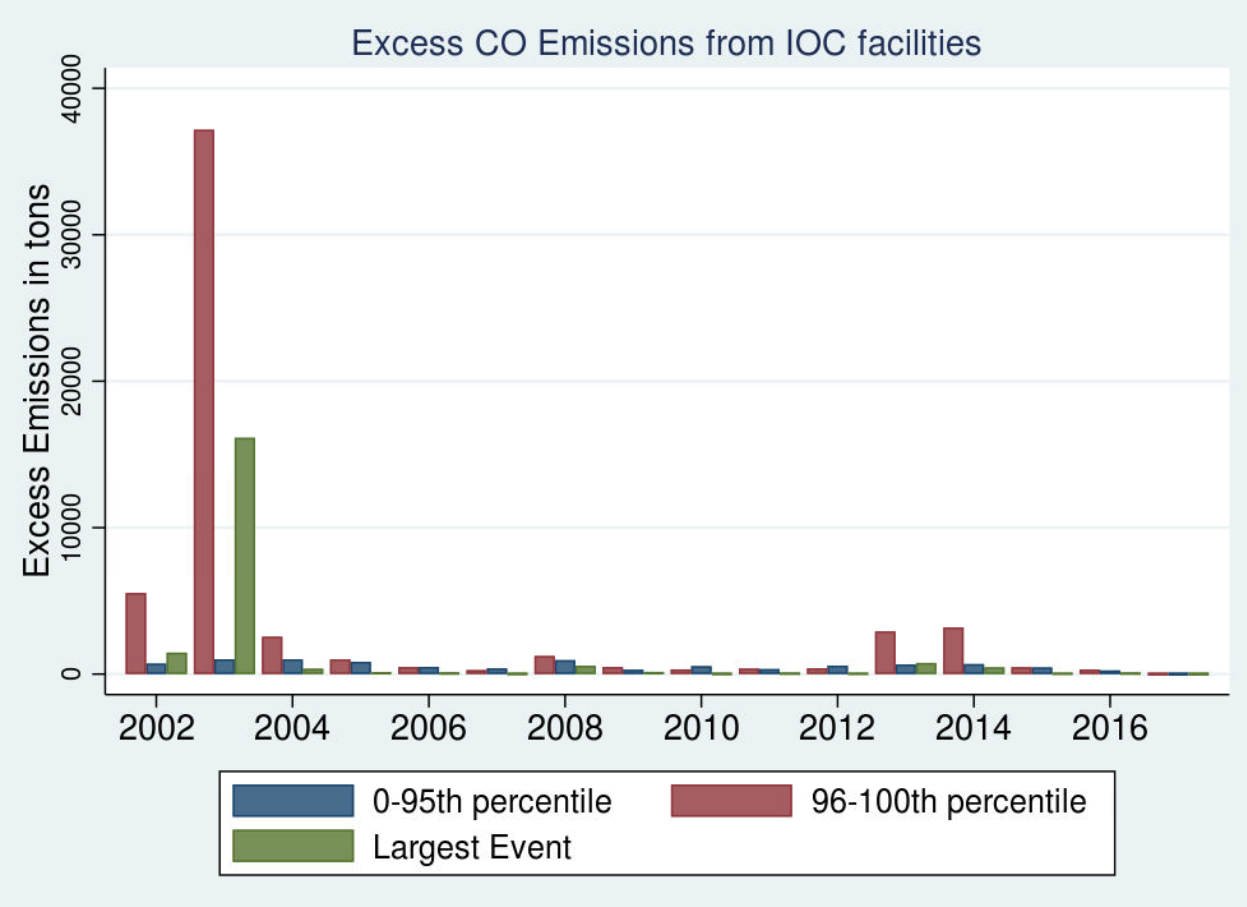


Figure S34: Distribution of SO_2 excess events by year (2002-2017) for 157 Industrial Organic Chemical (IOC) facilities in Texas. Source: Figure compiled by the authors using data from TCEQ [1]. The blue bars show the total amount of excess emissions (by year) from the bottom of the distribution up to (and including) the 95th percentile. The red bars show the total amount from the 96th percentile to the top of the distribution. The green bars show the emissions from the single largest events in each year.

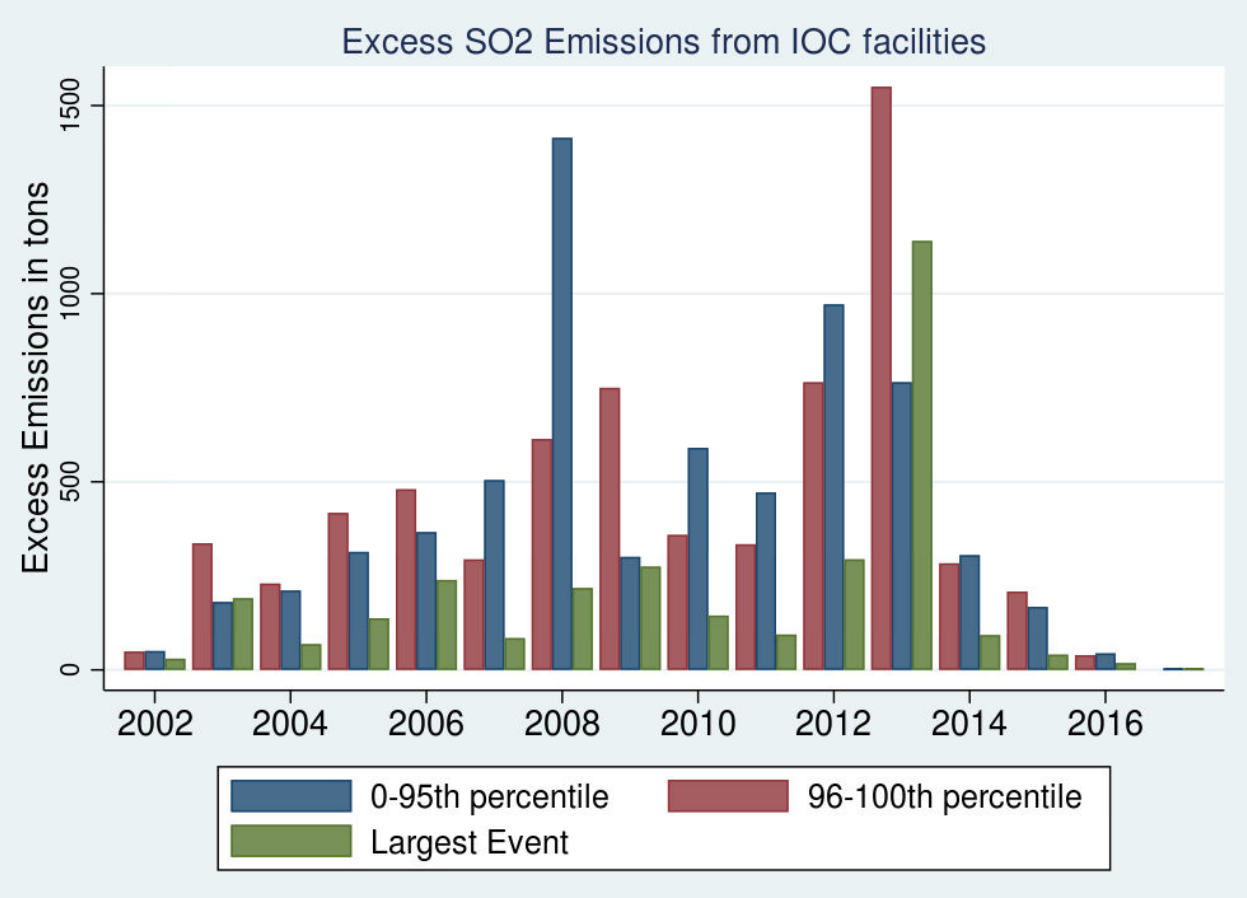


Figure S35: Excess emissions and number of excess emission events involving the release of Particular Matter (PM) for the top 6 most polluting refineries (out of a total of 30 refineries reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities released 98% of all PM excess emissions across all refineries between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

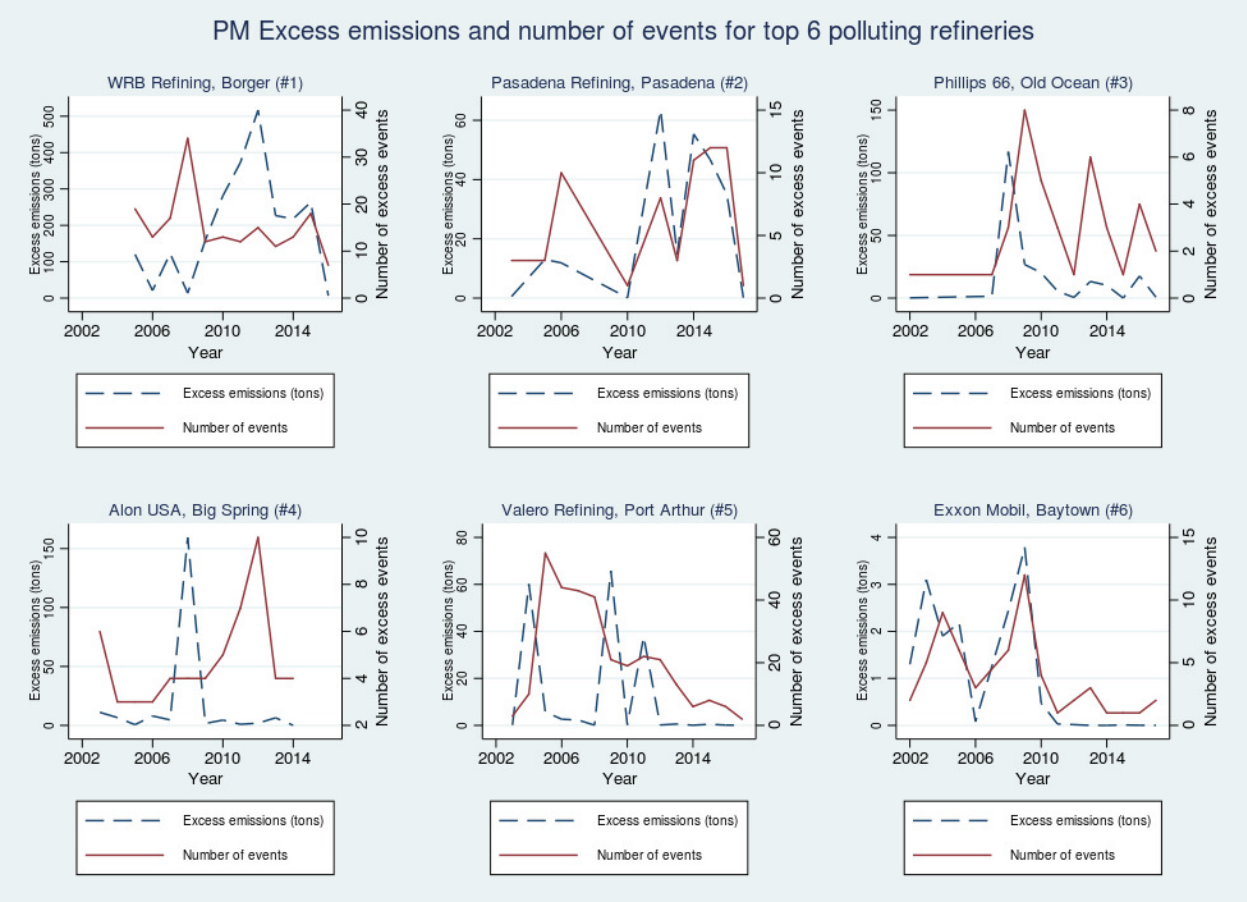


Figure S36: Excess emissions and number of excess emission events involving the release of Nitrogen Oxides (NO_x) for the top 6 most polluting refineries (out of a total of 30 refineries reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities released 62% of all NO_x excess emissions across all refineries between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

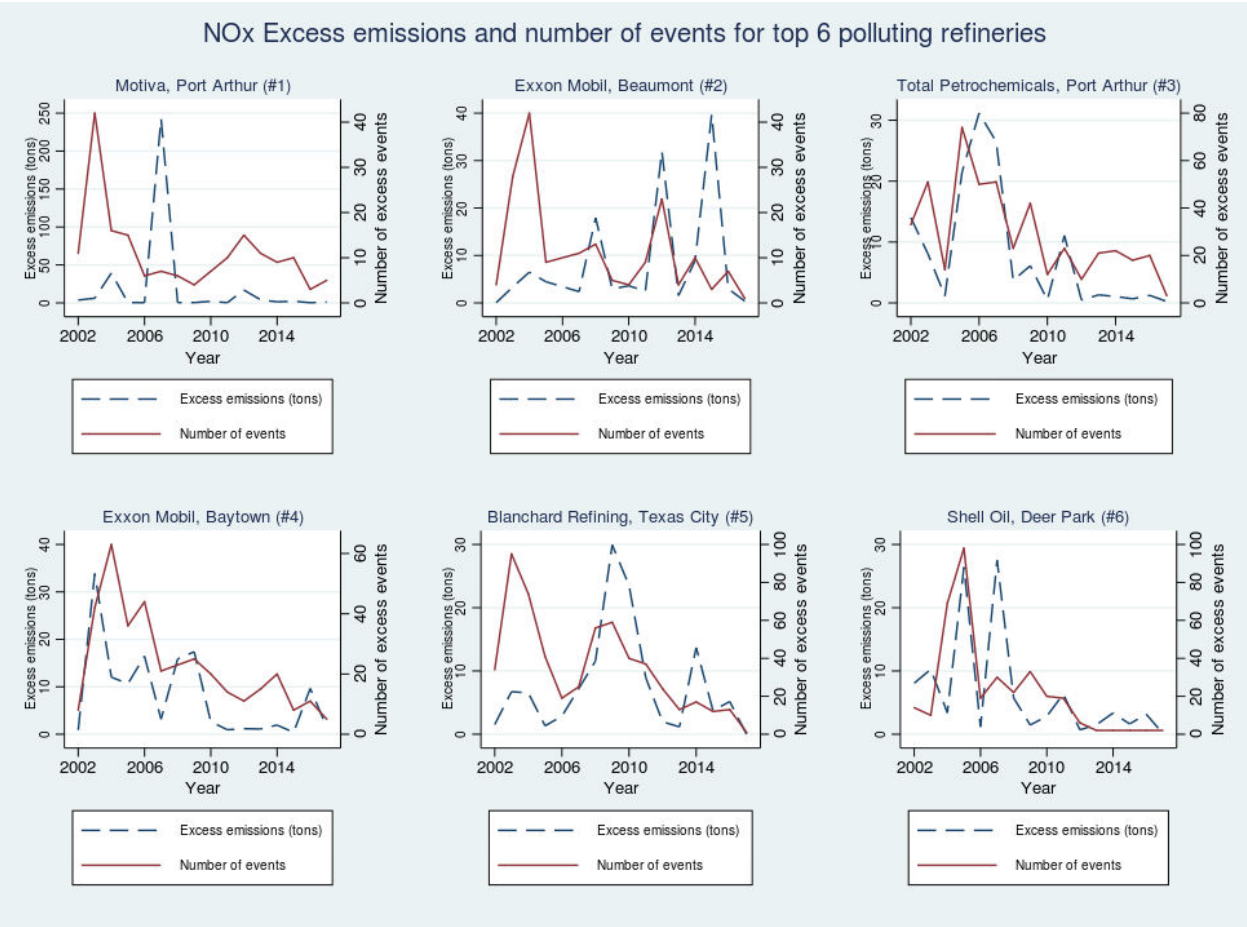


Figure S37: Excess emissions and number of excess emission events involving the release of Sulfur Dioxide (SO_2) for the top 6 most polluting refineries (out of a total of 30 refineries reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities released 70% of all SO_2 excess emissions across all refineries between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

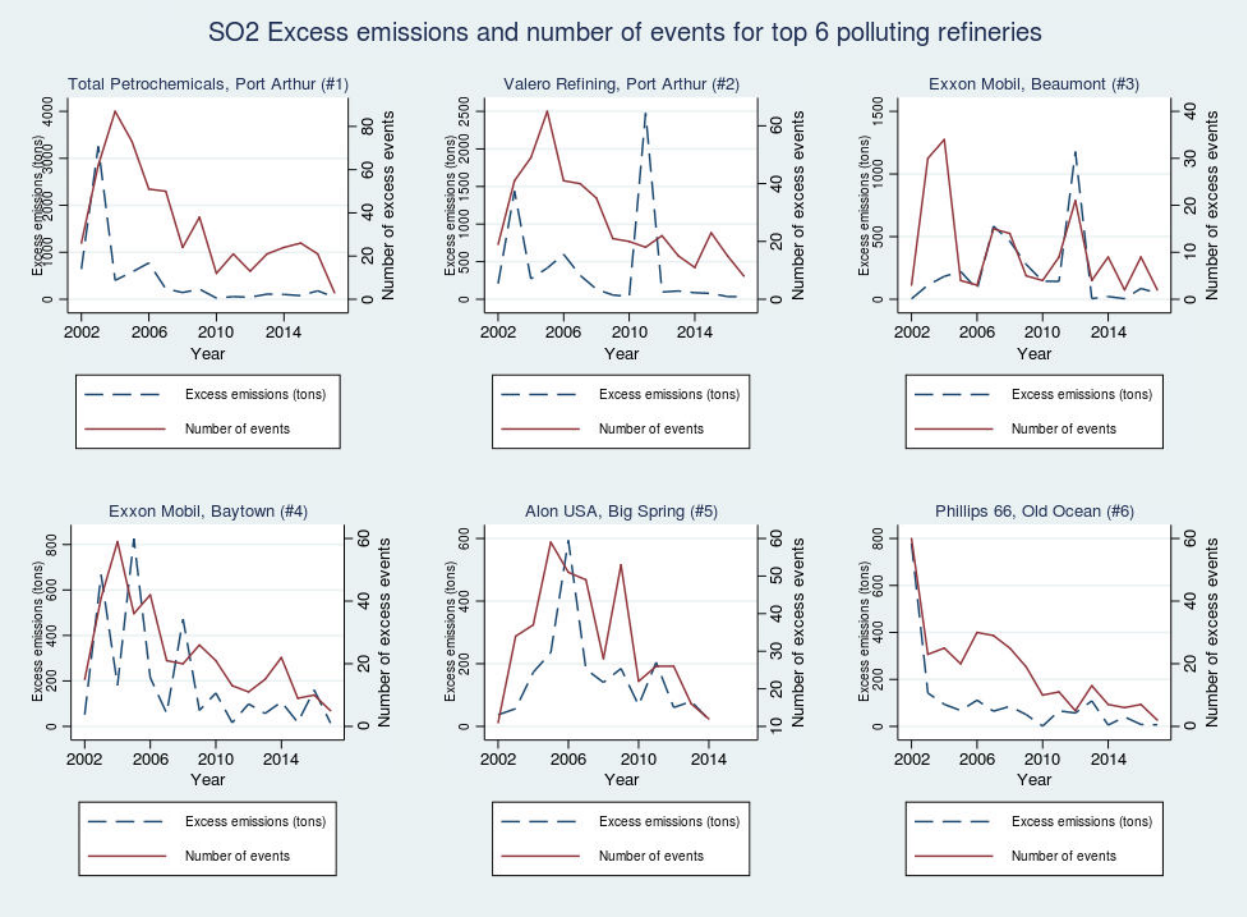


Figure S38: Excess emissions and number of excess emission events involving the release of Volatile Organic Compounds (VOCs) for the top 6 most polluting refineries (out of a total of 30 refineries reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities released 64% of all VOC excess emissions across all refineries between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

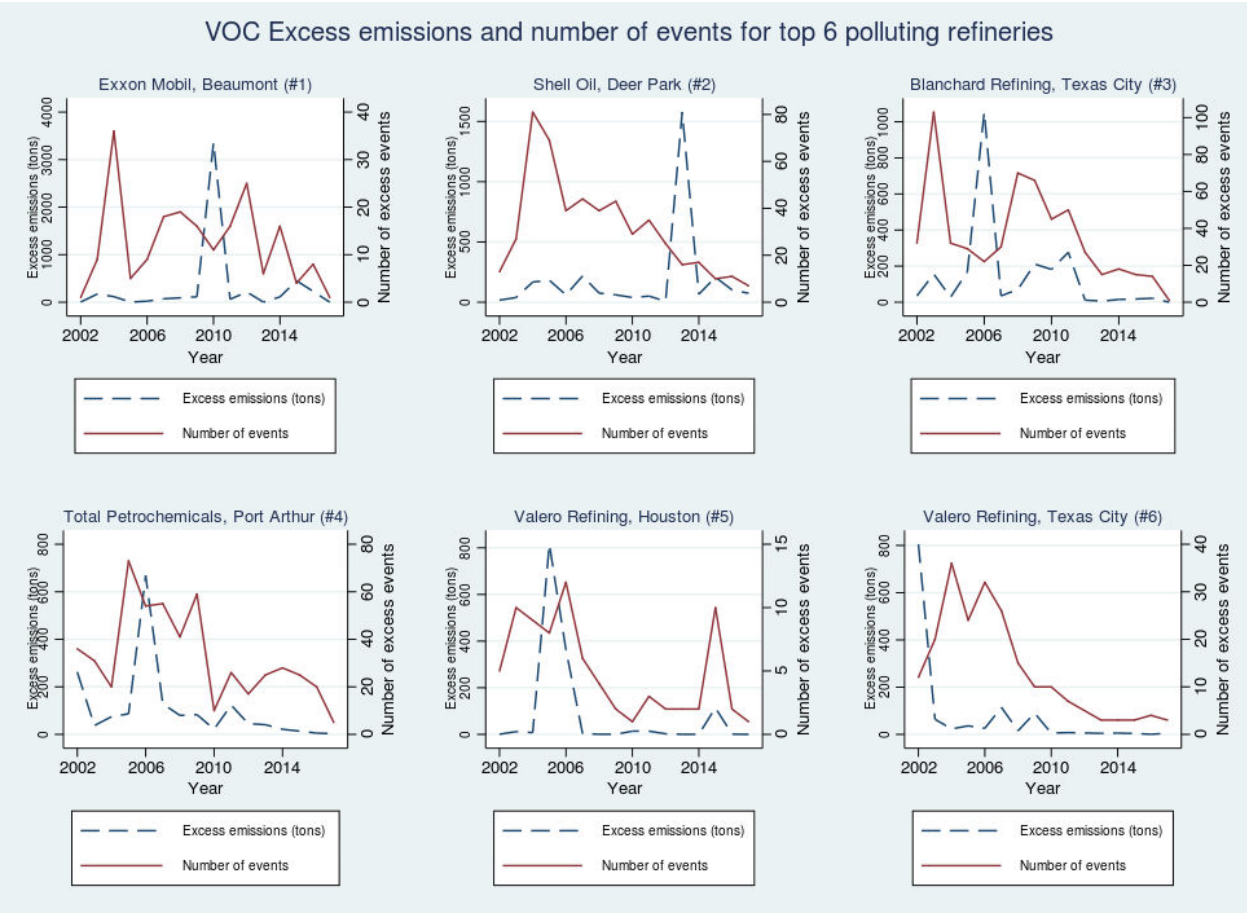


Figure S39: Excess emissions and number of excess emission events involving the release of Carbon Monoxide (CO) for the top 6 most polluting Natural Gas Liquids (NGL) facilities (out of a total of 174 NGL facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 72% of all CO excess emissions across all NGL facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1]. The fourth most polluting facility (Midmar West Gas plant, Andrews) had seven excess emissions events (all in 2011) amounting to 684 tons of CO emissions. To avoid illustrating a panel with a single data point, we have replaced that facility with the seventh most polluting one (Oxy USA, Seminole) in the Figure.

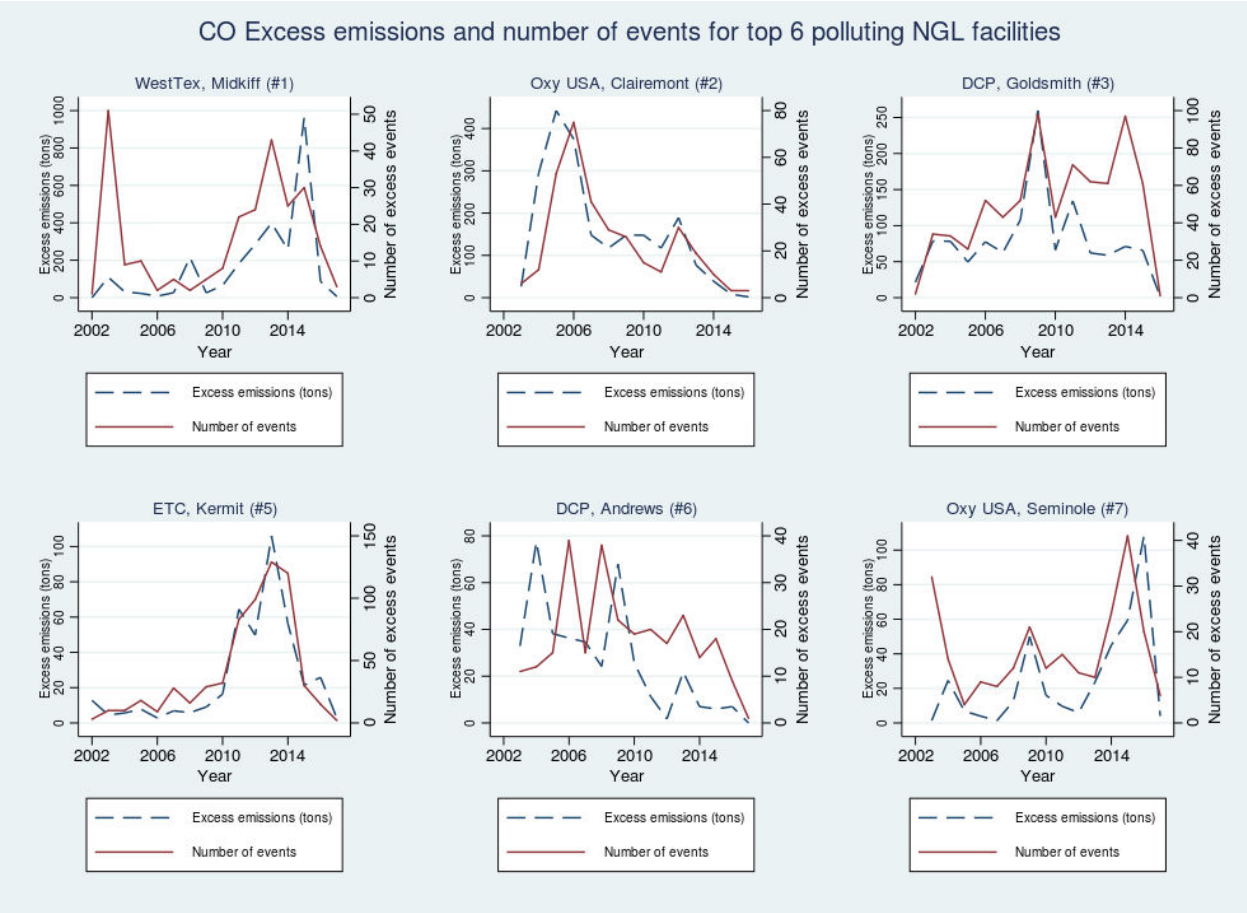


Figure S40: Excess emissions and number of excess emission events involving the release of Sulfur Dioxide (SO_2) for the top 6 most polluting Natural Gas Liquids (NGL) facilities (out of a total of 174 NGL facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 86% of all SO_2 excess emissions across all NGL facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

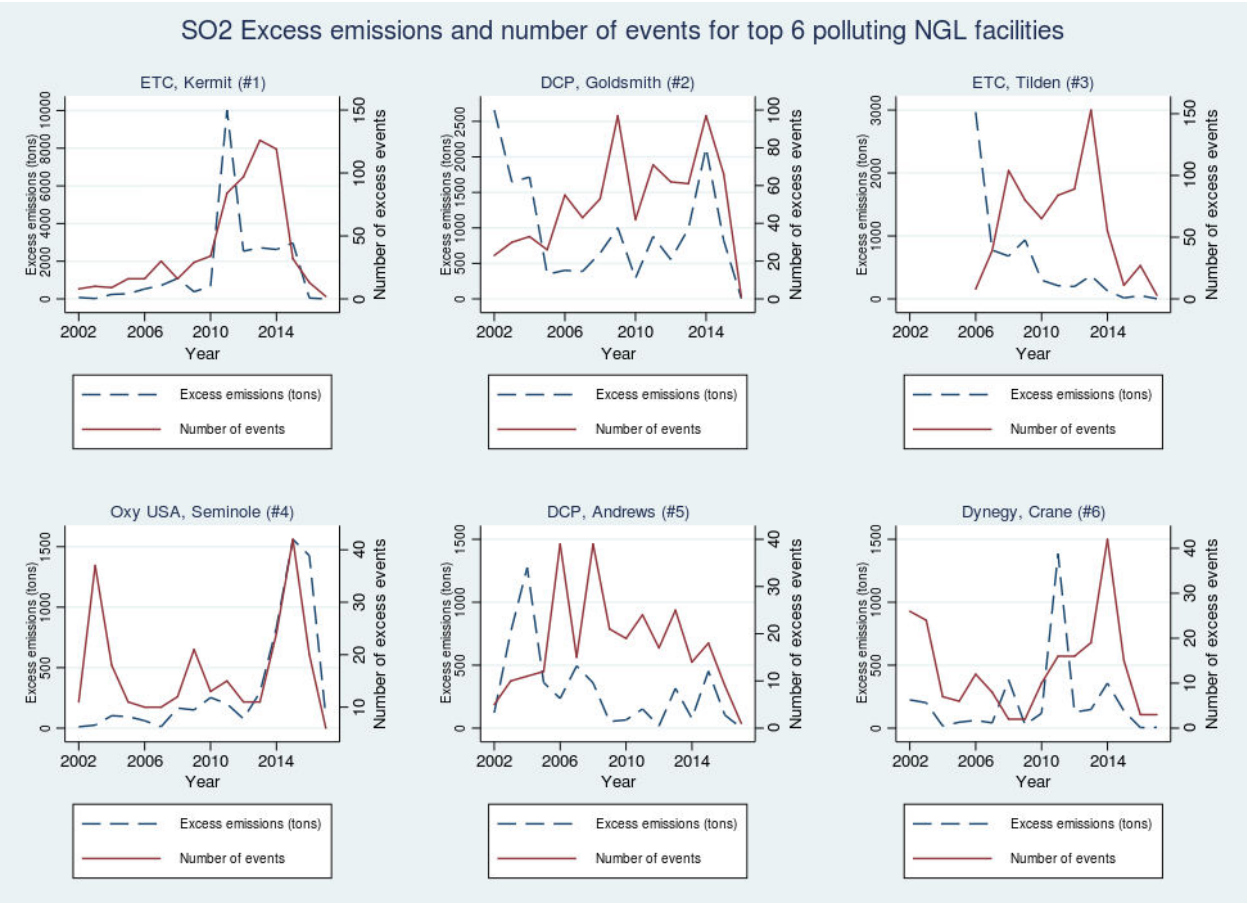


Figure S41: Excess emissions and number of excess emission events involving the release of Nitrogen Oxides (NO_x) for the top 6 most polluting Natural Gas Liquids (NGL) facilities (out of a total of 174 NGL facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 73% of all NO_x excess emissions across all NGL facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1]. The fourth most polluting facility (Midmar West Gas plant, Andrews) had eight excess emissions events (all in 2011) amounting to 345 tons of NO_x emissions. To avoid illustrating a graph with a single data point, we have replaced that facility with the seventh most polluting one (DCP Midstream, Andrews) in the Figure.

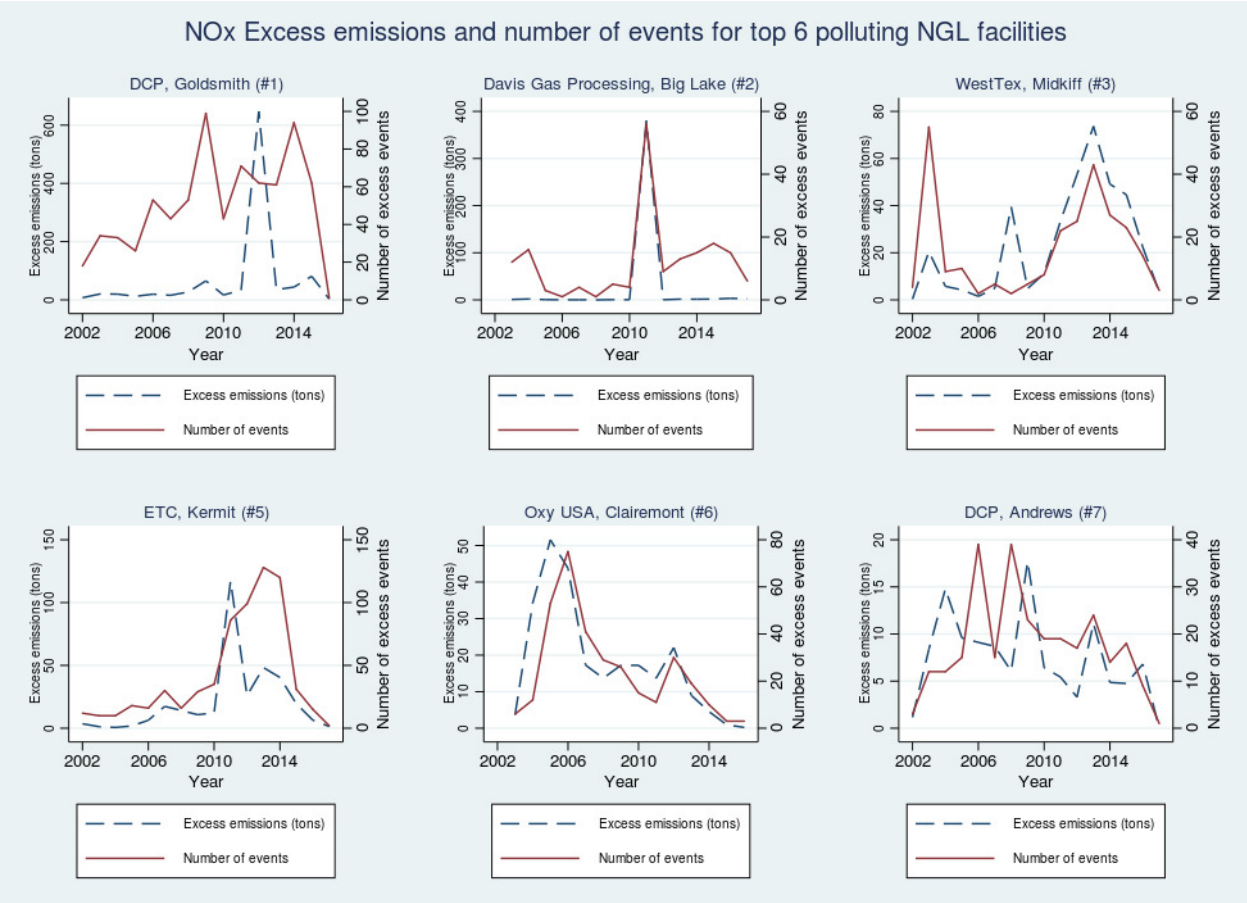


Figure S42: Excess emissions and number of excess emission events involving the release of Volatile Organic Compounds (VOC) for the top 6 most polluting Natural Gas Liquids (NGL) facilities (out of a total of 174 NGL facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 65% of all VOC excess emissions across all NGL facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

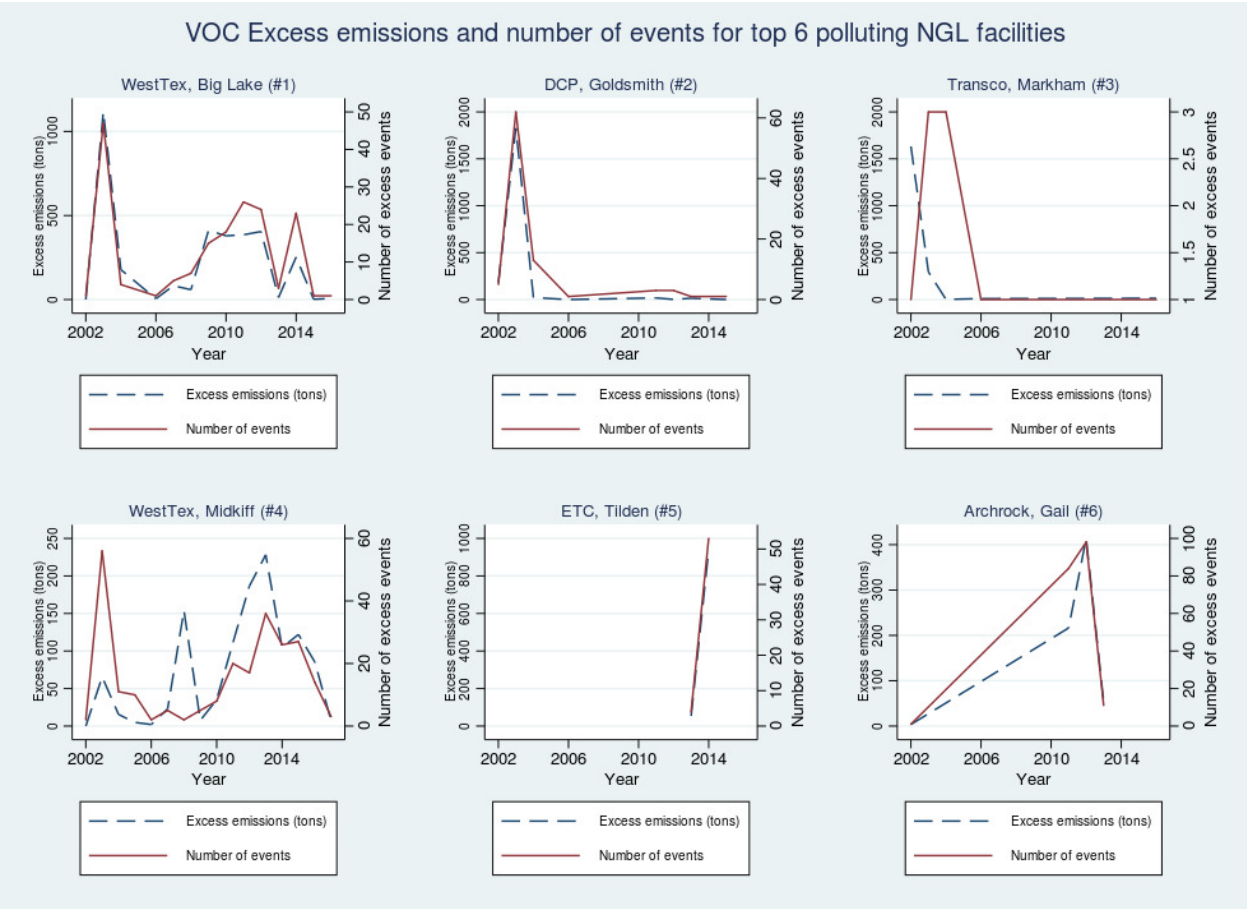


Figure S43: Excess emissions and number of excess emission events involving the release of Carbon Monoxide (CO) for the top 6 most polluting Industrial Organic Chemicals (IOC) facilities (out of a total of 157 IOC facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 83% of all CO excess emissions across all IOC facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

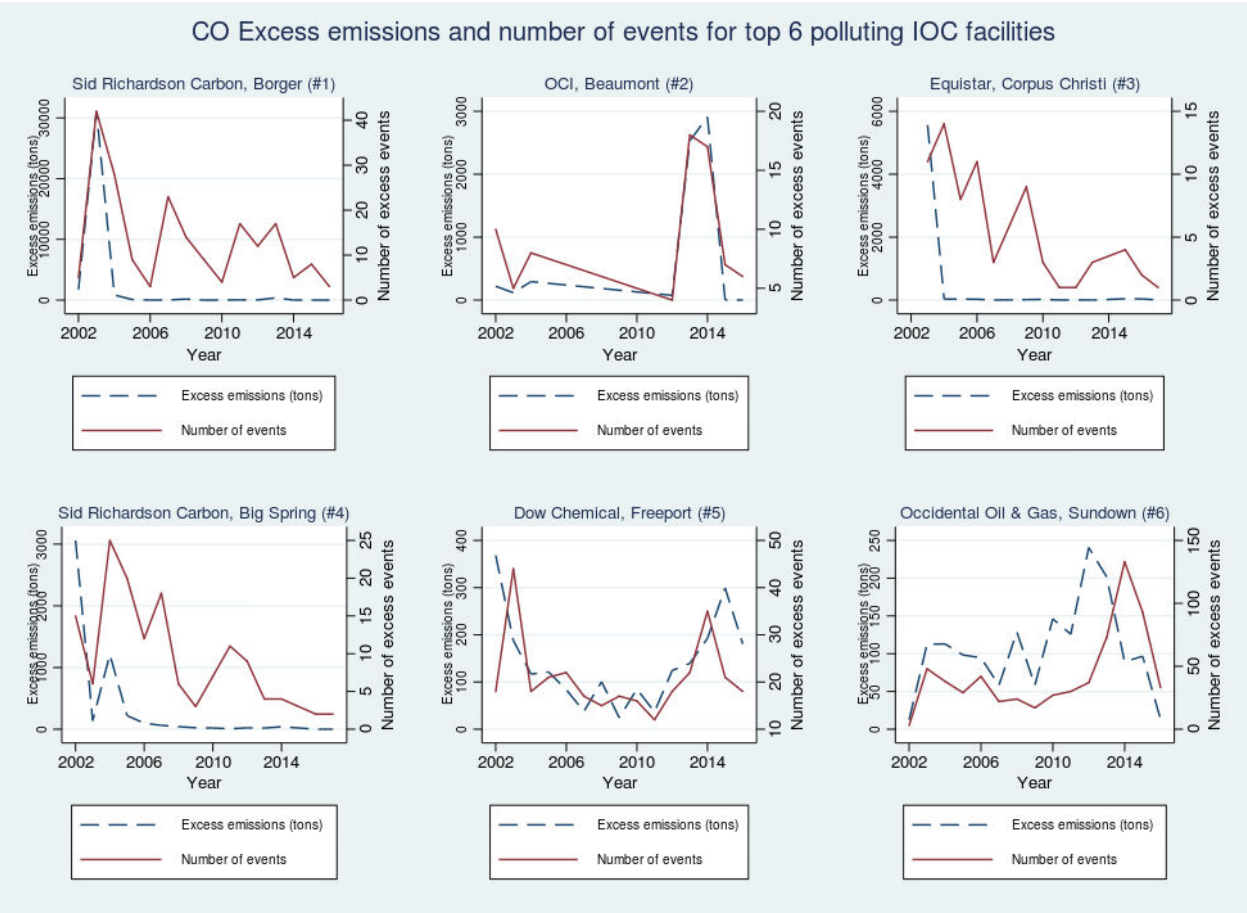


Figure S44: Excess emissions and number of excess emission events involving the release of Sulfur Dioxide (SO_2) for the top 6 most polluting Industrial Organic Chemicals (IOC) facilities (out of a total of 157 IOC facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 98% of all SO_2 excess emissions across all IOC facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

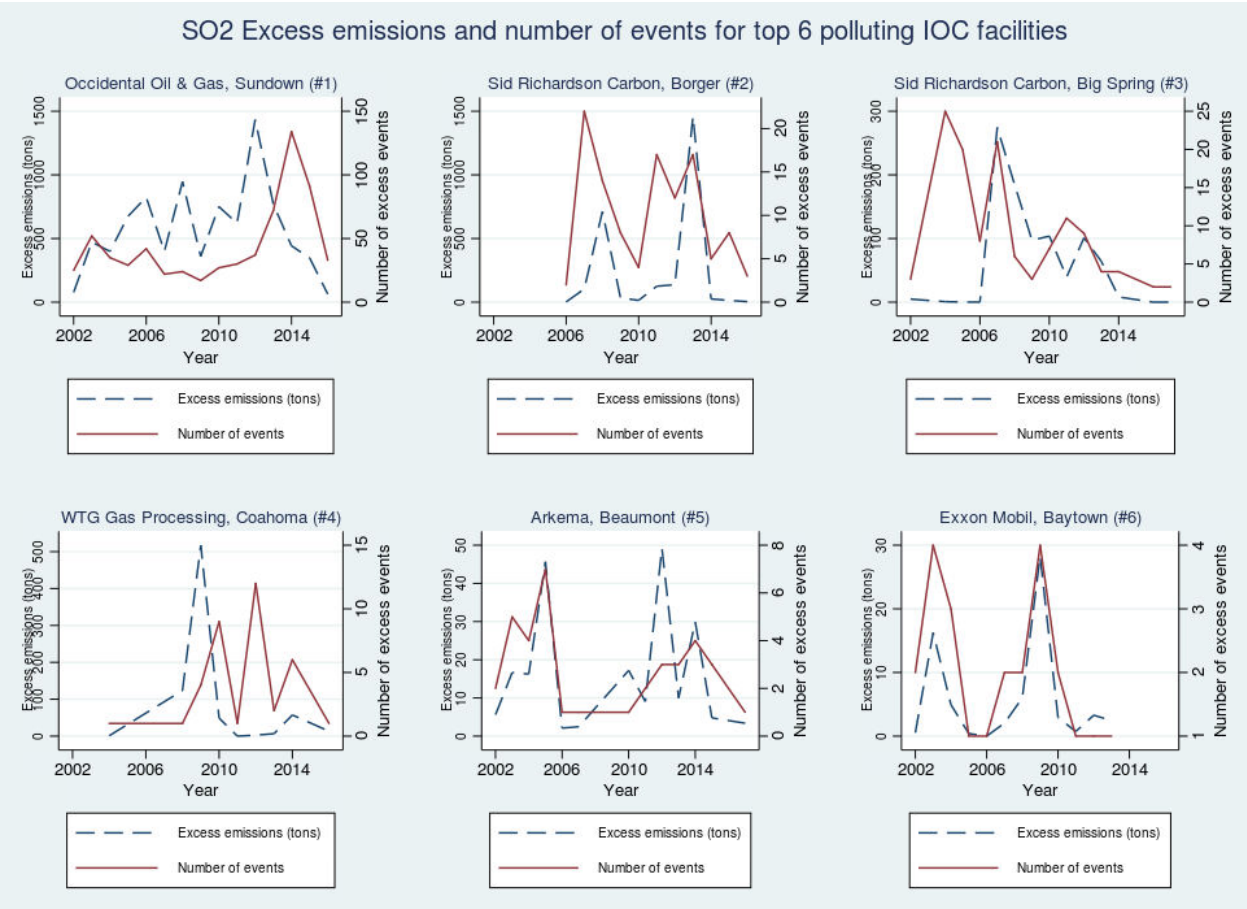


Figure S45: Excess emissions and number of excess emission events involving the release of Nitrogen Oxides (NO_x) for the top 6 most polluting Industrial Organic Chemicals (IOC) facilities (out of a total of 157 IOC facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 46% of all NO_x excess emissions across all IOC facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

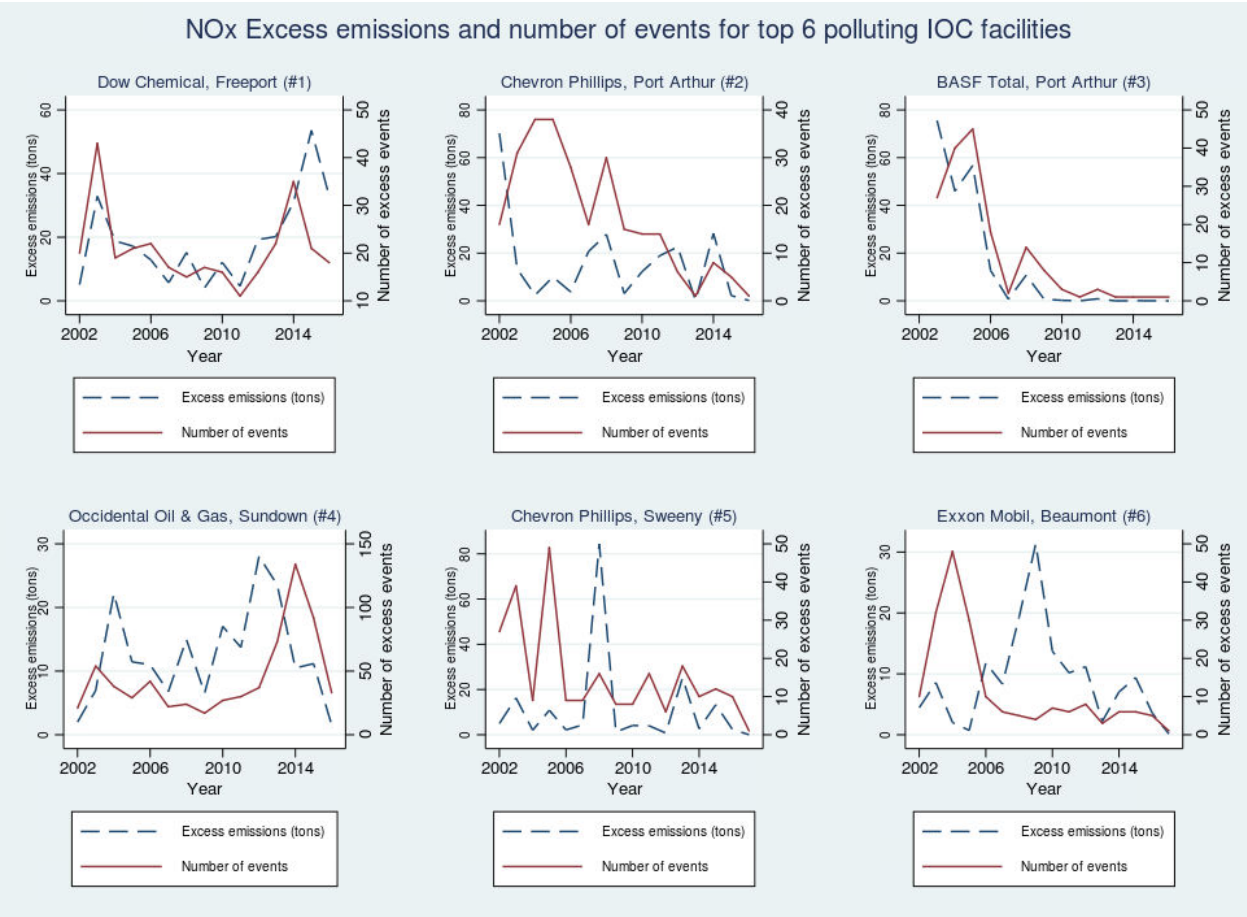


Figure S46: Excess emissions and number of excess emission events involving the release of Volatile Organic Compounds (VOC) for the top 6 most polluting Industrial Organic Chemicals (IOC) facilities (out of a total of 157 IOC facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 44% of all VOC excess emissions across all IOC facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

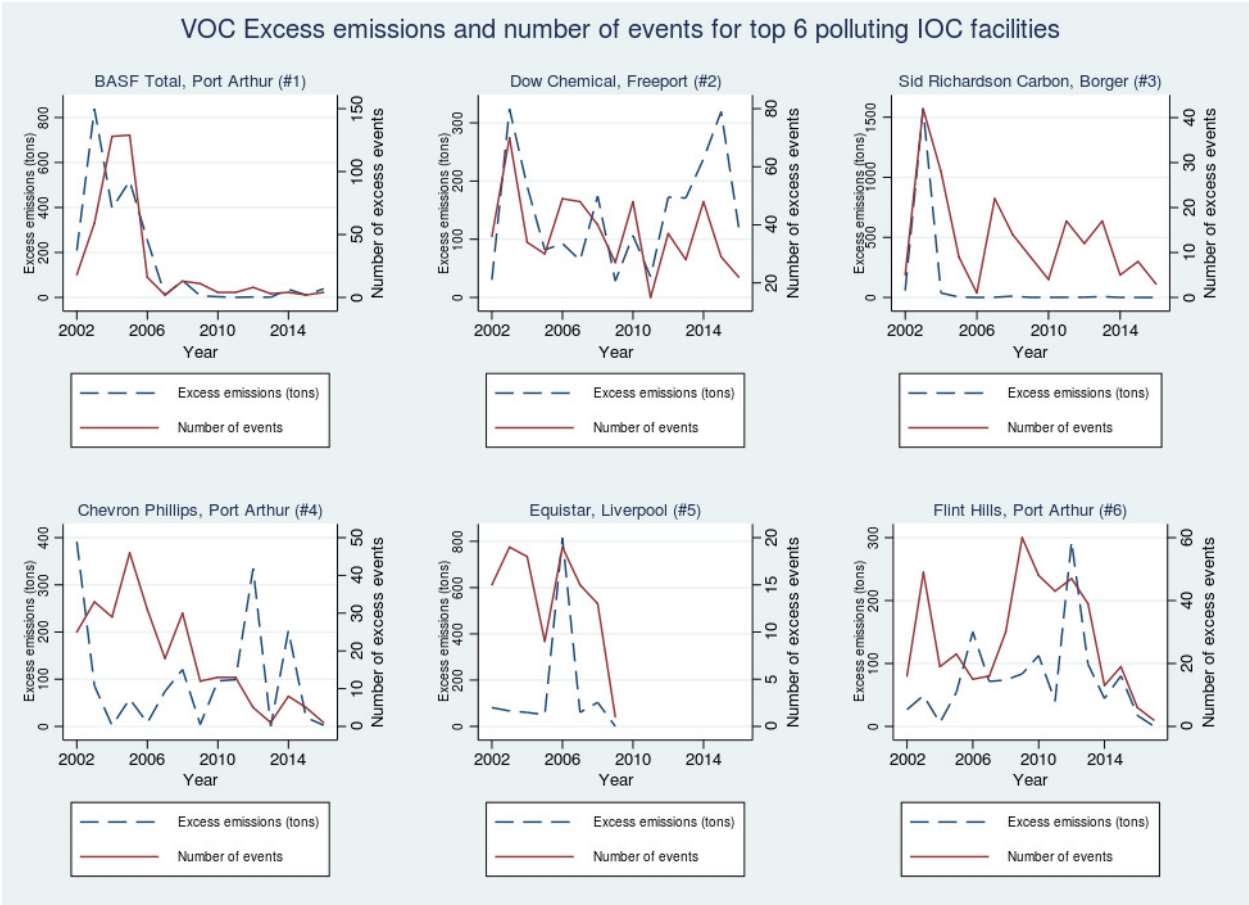


Figure S47: Excess emissions and number of excess emission events involving the release of Carbon Monoxide (CO) for the top 6 most polluting Crude Petroleum and Natural Gas (CPNG) facilities (out of a total of 1,071 CPNG facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 31% of all CO excess emissions across all CPNG facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

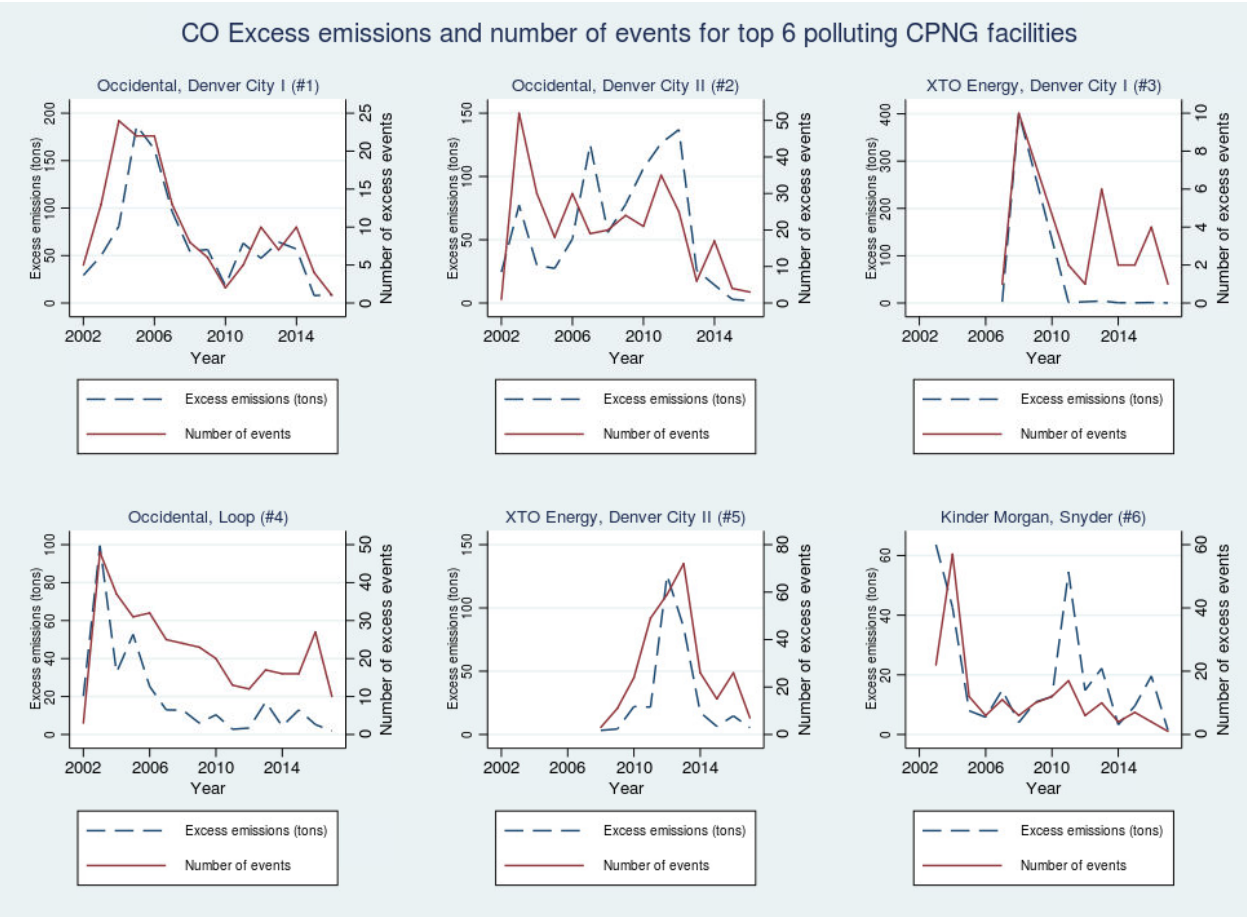


Figure S48: Excess emissions and number of excess emission events involving the release of Sulfur Dioxide (SO_2) for the top 6 most polluting Crude Petroleum and Natural Gas (CPNG) facilities (out of a total of 1,071 CPNG facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 28% of all SO_2 excess emissions across all CPNG facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

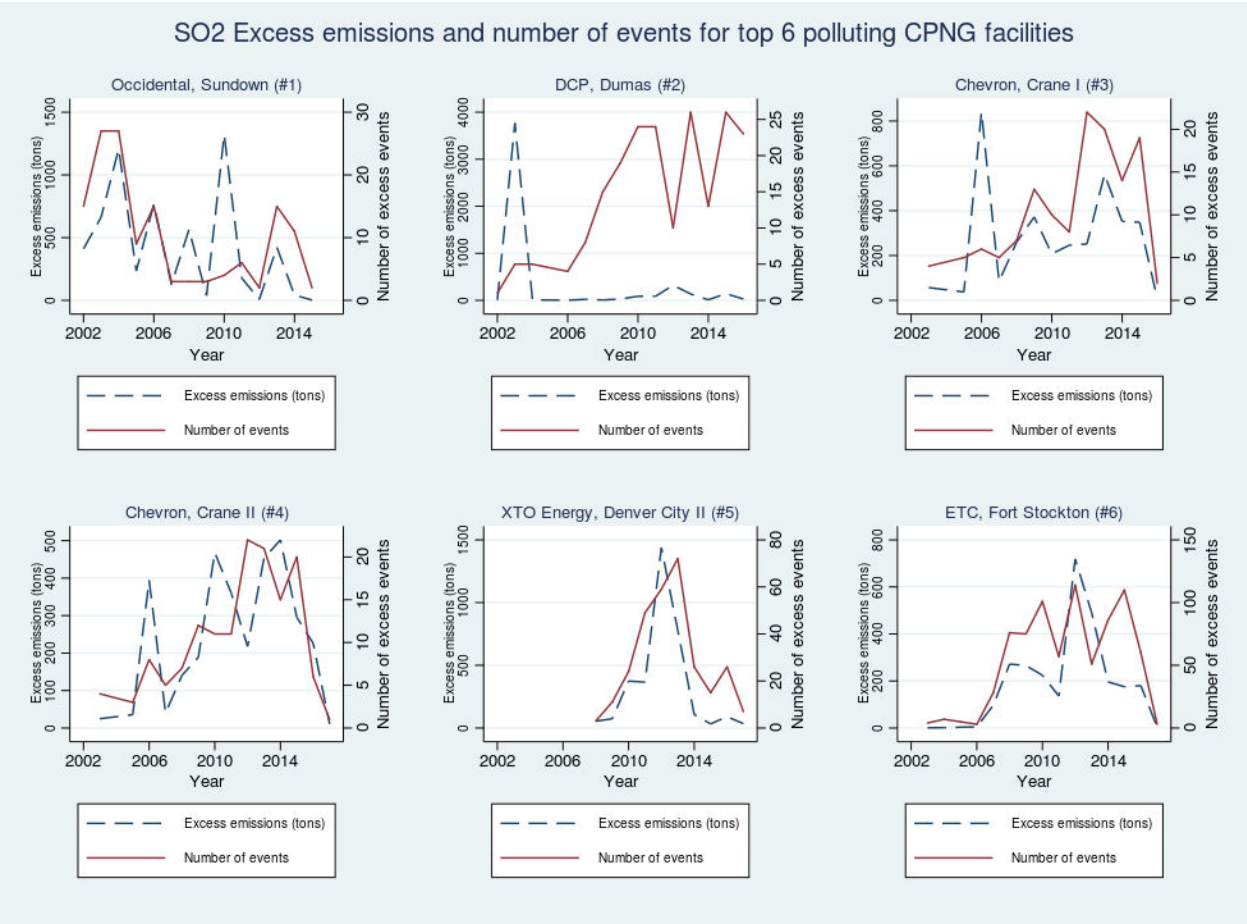


Figure S49: Excess emissions and number of excess emission events involving the release of Nitrogen Oxides (NO_x) for the top 6 most polluting Crude Petroleum and Natural Gas (CPNG) facilities (out of a total of 1,071 CPNG facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 23% of all NO_x excess emissions across all CPNG facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

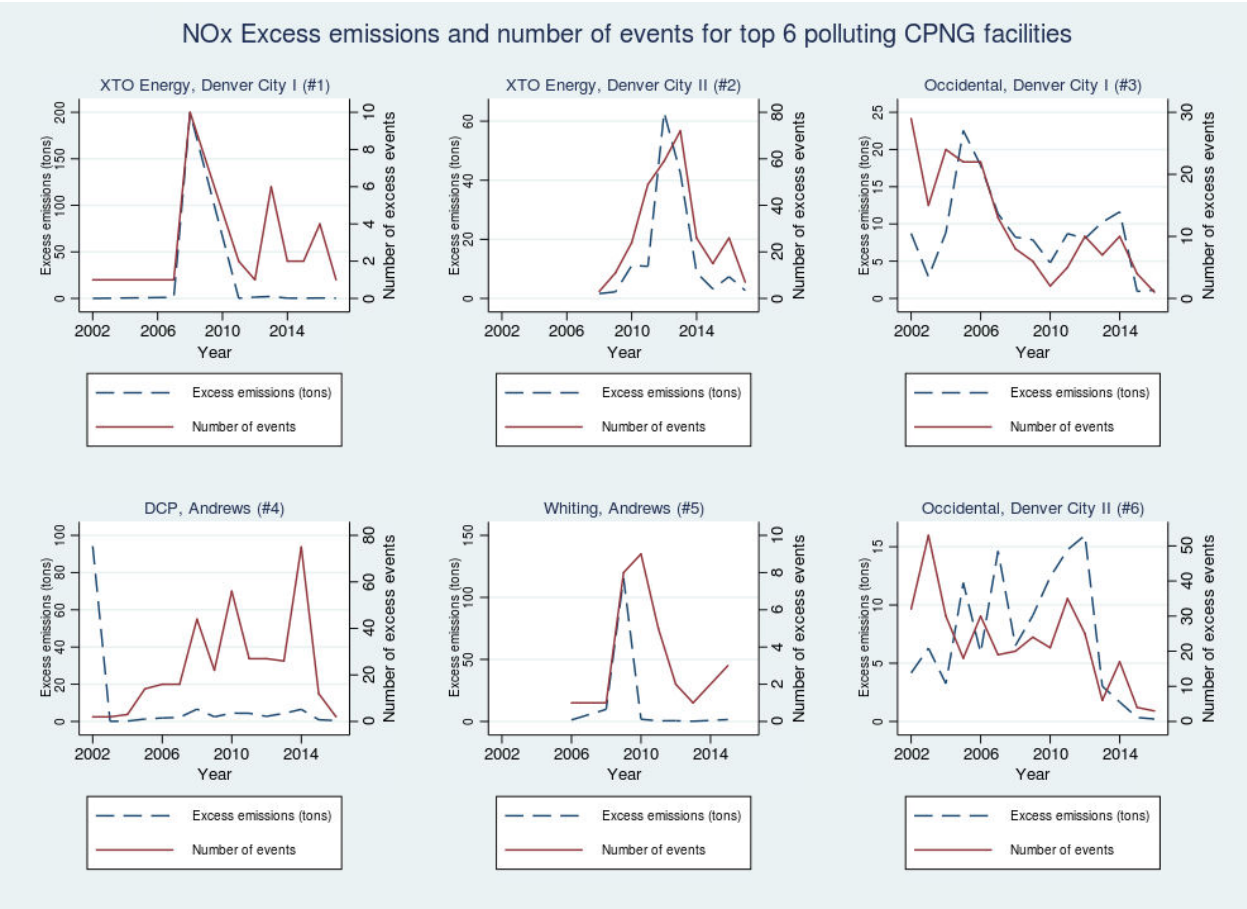


Figure S50: Excess emissions and number of excess emission events involving the release of Volatile Organic Compounds (VOC) for the top 6 most polluting Crude Petroleum and Natural Gas (CPNG) facilities (out of a total of 1,071 CPNG facilities reporting to the AEME dataset of the TCEQ). In each of the six panels, the amount of excess emissions for each facility is measured on the left axis and illustrated with the blue dotted line, while the number of excess emission events for each facility is measured on the right axis and illustrated with the red solid line. The name and location (city) of each facility are listed in the title of each panel. Those 6 facilities, collectively, released 28% of all VOC excess emissions across all CPNG facilities between 2002-2016. Source: Figure compiled by the authors using data from TCEQ [1].

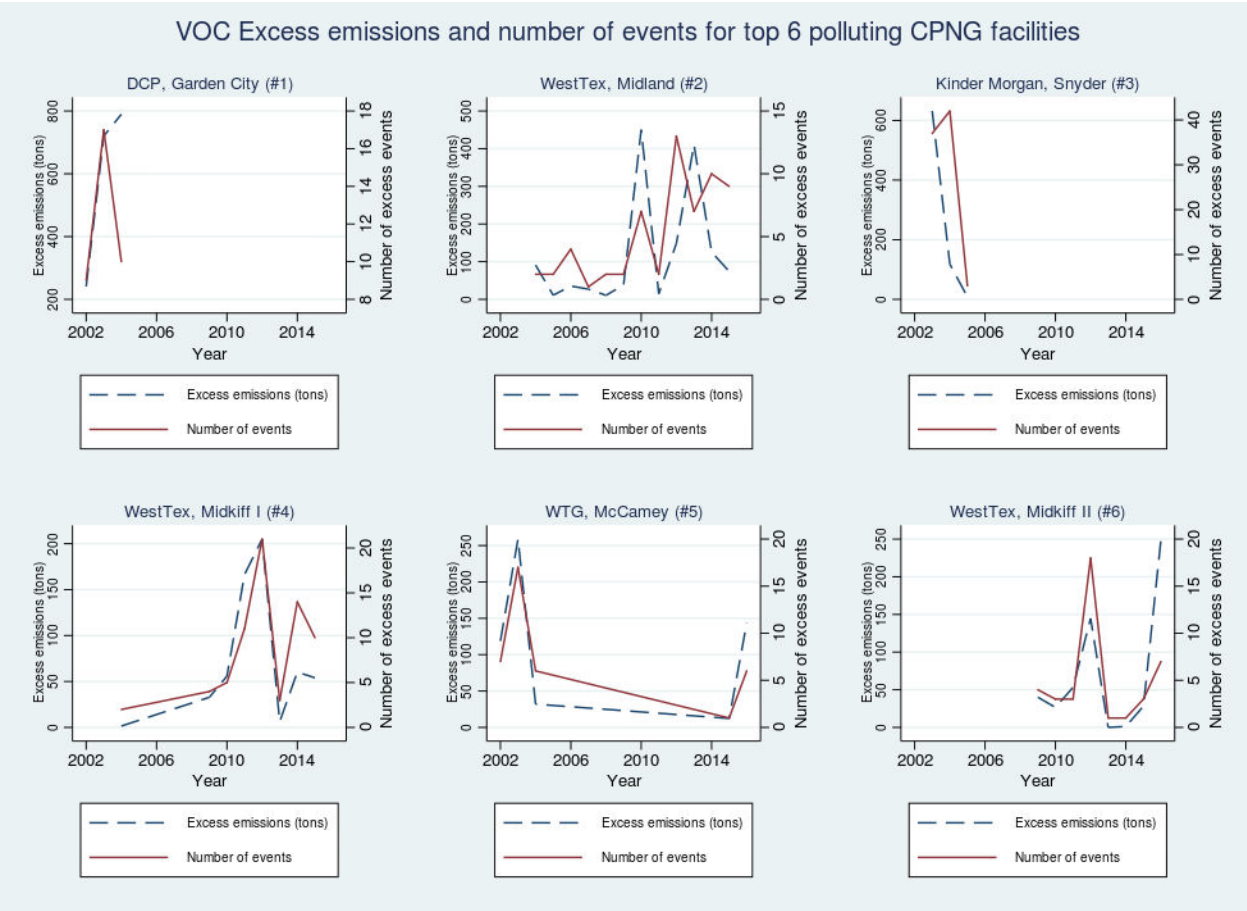


Figure S51: Word cloud of most frequent words in hurricane topic of Structural Topic Modeling analysis. Source: Figure compiled by the authors using data from TCEQ [1].

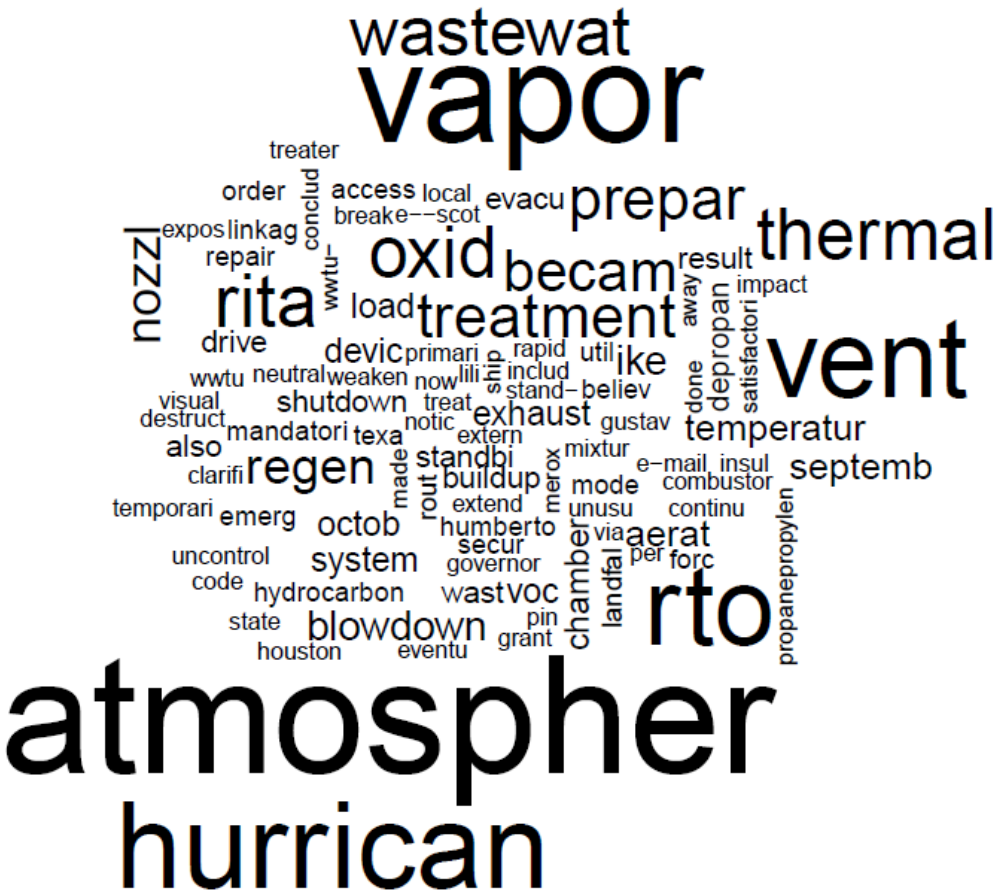


Figure S52: Damages from Excess Emissions (all pollutants, all industries) by year (2004-2015), by Texas county. Source: Figure compiled by the authors using data from TCEQ[2], EASIUR[3], QGIS[4] and Manson et al. (2017)[5].

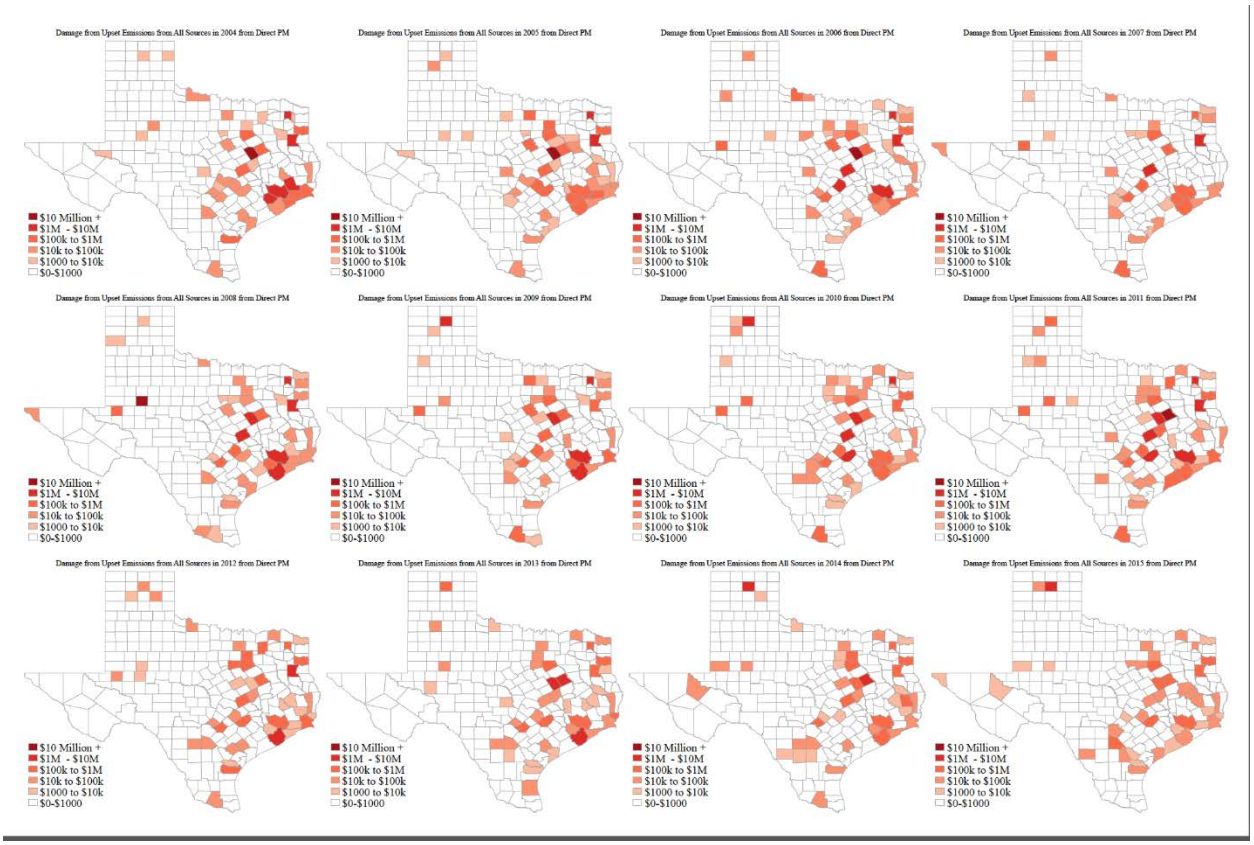


Figure S53: Damages from Excess Emissions (directly emitted PM, all industries) by year (2004-2015), by Texas county. Source: Figure compiled by the authors using data from TCEQ[2], EASIUR[3], QGIS[4] and Manson et al. (2017)[5].

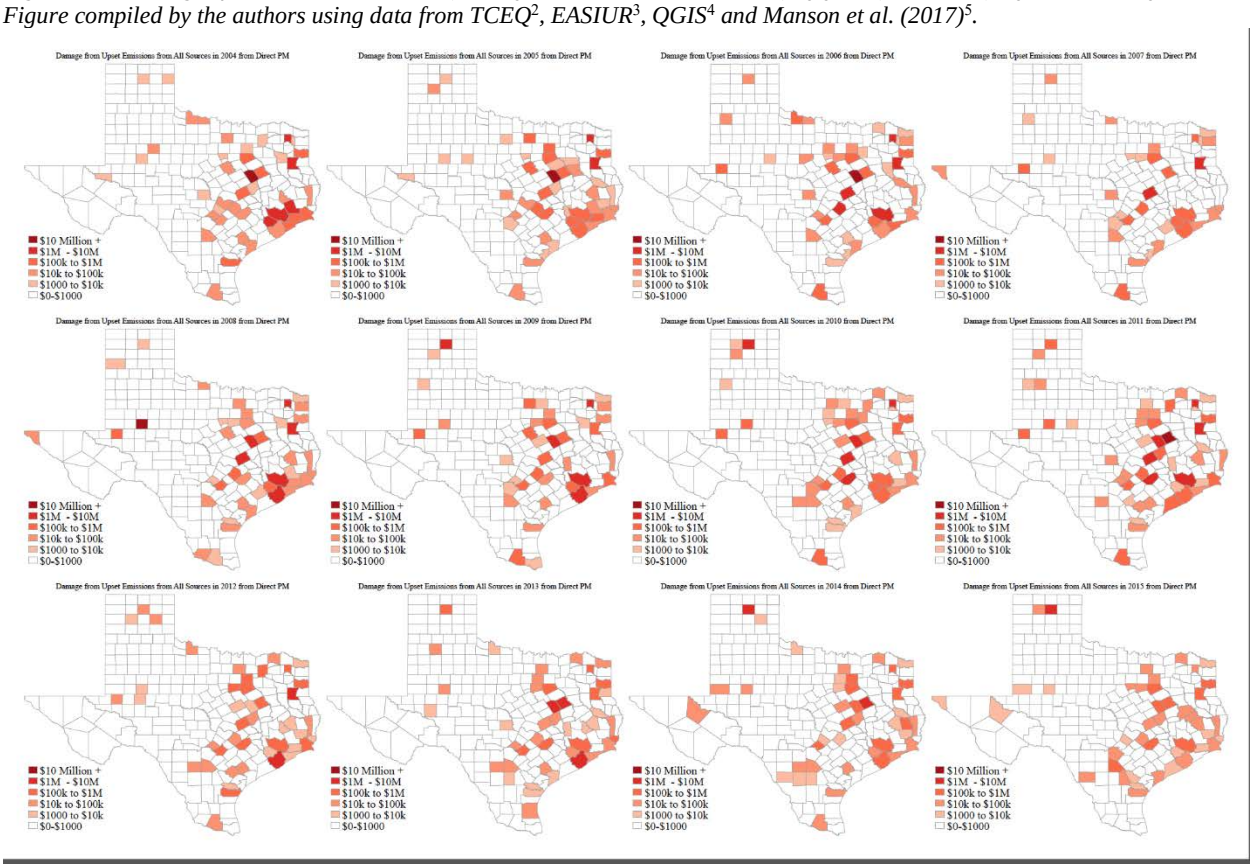


Figure S54: Damages from Excess Emissions (secondary PM from SO_2, all industries) by year (2004-2015), by Texas county. Source: Figure compiled by the authors using data from TCEQ[2], EASIUR[3], QGIS[4] and Manson et al. (2017)[5].

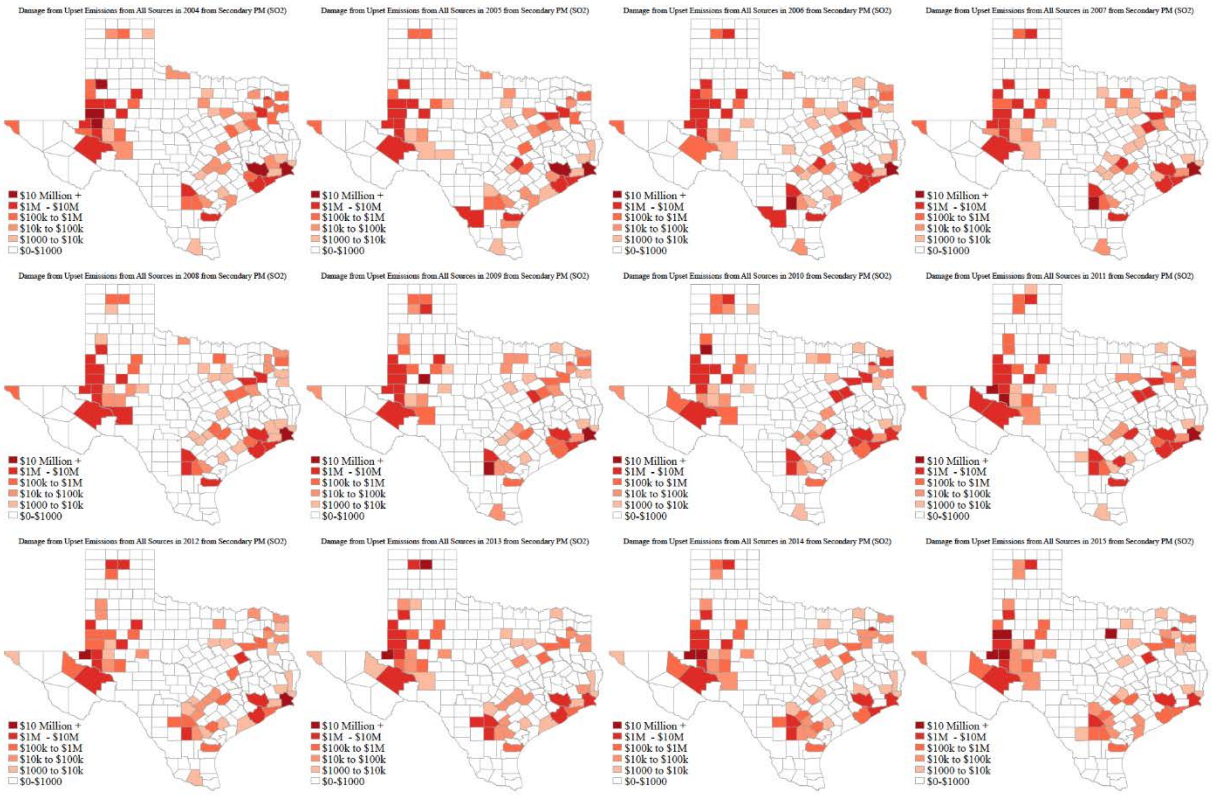


Figure S55: Damages from Excess Emissions (secondary PM from NO_x, all industries) by year (2004-2015), by Texas county. Source: Figure compiled by the authors using data from TCEQ[2], EASIUR[3], QGIS[4] and Manson et al. (2017)[5].

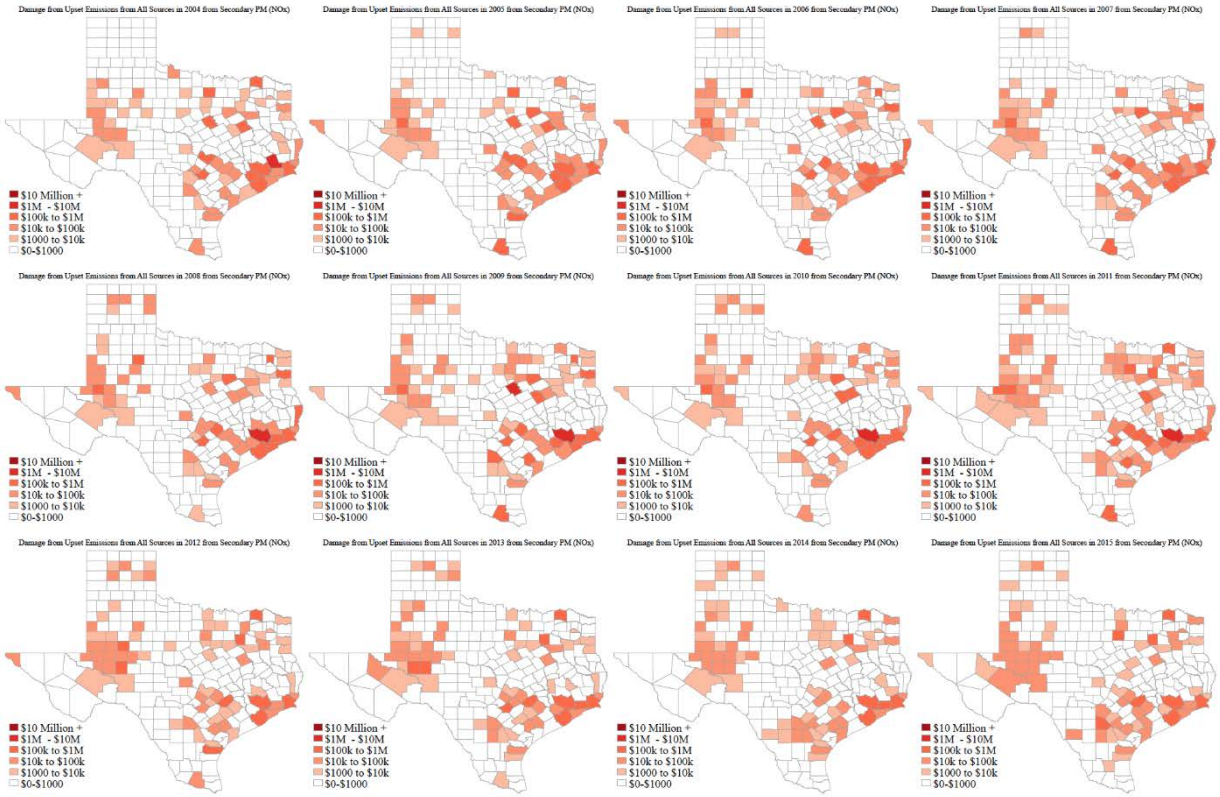
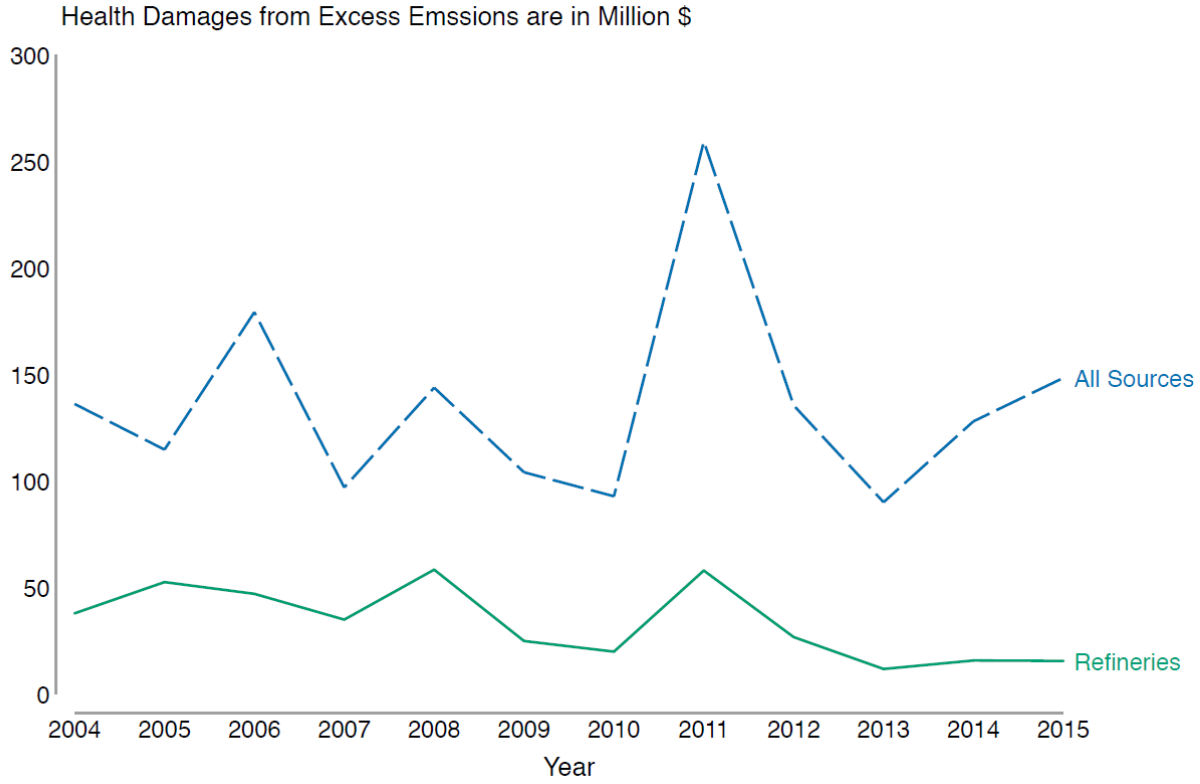


Figure S56: Health damages (in $ Million) for all Texas counties attributed to excess emissions of $PM_{2.5}$, SO_2, and NO_x from all facilities in the state (blue dotted line) and all refineries (green solid line). Source: Figure compiled by the authors using data from TCEQ[2] and EASIUR[3].



References in the Supporting Information

1. Texas Commission on Environmental Quality. *Air Emissions and Maintenance Events Dataset*.; 2017.

2. Texas Commission on Environmental Quality. *Emissions Inventory Dataset*.; 2016.

3. Heo J. Evaluation of Air Quality Impacts on Society: Methods and Application. February 2015. http://repository.cmu.edu/dissertations/503 (accessed on 9/5/17).

4. QGIS Development Team. QGIS Geographical Information System. https://qgis.org/en/site/index.html. Published 2017. Accessed March 24, 2017.

5. Manson S, Schroeder J, Van Riper D, Ruggles S. IPUMS National Historical Geographic Information System: Version 12.0. *Minneap Univ Minnesota http//doi org/1018128 D (accessed 4/20/17)*. 2017.

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May 21, 2019

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P.O. Box 13087
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Austin, Texas 78711-3087

Re: 2019 Annual Monitoring Network Plan

Dear Sirs:

On behalf of its respective clients identified below and their represented communities, Lone Star Legal Aid (LSLA) submits these comments to the Texas Commission on Environmental Quality (TCEQ) on the 2019 Annual Monitoring Network Plan. We hope that the TCEQ and the U.S. Environmental Protection Agency (EPA) will consider and respond to these comments made on behalf of LSLA's represented clients.

I. INTRODUCTION

LSLA's mission is to protect and advance the civil legal rights of the millions of Texans living in poverty by providing free advocacy, legal representation, and community education that ensures equal access to justice. Our service area encompasses one-third of the state of Texas, including 72 counties in the eastern and Gulf Coast regions of Texas. LSLA's Environmental Justice Team focuses on the right to fair distribution of environmental benefits and burdens and the right to equal protection from environmental hazards on behalf of impacted communities in LSLA's service area. These comments are submitted on behalf of the environmental justice communities and residents represented by LSLA's organizational clients: Caring for Pasadena Communities, Port Arthur Community Action Network, and Pleasantville Civic League.

II. REPRESENTED COMMUNITIES

A. CARING FOR PASADENA COMMUNITIES

Caring for Pasadena Communities (CPC) is a community-based nonprofit organization committed to raising awareness of environmental issues affecting residents of Pasadena and nearby communities along the Houston Ship Channel, where many of its members live and work. CPC is organized to advocate for these communities, improve public education on environmental issues, and to ensure equal treatment for low-income residents in environmental matters. This work has entailed direct involvement in the public participation process of numerous projects by highlighting environmental justice concerns for various permitting agencies that would otherwise go unnoticed and unaccounted for.

B. PORT ARTHUR COMMUNITY ACTION NETWORK

Port Arthur Community Action Network (PA-CAN) is a not-for-profit community-based organization in Port Arthur that mobilized immediately after Hurricane Harvey to address a slew of environmental releases and problems associated with the storm. The organization was responsible for hosting disaster relief legal clinics for the citizens and advocating for the City of Port Arthur to shut down or relocate a temporary debris site on 19th Street in the west end of Port Arthur. In addition, PA-CAN has been investigating many releases during the 2017 storm and evaluating appropriate action through regulatory channels. Further, the organization is active in reviewing and challenging new air permit applications in the area that would compound the already existing issues with air and water quality in the City. This organization is committed to improving the quality of life of residents of Port Arthur, Texas.

C. PLEASANTVILLE CIVIC LEAGUE

Pleasantville Civic League, Inc. was established in 1951, and the organization serves as the official civic association for the historic Pleasantville Community. The purpose of the organization is to amplify citizens of the community with local and state government agencies and officials on local issues. It also advises and organizes recreational, cultural, and educational matters in the community. For example, Pleasantville Civic League led the community efforts to break ground on the Judson Robinson, Sr. Community Center, which is a 12,800 square foot LEED-certified facility with a gymnasium, large classroom, kitchen, computer room, new playground, football field and an expanded parking lot. The Community Center officially opened in April 2018 and serves as gathering place for Pleasantville Civic League meetings and other community events. The objectives of the organization include promoting programmatic opportunities and special events, expanding volunteer participation, generating and administering council's funds to maximize the benefit to the local Community Center, and promoting programs of the Community Center.

III. PLACEMENT OF MONITORS IN ENVIRONMENTAL JUSTICE COMMUNITIES

Environmental justice is an ongoing struggle to remedy environmental discrimination in this country. The EPA defines environmental justice as follows:

> Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

Environmental discrimination has historically been evident in the process of selecting and building environmentally hazardous sites, including waste disposal, manufacturing, and energy production facilities. The siting of these hazardous facilities in communities of color or lower income communities can have a disproportional impact on the overall health of those communities. Pasadena, the Westside Community of Port Arthur, and Pleasantville all qualify and have been recognized as environmental justice communities by the EPA and other organizations working for social and economic change.[1]

In each of the three environmental justice communities profiled in these comments, there are also historic considerations regarding the siting choices of hazardous facilities that should be taken into account by the TCEQ as it modifies its Monitoring Network Plan. A report from 2015 stated that hazardous waste, treatment and disposal facilities "may be sited in locations that are both disproportionately nonwhite at the time of siting and are already undergoing demographic changes."[2] Demographic changes typically attract hazardous sites rather than minority groups being drawn to the areas around hazardous sites. Regardless of how the proximity occurred, it is important to recognize the potential health impacts from air pollution on these communities located so close to industry like Westside Port Arthur, Pleasantville, Pasadena and other communities around the Houston Ship Channel.

Although LSLA acknowledges that the TCEQ has a large number of monitors in the Beaumont-Port Arthur Region and the Houston-Galveston-Brazoria Region, there are still holes in both regional monitoring networks particularly for environmental justice communities surrounded by industrial facilities. First, not all monitoring stations are monitoring for all criteria pollutants, so the actual number of monitors does not guarantee that all pollutants are being monitored in a community sufficiently based on the types of pollutants being generated in that area. Second, there are not enough monitors within the environmental justice communities where the people live to know if they are being impacted by emissions from facilities that are clustered in and around their neighborhoods. Third, there should be more of an effort to make the information reported from monitors more accessible to the public for real time events as well as a stronger mobile monitoring system that can be deployed in the event of emergencies so that the public can be aware of what risks there are to their heath during the event.

Communities should be able to easily access information on the toxic emissions coming from industrial facilities, along with information about the chemicals' health hazards. There are

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[1] EPA, Texas Environmental Justice Collaborative Action Plan at 4 (Aug. 3, 2016) available at https://www.epa.gov/sites/production/files/2016-12/documents/texas_ej_plan_8-3-16_final.pdf.

[2] Mohai, Paul and Robin Saha, *Which came first people or pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice,* Environmental Research Letters, at 7.

several key limitations on the TCEQ's existing monitoring technology: (1) it is not recorded in real time; (2) it does not identify sources of the pollution, and (3) it only measures emissions at the fence line as opposed to requiring monitoring systems in the communities. Real time information will reveal big spikes in emissions, how long they last, and where they are coming from. Because stationary monitors don't move and are all at a set height, they do not pick up all emitted pollutants and will likely miss the smaller upset events that also have a direct impact on public health.

Starting on Sunday, March 17, the disaster at Intercontinental Terminals Company (ITC)'s Deer Park facility that took place in impacted air quality in the Houston region and beyond for at least a week. Not only were the nearby communities exposed to increased levels of particulate matter, but also elevated levels of toxic volatile organic compounds (VOCs) related to the product that ITC was storing in its tank farm on site. The fire compromised the tanks and subsequently caused further release of these VOC products during the fire and ITC's response and recovery phases. In addition to the direct impacts on Deer Park, this event drastically impacted Pasadena and the surrounding communities, including Pleasantville and Channelview.

Likewise, in April 2017, in the City of Port Arthur, German Pellets had an industrial fire at its silo storage facility for wood pellets that burned and smoldered for almost three months impacting the quality of life of residents in the Westside of Port Arthur. There were insufficient existing monitors in the area to track the amount of increased particulate matter generated from this ongoing campfire that directly impacted the health of residents in the area. Later that same year in September, the tank fire at the Valero's facility released over a quarter-million pounds of soot related to that single event.

It should not take disasters of these sorts to force the TCEQ into realizing that its monitoring programs in these areas is insufficient given the number of industrial facilities and potential threats to public health in the event that there are emissions upsets, fires, or disasters of this nature. The following comments provide some specific details on three environmental justice communities and the bases for analyzing these types of monitoring deficiencies in other similarly situated neighborhoods.

A. PASADENA AND SURROUNDING COMMUNITIES NEAR THE HOUSTON SHIP CHANNEL

As shown on the map below, in the city limits of Pasadena, there is only one air monitor, Pasadena North (#482011049), for the entire city covering 44.52 square miles with a population of 149,043 recorded in the 2010 census, making it the second largest municipality in Harris County. The monitor unfortunately only tracks VOCs. There are at least 19 facilities located in Pasadena, Texas registered with the EPA and regularly making Toxic Releases Inventory (TRI) reports of VOCs and other chemicals being released in the area. In addition to these facilities, there are other types of facilities emitting particulate matter, including five concrete batch plants. There are other air monitors surrounding the City of Pasadena that are physically located in other municipalities, such as Houston, Shore Acres, Seabrook, League City, and Deer Park. However, these monitors are not sufficient to monitor air quality for Pasadena residents. Table 1 below reveals more monitoring is needed within Pasadena's borders for other criteria pollutants.

TABLE 1: PASADENA AIR MONITORS			
EPA Site No.	**Monitor Name**	**Location**	**Pollutant(s) Monitored**
482011049	Pasadena North	702 Light Co Service Road	VOCs

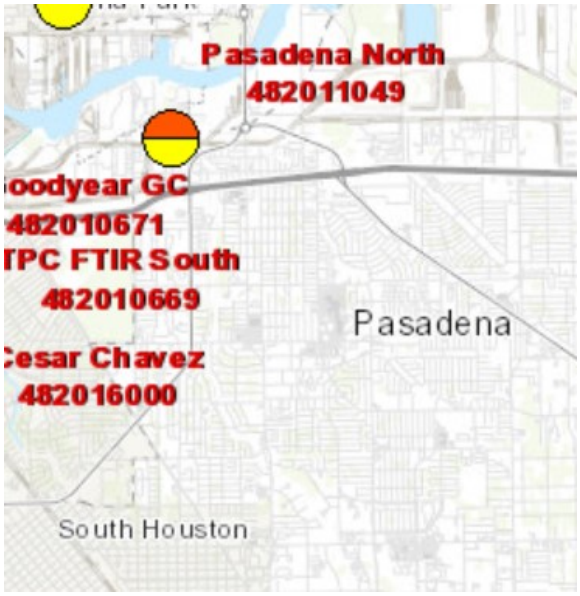

Figure 1: Air Monitors in Pasadena

In the communities surrounding Pasadena, additional stationary monitors exist that record other pollutants in addition to VOCs. However, these monitors listed in Table 2 do not reflect the air pollutants inside the Pasadena community:

TABLE 2: AIR MONITORS AROUND HOUSTON SHIP CHANNEL			
EPA Site No.	**Monitor Name**	**Location**	**Pollutant(s) Monitored**
482016000	Cesar Chavez	4829A Galveston Rd (Houston)	VOC
482010572	Clear Lake HS	2929 Bay Area Blvd (Houston)	O3
482011035	Clinton	9525 1/2 Clinton Dr. (Houston)	NOx, O3, PM2.5, PM10, SO2, VOC
482010673	Goodyear Houston Site #2	2000 Goodyear Dr. (Houston)	VOC
482010062	Houston Monroe	9726 1/2 Monroe St. (Houston)	O3, PM10
482010307	Manchester/Central	9401 1/2 Manchester St. (Houston)	SO2, O3, VOC
482010069	Milby Park	2201A Central St. (Houston)	VOC

TABLE 2: AIR MONITORS AROUND HOUSTON SHIP CHANNEL			
EPA Site No.	**Monitor Name**	**Location**	**Pollutant(s) Monitored**
482010416	Park Place	7421 Park Place Blvd (Houston)	NOx, O3, PM2.5, SO2
482010669	TPC FTIR South	8600 Park Place Blvd (Houston)	NOx, O3, PM2.5, SO2
482011039	Houston Deer Park #2	4514 1/2 Durant St. (Deer Park)	O3, PM2.5, SO2
482010057	Galena Park	1713 2nd St. (Galena Park)	VOC
482010061	Shore Acres	3903 ½ Old Hwy 146 (La Porte)	VOC
482011050	Seabrook Friendship Park	4522 Park Rd (Seabrook)	NOx, O3, PM2.5

More efforts need to be made to increase monitoring in these surrounding areas near the Houston Ship Channel and ensure that the public has a complete picture of air pollutants in their city as well as easy access to this information.

B. PORT ARTHUR

Although its founders intended to create a tourist resort town on the Gulf Coast of Texas, Port Arthur became an industrial center just after the turn of the 20th century after the Spindletop oil geyser erupted in 1901 in Beaumont, only 21 miles from Port Arthur. This discovery fueled the development of oil and gas in the region generally, and companies located in the City of Port Arthur because of the proximity to oil activity and the Port of Port Arthur. By 1914, Port Arthur was the second largest refining source in the US and has remained an industrial town ever since. Its future is to remain so with the number of existing facilities in the area presently seeking permits to expand operations and increase significantly the amount of air pollution put out into the community on an annual basis.

The Westside of Port Arthur or West Port Arthur is a residential neighborhood, predominately a community of color, in this heavily industry-laden area. Today, Port Arthur suffers from excessive releases of smog-causing and toxic pollution, due to the large concentration of refineries and petrochemical plants. The City of Port Arthur has four stationary air monitors; however, given the number of industrial facilities in Port Arthur, the monitoring network remains insufficient. There are at least 20 facilities located in Port Arthur, Texas registered with the EPA, making regular TRI reports of VOCs and other chemicals being released in the area. In combination with these facilities, there are five large refineries that emit other pollutants like SO2 and NOX. There are also 6 petrochemical plants in Port Arthur and one incinerator plant. The proximity between the community and the industrial activity in Port Arthur directly contributes to substantial air pollution, environmental degradation, poverty, and increased rates of respiratory issues and cancer for the area. Despite having four monitors, the number of pollutants being monitored at each station is minimal as shown in Table 3 below.

TABLE 3: PORT ARTHUR AIR MONITORS			
EPA Site No.	**Monitor Name**	**Location**	**Pollutant(s) Monitored**
482450011	Port Arthur West	623 Ellias Street	SO2, O3, VOC
482451071	Port Arthur 7th Street	7th Street / Texaco Island Road	SO2
482450021	Port Arthur Memorial School	2200 Jefferson Drive	PM2.5
482450628	SETRPC Port Arthur	Unavailable	NOX, O3

Figure 2: Monitors in Port Arthur

A need exists for at least one PM10 monitor in Port Arthur given the amount of particulate pollution generated in the area. One in five West Port Arthur households has someone in it with a respiratory illness. Port Arthur also sits in Jefferson County, whose cancer mortality rate, according to a recent study, is 25 percent higher than the state average. The health impacts from this continued, concentrated pollution in West Port Arthur are known, and more monitoring within the community itself would paint a better picture of how their health is being impacted by industry. Port Arthur suffers from very high asthma and elevated cancer risk compared to statewide statistics. A study on the health impacts of proximity to industrial facilities in Port Arthur found that 80 percent of those residents interviewed in West Port Arthur reported having cardiovascular and respiratory problems.

Overall, air in the Westside community meets health-based standards because the air quality has been in attainment since 2005. EPA uses the term “attainment” when the levels of air pollution are at or below the air quality standards known as the National Ambient Air Quality Standards (NAAQS). Although benzene has exceeded state screening levels in the past, it does not currently. Because of its history with this hazardous air pollutant, the TCEQ has been monitoring benzene in the area on a continuing basis, and these efforts to monitor VOCs in

earnest because of the potential acute and long-term impacts on the population should continue.

C. PLEASANTVILLE

Developed after World War II, the community of Pleasantville is predominantly African-American and home to 2,860 residents in 2015. The Pleasantville Area, also designated as Super Neighborhood #57 by the City of Houston, includes many industrial areas, as well as two distinct residential areas. Groveland Terrace is a small residential area in the north, and south of Interstate 10 (East Freeway) is the Pleasantville subdivision. The high homeownership rate and strong neighborhood identity has staved off deterioration even as the two residential areas within the Super Neighborhood have been surrounded by warehouses and industries.

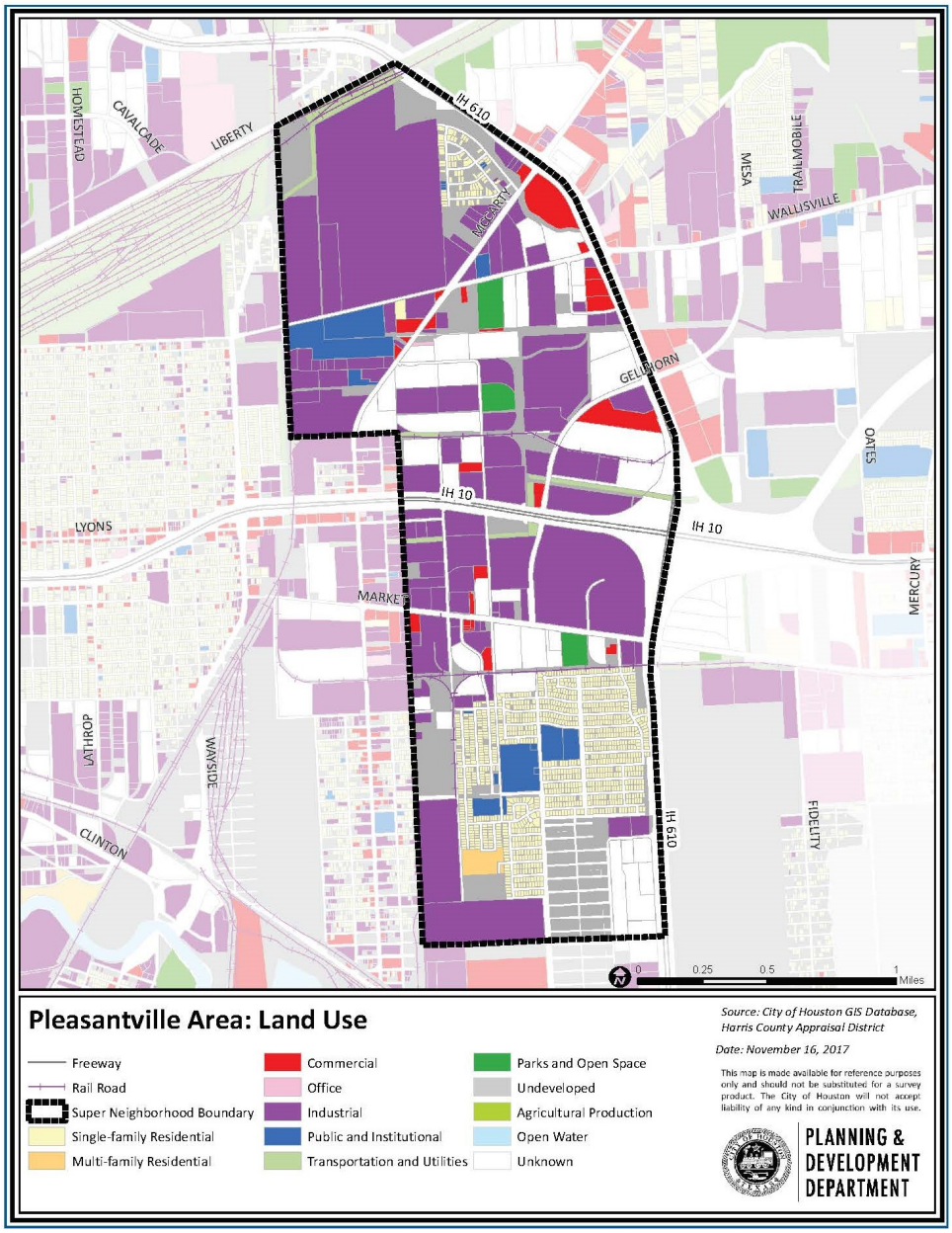

Figure 3: Pleasantville Area Land Use

Numerous industrial facilities within the Super Neighborhood's footprint encircle the two residential neighborhoods shown in Figure 3. These facilities include two metal recycling plants. In addition, there are at least eight (8) facilities located in the area registered with the EPA and regularly making TRI reports of VOCs and other chemicals being released in the area in the last few years. Because of industrial nature of this neighborhood, Pleasantville was included as one of 9 super neighborhoods studied in Mayor White's 2005 Task Force on Air Pollution health risks in Houston. Within one mile of the Pleasantville Area, there are 37 TRI reporting facilities, 13 large quantity generators of hazardous waste, 3 facilities that treat, store or dispose of hazardous waste, 9 major discharges of air pollutants, 4 major storm water discharging facilities, and 1 radioactive waste site, which is also a Superfund site.

The Pleasantville neighborhood is predominantly Black/African-American and Latino/Hispanic, with 64% of Pleasantville Elementary School's 301 students identified as Black/African-American, 34% as Latino/Hispanic, and 2% as white or mixed race. 95% of Pleasantville Elementary students qualify for free or reduced price lunch and 15% are learning English as a second language.[3] In 2015, eighteen (18) percent of the population living in the Super Neighborhood boundaries was over the age of 65% and twenty (20) percent was under the age of 18. The median household income in this area was $32,899 in 2015.

A 1995 warehouse fire near Pleasantville brought home the dangers of living in a heavily industrial area to its residents. Neighbors had to shelter-in-place during the fire, which burned for three weeks due to the presence of flammable, hazardous materials in the warehouse. Temporary monitors were placed along Market Street to track impacts from the fire on the community. The Pleasantville community's efforts to improve safety at warehouses since this event spurred in the adoption of regulatory changes at the City, which required the City of Houston's Fire Department and Public Works and Engineering Department to inspect warehouses, provide neighborhoods with information on the materials stored at nearby warehouses, and ensure the safety of permitted warehouses. Because of this history, Pleasantville remains concerned that other industrial upset events, such as the recent ITC Deer Park fire, will continue to impact their neighborhood and their health.

Overwhelming evidence shows that particle pollution in the outdoor air we breathe—like that coming from vehicle exhaust, coal-fired power plants and other industrial sources—can cause lung cancer. Particle pollution increases the risk of dying early, heart disease and asthma attacks, and it can also interfere with the growth and function of the lungs. During the years 1999-2003, the residents of Pleasantville Area Super Neighborhood had higher overall and cause-specific annual average mortality rates from leading causes than those of Houston as a whole. In particular, the deaths from cancer in the Pleasantville Area during this period totaled 74, which is an age-adjusted mortality rate of 70.9 higher than the City of Houston. Deaths from bronchus-lung cancer in Pleasantville totaled 22 for this period, which again was a rate of 12.2 higher than Houston in total. Rates of heart disease deaths in Pleasantville (113) similarly exceeded that of the City of Houston by a rate of 154, and coronary heart disease, which claimed 73 lives in Pleasantville, was at a rate of 83.2 higher compared to the City. Both cancer and heart disease were the primary causes of premature mortality in Pleasantville over this same period,

[3] Houston Independent School District. Pleasantville Elementary School Profile. Retrieved from http://www.houstonisd.org/domain/45450.

which resulted in years of potential life lost (YPLL) for those dying before age of 65 at YPLL rates of cancer (1890.8), heart disease (1890.8) and coronary heart disease (1020.6).

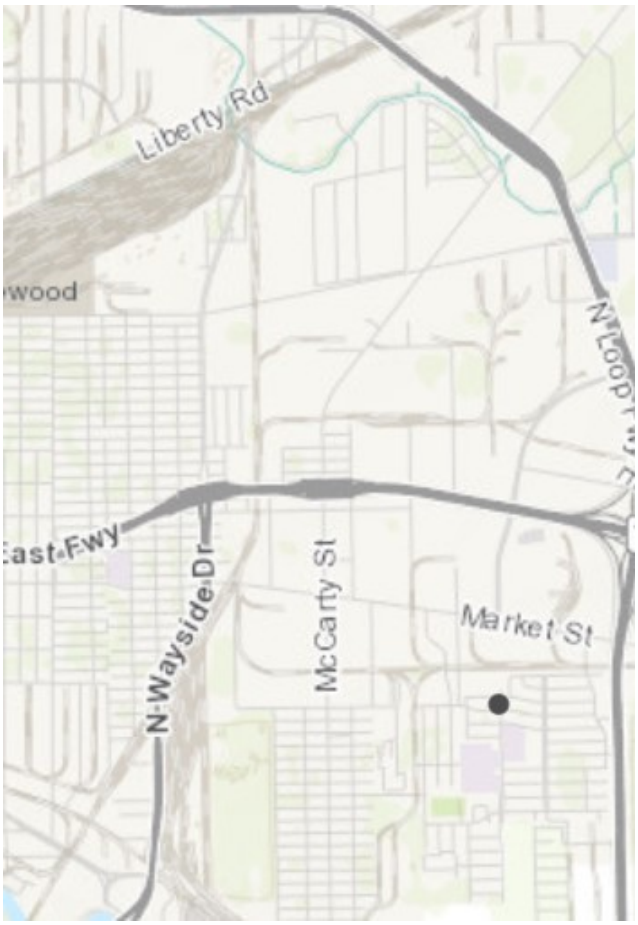

Figure 4:
Absence of Air Monitors in the Pleasantville Area

As Figure 4 above shows, there are no air monitors operated by TCEQ within the Pleasantville community. The closest air monitor is the Clinton air monitor (#482011035) which primarily tracks SO2, NOx, Ozone, PM2.5, PM10, and VOCs. Located at 9525 1/2 Clinton Dr., this monitor is more than 2.5 miles away from the closest Judson Robertson, Sr. Community Center.

One nonprofit community organization in Pleasantville, ACTS (Achieving Community Tasks Successfully), has been working with the Environmental Defense Fund (EDF), Texas Southern University and HBCU-CBO Gulf Coast Equity Consortium to increase monitoring capacity in the neighborhood, installing a network of air monitors measuring particulate matter that will likely take place by June 2019. Two of these PM2.5 monitors, provided by EDF and the City of Houston, are located at the Pleasantville Elementary School, 1431 Gellhorn Dr, Houston, TX 77029 and on Laurentide near Cowart St. A third monitor will be located on Pearl Street at Houston Fire Department Station 41, 805 Pearl St, Houston, TX 77029. Once installed, two of the three PM2.5 monitors will be on the Clarity Movement, Inc.'s network.

While these community-placed monitors will help the community understand the air quality index in their area, there is still some question whether the TCEQ will accept the data

generated from these monitors in the event of an enforcement action, permitting challenge or other air quality complaint. It is important if the TCEQ is not going to supplement its monitoring system in these socially and economically vulnerable areas, that it at least accept the data generated through these less formal community monitoring efforts that still are scientifically verifiable and sound.

IV. COMMENTS ON REGULATORY NETWORK REVIEW

Beginning in the 1970s, the EPA developed the NAAQS for six common air pollutants that pose serious effects to human health and the environment: carbon monoxide (CO), lead (Pb), nitrogen oxides (NOx), ozone (O3), airborne liquid and solid particles (known as particulate matter or PM2.5 and PM10), and sulfur dioxide (SO2). EPA often refers to these pollutants as "criteria pollutants" because allowed levels are set using human health or environmental criteria. On behalf of its represented client communities, LSLA offers the following comments on specific criteria pollutants measured by the TCEQ's regulatory network in addition to one non-criteria pollutant, hydrogen cyanide (HCN).

A. SULFUR DIOXIDE

Sulfur Dioxide (SO2) is an air toxic with a variety of negative health effects. Short term exposure to SO2 can harm the respiratory system and cause symptoms including coughing, shortness of breath, difficulty breathing and tightness in the chest.[4] SO2 exposure can exacerbate asthma and at high concentrations can cause a life-threatening accumulation of fluid in the lungs.[5] Children and people with existing pulmonary issues such as asthma are especially vulnerable to the negative effects of SO2.[6] Additionally, SO2 can react with other compounds in the air to form particulate matter (PM), another potent respiratory irritant discussed in greater detail below.

1. SO2 monitoring in Port Arthur is inadequate.

Port Arthur is home to Oxbow Calcining, a relatively small facility that because of its continued refusal to install pollution controls is the largest emitter of SO2 in Jefferson County. Oxbow emitted 11,319 tons of SO2 in 2014, roughly 85% of the total county-wide emissions that years, and over five times the amount emitted by every other source in the county. Oxbow's SO2 emissions dwarf those from the nearby sources like the Valero Port Arthur Refinery, the Exxon Beaumont Refinery, and the Motiva Port Arthur Refinery, the last of which is currently the largest refinery in the United States and located in Port Arthur.

Because Oxbow's SO2 emissions are above 2,000 tons per year, the facility is subject to EPA's Data Requirement Rule for the 2010 one-hour SO2 primary standard, which requires the agency to provide additional air quality data around major sources of SO2 to ensure compliance with the NAAQS.[7] The agency can provide this through a combination of modeling and

[4] EPA, SO2 Basics, available at https://www.epa.gov/so2-pollution/sulfur-dioxide-basics
[5] *See* Primary NAAQS for SO2 Final Rule, 75 Fed. Reg. 35,520, 35,525 (June 22, 2010).
[6] *Id.*
[7] EPA, Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO2) Primary NAAQS, 80 Fed. Reg. 51,052 (Aug. 21, 2015) (to be codified at 40 C.F.R. § 51, Subpart BB).

monitoring, and must demonstrate that it is collecting monitoring data from locations where peak 1-hour SO2 concentrations are expected to occur.[8]

Unfortunately, there is ample evidence that Oxbow has been altering its operating procedures to intentionally bypass the nearby SO2 monitor, and that the monitor is no longer sited appropriately to capture peak concentrations. Oxbow had been routing emissions through their cold stacks after removing some of the waste heat and selling it to Port Arthur Steam Energy (PASE). When the nearby monitor began registering a number of NAAQS violations, they discontinued used of the cold stacks and routed all emissions through the hot stacks. Unfortunately for the people of Port Arthur, the current monitors are not adequately placed to capture emissions from the hot stacks.

This pattern of behavior explains the drop in exceedances of the 1-hour daily maximum SO2 concentrations between 2017 and 2018, despite nearby SO2 emissions either staying flat or increasing. On December 20, 2017, the Director of the Air Quality Division, David Brymer, at TCEQ notified Oxbow that the monitoring data from January-November 2017 indicated that the 75 ppb NAAQS had been exceeded during that timeframe on 8 separate occasions.[9] In that same letter, TCEQ informed Oxbow that the exceedances occurred during periods where the facility used its cold stacks instead of the hot stacks, which TCEQ noted were better at effectively dispersing emissions.[10] Brymer stated: "The TCEQ appreciates any efforts that Oxbow can make to ensure the area surrounding its Port Arthur facility does not exceed the hourly standard."[11] From November 2017 through the end of 2018, there were only 3 further hourly exceedances based on data from the monitor near the plant.

Oxbow's recent legal battle with PASE provides more evidence that the facility has been and is taking steps to intentionally circumvent the current SO2 monitoring setup. Oxbow originally entered into a contractual agreement with PASE in 2005 to provide PASE with waste heat that PASE would use to create steam that it would then sell to another refinery to generate electricity.[12] PASE operated a waste-heat facility on-site at the Oxbow plant that generated steam from Oxbow's waste heat, but only when Oxbow used the cold stacks.[13] However, Oxbow in recent years has increasingly opted to use only the hot stacks in releasing waste heat from the kilns, depriving PASE of waste heat and causing PASE to initiate legal proceedings that eventually reached the Texas Court of Appeals. By June 2018 all use of the cold stacks had been suspended.

Oxbow counsel's brief submitted to the Court of Appeals for the Ninth District in October 2018 explicitly tied these actions to efforts to avoid exceeding the NAAQS standard, citing the aforementioned communication between TCEQ and Oxbow regarding the exceedances recorded at the monitoring site, as well as letter from Jefferson County Judge Jeff Branick in July

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[8] *See* EPA, SO2 NAAQS Designations Modeling Technical Assistance Document (August 2016), available at https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf.
[9] *See* Letter from David Brymer to Tony Botello sent December 20, 2017.
[10] *Id.*
[11] *Id*.
[12] *See Oxbow Calcining LLC v. Port Arthur Steam Energy, L.P.* (Tex. App. 2018) available at https://www.courtlistener.com/opinion/4572889/oxbow-calcining-llc-v-port-arthur-steam-energy-lp/.
[13] *Id*.

2018 that warned of possible suit for injunctive relief to preclude further NAAQS violations.[14] Oxbow's main defense for stopping use of the cold stacks was that the NAAQS 75 ppb standard was impossible to meet while using the cold stacks and continued use would have required installation of pollution control equipment at a high cost to the company.[15]

Furthermore, during the appeal PASE presented evidence, undisputed by Oxbow, that the SO2 monitor near the facility "was placed based upon discharge of waste heat from Oxbow's 'cold stacks' after the waste heat passed through PASE's steam generation facility." Other uncontroverted evidence indicated that "Oxbow was using real time wind direction data to close its dampers to deliver waste heat to PASE, discharging that waste heat, instead, through Oxbow's hot stacks into the atmosphere to avoid the monitor."

Beyond the facts brought to light by the Oxbow-PASE litigation, there is another reason to think that the modeling used by TCEQ to place the SO2 monitor where it did is no longer valid. On September 20, 2018, TCEQ approved an alteration to Oxbow's NSR permit for the replacement of the plant's Kiln 4 stack due to corrosion and structural issues. TCEQ approved a replacement stack that was 20 feet higher than the old stack with a stack diameter about 3 feet smaller. No modeling was conducted to assess potential impacts of the changes to the stack, but the permit alteration noted that "the increase in stack height and decrease in diameter is expected to result in better dispersion of emissions and lower off-property impacts since the release height will be greater and the exit velocity resulting from the decreased diameter will be greater than the current stack." Because the siting of the SO2 monitor for Oxbow was based on TCEQ's modeling of the facility stacks as they were in 2016, this alteration to the Kiln 4 stack likely affects the continuing validity of that modeling and consequently the viability of the current location of the monitor as a place best suited to record maximum hourly SO2 concentrations from the facility.

Oxbow's determination to use only the hot stacks for emissions, as well as the construction of a new stack for Kiln 4, provide evidence that the current SO2 monitoring system is inadequate. Exclusively using the hot stacks means that SO2 emissions are dispersed higher and wider than they would be otherwise. Critically, the amount of SO2 Oxbow emits has not changed. Oxbow has simply altered the way it releases SO2 to bypass the nearby monitor. The drop in exceedances recorded at that current monitor suggests that it is no longer best positioned to capture the maximum hourly concentrations of SO2 as required by the EPA under the Data Requirement Rule.

To remedy this situation, TCEQ must conduct additional modeling of Oxbow's emissions to determine where SO2 monitors should be sited to capture peak concentrations. This modeling must take into account Oxbow's newly reconstructed stack and its new policy of routing all emissions through the hot stacks.

In addition to monitors that measure peak concentrations from Oxbow, TCEQ should also add SO2 monitoring to existing SETRPC Port Arthur site in the West Side. Residents of that neighborhood, including several members of PA-CAN, are intimately familiar with the

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[14] Appellant Oxbow Calcining's Brief, 11-13, *Oxbow Calcining LLC v. Port Arthur Steam Energy, L.P.*, (Tex. App. 2018) (No. 09-18-00392-CV).
[15] *Id*.

rotten-egg odor of SO2. The smell is sometimes so strong that it drives them inside, and prevents them from engaging in outdoor activities. They deserve to know if the air they are breathing is adequately protective of their health.

2. SO2 monitoring in Pasadena is inadequate.

As discussed above, the City of Pasadena suffers from a lack of adequate monitoring. The city contains and is adjacent to a number of facilities that emit SO2 and sulfur compounds in large quantities, and should have at least one SO2 monitor to ensure that citizens are protected from these emissions. The following map, identified as Figure 5, shows the location of sulfur-emitting facilities (in red), and existing SO2 monitors (in yellow).

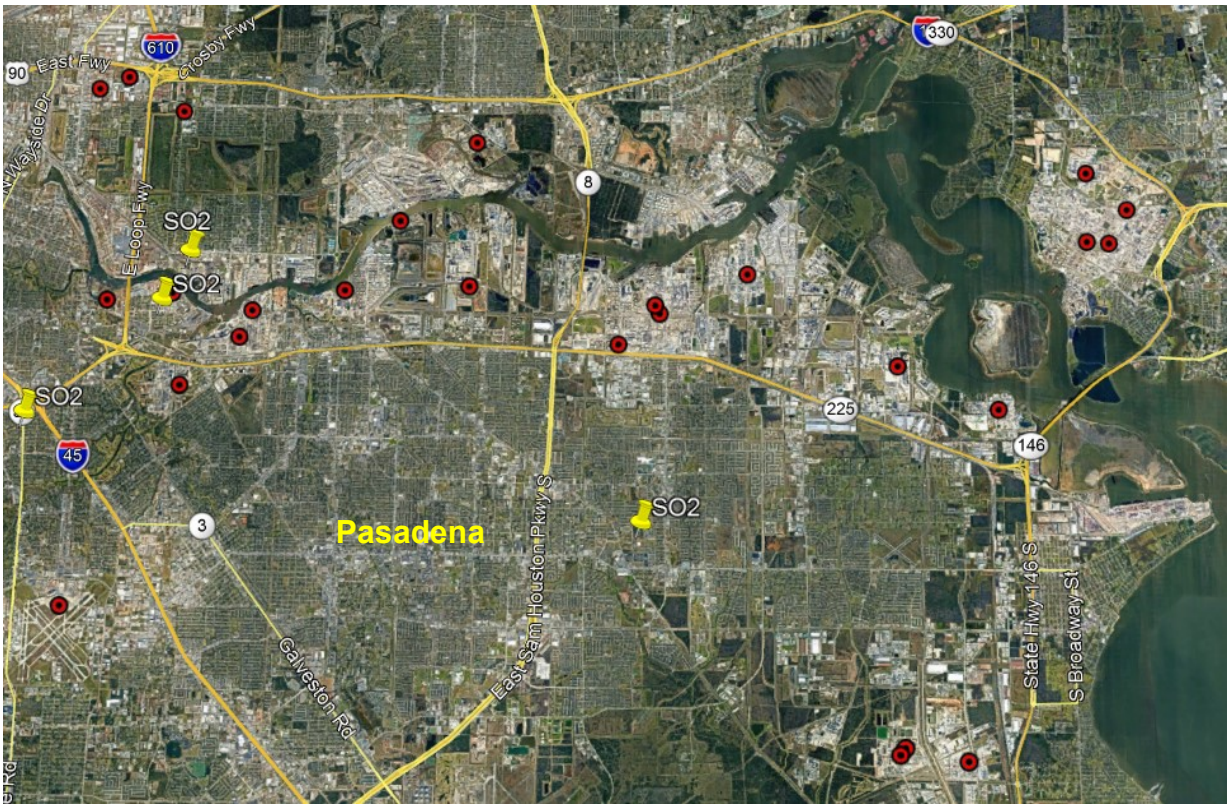

Figure 5: SO2 Monitors and Facilities near Pasadena

Several the facilities near Pasadena are major emitters of SO2. For example, in 2014 Exxon's Baytown Refinery released 2,203 tons of SO2, Pasadena Refining System's Refinery released 1,064 tons of SO2, Eco-services' Houston Plant released 918 tons of SO2, Motiva's Houston Refinery released 366 tons of SO2, and Arkema's Houston Plant released 372 tons of SO2, among many others.[16] Despite their proximity to this collection of high-emitting facilities, most residents of Pasadena live three to five miles from the nearest SO2 monitors in either Manchester or Deer Park.

[16] EPA, 2014 National Emissions Inventory Report, available at https://gispub.epa.gov/neireport/2014/

Several members of CPC have smelled and continue to smell the rotten-egg odor that is indicative of SO2 pollution. SO2 is clearly in the air, but without any monitors it is impossible to know exposure levels. The community deserves to know if they air they are breathing contains harmful levels of SO2, and TCEQ has a duty to collect and share that information. A SO2 monitor in central Pasadena would enable TCEQ to "measure typical concentrations in areas of high population density," and would further the monitoring goal of providing "air pollution data to the general public in a timely manner."[17]

B. OZONE

Ozone at ground level is a harmful air pollutant, because of its effects on people and the environment and because it is the main ingredient in "smog." Ozone in the air that residents breathe can harm their health. People most at risk from breathing air containing ozone include people with asthma, children, older adults, and people who are active outdoors, especially outdoor workers. In addition, people with certain genetic characteristics, and people with reduced intake of certain nutrients, such as vitamins C and E, are at greater risk from ozone exposure.

Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and airway inflammation. It also can reduce lung function and harm lung tissue. Ozone can worsen bronchitis, emphysema, and asthma, leading to increased medical care. It is important that levels of ozone be monitored in environmental justice communities, like Pasadena and Port Arthur, which are already vulnerable or have compromised health or limited access to health care due to other social and economic factors.

1. The Need for More Ozone Monitoring in Pasadena and Other Communities near the Houston Ship Channel

Pasadena itself is wholly without any comprehensive monitoring network save for the single monitor on the north end of the City. TCEQ can and should remedy this under the proposed network monitoring plan. Any plan to deploy new monitors in and around Pasadena should include ozone tracking capabilities since the amount of exposure is currently unassessed and unknown.

A review of Appendix H and the current ozone monitoring status in the Houston-The Woodlands-Sugarland area demonstrates that the area is in non-attainment for ozone with a design value expressed as a percent of NAAQS of 111%. CPC is pleased to see that there is currently a total of 20 existing monitors tracking ozone, well above the required 4, in the Metropolitan Statistical Area (MSA), but nevertheless it encourages the deployment of more ozone monitors in order to track the levels, extent and concentration of ozone that are leading to non-attainment for this area. The only new ozone SPM monitor proposed in CPC's area of interest is proposed along Harvard Street at the new Houston West End site. CPC would like to see additional ozone monitoring implemented more towards the East end of the greater Houston area, but especially in and along the various communities that border Buffalo Bayou and the Houston Ship Channel.

[17] 40 C. F. R. 58 Appx. D 1.1.1(b), 1.1 (a).

The City of Pasadena has only a single monitoring site (Pasadena North) in the City limits that monitors VOCs, not ozone. The nearest ozone monitors are Park Place, Clinton, Houston East, HRM #3 Raden Road, and Houston Deer Park #2. CPC would like to see more monitors placed in the City of Pasadena itself, but especially monitors capable of tracking ozone. As of right now the citizens of Pasadena do not know their exposure levels to ozone unlike residents in other parts of the Houston-The Woodlands-Sugarland MSA which is otherwise well covered by the TCEQ's network. Placing at least one ozone monitor in Pasadena would be further the community's interest in addressing this vital health and safety and environmental issue that as of right now is undocumented in that area.

2. Port Arthur needs additional ozone air monitors.

When the EPA compiled the Environmental Profile for the Westside Community of Port Arthur, Texas in or around 2011, it noted that the air quality in the area as it related to ozone "was not within guidelines" based on air monitoring results that took place during the time that the profile was generated.[18] Ozone continues to be a concern for the community despite Jefferson County's current attainment status based on the following events:

- On October 1, 2015, the EPA lowered the primary and secondary eight-hour ozone NAAQS to 0.070 parts per million (80 FR 65292). Hardin, Jefferson, and Orange Counties were designated attainment/unclassifiable under the 2015 eight-hour ozone NAAQS, effective January 16, 2018.

- On March 27, 2008, the EPA lowered the primary and secondary eight-hour ozone NAAQS to 0.075 parts per million (73 FR 16436). Hardin, Jefferson, and Orange Counties were designated unclassifiable/attainment under the 2008 eight-hour ozone NAAQS, effective July 20, 2012.

- The Beaumont–Port Arthur area, including Hardin, Jefferson, and Orange counties, was designated "attainment" under the 1997 eight-hour ozone NAAQS on October 20, 2010 with an effective date of November 19, 2010. In December 2008, the TCEQ submitted a redesignation request and maintenance-plan Texas State Implementation Plan (SIP) revision for the BPA area using certified monitoring data from 2005, 2006, and 2007. On October 20, 2010, the EPA published notice in the *Federal Register* finalizing approval of the 2008 redesignation request and maintenance-plan SIP revision, including a determination that the Beaumont-Port Arthur area has attained the 1997 eight-hour ozone standard and has met all of the applicable 1997 eight-hour ozone requirements and one-hour ozone anti-backsliding requirements for the purposes of redesignation.

The 2016-2018 8-hour design value for ozone in the Beaumont-Port Arthur area is 0.067.[19] This design value is 96% of the current NAAQS of 0.070, meaning that Beaumont-Port Arthur remains on the verge of non-attainment. There are a number of pending major air quality permit applications for the area, including Golden Pass and Exxon LNG terminals, Exxon's

[18] EPA, Environmental Profile, Port Arthur, Texas Westside Community
[19] TCEQ, 2019 Annual Monitoring Network Plan at H-1.

refinery expansion, Valero's Coker expansion, Motiva's terminal expansion, Motiva's olefins plant, and Motiva's plastics unit. Combined, these proposed projects will emit thousands of tons per year of ozone precursors NOx and VOCs, which could very well push the area into non-attainment. We urge TCEQ to require additional ozone monitoring to ensure that the area remains in attainment with the NAAQS. We also urge TCEQ to conduct prospective ozone modeling of these future emissions, in the hope that impacts from industrial expansion can be mitigated *before* they cause harm.

C. PARTICULATE MATTER

Particulate matter refers to microscopic particles in the atmosphere that can be hazardous to human health. Also called PM or soot, particulate matter consists of microscopically small solid particles or liquid droplets suspended in the air. The smaller the particles, the deeper they can penetrate into the respiratory system and the more hazardous they are to breathe. Recent studies indicate that PM can have the following effects on our bodies:

- PM pollution can cause lung irritation, which leads to increased permeability in lung tissue;
- PM aggravates the severity of chronic lung diseases, causing rapid loss of airway function;
- PM causes inflammation of lung tissue, resulting in the release of chemicals that can impact heart function;
- PM causes changes in blood chemistry that can result in clots that may lead to heart attacks; and
- PM can increase susceptibility to viral and bacterial pathogens leading to pneumonia in vulnerable persons who are unable to clear these infections.

The smaller-sized particles—those 2.5 micrometers or less in diameter, called PM2.5—are of greatest health concern because they can pass through the nose and throat and be absorbed deep inside the lungs. PM2.5 are sometimes called "fine" particles, and they are about 1/28th the diameter of a human hair or smaller. PM10 describes inhalable particles, with diameters that are generally 10 micrometers and smaller.

1. West Port Arthur's single PM monitor is insufficient

Within the Beaumont-Port Arthur MSA there are currently no monitors tracking PM10 and only three monitors that track PM2.5 (Hamshire, Port Arthur West and SETRPC 42 Mauriceville). Only the Port Arthur West monitor is within the City of Port Arthur despite the city playing host to at least 20 industrial sites, including five large refineries. PA-CAN encourages the TCEQ to increase the amount of both types of monitors in the Beaumont-Port Arthur MSA for the reasons outlined below.

A study from April 2018 whose main objective was to quantify nationwide disparities in the location of PM emitting facilities with regard to surrounding residential populations states that, "the amount of PM2.5 emitted …is likely a general indicator of the overall emissions in that area."[20] This means that monitoring and tracking PM2.5 is imperative to understanding environmental threats in the area. This same study demonstrated that "[b]lacks in particular are likely to live in high-emission areas" with the burden of PM2.5 on those populations being 1.54 times greater than that of the overall population. The study was conscious to note that this particular disparity was greater than the poverty based disparity-which was 1.35 times greater than the overall population.

Equally concerning, the study concluded that populations living within block groups with emissions above overall means were amongst the top 15% most burdened by PM2.5 populations. The Beaumont-Port Arthur MSA is no doubt one such block group as the report stated "high non-white populations coincide with high emissions nationally"[21]which would make the population in that area amongst the most burdened in the Nation.

The Beaumont-Port Arthur area is full of examples of residential neighborhoods occupying the space directly next to industry or in very close proximity, a fact that can lead to various health risks that are well documented. Exposure to both PM10 and PM2.5 has been linked to increased morbidity and mortality, with the potential increase in exposure explaining a higher prevalence of cardiovascular disease mortality and asthma in the black population.[22] This knowledge combined with the EPA's investigations regarding racially discriminatory treatment in a public participation process demonstrates that "the lack of political capital is an obstacle to obtaining more desirable living conditions."[23]

2. No PM Monitors in Pasadena fails to paint the true picture of health impacts.

The City of Pasadena does not currently have any PM monitors within its city limits except for the single monitor on the north end of the City. The nearest monitors that track either type of PM are the Park Place Monitor (PM2.5) and the Clinton Monitor (PM10 and PM2.5), both located outside Pasadena's city limits.

Pasadena's demographics, especially its racial/ethnic and socio-economic makeup, speak to the need for more monitoring within the city limits. The rationale for increased PM monitoring in and around Pasadena is similar to that for the Beaumont Port Arthur MSA that was previously discussed, including its high minority population and proximity to industry.

The PM10 measurements at the Clinton Monitor have the highest measured concentrations during the 2016-18 evaluation period.[24] Because this is the only monitor along the Houston Ship Channel that is measuring for PM, CPC is of the opinion that TCEQ can shore up its network by increasing the amount of PM monitors in the area, starting with Pasadena. CPC

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[20] *Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status*, April 2018 Vol. 108, No. 4, pg. 481-82.
[21] *Id.* at pg. 482.
[22] *Id.* at pg. 484.
[23] *Id.*
[24] TCEQ Annual Monitoring Network Plan, 2019, pg. 16.

urges the TCEQ to augment the Clinton, Houston East and Houston Deer Park #2 monitors by deploying more monitors capable of tracking both PM10 and PM2.5. These enhancements can be accomplished by installing monitors in the cities of Pasadena, Deer Park, La Porte, and Galena Park. CPC urges the TCEQ to install these monitors not only along the ship channel, where there is the highest concentration of industry, but also away from the Ship Channel and within residential areas of each of the respective municipalities. CPC also encourages the TCEQ to consider the placement of PM monitoring capabilities in the Houston community of Manchester. The monitor currently deployed in Manchester is often not functional with regard to its non-methane organic compounds monitoring capabilities which is an ongoing issue that merits immediate attention.

The TCEQ has proposed to reduce the sampling frequency of the collocated quality control PM10 monitor at Clinton citing 40 CFR Section 58, Appendix A, 3.34.1(d). CPC is opposed to any action or reduction in sampling that would compromise the validity, integrity or trustworthiness of collected data related to PM exposure. The TCEQ should ensure that any action it takes to reduce sampling frequency does not have the direct or indirect effect of impeding the access to reliable data.

CPC takes issue with TCEQ's plan to decommission the Houston Deer Park #2 PM2.5, non-NAAQS comparable continuous monitor, in favor of leaving behind the Federal Reference Method Site non-continuous monitoring and Federal Equivalent Method continuous monitoring. CPC urges the TCEQ to ensure that data that is currently supplied to the Air Quality Index (API) by the soon-to-be-decommissioned monitor will continue to be supplied to the API. The API is one of the most user friendly, accessible, outward facing indices available to the public regarding air quality. It is imperative that it continue to be supplied with reliable information not only so that the public can make informed decisions about daily exposure to air quality but also to aid public officials as well in the event of disaster.

D. RECOMMENDATIONS FOR BETTER MONITORING OF VOLATILE ORGANIC COMPOUNDS / HAZARDOUS AIR POLLUTANTS

Hazardous Air Pollutants (HAPs) are known as toxic air pollutants or air toxics, which cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Examples of HAPs include benzene, perchloroethylene, and methylene chloride, which are all volatile organic compounds also known as VOCs.

The ITC Deer Park disaster that occurred in Harris County, Texas starting on March 17, 2019 raised the public's awareness about VOCs as well as the gaps in the existing monitoring systems to deliver real time information about VOC exposures in Harris County, Texas. The table below reveals the shelter-in-place warnings issued and related school closures during the first week of the disaster.

Impacted Population	*March 18 MON.*	*March 19 TUES.*	*March 20 WED.*	*March 21 THURS.*	*March 22 FRIDAY*	*March 30 SAT.*
Deer Park ISD	**X**		**X**	**X**		
LaPorte ISD	**X**		**X**	**X**		
Channelview ISD			**X**	**X**		
Sheldon ISD			**X**	**X**		
Galena Park ISD			**X**	**X**		
Pasadena ISD				**X**		
Industrial Neighbors	**X**			**X**	**X**	**X**

This disaster situation with large quantities of VOCs, like benzene, toluene, and xylene, being held in 14 tanks that were on fire off and on again over several days posed health concerns to the public at large and the first responders on site. It also revealed that City of Houston was the only entity in the region with hand-held monitors that could measure benzene. The monitoring response needed to begin faster, and more fixed-site monitors are needed to generate faster data output. A two-hour delay in reporting VOC results inhibits the ability to respond accurately. Readings should have been set for 20-minute intervals so TCEQ could better determine when spikes were occurring and then use those readings to extrapolate for an hour exposure. SIP and Texas Emissions Reduction Plan (TERP) monies should be directed towards the purchase of more stationary VOC monitors, particularly given the number of TRI reporting facilities in Regions 10 and 12.

Similarly, during Hurricane Harvey, elevated benzene readings were measured by the EPA and private monitoring firm hired by EDF and Air Alliance Houston, who both did mobile monitoring in the Manchester area in early September 2017 after the nearby Valero Refinery suffered a damaged storage tank during the storm. After reviewing the air monitoring results, the EPA acknowledged Valero had significantly underestimated the amount of benzene that leaked out and had failed to report fully the community's exposure. Such events validate why more VOC monitors are needed to protect fence line communities living near these industrial facilities. Here also is an example of another circumstance where the TCEQ failed to deploy its own sophisticated mobile air monitoring equipment to measure real-time community exposures to HAPs.

Given the safety risks of using hand-held monitors to those deployed to use them, the TCEQ should investigate using drones, which currently can only be used by local law enforcement, for the purposes of conducting readings of toxic VOCs. Using drone technology for monitoring would have also allowed sampling around the site during the ITC Deer Park fire or in cases where there is a risk of explosion. Earlier detection of the escaping fumes from the compromised Tank 80-7 might have shifted the trajectory of the disaster response and saved possible VOCs exposures.

As noted in the EPA's Environmental Profile, even though pollutants like benzene are typically below state screening levels as read on community monitors, the EPA's Modeling "Regional Air Impacts Modeling Initiative" (RAIMI) indicates risk for the Westside Community

of Port Arthur, Texas in the middle to upper end of EPA's acceptable risk for long term effects based on modeled risk past the fence lines of existing facilities. Further, the EPA continues to believe there was a moderate risk of exposure from exceptional accidents or large episodic releases due to accidents, power outages, or other events that might result in shelter-in-place events in Port Arthur. Given the number of industrial facilities surrounding Pasadena, the Ship Channel and Pleasantville communities, it is safe to assume similar risks exist in these environmental justice communities as well.

E. MONITORING NON-CRITERIA POLLUTANTS

While it is not a criteria pollutant, TCEQ should conduct monitoring for Hydrogen Cyanide (HCN) in Pasadena and along the Houston Ship Channel. (HCN) is a colorless gas with a faint, bitter, almond-like odor that is emitted from Fluid Catalytic Cracking Units. This well-known poison has been used for executions and in chemical warfare. As a gas it may be inhaled or absorbed through the skin. Chronic and sub-chronic inhalation of HCN can cause a range of effects to the central nervous system, like "headaches, weakness, nausea, and changes in taste and smell." Such exposure can also enlarge the thyroid, affect its uptake of iodine, and alter thyroid hormone levels. Chronic inhalation of HCN may also harm pulmonary function.

Other associated adverse health effects of exposure to HCN include Parkinson-like symptoms; bilateral lesions in basal ganglia (neurodegenerative disorder); memory problems; personality changes; sudden collapse; anxiety; hyperventilation; giddiness; headache; arrhythmias; nausea; vomiting; tachycardia; bradycardia (slower-than-normal heartrate); hypertension; hyperpnoea (increased depth and rate of breathing); seizures; coma; palpitations; apnea; dilated pupils; pulmonary edema (excess fluid in the lungs); syncope (temporary loss of consciousness due to insufficient blood flow to the brain); cardiopulmonary failure (cardiac arrest); acidosis (excess of acid in the blood); encephalopathy (brain disease); diabetes; and skin burns.

In 2002, EPA recognized that industry-reported HCN emissions were much higher than it had previously understood. The EPA estimated HCN emissions from existing fluid catalytic cracking units (FCCUs) had a chronic non-cancer target organ-specific hazard index from inhalation exposure of 1, which EPA recognizes is significant. Unfortunately, while EPA and TCEQ have set health-based effects screening levels for HCN, neither has adopted technology standards to control emissions. HCN emitting facilities have been required to conduct stack testing to determine emissions and to report those emissions to the EPA, but no off-site monitoring has been conducted. According to TRI data, facilities along the Houston Ship Channel released a combined 340,103.40 pounds of HCN in 2017. Large emitters include the ExxonMobil Baytown Refinery, the Shell Deer Park Refinery, the Valero Houston Refinery, and the LyondellBasell Houston Refinery. According to the EPA, out of all Hazardous Air Pollutants, HCN emitted from refineries is the primary driver of non-cancer health risk and the most highly ranked pollutant on the Maximum Neurological Hazard Index.[25] TCEQ must not downplay the risks posed by HCN, and must quantify those risks for the hundreds of thousands of people living near these facilities.

[25] EPA, Final Residual Risk Assessment for the Petroleum Refining Source Sector at 36, 41, 44 (September 2015).

Because no off-site monitoring has been conducted, and because no cumulative modeling has been performed, exposure levels remain a mystery. HCN has a variety of negative health effects, and existing standards leave the public uncertain about their exposure. It is imperative that TCEQ monitor this pollutant. TCEQ must conduct an in-depth review of the effects of HCN exposure on the surrounding population and effectively convey that information to the public. Satisfaction of this duty must be based on implementation of proper techniques that yield more monitoring data.

V. CONCLUSION

LSLA, and its organizational clients, Caring for Pasadena Communities, Port Arthur Community Action Network, and Pleasantville Civic League would appreciate a complete response from the TCEQ in response to the comments and concerns raised in this letter. Please contact the undersigned counsel if you have any questions or need clarification regarding the comments contained herein.

Sincerely,

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May 21, 2019

Air Monitoring Network Plan Implementation Team
Texas Commission on Environmental Quality
Comments to: monops@tceq.texas.gov

Dear Monitoring Operations:

Comments are submitted by Community In-powerment Development Association in Port Arthur and Lone Star Chapter of Sierra Club on TCEQ's 2019 Annual Monitoring Network Plan (AMNP).

Health concerns and life-threatening illness such as cancer and respiratory disease have been raised in Port Arthur for a long time over air pollution, and especially with respect to criteria pollutants and air toxics, including but not limited to *sulfur dioxide, lead particles, particulate matter, volatile organic compounds* (*benzene)*, *and other toxins*.

Complaints have been filed by Port Arthur residents to TCEQ's Beaumont R10 office for decades about the industrial air pollution from the east and west clusters that they smell and see on a frequent basis and that often adversely impacts their health and welfare.

Moreover, Port Arthur is a historic environmental justice (EJ) community where many residents in the EJ community believe that their *air pollution complaints* and efforts to speak out have fallen on deaf ears due to their poverty and racial status. As a result, Port Arthur continues to be one of the most polluted cities in Jefferson County and Texas due to the unsafe concentrations of industrial air pollution in West and East Port Arthur. TCEQ has allowed Port Arthur to be a dumping ground by industry.

1. One type of EJ community complaint is about the *sulfur dioxide* plumes and *related visible sulfur dioxide emissions* in West Port Arthur where industrial plants emit large volumes of *sulfur dioxide and related visible emissions*.

Air permitting has failed to address local EJ complaints of *high sulfur dioxide pollution and related visible emissions*. *Sulfur dioxide plumes* are frequently visible in West Port Arthur impacting the ground level EJ neighborhoods and the *sulfur dioxide* plumes have a characteristic acrid smell irritating to the lungs, eyes and skin as frequently noticed by EJ residents. *Sulfur dioxide* is well known to have an acidic odor. Sulfur dioxide is also a significant air contaminant in Port Arthur.

2. TCEQ needs to address *the large volume of uncontrolled sulfur dioxide* emitted in West Port Arthur and the correlated *sulfur dioxide exceedances*. The *sulfur dioxide* National Ambient Air Quality Standard (NAAQS) *is being violated*. *Sulfur dioxide visible emissions* are a serious concern because it's evidence of unsafe ambient concentrations of the toxic gas being present in the city.

According to EPA, even short-term exposure to *toxic sulfur dioxide gas* can cause injury and harm to the human respiratory system, making breathing difficult for those who suffer from asthma as well as the elderly and children. Previous studies have shown a correlation between short-term exposure to *toxic sulfur dioxide gas* and increased visits to hospital emergency rooms.

Port Arthur EJ community members are concerned that the TCEQ Beaumont R10 office has been ineffective in receiving, tracking, understanding and investigating their odor complaints, since residents could not always point to the source of air pollution odors or identify the specific airborne chemicals. Visible emissions are often noted emanating from Oxbow's plant, since the plant site is south of the West Port Arthur refineries and chemical plants. The TCEQ has known about the high levels of air pollution in Port Arthur and nearby Port Neches for years, and more rigorous reviews need to be carried out by the agency.

Exceedances of Sulfur Dioxide NAAQS and Related Pollution in W. Port Arthur

Based on the large sources of *sulfur dioxide pollution* in West Port Arthur, the TCEQ has been operating two monitors to attempt to track the local problem of illegal sulfur dioxide as measured in nearly twenty *sulfur dioxide exceedances:* 1) monitor CAMS 28 is sited at 623 Elias street and 2) monitor CAMS 1071 is sited at 7th street and Texaco Island road. However, other than conducting air monitoring, TCEQ has not required adequate reductions in *sulfur dioxide* and air modeling has not been required.

Regarding *sulfur dioxide* monitoring of *high sulfur dioxide* at CAMS 1071 and CAMS 28 in West Port Arthur, local EJ health concerns are obvious based on the number of exceedances of the EPA's 1-hour NAAQS for sulfur dioxide set at 75 parts per billion.

Are other *sulfur dioxide exceedances* occurring at other locations in West Port Arthur given the high *sulfur dioxide levels* that have been observed?

Sources of Sulfur Dioxide Pollution in West Port Arthur

According to TCEQ's detailed data in its online 2016 Point Source Emissions Inventory (EI) at *https://www.tceq.texas.gov/airquality/point-source-ei/psei.html*, the largest source of *sulfur dioxide pollution* in West Port Arthur is Oxbow Calcining at 11,182.65 tons – an

emission rate made possible by the lack of air pollution control.

Oxbow is effectively allowed to operate as a quasi-"grandfathered" petroleum coke calcining facility and an outlier with bare bones air pollution controls because the TCEQ and EPA have failed to enforce the Clean Air Act in Port Arthur.

Oxbow's massive annual sulfur dioxide emissions are ten times that of the combined sulfur dioxide emissions of the next-highest sulfur dioxide emitters in Port Arthur which include five refineries, three chemical/petrochemical plants. Unlike Oxbow, three of those refineries have installed effective sulfur dioxide controls that cost millions of dollars to install and operate.

3. Oxbow has made illegal operational changes and intentionally deceived TCEQ and EPA.

Oxbow Facility Background

Oxbow Calcining LLC ("Oxbow") owns and operates a petroleum coke calcining facility in Port Arthur that today represents the largest source of air pollution in Port Arthur. The Oxbow facility is about eighty years old and was previously known as Great Lakes Carbon. The facility currently operates under Title V Part 70 permit O1493 issued by TCEQ on 9/13/2013.[1]

The heart of Oxbow's operations are its four kilns: kilns #2, #3, #4 & #5. (Kiln 1 was built back in the 1930's and has since been removed.) Exhaust from kilns 3, 4 and 5 can be routed to waste heat recovery boilers, referred to as boilers 3, 4 and 5 respectively.[2] Each boiler exhausts ~400 oF kiln gas to "cold stack". When Oxbow decides not to utilize a boiler, kiln gases are exhausted to the atmosphere from a "hot stack" at ~2,000 oF. Conversely, when Oxbow decides to utilize a boiler, the kiln gases are exhausted to the atmosphere from a "cold stack" at ~400 oF. In addition to reducing the kiln gas temperature, each boiler is followed by a multi-cyclone, which removes particulate matter (PM) from the exhaust. When kiln gases are routed to a "hot stack", the PM reduction from the multi-cyclone does not occur. Until 2017, Oxbow has maximized the use of the

[1] An application for a permit renewal was submitted to TCEQ on 3/5/2018.

[2] In conjunction with some major facility reconstruction, a waste heat cogeneration system was added in 2004/2005. The system consists of waste heat boilers, a steam turbine and ancillary equipment. A small company – completely independent of Oxbow – named Port Arthur Steam Energy (PASE) owns and operates the system, which simultaneously generates electricity and steam from the waste heat exhausted by Oxbow's kilns. As a waste energy production system that produces zero emissions, the outstanding energy savings and pollution reduction qualities of the PASE cogeneration system were recognized by EPA in 2010 when the system won an ENERGY STAR CHP Award

boilers because of their significant economic benefit and its legal obligation to do so.[3]

See "Oxbow Operations Overview.pdf" for pictures and diagrams.

There is a stark difference in the emissions plume from Oxbow between "cold stack" and "hot stack" operation. In concise terms, the emissions plume from "hot stack" operation largely bypasses a TCEQ and EPA monitor specifically designed to measure the concentration of sulfur dioxide in ambient as a direct result of Oxbow operations.

See "Visualization of Modeled AQI from CS and HS Use.pdf".

Development of the EPA's 2010 1-hour Sulfur Dioxide NAAQS

As part of the 2010 SO2 1-hr NAAQS development process, TCEQ revised its SO2 Network Monitoring Plan.[4] The plan specifically identifies and addresses Oxbow because of its *extremely high SO2 emissions*. Implementation of that plan – which was approved by EPA – resulted in the decision to monitor (instead of model) the *SO2 emissions impact* of Oxbow. The plan also includes a monitor citing evaluation that outlines the process used by TCEQ to select the specific location of the EPA-required SO2 monitor (CAMS 1071 at 7th street and Texaco Island road).[5] This evaluation/determination was completed using physical and historical operational information about each facility. In other words, the monitor location was principally based on historical Oxbow operation; i.e. predominant use of "cold stacks."

Oxbow's Intent as revealed in Court Documents

> Oxbow aims to achieve two goals by illegally routing kiln exhaust to the "hot stacks." First, by deceiving the SO2 monitor, Jefferson county will be improperly designated as attainment under the 2010 1-hr SO2 NAAQS. As the largest and predominant emitter of SO2 in Jefferson country that does not use SO2 controls, Oxbow understands that an SO2 non-attainment designation would ultimately

[3] Oxbow is legally obligated – by way of its contract with PASE – to maximize its use of the waste heat cogeneration system with few exceptions; e.g., if doing so violates applicable laws or Oxbow's permit.

[4] In August 2015, EPA issued the Data Requirements Rule to provide explicit direction to state agencies for the characterization of air quality in areas with large sources of SO2 emissions. Portions of the 2016 Network Monitoring Plan reflect some of TCEQ's efforts to adhere to the Rule. Oxbow is specifically addressed on pages 7 and E-41 through E-57.

[5] The ground level monitor is located approximately 5,000 ft to the north of the Oxbow facility. Monitored data began collection on 1/1/2017 and is available at: https://www.tceq.texas.gov/cgi-bin/compliance/monops/daily_summary.pl?cams=1071

result in a mandate that it purchase and install expensive SO2 controls.[6,7,8]By altering its emissions plume such that it bypasses the SO2 monitor, the concentration of SO2 in the ambient air monitored and recorded by the monitor is much lower than what should be recorded. Air quality exceedances that would have normally occurred at the monitor occur elsewhere and are thus not recorded by the monitor. The resulting data inaccurately indicates that exceedances do not occur, and that Jefferson County's air quality appears to be in attainment with the respective NAAQS.[9]

Oxbow's actions clearly constitute the use of dispersion techniques and render inaccurate the monitor, both of which are explicitly prohibited by the Clean Air Act and subject to substantial criminal fines.[10,11] In fact, EPA has previously and specifically concluded that the attainment designation of a county cannot be influenced by dispersion techniques used to prevent violations of air quality standards.[12]

Secondly, it has been demonstrated and documented how Oxbow has been attempting (in bad faith) to acquire the waste heat cogeneration system from PASE at a distressed price.[13] In 2011, an arbitration panel ruled that Oxbow must pay PASE ~$4.5M in damages from breach of contract. However, because of Oxbow's recently successful machinations, PASE was forced to suspend operations in 2018.

Note: Less than two weeks from the start of monitor operation in January 2017, the SO2 monitor recorded its first exceedance. Oxbow promptly explored the option of deceiving

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[6] In a 3/16/17 email, Oxbow acknowledged to PASE that routing exhaust to the cold stacks will cause SO2 exceedances and that the solution to this problem is the immediate cessation of cold stack use.
[7] In a 4/20/17 letter, TCEQ explicitly notified Oxbow that exceedances will lead to a nonattainment designation and could result in a requirement to install pollution controls. Follow up letters to this regard were sent to Oxbow on 6/13/17.
[8] In a 5/8/17 email, Oxbow informed PASE that the estimated cost of a new SO2 and particulate control system determined to be the "best technology and value" is approximately $56M (capital) and $10M/yr (operating).
[9] Supported by modeling, analyses and evaluations completed by subject matter experts and their testimonies in a trial in Jefferson county state district court. Trial transcripts are being submitted to the TCEQ in support of the May 21, 2019 comments.
[10] Federal Register Vol. 50, No. 130 (7/8/85) and 40 CFR 51: "Section 123 of the Clean Air Act, as amended, requires EPA to promulgate regulations to ensure that the degree of emission limitation required for the control of any air pollutant under an applicable state implementation plan (SIP) is not affected by that portion of any stack height which exceeds good engineering practice (GEP) or by any other dispersion technique."
[11] 40 CFR 70.1(a) and 40 CFR 70.11(a)(3)(i)
[12] Federal Register, Vol. 43, No. 194 (10/5/78)
[13] Documented in 2011 court proceedings. Court transcripts being submitted with these comments.

the SO2 monitor when meteorological conditions were expected to increase SO2 concentrations at the monitor.[14]

TCEQ's Failure to Act and Protect Public Health in Port Arthur

In a 10/20/17 letter to Oxbow, TCEQ indicated that:

- It received an "allegation that Oxbow is reducing its feed rate in response to high values seen from the 5-minute SO2 monitor data that DEQ staff is providing via a .csv link, and/or that Oxbow is accessing this near real-time data from the monitor to determine when to reduce feed rates in order to ensure that SO2 readings do not exceed the National Ambient Air Quality Standard (NAAQS)."
- "In order for DEQ to continue to certify to EPA that the data being gathered by the monitor is accurate and depicts the true SO2 levels that exist and will exist in the future, DEQ has determined that it can no longer provide 5-minute data to Oxbow via the .csv link. Oxbow will still be able to view the publicly available 1-hour data that is available on DEQ's website."

In a 12/10/17 letter from TCEQ to Oxbow, TCEQ stated:

- How it "appreciates any efforts that Oxbow can make to ensure the area surrounding the facility does not exceed the hourly standard."
- The monitored data and operational data suggest that utilizing "hot stacks" likely disperses emissions more effectively than utilizing "cold" stacks.
- That eight exceedances were recorded in 2017 and it is TCEQ's understanding that "cold" stacks were used during those periods.

In a 5/30/18 presentation, TCEQ notes how its own analyses of the monitored data show that 100 percent of the recorded exceedances occur when the wind direction is from due south; from Oxbow to the monitor.[13]

4. The TCEQ needs to address *the large volume of uncontrolled lead particle pollution* emitted in West Port Arthur. *Lead particle pollution* is another local EJ community concern due to West Port Arthur industrial emissions.

Inadequate lead air monitoring exists in West Port Arthur to measure if the Lead NAAQS of 0.15 micrograms/cubic meter per quarterly period is being exceeded despite lead soil contamination being discovered on the West side in the former Carver Terrace HUD project area. At the same time, it appears that the TCEQ has not attempted track airborne lead particle pollution levels in West Port Arthur in spite of large lead stack emissions over many decades.

[14] Email dated 1/10/17 from Garland Simpson to PASE.

Soot particulate matter pollution routinely falls out on West Port Arthur residents and other areas of the city leaving obvious dark-colored deposits on private properties without TCEQ taking action to protect public health from the soot that residents assert comes from the West Port Arthur industrial plants.

The largest source of lead particle pollution (749 pounds in the 2016 EI) in West Port Arthur is the Oxbow plant, and since Oxbow used to typically report 5,000 - 6,000 pounds per year because Oxbow lacked efficient lead particulate pollution controls. Oxbow ranks #1 in Jefferson County lead particle air pollution in 2016 with the ExxonMobil Beaumont refinery #2 at 147 pounds. The second largest lead source in Port Arthur is a large west side refinery with 89.4 pounds in 2016 among the Port Arthur industrial plants emitting lead particle pollution.

Finally, Port Arthur is the largest EJ industrial community by % in Texas and home to large clusters of refineries, chemical and petrochemical plants, pet coke calcining, major crude oil and product tank farms, a commercial hazardous waste incinerator, and more.

Conclusion

In conclusion, there is clear evidence (data, analyses conducted by subject matter experts and detailed testimony) that Oxbow is directly responsible for the *high sulfur dioxide emissions* occurring in West Port Arthur and (at times) causes exceedances and violations of the EPA's 1-hour health-based SO2 standard of 75 ppb. TCEQ needs to enforce the Clean Air Act's Sulfur Dioxide NAAQS and declare a nonattainment designation.

Sincerely,

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Cc: EPA Region 6 Air section, TCEQ Beaumont Region 10

Attachments

1. *"Oxbow Operations Overview.pdf" for pictures and diagrams.*
2. *"Visualization of Modeled AQI from CS and HS Use.pdf".*
3. *Court Documents: A) 392 Appeals Court Opinion 1.pdf; B) 392 Brief – PASE.pdf; C) 392 Brief – Oxbow.pdf;*

ACCEPTED
09-18-00359-CV
NINTH COURT OF APPEALS
BEAUMONT, TEXAS
10/9/2018 5:38 PM
CAROL ANNE HARLEY
CLERK

No. 09-18-00392-CV

No. 09-18-00359-CV

IN THE COURT OF APPEALS
FOR THE NINTH DISTRICT OF TEXAS
BEAUMONT, TEXAS

FILED IN
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CAROL ANNE HARLEY
Clerk

OXBOW CALCINING LLC

Appellant,

v.

PORT ARTHUR STEAM ENERGY, L.P.

Appellee.

On Appeal from the 172nd Judicial District Court,
Jefferson County, Texas, Cause No. E-201894
The Honorable Donald J. Floyd presiding

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ORAL ARGUMENT REQUESTED

IDENTITY OF PARTIES AND COUNSEL

Pursuant to Texas Rule of Appellate Procedure 38.1(a), Appellant Oxbow Calcining LLC ("Oxbow") provides this list of all parties to the district court's order and the names and addresses of all trial and appellate counsel:

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STATEMENT OF THE CASE

Nature of the Case: This is an accelerated interlocutory appeal from (1) an order denying Oxbow's motion to compel arbitration and (2) a turnover order appointing a receiver to monitor Oxbow's Port Arthur petroleum coke calcining plant.

Course of Proceedings Port Arthur Steam Energy, L.P. ("PASE") sued Oxbow in the 172nd District Court, Honorable Donald J. Floyd presiding, alleging that (1) since March 2017, Oxbow's waste heat deliveries to PASE's adjacent facility have been too low due to how Oxbow is operating its plant, purportedly violating the parties' 2005 Heat Energy Agreement ("HEA"), and (2) consequently, PASE has not been able to recoup $3.4 million in contractual credits under the HEA that it received in a 2011 arbitration award ("Arbitration Award") that was confirmed by a Harris County District Court in 2015 ("Judgment"). CR 6, 14-15, 17. Claiming to be a judgment creditor, PASE sought orders under Texas Civil Practice and Remedies Code Section 31.002 ("Turnover Statute") mandating how Oxbow operates its plant and appointing a receiver to monitor Oxbow's operations. CR 6. Oxbow moved to compel arbitration under the HEA's mandatory arbitration provision and to transfer the case to the court that issued the Judgment. CR 79, 85. The trial court heard but did not rule on Oxbow's motions and instead immediately held a three-day evidentiary hearing on the merits of PASE's Petition ("Merits Hearing").[1]

Trial Court's Disposition: On September 12, 2018, the trial court signed orders denying Oxbow's motions and granting PASE's proposed turnover order ("Turnover Order"), which, among other things, appointed a receiver to monitor Oxbow's operations. CR 421-22. Oxbow filed this accelerated interlocutory appeal of the order denying arbitration and the Turnover Order appointing the receiver.[2]

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[1] Given its pending motions to compel arbitration and transfer venue, Oxbow sought mandamus review of the trial court's refusal to quash the merits hearing, which this Court denied on the ground that an appeal of a turnover order would provide adequate relief. CR 395, 401.

[2] Because the Turnover Order grants injunctive relief, Oxbow also filed a regular notice of appeal of the Turnover Order in an abundance of caution.

STATEMENT REGARDING ORAL ARGUMENT

The case involves both procedural and substantive complexities that would benefit from oral argument.

ISSUES PRESENTED

ISSUE ONE

Did the trial court err in denying Oxbow's motion to compel arbitration, when the allegations that PASE pleaded and litigated fall within the scope of the mandatory arbitration provision in the parties' HEA?

ISSUE TWO

Did the trial court err in entering the Turnover Order appointing a receiver to oversee Oxbow's operations, when (i) the trial court had no jurisdiction over the proceeding, (ii) the Turnover Statute does not authorize such unprecedented relief, (iii) the underlying Arbitration Award and Judgment expressly rejected similar relief, and (iv) PASE waived any right to such relief in the HEA's exclusive remedy provision?

INTRODUCTION

PASE ostensibly brought this turnover proceeding to recover a 2015 Judgment, but that is not the reality. For nearly two years, Oxbow and PASE have disputed Oxbow's performance under the parties' HEA—whether Oxbow properly suspended delivery of the waste heat necessary for PASE to run its plant and whether Oxbow must spend tens of millions of dollars in capital expenditures and millions more annually to install pollution control equipment solely to benefit PASE. Rather than resolve that dispute in arbitration—as the HEA requires and as PASE itself recognized was necessary when it sent an April 2017 notice of a "Dispute" under the HEA's arbitration provision—PASE made an end-run around both the arbitration provision and the Harris County district court that issued the 2015 Judgment, and sought instead to have a Jefferson County district court resolve the parties' substantive dispute in a turnover proceeding.

PASE's stratagem violated the HEA's arbitration provision and ignored well-settled jurisdictional principles governing post-judgment relief. It also resulted in the trial court signing verbatim the 12-page Turnover Order that PASE proposed, which not only purports to decide the parties' substantive contractual dispute but also (1) authorizes a receiver to take actions not permitted by the Turnover Statute or this Court's specific instructions to the trial court in its

mandamus ruling, (2) grants relief far beyond what the 2015 Judgment authorizes, and (3) violates the HEA's exclusive remedy provision.

In reality, the Turnover Order will not result in any reduction of the 2015 Judgment because the evidence conclusively established that the calcined coke market and gas prices have shifted in a way that prevents PASE from recovering a penny on the 2015 Judgment. That fact reveals the Turnover Order for what it is—a tactic to force Oxbow to end the contractual suspensions of waste heat delivery without giving an arbitral panel the chance to rule that the HEA authorizes those suspensions. Neither Texas law nor the HEA supports PASE's conduct, and this Court must vacate the Turnover Order accordingly.

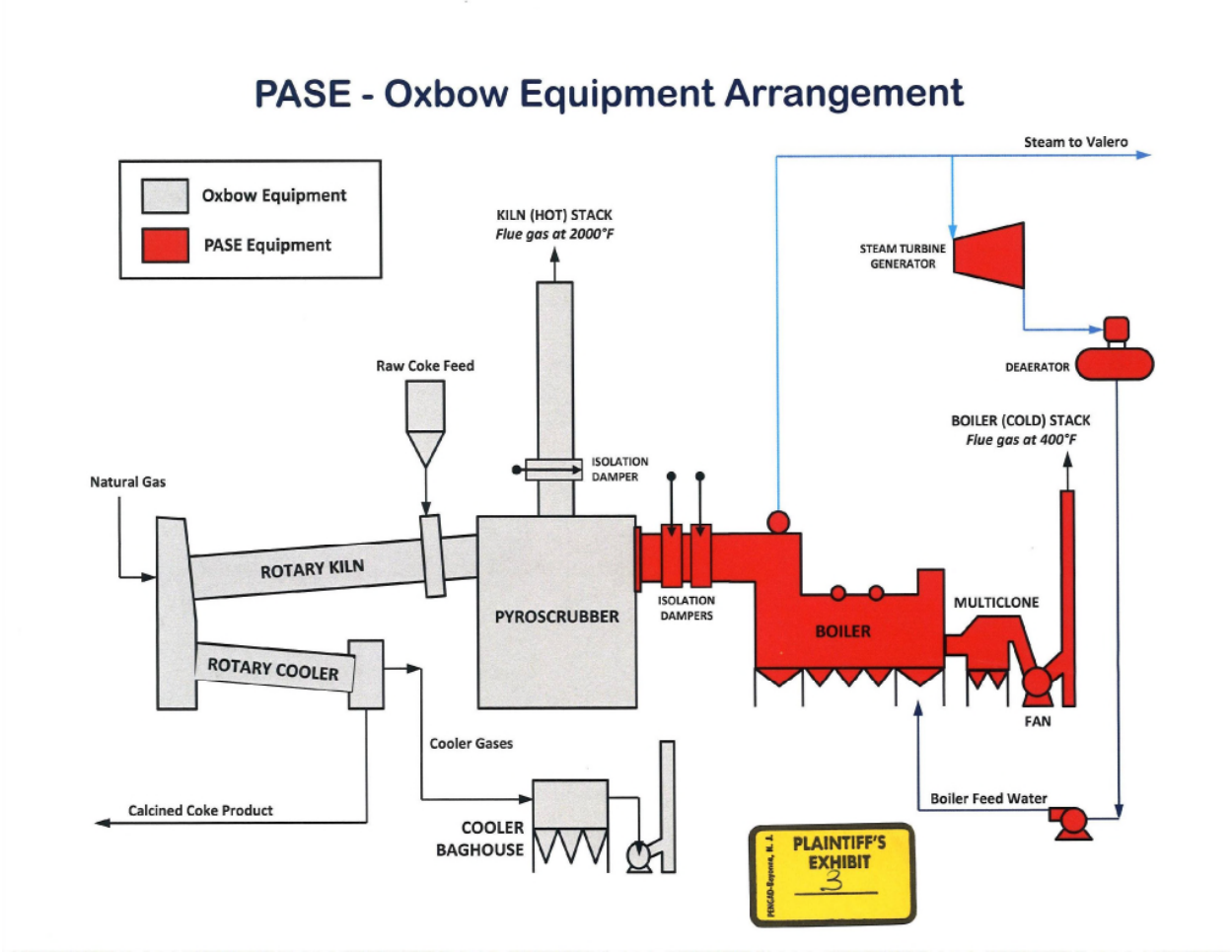
STATEMENT OF FACTS

I. The HEA governs the relationship between Oxbow and PASE.

Oxbow owns and operates a petroleum coke calcining plant in Port Arthur, Texas, which has been in operation since the 1930s. CR 9, 28. At its plant, Oxbow takes petroleum coke ("petcoke")—a refining co-product—from refineries and heats it to more than 2,500 degrees in four kilns (kilns 2, 3, 4, and 5) to manufacture calcined coke, which is used in industrial processes (primarily, the manufacture of aluminum). CR 28. Since 2005, PASE has owned and operated a waste heat recovery facility ("Waste Heat Facility") that is located adjacent to Oxbow's four kilns. CR 9-10. The Waste Heat Facility extracts heat produced by

kilns 3, 4, and 5 to boil water to make steam, which PASE then sells to the nearby Valero Port Arthur Refinery.[3] *Id*.

As depicted below, the waste heat from kilns 3, 4, and 5 can be released in two ways: (1) through three "hot stacks," which connect directly to the kilns and release waste heat at a temperature of approximately 2,000 degrees, or (2) through three "cold stacks," after the waste heat is routed through the Waste Heat Facility and cooled to a temperature of approximately 400 degrees:



[3] Kiln 2 is not connected to the Waste Heat Facility and releases its waste heat through a "hot stack" only. 2 RR 111.

5 RR Ex. 3. Because waste heat released through the hot stacks does not go through PASE's Waste Heat Facility, PASE generates steam only when Oxbow releases waste heat through the cold stacks. *See id.*; 2 RR 98-101.

In February 2005, PASE and Oxbow's predecessor in interest, Great Lakes Carbon LLC, executed a Heat Energy Agreement to govern the parties' relationship with respect to the Waste Heat Facility. CR 9; *see also* App'x Tab. D.[4] The HEA does not detail how Oxbow must operate its plant. Instead, it obligates Oxbow to act "in accordance with Prudent Operating Practice," which the HEA defines as those "practices, methods, standards and acts . . . which, in the exercise of reasonable judgment in light of the facts known at the time that a decision was made, could reasonably have been expected to accomplish the desired result in a manner that complied with all applicable Permits and Laws at the lowest reasonable cost in a prompt and expeditious manner." CR 109 (HEA §1.1); CR 117 (HEA §3.3).

The HEA also does not guarantee PASE any quantity of waste heat (i.e., there is no minimum amount of waste heat Oxbow must provide PASE). 2 RR 216. Instead, the HEA only obligates Oxbow to "use *Commercially Reasonable Efforts* to maximize the production and delivery of [waste heat]," CR 122 (HEA §5.1) (emphasis added), which the HEA defines as follows:

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[4] For ease of reference, Oxbow has included key portions of the HEA in Appendix Tab D.

> such prompt, substantial and persistent efforts of the Party as are commercially reasonable under the circumstances in the industry of such Party. Commercially Reasonable Efforts *shall not require a Party to expend unlimited amounts of money, but only such amounts as are commercially reasonable in the applicable circumstances*.

CR 103 (HEA §1.1) (emphasis added). The HEA also specifically authorizes Oxbow to suspend production and delivery of waste heat in certain circumstances:

> Notwithstanding anything otherwise set forth in this Agreement, *[Oxbow] shall have the right to suspend its performance hereunder, including by suspending production and delivery of [waste heat] to PASE, without liability to PASE* at anytime that [Oxbow]: (a) receives a notice of alleged violation of Law[5] or any similar notice from any Governmental Authority[6] relating to, arising out of or in connection with the Steam Production Upgrade, the Steam Production Facility or the performance of this [HEA] which, if further prosecuted or pursued, may subject [Oxbow] to a material harm or detriment as reasonably determined by [Oxbow] and the suspension of its performance may be expected to mitigate the potential material harm or detriment as reasonably determined by [Oxbow], or (b) is named in, or otherwise made a party to or becomes subject to, a suit,

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[5] The HEA broadly defines "Law" to include "any law, legislation, statute, act, rule, ordinance, decree, treaty, regulation, order, judgment, or other similar legal requirement; or any legally binding announcement, directive or published practice or interpretation thereof, enacted, issued or promulgated by any Governmental Authority including all amendments, modifications, extensions, replacements or reenactments thereof." CR107 (HEA §1.1).

[6] The HEA also broadly defines "Governmental Authority" to include "the federal government of the United States, and any state, county, municipal or local government or regulatory or administrative department, body, political subdivision, commission, agency, instrumentality, ministry, court, judicial or administrative body, taxing authority, arbitrator, or other authority thereof having jurisdiction over either Party, the Steam Production Facility (including its heat supply and electric service), the GLC Site, the Premcor Site, or the Refinery." CR 106 (HEA §1.1).

> sanction, action, legal or arbitral proceeding of any kind relating to, arising out of or in connection with the Steam Production Upgrade, the Steam Production Facility, or the performance of this Agreement, the result of which might subject [Oxbow] to material harm or detriment as reasonably determined by [Oxbow].

CR 135-36 (emphasis and footnotes added).

PASE paid Oxbow only $1.00 for the Waste Heat Facility in 2005, and PASE does not pay Oxbow anything for the waste heat Oxbow delivers. CR 111, 124 (HEA §§2.3, 6.1). Instead, Oxbow's sole compensation for delivering waste heat comes as a part of a shared stream of revenues from PASE's sale of steam generated by the Waste Heat Facility. CR 124-26. Specifically, the HEA calls for PASE to make a monthly "Heat Payment" to Oxbow equal to 30% of the steam revenue received by PASE for the preceding month, adjusted by a mechanism referred to by the parties as the "heat bank." *See* CR 124 (HEA §6.1); 2 RR 134-35. In a nutshell, the heat bank adjusts the amount of Heat Payments due to Oxbow based on Oxbow's calcined coke production from kilns 3, 4, and 5 and the price of natural gas. 2 RR 134-36. If Oxbow produces more than the "Threshold Amount" of 43,675 tons of calcined coke per month, then it accumulates a credit in the heat bank. 2 RR 175-77; CR 110 (HEA §1.1). If Oxbow produces less than the Threshold Amount, it accumulates a deficit in the heat bank. 2 RR 177.

Oxbow received Heat Payments from 2005-2011, when calcined coke production and gas prices—the two main drivers of PASE's steam revenues—were high. *See* 4 RR 14-23. However, Oxbow's production of calcined coke fell below the threshold amount in 2009, and its balance in the heat bank went negative in 2011, after calcined coke markets fell and gas prices cratered as part of the shale boom. *See* 4 RR 22-23. Since that time, gas prices have remained depressed, and the market for calcined coke has not recovered. 4 RR 25; 6 RR Ex. 27. Oxbow has received no Heat Payments from PASE since 2011, and as of the end of 2017, Oxbow's negative balance in the heat bank was approximately $4 million. 2 RR 177; 3 RR 144.

II. The HEA contains a mandatory arbitration provision and limits PASE to a sole, exclusive remedy.

The HEA contains a "Dispute Resolution and Arbitration" provision ("arbitration provision") that applies to any "Dispute," which the HEA broadly defines to include "*[e]very dispute of any kind* or nature between the Parties arising out of or in connection with this Agreement[.]" CR 138-39 (emphasis added); *see also* App'x Tab D. Under that provision, if a "Dispute" arises, either party may send a notice to the other party "requesting that the Dispute be referred to the senior management of the Parties." CR 138. If the parties are unable the resolve the Dispute within 30 days, the HEA requires that the Dispute "*shall be submitted* by either Party *to binding arbitration* pursuant to the procedures set forth in this

Article and pursuant to the" commercial arbitration rules of the American Arbitration Association ("AAA Rules"). CR 102, 139. (emphases added.) With respect to court proceedings, the arbitration provision states that "neither Party shall seek recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision," and it authorizes a party to "commence an action or proceeding in a court of competent jurisdiction" in only two circumstances: "to (i) compel the other Party to arbitrate a Dispute as contemplated by this Section 14.3, or (ii) seek and obtain a restraining order or injunction, but not monetary damages, to enforce the confidentiality provisions set forth in Article 17." CR 140.

The HEA also contains a limitation of liability and exclusive remedy provision ("exclusive remedy provision") that both limits Oxbow's liability to PASE and provides PASE with a "sole and exclusive source of monetary recovery" from Oxbow for any "Claim," which the HEA defines broadly as "any cost, expense or damage due to any injury, death, damage or destruction of property, damage or destruction of the environment, suit, sanction, action, legal or arbitral proceedings, demands, or losses of any kind or character." CR 103 (HEA §1.1). The exclusive remedy provision states that Oxbow's "aggregate maximum liability for monetary damages with respect to any and all Claims in connection with the performance or non-performance of this [HEA] or otherwise arising out of

or in connection with this [HEA] shall be limited to the aggregate amount of future Heat Payments otherwise due to [Oxbow]." CR 138 (HEA §13.6). It further provides that PASE's "exclusive means of monetary recovery from or against [Oxbow] with respect [to] any Claim whether pursuant to an arbitral award . . . or pursuant to any judgment, sanction, penalty, other award or otherwise, shall be to withhold amounts otherwise due [Oxbow] hereunder in accordance with Article 6"—i.e., amounts, if any, due to Oxbow from the heat bank—"with the understanding that *[Oxbow] shall never be required to make any direct payment to PASE as a result of any Claim.*" *Id.* (emphasis added). PASE has conceded that its sole remedy against Oxbow is to withhold Heat Payments in accordance with the heat bank provision. 2 RR 214-15; 6 RR Ex. 6 at 53.

III. In 2016-2017, disputes arise over Oxbow's operation of the plant and delivery of waste heat to PASE.

To calcine coke, sulfur dioxide ("SO_2") is necessarily emitted. *See* 3 RR 97. In 2010, the Environmental Protection Agency ("EPA") substantially lowered the maximum concentration levels for the National Ambient Air Quality Standards ("NAAQS") for SO_2, moving from 150 parts per billion (ppb) measured by a 24-hour average, to 75 ppb measured by a one-hour average.[7] Changing the standard

[7] *See* Primary National Ambient Air Quality Standard for Sulfur Dioxide, 40 C.F.R. § 50.17 (2010); 75 Fed. Reg. 35520, 35550 (Jun. 20, 2010) (to be codified at 40 C.F.R. pts. 50, 53, and 58). Under the Clean Air Act, the EPA is required to set NAAQS for six "criteria pollutants," which includes sulfur oxides such as SO_2. *See* 42 U.S.C. §§ 7408-09; *see also* EPA, Criteria Air Pollutants, https://www.epa.gov/criteria-air-pollutants (last visited Oct. 8, 2018). According to

from a 24-hour to a 1-hour average represented an unprecedented change to the SO_2 NAAQS. An EPA-driven monitoring program to measure SO_2 levels, administered by the Texas Commission on Environmental Quality ("TCEQ"), officially began on January 1, 2017, and the State of Texas followed EPA guidance and independently sited a monitor about one mile north of Oxbow's and PASE's facilities in late 2016 to capture the impact of these operations on ambient air quality. 2 RR 138-39.

To address this dramatic change in the regulatory landscape, in August 2016, Oxbow and PASE representatives met to discuss SO_2 emissions and the EPA's revised SO_2 NAAQS. CR 198. Oxbow explained that to ensure immediate and cost-effective compliance with the SO_2 NAAQS, Oxbow likely would need to operate solely out of the hot stacks. *Id.* In other words, due to the revised SO_2 NAAQS, Oxbow was unlikely to be able to supply waste heat to the cold stacks that PASE uses to generate steam unless Oxbow spent huge sums of money to install pollution control equipment for the benefit of PASE. *Id.*; *see also* 3 RR 20-21; 6 RR Ex. 9.

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the EPA, "[s]hort-term exposures to SO_2 can harm the human respiratory system and make breathing difficult. Children, the elderly, and those who suffer from asthma are particularly sensitive to effects of SO_2." EPA, Sulfur Dioxide Basics, https://www.epa.gov/so2-pollution/sulfur-dioxide-basics (last visited Oct. 8, 2018).

Having no obligation under the HEA to pay any of the costs associated with pollution control and compliance, PASE objected, because without waste heat from the cold stacks, PASE could not operate. *See* 2 RR 223-24. In response to PASE's objection, and to assist PASE's operations, Oxbow explored various possibilities. For example, Oxbow considered adding scrubbers to its kilns to reduce SO_2 emissions. *See* 2 RR 225-30. Oxbow sought bids for SO_2 scrubbers and shared with PASE the best bid—a quote for at least $27.2 million to install scrubbers for kilns 3 and 5 only, with annual operating costs of approximately $5 million. *See* 6 RR Ex. 9 at 1; 3 RR 6-7. To install scrubbers on all four of its kilns, Oxbow estimated that the capital expense would be at least $56 million with annual operating costs of approximately $10.4 million. 6 RR Ex. 9 at 1. PASE disputed Oxbow's estimate, despite offering no evidence to rebut it, but even PASE's view—that Oxbow could achieve sufficient SO_2 emissions control with approximately $27-$28 million in capital expenditures plus $5 million in annual operating costs—would have required Oxbow to spend huge sums. 3 RR 20-21

Oxbow also agreed to perform tests of SO_2 emissions using various configurations of both hot and cold stacks to determine whether it was possible to satisfy the new SO_2 NAAQS while still providing some level of waste heat to PASE through at least one of the cold stacks. CR 198. That testing, which Oxbow

began in January 2017, consistently confirmed that running waste heat through the cold stacks resulted in violations of the SO_2 NAAQS. CR 198-99.

On March 16, 2017, Oxbow notified PASE that it was suspending use of the cold stacks for kilns 3 and 4 to mitigate the risk of SO_2 NAAQS violations:

> Continued use of the colds stacks associated with Kilns 3 and 4 creates a strong risk of violation of the [SO_2 NAAQS]. To mitigate the potential material harm to Oxbow associated with this risk, Oxbow is hereby indefinitely suspending production and delivery of [waste heat] from Kilns 3 and 4 to PASE.

6 RR Ex. 7. Oxbow further advised that it did "not have enough data necessary to draw any conclusions regarding the continued delivery of [waste heat] from Kiln 5" but would inform PASE "[a]s soon as Oxbow is able to make a determination regarding Kiln 5." *Id.*

Letters from the TCEQ validated Oxbow's concern. In April and June 2017, the TCEQ notified Oxbow that preliminary air monitoring data showed exceedences of the SO_2 NAAQS at the Port Arthur SO_2 monitoring station. 6 RR Exs. 13, 14. Oxbow representatives met with TCEQ staff and provided operational data regarding Oxbow's use of various hot and cold stack combinations. 6 RR Ex. 16. After reviewing the Port Arthur SO_2 monitor data and Oxbow's operational data, the TCEQ agreed that all exceedences of the SO_2 NAAQS occurred while Oxbow's plant had at least one cold stack operating:

> The monitor data and operational data provided by Oxbow suggest that utilizing hot stacks likely disperses emissions more effectively than utilizing cold stacks. The provided data show that there have been only eight hours between January 1, 2017 and November 8, 2017 where the SO_2 concentrations were greater than 75 parts per billion at the . . . air monitoring station. From conversations with Oxbow representatives, TCEQ staff understand that cold stacks were used during those eight hours.

6 RR Ex. 16.

Meanwhile, in response to Oxbow's suspensions, PASE invoked the HEA's arbitrtation provision. *See* 6 RR Ex. 8. On April 8, 2017, PASE sent Oxbow a "Notice of Failure to Perform Material Obligations under the Heat Energy Agreement," in which PASE stated that "[p]ursuant to Section 14.2"—i.e., the arbitration provision—"PASE is hereby providing notice to Oxbow of the occurrence/existence of a Dispute that should be referred to senior management of Oxbow." 6 RR Ex. 8. As the arbitration provision required, Oxbow responded to PASE's notice by designating its senior management representatives. 6 RR Ex. 12. Thereafter, the parties engaged in extensive settlement negotiations, including a mediation in Houston on April 17, 2018. CR 62. Ultimately, however, the parties' efforts to resolve the Dispute were unsuccessful.

On May 7, 2018, Jefferson County Judge Jeff Branick notified Oxbow by letter that TCEQ monitoring data showed SO_2 concentrations in excess of the 75ppb NAAQS threshold. 6 RR Ex. 17. Judge Branick also wrote that "[t]hese

conditions [violations of the Clean Air Act or rules, orders, or permits], if not corrected, may require me to institute suit for injunctive relief to preclude further violations." *Id.* Oxbow ultimately determined that it could not continue using the cold stacks associated with kiln 5 and remain in compliance with the SO_2 NAAQS. Accordingly, in June 2018, Oxbow advised PASE that it was indefinitely suspending production of waste heat from kiln 5. *See* CR 221; 2 RR 142-43. As PASE has acknowledged, since suspending all waste heat to PASE, Oxbow has operated solely through the hot stacks without any exceedences of the SO_2 NAAQS. 4 RR 75.

IV. Despite the HEA's mandatory arbitration provision, PASE files this action, a purported turnover proceeding, to avoid arbitration and end the suspensions.

Despite having invoked the arbitration provision with its Notice of Dispute, PASE did not initiate an arbitration after exhausting the HEA's pre-arbitration dispute resolution procedures as the HEA requires. Instead, PASE decided to go to Jefferson County state court and file this lawsuit in violation of the HEA.

PASE's Petition raised the same Dispute at issue in its April 2017 Notice of Dispute. PASE alleged that since March 2017—i.e., when Oxbow stopped using the cold stacks for, and thus suspended delivery of waste heat delivery from, kilns 3 and 4—Oxbow has been operating its plant in a manner that constitutes a breach of both its obligation to "use Commercially Reasonable Efforts to maximize the

production and delivery of" waste heat to PASE and duties of good faith and fair dealing owed under the HEA. *See* CR 9-10, 14-16. PASE further alleged that, as a result, it has not been able to use $3.4 million in contractual credits under the HEA that it received in the 2011 Arbitration Award, which was confirmed in the 2015 Judgment. CR 6-7. Contending that the Arbitration Award and Judgment make it a judgment creditor entitled to injunctive relief under the Turnover Statute, PASE sought orders mandating that Oxbow operate its plant to maximize delivery of waste heat to PASE by ending the suspensions and appointing a receiver to oversee Oxbow's operations. CR 19-23.

Although PASE claimed that such relief served to enforce the Arbitration Award and Judgment, the 2010-2011 arbitration actually resolved an entirely different set of disputes centering on which party bore financial responsibility for environmental compliance costs at PASE's Waste Heat Facility. *See generally* 6 RR Ex. 3. In that arbitration, PASE sought to avoid any environmental responsibility—including the attendant millions of dollars in equipment costs and potential environmental risk—and to require that Oxbow assume 100% of the cost of any pollution control efforts required at Oxbow's plant and PASE's Waste Heat Facility. *See* 6 RR Ex. 3 at 14-15. As part of its argument to avoid being held responsible for environmental compliance costs, PASE expressly confirmed that the HEA's suspension provision gave Oxbow "the right to suspend [waste heat]

delivery if required to mitigate violations of environmental laws." 6 RR Ex. 3 at 15.

The 2010-2011 panel ultimately agreed with PASE and held that the HEA imposed entirely on Oxbow responsibility for "installing and maintaining pollution control equipment that will ensure [Oxbow's plant and PASE's Waste Heat Facility's] operation in accordance with Oxbow's air permits and any other applicable environmental laws." CR 32. In support of that conclusion, the panel stated that "[Oxbow] gave up on inserting a specific standard for the amount of pollution control to be achieved [by PASE]; *in exchange for getting the control right to shut everything down if there was a problem.*" *Id.* (emphasis added). The panel made no determination as to any amounts the HEA obligated Oxbow to spend on pollution control efforts to comply with environmental regulations, nor did it preclude Oxbow from suspending delivery of waste heat to comply with emissions regulations in the future. *See* CR 35-36; *see also infra* Section I.C. Instead, the panel expressly recognized that the HEA only requires Oxbow to use "*Commercially Reasonable Efforts*" in the production and delivery of waste heat to PASE. CR 34 (emphasis added).

Although the arbitration primarily concerned allocation of financial responsibility for past environmental compliance and equipment installation, PASE also asserted affirmative claims for lost profits and declaratory relief based on

Oxbow's alleged failure to provide enough waste heat for PASE's operations. 6 RR Ex. 3 at 27-40; *see also* CR 34-35. Specifically, PASE claimed that certain operational and maintenance problems at Oxbow's plant amounted to a breach of Oxbow's Prudent Operating Practice and Commercially Reasonable Efforts obligations, that Oxbow breached its duty of good faith and fair dealing, and that the panel "should institute joint operating practices." 6 RR Ex. 3 at 27-40. In the Arbitration Award, the panel *denied* PASE's good faith and fair dealing claim, did *not* award PASE any injunctive relief, and *declined* to award the relief PASE specifically requested on how Oxbow was to operate for PASE's benefit, reasoning that "[t]he [HEA] governs the parties' obligations to each other, including the duty to act in good faith toward each other in the future." CR 35.

Even though the panel issued PASE a net $3.4 million award on its breach of contract counterclaim—after offsetting $1,105,274.43 that the panel determined PASE owed Oxbow on Oxbow's affirmative claims, CR 34-36—the panel did *not* require Oxbow to make a direct payment to PASE. Rather, consistent with the HEA's exclusive remedy provision, the panel declared that the $3.4 million award:

> is *not* a cash award requiring Oxbow to write PASE a check. It shall be handled in accordance with the specific provisions of the [HEA] regarding the heat bank as an offset.

CR 36 (emphasis added). In effect, the panel awarded PASE a $3.4 million credit—and only a credit—under the HEA. Because the panel concluded that

"neither party is clearly the prevailing party," it declined to award attorneys' fees and costs to either party. CR 36.

PASE moved to confirm the Arbitration Award in the 151st Judicial District Court of Harris County, Texas in December 2011, CR 8-9, and the Honorable Mike Engelhart ultimately confirmed the Arbitration Award in January 2015. CR 26.[8] During the next three-and-a-half years, PASE never requested a turnover order nor sought any other post-judgment relief from Judge Englehart. 2 RR 212-13.

Not until June 2018—after Oxbow partially suspended delivery of waste heat from kilns 3 and 4 to comply with the SO_2 NAAQS, and after the parties' subsequent negotiations and mediation to resolve the suspensions failed in 2017-2018, but before Oxbow suspended delivery of waste heat from kiln 5—did PASE decide to file this lawsuit. *See* 3 RR 29-30; *see also* 3 RR 121 (PASE's corporate representative Ray Deyoe: "It wasn't until [Oxbow] started terminating [PASE's] boilers when we realized we were going to have to seek injunctive relief; we're going to have to get help from the Court."). Moreover, despite styling its pleading a "Petition and Application for *Post-Judgment Enforcement Orders*," PASE did not file the Petition in the trial court that rendered the underlying Judgment. *See*

[8] Judge Engelhart originally entered an order vacating the award, but PASE successfully appealed to the First Court of Appeals, and Judge Engelhart then confirmed the award pursuant to that decision. *See Port Arthur Steam Energy LP v. Oxbow Calcining LLC*, 416 S.W.3d 708, 715 (Tex. App.—Houston [1st Dist.] 2013, pet. denied); CR 26.

CR 6. Instead, PASE picked a new court in a new venue—the 172nd Judicial District Court of Jefferson County. *Id*.

V. The trial court fails to rule on Oxbow's motion to compel arbitration and, instead, holds a three-day evidentiary hearing on PASE's Petition.

Upon learning that PASE had unilaterally set its Petition for an evidentiary hearing on the merits beginning July 23, 2018, Oxbow moved to compel arbitration and to quash the hearing on the ground, among others, that the motion to compel arbitration had to be heard and decided first, before the merits of the Petition could ever be reached. *See generally* CR 85-96, 51-60. Oxbow also objected to proceeding in Jefferson County and timely moved to transfer venue to the court that issued the Judgment confirming the Arbitration Award. CR 79-85. When the trial court denied Oxbow's motion to quash, Oxbow sought mandamus relief and an emergency stay of the merits hearing. CR 385-86. This Court initially stayed the merits hearing but later denied Oxbow's mandamus petition, concluding that "an appeal of a turnover order will provide adequate relief in this instance." *See* CR 395, 401. In its Memorandum Opinion, this Court provided clear guidance to the trial court on what could, and could not, be decided in PASE's turnover proceeding—the trial court could address only three specific questions set forth in the Turnover Statute and could not determine "the parties' substantive rights." CR 399-400.

Thereafter, PASE reset the merits hearing for August 21, 2018, and Oxbow set its motions to transfer venue and compel arbitration for hearing on the same day. CR 408-14. On August 21, the trial court heard argument on Oxbow's motions but, at the request of PASE's local counsel, declined to rule on them and instead proceeded immediately to hear the merits of PASE's Petition ("Merits Hearing"). 2 RR 11, 84-86. The Merits Hearing was anything but a typical evidentiary hearing. Among other things:

- The trial court overruled evidentiary objections by Oxbow when PASE argued that the rules of evidence did not apply because this was not a trial—despite sustaining numerous hearsay and other objections by PASE to documents offered by Oxbow. *Compare* 3 RR 151-52 (overruling Oxbow's objection under Rule 1006 after PASE's counsel argued that the rules of evidence did not apply to this proceeding), *with* 2 RR 207-08 (sustaining hearsay objections by PASE to documents offered by Oxbow) *and* 3 RR 68-69 (same).

- PASE's retained expert witnesses testified without first providing disclosures. *See* 2 RR 33.

- Even though Oxbow presented no witnesses (because PASE had failed to carry its burden of proof during its case in chief), the trial court allowed PASE to present rebuttal witnesses. *See* 4 RR 106-114. Recognizing the clear error in this ruling, which PASE invited, PASE reversed course and chose to present its rebuttal witnesses only as a proffer. *Id.* at 122-58.

VI. The trial court denies Oxbow's motions and enters the Turnover Order, telling Oxbow how to run the plant, undoing the contractual suspensions, and appointing a receiver to oversee Oxbow's operations.

On September 12, 2018, the trial court signed an order denying Oxbow's motion to compel arbitration. CR 421. The same day, the trial court signed

verbatim PASE's proposed 12-page Turnover Order. *See* CR 422-39.[9] The Turnover Order grants the extraordinary relief of (1) requiring Oxbow to deliver all waste heat generated by kilns 3, 4, and 5 to PASE—thereby reversing the contractual suspension in PASE's favor, and (2) appointing a receiver with "full and unfettered access" to Oxbow's plant and operational personnel to monitor Oxbow's operations and its compliance with the Turnover Order, and requiring Oxbow to pay the receiver's fees and expenses. CR 432. The trial court signed the Turnover Order despite being presented with no authority—from the Turnover Statute itself or cases applying it—authorizing such relief.

As the face of the Turnover Order confirms, the trial court heard and decided numerous substantive disputes, including disputes arising out of or in connection with the HEA. Among other things, the Turnover Order states:

- "The Court received evidence, argument, and takes judicial notice that the [TCEQ] is presently in the second year of a three year monitoring program to monitor SO_2 in the vicinity of Oxbow's plant relating to an ultimate determination as to whether Jefferson County is in 'attainment' or 'non-attainment' under the [NAAQS] for SO_2 in the atmosphere." CR 424-25.
- "The Court received evidence that since the Judgment was confirmed in January of 2015, Oxbow has hindered PASE's ability to collect its Judgment by depressing the temperature and volume of waste heat delivered to PASE and by intermittently suspending delivery of waste

[9] The only change the trial court made to PASE's proposed turnover order was to fill in blanks left for the receiver's identity and compensation. *See* CR 422-33. Oxbow has requested that PASE's proposed turnover order be included in a Supplemental Clerk's Record.

heat to PASE's boilers, sometimes for many months, which reduced PASE's revenues from selling steam to Valero." CR 426.

- "Relying upon various letters and communications introduced into evidence, Oxbow's counsel argued that Oxbow indefinitely suspended delivery of waste heat to PASE because of SO_2 pollution concerns involving TCEQ's SO_2 monitor. Oxbow's position, expressed through letters the Court received into evidence and through the argument of its counsel, was that Oxbow faces a greater likelihood of registering an exceedance of SO_2 at the monitor and facing possible governmental or regulatory action at some point in the future if waste heat is delivered to PASE and then discharged through the Cold Stacks. Oxbow's counsel argued that if Oxbow only uses its Hot Stacks and does not deliver waste heat to PASE, Oxbow can avoid registering exceedances at the monitor and can keep Jefferson County in 'attainment' under the NAAQS SO_2 standard." CR 427.

- "The Court concludes that Oxbow intends to continue to try to avoid SO2 exceedance readings at the TCEQ monitor for the balance of the three-year monitoring program by discharging its [waste heat] exclusively through its Hot Stacks." CR 428.

- "Oxbow's contentions [regarding environmental compliance] do not justify shutting down delivery of waste heat to PASE . . ." CR 428.

On September 13, 2018, Oxbow perfected its accelerated interlocutory appeal of the arbitration order and the Turnover Order (given its appointment of a receiver). CR 435-36. On September 20, 2018, this Court granted a temporary stay of the Turnover Order until further order of the Court. *Oxbow Calcining LLC v. Port Arthur Steam Energy, LP*, No. 19-18-00359-CV (Tex. App.—Beaumont Sep. 20, 2018) (order).

STANDARD OF REVIEW

A party seeking to compel arbitration under the Federal Arbitration Act ("FAA") must establish that "the dispute falls within the scope of an existing agreement to arbitrate." *Venture Cotton Coop. v. Freeman*, 435 S.W.3d 222, 227 (Tex. 2014).[10] Because it is undisputed that the HEA contains a valid arbitration provision, the sole issue is whether the dispute falls within the scope of that provision.

Whether PASE's allegations fall within the scope of the arbitration provision is a legal determination subject to *de novo* review. *Henry v. Cash Biz, LP*, 551 S.W.3d 111, 115 (Tex. 2018) ("Whether the claims in dispute fall within the scope of a valid arbitration agreement . . . are questions of law, which are reviewed de novo."); *accord Sam Houston Elec. Coop., Inc. v. Berry*, No. 09-16-00346-CV, 2017 WL 4319849, at *2 (Tex. App.—Beaumont Sept. 28, 2017, no pet.) (same); *see also In re Labatt Food Serv., L.P.*, 279 S.W.3d 640, 642-43 (Tex. 2009) ("Whether an arbitration agreement is enforceable is subject to de novo review.") (citation omitted). In a *de novo* review, this Court gives the trial court's decision "absolutely no deference." *Quick v. City of Austin*, 7 S.W.3d 109, 116 (Tex.

[10] The analysis is the same under the Texas Arbitration Act ("TAA"), which Oxbow also relied on in its motion to compel arbitration. *See* CR 91; *see also, e.g., Sam Houston Elec. Coop., Inc. v. Berry*, No. 09-16-00346-CV, 2017 WL 4319849, at *2 (Tex. App.—Beaumont Sept. 28, 2017, no pet.) ("A party seeking to compel arbitration under the TAA must first establish, as a threshold matter, that there exists a valid arbitration agreement and that the claims in dispute fall within the scope of that agreement.").

1998). Therefore, when reviewing whether PASE's allegations fall within the scope of the arbitration provision, the Court must remain mindful of the liberal state and federal policy favoring arbitration agreements and resolve any doubts about the agreement's scope in favor of arbitration. *See In re FirstMerit Bank, N.A.*, 52 S.W.3d 749, 753 (Tex. 2001) (orig. proceeding) ("Because state and federal policies continue to favor arbitration, a presumption exists favoring agreements to arbitrate under the FAA, and courts must resolve any doubts about an arbitration agreement's scope in favor of arbitration"); *Cantella & Co. v. Goodwin*, 924 S.W.2d 943, 944 (Tex. 1996) (orig. proceeding) (same); *see also Henry*, 551 S.W.3d at 115 ("[A]ny doubts concerning the scope of arbitrable issues should be resolved in favor of arbitration.").

The entry of a turnover order appointing a receiver is reviewed for abuse of discretion. *Beaumont Bank, N.A. v. Buller*, 806 S.W.2d 223, 226 (Tex. 1991); *Congleton v. Shoemaker*, No. 09-11-00453-CV, 2012 WL 1249406, at *2 (Tex. App.—Beaumont Apr. 12, 2012, pet. denied) (mem. op.). As the Texas Supreme Court has repeatedly confirmed, a trial court necessarily abuses its discretion where its conclusion is based on an erroneous determination of the law, and questions of law are reviewed *de novo*. *E.g.*, *Walker v. Packer*, 827 S.W.2d 833, 840 (Tex. 1992); *see also State v. T.S.N.*, 547 S.W.3d 617, 620 (Tex. 2018) ("Under the abuse of discretion standard, appellate courts afford no deference to

the trial court's legal determinations because a court has no discretion in deciding what the law is or in applying it to the facts."). When considering whether a trial court abused its discretion in issuing a turnover order, sufficiency of the evidence is a relevant consideration. *Bueller*, 806 S.W.2d at 226.

Here, the Turnover Order is based on multiple legal determinations that merit *de novo* review. First, the threshold question of whether the trial court had subject matter jurisdiction to enter a turnover order appointing a receiver is a question of law subject to *de novo* review. *Tex. Dep't of Parks & Wildlife v. Miranda*, 133 S.W.3d 217, 226 (Tex. 2004) ("Whether a pleader has alleged facts that affirmatively demonstrate a trial court's subject matter jurisdiction is a question of law reviewed *de novo*."). Second, whether the Turnover Statute authorizes the relief awarded by the trial court presents an issue of statutory construction subject to *de novo* review. *See Atmos Energy Corp. v. Cities of Allen*, 353 S.W.3d 156, 160 (Tex. 2011) ("The construction of a statute is a question of law that we review de novo."). Finally, whether PASE waived its right to such relief by agreeing to the HEA's exclusive limited remedy provision turns on the interpretation of a contract and, thus, involves a question of law reviewed *de novo*. *See URI, Inc. v. Kleberg County*, 543 S.W.3d 755, 763 (Tex. 2018) ("Both the presence of ambiguity and interpretation of an unambiguous contract are questions of law we review de novo using well-settled contract-construction principles.").

SUMMARY OF ARGUMENT

Arbitration agreements are favored in both federal and Texas law and must be enforced by the courts. *E.g.*, *In re Olshan Found. Repair Co*., 328 S.W.3d 883, 892 (Tex. 2010). The uncontroverted evidence conclusively establishes that PASE agreed in the HEA to arbitrate its disputes with Oxbow. On its face, the Petition raises a dispute over Oxbow's performance under the HEA, including its contractual suspensions of waste heat delivery and whether new pollution control equipment is contractually required for SO_2 emissions. It is undisputed that PASE invoked the HEA's dispute resolution procedures (which culminate in mandatory arbitration) for that very same dispute in 2017, and PASE expressly acknowledged during the Merits Hearing that the dispute can be resolved in arbitration. Moreover, by expressly agreeing in the HEA that the AAA Rules would govern any arbitration, PASE also agreed that the arbitrator, rather than the court, would decide the arbitrability of any dispute. Under these circumstances, the trial court was required to grant Oxbow's motion to compel arbitration and stay the litigation. Its failure to do so is clear error. Because Oxbow met its burden of proving that the parties agreed to arbitrate this dispute, and because PASE failed to prove any valid defense to arbitration, this Court must vacate the Turnover Order and the order denying arbitration and order the trial court to compel arbitration of this dispute.

Even if PASE could somehow avoid the binding arbitration provision, the trial court still erred in granting the Turnover Order and appointing a receiver for at least four independent reasons. First, the trial court lacked jurisdiction to enter a Turnover Order enforcing the 2015 Judgment because exclusive jurisdiction to enter post-judgment orders rested with the 151st District Court of Harris County, which rendered the Judgment. Second, the Turnover Statute itself does not authorize the relief the trial court awarded in the Turnover Order. Third, the Turnover Order impermissibly imposes new obligations that are inconsistent with the 2015 Judgment. Finally, the Turnover Order violates the HEA's exclusive remedy provision. These legal errors require that the Turnover Order be vacated and judgment be entered for Oxbow.

ARGUMENT

I. The trial court erred in refusing to compel arbitration because PASE agreed to arbitrate its dispute with Oxbow.

PASE does not deny that the HEA's mandatory arbitration provision is a valid and enforceable agreement to arbitrate its disputes with Oxbow. In fact, it was used by both parties the last time they had a dispute. Nor does PASE deny that the dispute pleaded in its Petition and litigated at the Merits Hearing—namely, whether the HEA's suspension provision authorized Oxbow's 2017 and 2018 suspensions of waste heat delivery to PASE, and whether the HEA's "Commercially Reasonable Efforts" obligation required Oxbow to spend an

estimated $56 million to install, and an estimated $10 million *per year* to operate, new SO_2 pollution control equipment—arises out of or in connection with the HEA. These uncontroverted facts alone are dispositive of Oxbow's motion to compel arbitration. *See, e.g.*, *FD Frontier Drilling (Cyprus), Ltd. v. Didmon*, 438 S.W.3d 688, 693 (Tex. App.—Houston [1st Dist.] 2014, pet. denied) ("A party seeking to compel arbitration under the FAA must establish: (1) a valid arbitration agreement exists; and (2) the claims at issue fall within that agreement's scope.").

Unable to deny that its allegations fall squarely within the scope of the arbitration provision, PASE tried to sidestep it, arguing that (1) this dispute was already litigated in the 2010-2011 arbitration and decided in the 2011 Arbitration Award, and (2) PASE did not plead a new "claim" but rather invoked the Turnover Statute, which PASE claims somehow absolves it from complying with the arbitration provision. Both arguments lack merit. First, the Petition, PASE's own conduct and admissions, and the Arbitration Award itself all confirm that the current dispute was neither litigated nor decided in the 2010-2011 arbitration. Second, PASE's argument that this is merely an "ancillary" turnover proceeding ignores the substance of its factual allegations and the relief it seeks and is precisely the kind of "artful pleading" to avoid arbitration that Texas courts routinely reject. Also, PASE's impermissible use of the Turnover Statute to avoid arbitration is preempted by the FAA.

Although the record conclusively establishes that PASE pleaded and litigated a dispute that must be arbitrated, any doubts the Court might have about the propriety of arbitration provide no basis to affirm the trial court's order denying arbitration. By agreeing to have the AAA Rules govern arbitrations under the HEA, PASE agreed to have the arbitrators, rather than the court, decide any questions of arbitrability. Thus, whether the arbitration provision encompasses the current dispute must be referred to arbitration.

A. Oxbow proved that PASE agreed to arbitrate this dispute.

The HEA's arbitration provision indisputably constitutes a valid agreement to arbitrate. It clearly and unambiguously mandates that "*[e]very dispute of any kind or nature* between the Parties arising out of or in connection with this [HEA]" "*shall be submitted* by either Party *to binding arbitration* pursuant to the procedures set forth in this Article and pursuant to the [AAA Rules]." CR 138-39 (emphases added). PASE does not contend otherwise.

PASE's allegations also indisputably fall within the scope of the arbitration provision. As the Texas Supreme Court recently confirmed, "the scope of an arbitration clause that includes all 'disputes,' and not just claims, is very broad and encompasses more than claims based solely on rights originating exclusively from the contract." *Henry*, 551 S.W.3d at 115-16 (quotation marks and citation omitted). "Such broad clauses are capable of expansive reach," "embrac[ing] all

disputes between the parties having a significant relationship to the contract regardless of the label attached to the dispute." *FD Frontier Drilling*, 438 S.W.3d at 695. Here, both PASE's Petition and its actions before and after filing the Petition confirm that, even with the "turnover proceeding" label, the dispute PASE pleaded and litigated has precisely the type of significant relationship to the HEA that brings it within the scope of the arbitration provision.

1. The allegations in PASE's Petition arise out of or in connection with the HEA.

Whether the parties' dispute falls within the scope of the arbitration provision is measured first by the factual allegations in PASE's Petition. *See, e.g.*, *In re FirstMerit Bank*, 52 S.W.3d at 754 ("To determine whether a party's claims fall within an arbitration agreement's scope, we focus on the complaint's factual allegations rather than the legal causes of action asserted."). Those allegations show that PASE used this proceeding to litigate a substantive dispute under the HEA.

For example, PASE's Petition repeatedly argues what the HEA purportedly requires of Oxbow and challenges Oxbow's performance under the HEA:

- "*[U]nder the definitions and terms of the [HEA]*, Oxbow is to use prompt, substantial and persistent efforts as commercially reasonable under the circumstances in the calcining industry to maximize the production and delivery of [waste heat] . . . . [T]o be prompt, substantial and persistent . . . Oxbow should spend such money as commercially reasonable under the applicable circumstances for pollution control[.]" CR 10-11 (emphasis added).

- "Oxbow *cannot meet its obligations under the [HEA]*, including its duties of good faith and fair dealing to PASE, by refusing to install SO_2 pollution control equipment or taking other pollution control measures while simultaneously stopping the delivery of [waste heat] to PASE and keeping PASE from recovering its Judgment under the guise of supposed SO_2 'compliance.'" CR 15-16 (emphasis added).

- *"[R]ather than meet its duties of good faith and fair dealing under the [HEA]*, Oxbow has opportunistically and falsely claimed that the [SO_2 NAAQS] require it to curtail the delivery of [waste heat] to PASE." CR 16 (emphasis added).

- "*As a result of Oxbow's continued failures to comply with the [HEA]*, PASE needs the aid of this Court to recover its Judgment pursuant to the Turnover Statute[.]" CR 16 (emphasis added).

These allegations make clear that the "dispute" here involves (1) whether the HEA's suspension provision permitted Oxbow's 2017 and 2018 suspensions of waste heat delivery, and (2) whether Oxbow's obligations under the HEA to use "Commercially Reasonable Efforts" to maximize waste heat delivery and to operate its plant in accordance with "Prudent Operating Practice" require Oxbow to (a) operate its plant in a manner that it believes will lead to non-attainment of the SO_2 NAAQS and potential violations of laws and permits applicable to the Port Arthur facility or (b) spend tens of millions of dollars installing and tens of millions more operating pollution control equipment. Because those issues indisputably "aris[e] out of or in connection with" the HEA, they fall within the scope of the HEA's arbitration provision and "shall be submitted . . . to binding arbitration." CR 138-40.

2. PASE's actions before and after filing this lawsuit confirm that this dispute is arbitrable.

In addition to the Petition, PASE's own actions confirm that this dispute falls within the scope of the HEA's arbitration provision.

First, PASE specifically invoked the arbitration provision *for this very dispute*. *See* 6 RR Ex. 8. As explained above, *see supra* p.13, before filing this lawsuit, PASE "provided notice to Oxbow of the occurrence/existence of a Dispute" subject to the arbitration provision. 6 RR Ex. 8. In the "Notice of Failure to Perform Material Obligations under the [HEA]," PASE specifically alleged that Oxbow's "interruption and suspension" of waste heat delivery were "failures to perform material obligations under Section 13.1(b) and a breach of the duty of good faith and fair dealing under the [HEA]." *Id.* PASE thus admitted that those allegations—which make up the vast majority of the same allegations in PASE's Petition here, *see* CR 15-16—constitute a "Dispute" within the scope of the arbitration provision.[11]

Second, PASE admitted at the Merits Hearing that the arbitration provision encompasses its allegations. When asked whether Oxbow's suspensions of waste heat delivery gave rise to an arbitrable dispute, PASE's manager Ray Deyoe, testifying as PASE's corporate representative, admitted that they did:

[11] Notably, had PASE initiated arbitration at that time, the dispute would have been decided by now, as the arbitration provision calls for a fast-track resolution within 180 days of the filing of an arbitration. CR 139.

> Q . . . You could go to arbitration t[o] say the suspension that was done for Kilns 3 and 4 and for Kiln 5 was wrong, right?
>
> A. We could.

See 3 RR 122:3-6.

The Texas Supreme Court has stated that "[t]he presumption in favor of arbitration is so compelling that a court should not deny arbitration *unless it can be said with positive assurance* that an arbitration clause is not susceptible of an interpretation which would cover the dispute at issue." *Henry*, 551 S.W.3d at 115 (quotation marks omitted). Because PASE's own actions and statements confirm that the arbitration provision encompasses this dispute, arbitration must be ordered here. *Id.*; *see also G.T. Leach Builders, LLC v. Sapphire V.P., LP*, 458 S.W.3d 502, 521 (Tex. 2015) ("Texas and federal law recognize a strong presumption in favor of arbitration such that myriad doubts—as to waiver, scope, and other issues not relating to enforceability—must be resolved in favor of arbitration.") (quotation marks omitted).

3. PASE failed to meet its burden to defeat arbitration.

The burden of defeating the presumption of arbitration fell squarely on PASE as the party opposing arbitration. *E.g.*, *Cantella*, 924 S.W.2d at 944. Yet PASE *never challenged* the enforceability of the HEA's arbitration provision or its reach. As a result, the trial court had no authority to hear the dispute but instead was obligated to compel arbitration. *See, e.g.*, *In re Bath Junkie Franchise, Inc.*,

246 S.W.3d 356, 369 (Tex. App.—Beaumont 2008, orig. proceeding) ("[Defendant] proved the existence of a valid arbitration agreement encompassing the claims that are the subject of this suit, and [plaintiff] failed to show that it has a valid defense to the arbitration clause. As a result, *the trial court had no discretion but to compel arbitration and stay its own proceedings*.") (emphasis added). The trial court erred in refusing to do so.

B. The current dispute was not litigated in or decided by the 2010-2011 arbitration.

Unable to deny that the dispute over the 2017-2018 suspensions falls within the scope of the arbitration provision, PASE claimed that the parties already litigated in the 2010-2011 arbitration, and the 2011 Arbitration Award already decided, the current dispute. *See, e.g.*, PASE's Resp. to Emerg. Mot. to Stay [hereinafter, "Stay Resp."] 15-16. In fact, whether Oxbow properly suspended waste heat delivery under the HEA's suspension provision, based on the revised SO_2 NAAQS and governmental demands that Oxbow comply with the NAAQS and its permits, *see* 6 RR Ex. 17; *supra* pp. 9-13, could not and did not arise until 2016 and 2017—years after the 2011 Arbitration Award.

Once again, PASE's own words belie its claim that the prior arbitration resolved this dispute. For example, the allegations in PASE's court papers, the arguments of its counsel, and PASE's testimony at the Merits Hearing all

demonstrate that the dispute arises from Oxbow's operations *after* the 2010-2011 arbitration:

- "*Since the Award was decided [in 2011], and particularly after the Award was upheld on appeal and became incorporated into the Judgment [in 2015]*, Oxbow has continuously operated its calcining plant in a manner to ensure that PASE will never receive enough flue gas energy to generate Heat Payments that PASE can offset to recover its Judgment." CR 14 (emphasis added).

- "*Over the last year or year and a half* Oxbow has been curtailing the heat delivery through these three kilns to our three boilers." CR 323 (emphasis added).

- "It wasn't until [Oxbow] started terminating [PASE's] boilers [in 2017 and 2018] when we realized we were going to have to seek injunctive relief; we're going to have to get help from the Court." 3 RR 121.

PASE's admissions during the Merits Hearing resolved any doubts about whether the 2010-2011 arbitration decided the current dispute:

> Q. There is no way that [the 2011] arbitration could have litigated a dispute that arose in 2016, '17, or '18, right?
>
> A. That's right.
>
> Q. . . . You would agree with me that the previous arbitration in 2011 did not decide whether the suspension disputes the parties have had in 2017 and '18 – didn't decide those issues, right?
>
> A. *It did not*.

2 RR 216-17 (emphasis added).

Despite these critical admissions, PASE continues to insist that the Arbitration Award somehow justifies resolving this dispute outside of arbitration. Stay Resp. 14-16. But PASE can make that argument only by mischaracterizing the Arbitration Award. Contrary to PASE's assertions, the panel did *not* hold that Oxbow must act to "ensure" either the operation of PASE's Waste Heat Facility or, at all costs and in all circumstances, the delivery of waste heat to PASE. *See* Stay Resp. 14. Nothing in the Arbitration Award required Oxbow to run its plant for a single day, and, in fact, the panel expressly acknowledged that the HEA allows Oxbow to suspend waste heat delivery in certain circumstances: "[Oxbow] gave up on inserting a specific standard for the amount of pollution control to be achieved [by PASE]; *in exchange for getting the control right to shut everything down if there was a pollution problem.*" CR 32 (emphasis added). That conclusion was entirely consistent with (1) the plain language of the HEA's suspension provision, (2) PASE's argument to the panel in 2011 that Oxbow has "the right to suspend [waste heat] delivery if required to mitigate violations of environmental laws," 6 RR Ex. 3 at 15, and (3) PASE's counsel's statement to the arbitral panel that the HEA's suspension provision "was specifically negotiated so that, if for some reason, the project could not meet future environmental regulation or if there was some violation of the air permit, [Oxbow's] remedy is to suspend." 2 RR 198–200.

Nor did the 2011 Arbitration Award require Oxbow to maintain waste heat deliveries to PASE no matter the cost or consequence, as PASE claims. *See, e.g.*, 3 RR 38 ("Q. . . . is it still PASE's position that Oxbow would have to spend up to a billion dollars to install pollution control to address SO_2 or just shut the whole thing down and close the entire plant. A. It is."). Instead, the panel recognized that in addition to authorizing Oxbow to suspend production and delivery of waste heat, the HEA only requires Oxbow to use "*Commercially Reasonable Efforts* to maximize the production and delivery" of waste heat to PASE. CR 34 (emphasis added). The HEA plainly states that "Commercially Reasonable Efforts *shall not require a Party to expend unlimited amounts of money*, but only such amounts as are commercially reasonable in the applicable circumstances," CR 103 (emphasis added)—a term that PASE studiously ignores.

PASE also refuses to address the fact that its Petition directly challenges the commercial reasonableness of Oxbow's 2017 and 2018 suspensions. PASE claims that "Oxbow cannot meet its obligations under the [HEA], *including its duties of good faith and fair dealing* to PASE, by refusing to install SO_2 pollution control equipment or taking other pollution control measures while simultaneously stopping the delivery of [waste heat] . . . ." CR 15-16 (emphasis added). But given that the panel *expressly denied* PASE's claim for breach of the duty of good faith

and fair dealing in the prior arbitration, CR 35, this new alleged breach of the duty of good faith and fair dealing is, by definition, a new dispute.

For these reasons, PASE's claim that Oxbow's duties under the HEA—and how it has performed those duties in response to the changing regulatory landscape on SO_2 emissions since the Arbitration Award issued in 2011—were "fully determined" in the 2010-2011 arbitration is patently incorrect. It simply is not the case that the 2017 and 2018 suspensions of waste heat delivery were or could have been litigated in the 2010-2011 arbitration. Indeed, the regulation implementing the SO_2 NAAQS—the Data Requirements Rule for the SO_2 NAAQS—was not promulgated until August 21, 2015. *See* 80 Fed. Reg. 51052 (Aug. 21, 2015). Contrary to PASE's litigation position, Oxbow's purported "continued failures to comply with the [HEA]," CR 16—in the wake of revised pollution regulations and governmental action on SO_2 emissions—give rise to a new dispute that the HEA dictates must be decided in a new arbitration.

C. PASE cannot avoid the arbitration provision by invoking the Turnover Statute.

PASE's second argument to avoid the arbitration provision—that this is a turnover proceeding—fares no better. PASE's purely tactical decision to label this case a turnover proceeding does not change its fundamental nature, nor can PASE employ the Turnover Statute to deprive Oxbow of its contractual right to arbitration.

1. PASE's labelling this lawsuit as a turnover proceeding does not make it so.

PASE asserts that this lawsuit is merely an "ancillary" turnover proceeding but insisting that this is a turnover proceeding that raises no new dispute does not make it so. The HEA's arbitration clause is clear and unmistakable and makes no exception for post-judgment proceedings or for this kind of dispute. Indeed, the HEA expressly provides that "neither party shall seek recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision." CR 140. By litigating the merits of Oxbow's 2017 and 2018 suspensions of waste heat delivery under the guise of the Turnover Statute, PASE has done just that.

Moreover, the turnover cases that PASE cited below look nothing like this case. CR 20-22, 223-25, 254-58. In those cases, the plaintiff obtained a money judgment and then sought a turnover order in the same court that issued the original judgment to require the defendant to deliver property to the sheriff or to a receiver to be sold to pay the judgment. *See, e.g.*, *Thomas v. Thomas*, 917 S.W.2d 425, 429-30 (Tex. App.—Waco 1996, no pet.) (turnover order sought to compel attorney to turn over fees received for legal services to satisfy money judgment); *Pillitteri v. Brown*, 165 S.W.3d 715, 721-23 (Tex. App.—Dallas 2004, no pet.) (turnover order sought to compel defendant to turn over shares of stock in various entities to satisfy money judgment); *Buller*, 806 S.W.2d at 226 (plaintiff obtained

turnover order requiring defendant to deliver $100,000 in cash to satisfy money judgment).

By contrast, PASE's use of the Turnover Statute is without precedent. PASE acknowledges, as it must, that the HEA prevents it from recovering cash damages from Oxbow. 2 RR 214-15.[12] PASE has cited, and Oxbow has located, no case in which the Turnover Statute was used to enforce a non-money judgment like the 2011 Arbitration Award and 2015 Judgment here, much less a case in which the Turnover Statute was used to convert a non-money judgment for a contractual credit into a receivership or mandatory injunction. PASE's dissatisfaction with the exclusive remedy provision it agreed to in the HEA is no justification for allowing PASE to make an end-run around the arbitration provision. PASE cannot avoid by artful pleading the fact that it is using the Turnover Statute to litigate a dispute subject to mandatory arbitration. *See, e.g.*, *In re FirstMerit Bank*, 52 S.W.3d at 754 ("To determine whether a party's claims fall within an arbitration agreement's scope, we focus on the complaint's factual

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[12] Texas courts routinely enforce waivers of damages or of other judicial rights or remedies. *See, e.g.*, *In re Prudential Ins. Co. of Am.*, 148 S.W.3d 124, 135 (Tex. 2004) (holding contractual jury waivers are enforceable); *Fid. & Deposit Co. of Md. v. Stool*, 607 S.W.2d 17, 24 (Tex. Civ. App.—Tyler 1980, no writ) ("[I]t is well established that parties having agreed upon the measure of damages for breach of their contract are accordingly bound."); *COC Servs., Ltd. v. CompUSA, Inc.*, 150 S.W.3d 654, 678 (Tex. App.—Dallas 2004, pet. denied) ("We conclude that the trial court could properly grant JNOV on the basis that COC had contractually waived its right to lost-profit damages under the unambiguous damages-limitation provision."); *Trinity Universal Ins. Co. v. Bill Cox Constr., Inc.*, 75 S.W.3d 6, 15 (Tex. App.—San Antonio, 2001, no pet.) (enforcing contractual waiver of right to sue for damages covered by insurance).

allegations rather than the legal causes of action asserted."); *Glassell Producing Co. v. Jared Res., Ltd.*, 422 S.W.3d 68, 77 (Tex. App.—Texarkana 2014, no pet.) ("The determination is made based on the substance of the claim, not artful pleading.").

2. The FAA preempts PASE's use of the Turnover Statute to adjudicate the merits of the parties' HEA dispute.

Even if PASE's invocation of the Turnover Statute were not artful pleading, PASE still could not avoid the arbitration provision because the FAA preempts any attempted use of the Turnover Statute to adjudicate the suspension dispute outside of arbitration.

"The principal purpose of the FAA is to ensure that private arbitration agreements are enforced according to their terms." *AT&T Mobility LLC v. Concepcion*, 563 U.S. 333, 344 (2011) (internal quotation marks omitted). The United States Supreme Court has thus held that the FAA preempts state rules that interfere with resolution of a controversy as envisioned in the arbitration agreement, including generally applicable state laws impacting arbitration incidentally. *See, e.g.*, *Preston v. Ferrer*, 552 U.S. 346, 357, 359 (2008) (holding that FAA preempted California statute giving labor commissioner exclusive jurisdiction over disputes involving talent agencies and rejecting argument that state rules merely delaying arbitration are not preempted, reasoning that delaying arbitration is "in contravention of Congress' intent to move the parties to an

arbitrable dispute out of court and into arbitration as quickly and easily as possible") (quotation marks and citation omitted).

The Texas Supreme Court has likewise consistently held that the FAA preempts any state rule that "stands as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress" in the FAA. *In re D. Wilson Constr. Co.*, 196 S.W.3d 774, 779 (Tex. 2006) (orig. proceeding) (quotation marks omitted); *see, e.g.*, *Jack B. Anglin Co. v. Tipps*, 842 S.W.2d 266, 271 (Tex. 1992) (orig. proceeding) (holding that FAA "preempt[ed] application of the nonwaiver provision of the DTPA to prevent or restrict enforcement of [an] arbitration agreement"); *In re Nexion Health at Humble, Inc.*, 173 S.W.3d 67, 69-70 (Tex. 2005) (orig. proceeding) (directing trial court to order arbitration under FAA, which preempted TAA rule requiring counsel to sign agreements to arbitrate personal injury claims).

Under these binding precedents, the FAA preempts PASE's and the trial court's use of the Turnover Statute here. By allowing PASE to adjudicate the propriety of Oxbow's suspensions at the Merits Hearing and to undo those contractual suspensions with the Turnover Order outside of arbitration, the trial court applied the Turnover Statute in a manner that frustrates the purpose of the FAA and interferes with resolution of the dispute required by the arbitration

provision. The trial court's order denying arbitration must be reversed on this ground as well.

D. All doubts must be resolved in favor of arbitration, with the arbitrator, not the court, having authority to decide jurisdiction.

As explained above, because "a presumption exists in favor of agreements to arbitrate . . . [c]ourts must resolve any doubts about an agreement to arbitrate in favor of arbitration." *E.g.*, *Cantella*, 924 S.W.2d at 944. Moreover, parties can agree to arbitrate whether claims are within the scope of their arbitration agreement, and where the arbitration agreement clearly and unmistakably evidences an intent to submit this issue to the arbitrator, courts must do so. *Jody James Farms, JV v. Altman Grp., Inc.*, 547 S.W.3d 624, 631 (Tex. 2018).

Here, the parties clearly and unmistakably agreed to submit the issue of whether a particular dispute should be arbitrated to the arbitrator. The HEA provides that arbitration shall be conducted pursuant to the "Arbitration Rules," defined as the AAA Rules. CR 102, 39. Under AAA Rule R-7(a), the "arbitrator shall have the power to rule on his or her own jurisdiction, including any objections with respect to the existence, scope, or validity of the arbitration agreement *or to the arbitrability of any claim* or counterclaim."[13]

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[13] AAA Rules, R-7, p.13, (Rules amended and effective Oct. 1, 2013), https://adr.org/sites/default/files/CommercialRules_Web.pdf (last visited Sept. 9, 2018) (emphasis added).

As this Court has held, a broad arbitration clause that incorporates the AAA Rules provides "clear and unmistakable evidence" of the parties' intent to delegate gateway issues of arbitrability to the arbitrator—including whether a particular dispute is arbitrable. *See Rent-A-Center Texas, L.P. v. Bell*, 2016 WL 4499093, at *4 (Tex. App.—Beaumont, Aug. 25, 2016, no pet.) ("The parties' agreement to a broad arbitration clause that expressly incorporates [the AAA Rules] provides clear and unmistakable evidence of RAC's and Patricia's intent to delegate gateway issues of arbitrability to the arbitrator . . . .") *overruled on other grounds by Jody James Farms, JV v. Altman Grp., Inc.*, 547 S.W.3d 624, 632 (Tex. 2018); *see also T.W. Odom Mgmt. Servs., Ltd. v. Williford*, No. 09-16-00095-CV, 2016 WL 4487883, at *4 (Tex. App.—Beaumont, Aug. 25, 2016, no pet.) (holding agreement incorporating AAA employment rules "clearly and unmistakably show[ed] that [the parties] intended to delegate gateway issues relating to the interpretation, applicability, or enforceability of the agreement to the arbitrator"). Other Texas courts have reached the same conclusion. *See, e.g.*, *Schlumberger Tech. Corp. v. Baker Hughes, Inc.*, 355 S.W.3d 791, 803 (Tex. App.—Houston [1st Dist.] 2011, no pet.) (holding incorporating AAA Rules meant that arbitrators, not court, had power to determine arbitrability of defense raised in arbitration); *Saxa Inc. v. DFD Architecture Inc.*, 312 S.W.3d 224, 230 (Tex. App.—Dallas 2010, pet. denied) ("When, as here, the parties agree to a broad arbitration clause and

explicitly incorporate rules that empower an arbitrator to decide issues of arbitrability, the incorporation serves as clear and unmistakable evidence of the parties' intent to delegate such issues to an arbitrator"); *In re Rio Grande Xarin II, Ltd.*, 2010 WL 2697145, at *8 (Tex. App.—Corpus Christi July 6, 2010, orig. proceeding) (concluding arbitrator had authority to decide arbitrability of dispute where agreement incorporated AAA Rules).

Once the trial court was presented with the HEA's arbitration provision, which included via the AAA Rules an agreement to submit the issue of the arbitrability of particular disputes to the arbitrator, it was error for the trial court to consider whether PASE's allegations fell within the scope of the arbitration provision. As a result, and in light of the presumption favoring arbitration, the trial court erred in denying Oxbow's motion to compel arbitration. *See Bell*, 2016 WL 4499093, at *5 ("We conclude that an arbitrator has the authority to decide the arbitrability of the disputes between the Bells and RAC. Accordingly, the trial court abused its discretion by denying RAC's motion to compel arbitration.").

II. The trial court erred by entering the Turnover Order appointing a receiver.

In addition to erroneously denying Oxbow's motion to compel arbitration, the trial court erred by entering the Turnover Order appointing a receiver for at least four independent reasons. First, the trial court lacked jurisdiction to enter a Turnover Order enforcing the 2015 Judgment because exclusive jurisdiction to

issue post-judgment orders rested with the 151st District Court of Harris County. Second, the Turnover Statute itself does not authorize the trial court to award *any* of the relief awarded in the Turnover Order. Third, the Turnover Order impermissibly imposes new obligations that are inconsistent with the 2015 Judgment. Finally, the Turnover Order violates the HEA's exclusive remedy provision.

A. The trial court had no jurisdiction to enter the Turnover Order.

As a threshold matter, the trial court erred in entering the Turnover Order appointing a receiver because the trial court lacked subject matter jurisdiction to enter any such order.[14] The Turnover Statute provides that "[a] judgment creditor is entitled to aid from a court of *appropriate jurisdiction* . . . ." TEX. CIV. PRAC. & REM. CODE ANN. §31.002(a) (emphasis added). Texas courts have interpreted this statutory language to mean that a court must have subject matter jurisdiction to enter a Turnover Order. *See In re Abira Med. Labs., LLC*, No. 14-17-00841-CV, 2018 WL 1004672, at *5 (Tex. App.—Houston [14th Dist.] Feb. 22, 2018, orig. proceeding) ("We conclude that turnover and receivership proceedings under

[14] Oxbow raised this issue in the trial court, both in its motion to transfer venue and during the hearing on that motion. CR 83-85; 2 RR 16-22. Regardless, it is well settled that subject matter jurisdiction cannot be waived, must be considered by this Court *sua sponte*, and can be raised for the first time on appeal. *E.g.*, *Tex. Ass'n of Bus. v. Tex. Air Control Bd.*, 852 S.W.2d 440, 470 (Tex. 1993); *see also Rusk State Hosp. v. Black*, 392 S.W.3d 88, 103 (Tex. 2012) (emphasis added) ("Subject matter jurisdiction cannot be waived or conferred by agreement, can be raised at any time, and must be considered by a court *sua sponte*.").

section 31.002 are required to be brought in a court, which has subject matter jurisdiction over the claims."). Nor can another court have exclusive jurisdiction over the matter. *See Cobb v. Thurmond*, 899 S.W.2d 18, 19-20 (Tex. App.—San Antonio, 1995, writ denied) ("We hold that the trial court was without authority to grant the turnover order because at the time it was entered this Court had acquired exclusive jurisdiction of the subject matter.").

It is well settled that the only court with subject matter jurisdiction to enforce a Texas judgment is the Texas court that rendered the judgment. *See, e.g.*, *Ex parte Gonzalez*, 238 S.W. 635, 636 (Tex. 1922) ("[T]he Forty-First district court had no jurisdiction to punish the relator as for contempt for acts in violation of the injunction issued by the Sixty-Fifth district court, committed prior to the transfer of the case."); *Spencer v. Spencer*, 371 S.W.2d 898, 899 (Tex. Civ. App.—San Antonio 1963, no writ) ("It is well settled that a court rendering judgment has exclusive jurisdiction for the purpose of enforcing its prior decree."). Likewise, "[d]isputes regarding the interpretation, meaning, and enforcement of a judgment rendered by a Texas trial court are resolved by the presiding judge of the trial court that rendered the judgment." *In re Akin Gump Strauss Hauer & Feld, LLP*, 252 S.W.3d 480, 490 (Tex. App.—Houston [14th Dist.] 2008 no pet.); *accord Woody K. Lesikar Special Trust v. Moon*, No. 14-10-00119-CV, 2011 WL 3447491, at *5 (Tex. App.—Houston [14th Dist.] Aug. 9, 2011, pet. denied). PASE argued below

that any court of "appropriate jurisdiction" may aid in satisfaction of a judgment, but the authorities PASE cited do not support that argument; rather, they stand for the unremarkable proposition that a trial court has inherent power to enforce *its own* judgments.[15]

Here, the only court with power to enforce its own Judgment is the 151st Judicial District Court of Harris County. Accordingly, the trial court lacked authority to enter a turnover order that purported to enforce that Judgment—particularly in light of the parties' disagreement over the effect of that Judgment. That power rests "exclusively" with the 151st District Court. Because the trial court lacked jurisdiction to enter the Turnover Order, that order is void and must be vacated. *See, e.g.*, *Jeter v. McGraw*, 218 S.W.3d 850, 853 (Tex. App.—Beaumont 2007, pet. denied) ("Lack of subject matter jurisdiction renders a judgment void rather than merely voidable.").

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[15] *See* CR 18 (citing TEX. GOV'T CODE ANN. § 21.001(a) ("A court has all powers necessary for the exercise of its jurisdiction and the enforcement of *its lawful orders* . . . .") (emphasis added); *Ex parte Gorena*, 595 S.W.2d 841, 843–44 (Tex. 1979) (habeas case appealing contempt order issued by court which issued the underlying judgment); *Arndt v. Farris*, 633 S.W.2d 497, 499 (Tex. 1982) (orig. proceeding) (court that issued judgment ordered defendant to attend post-judgment deposition); *Matz v. Bennion*, 961 S.W.2d 445, 452 (Tex. App.—Houston [1st Dist.] 1997, writ denied) (trial court that entered judgment on arbitration award entered order modifying date that sale of partnership property was to occur).

B. The Turnover Statute does not authorize the relief awarded in the Turnover Order

Even if the trial court had jurisdiction over this proceeding, the Turnover Order still would be subject to reversal because the Turnover Statute does not authorize appointment of a receiver to do what the receiver has been authorized to do here—oversee Oxbow's ongoing operations.

1. The Turnover Order appointing a receiver exceeded the trial court's authority under the Turnover Statute.

The Turnover Order exceeded the relief authorized by the Turnover Statute in two separate ways. First, the Turnover Order improperly disposed of a contested substantive dispute between the parties. As Texas courts have recognized, the Turnover Statute is not a proper vehicle for disposing of contested claims between the parties. *See, e.g.*, *Commerce Sav. Ass'n v. Welch*, 783 S.W.2d 668, 671 (Tex. App.—San Antonio 1989, no writ) (affirming denial of turnover relief, reasoning that "[b]ecause Commerce's requests for relief require an equitable exercise of judicial power and discretion, the trial court could refuse to allow Commerce Savings to employ the court's post-judgment power *for the purposes of unilaterally dismissing substantial contested and unliquidated claims between the parties*") (emphasis added). Instead, the Turnover Statute authorizes a trial court to do only three specific things:

> (1) order the judgment debtor to turn over nonexempt property that is in the debtor's possession or is

> subject to the debtor's control, together with all documents or records related to the property, to a designated sheriff or constable for execution;
>
> (2) otherwise apply the property to the satisfaction of the judgment; or
>
> (3) appoint a receiver with the authority to take possession of the nonexempt property, sell it, and pay the proceeds to the judgment creditor to the extent required to satisfy the judgment.

TEX. CIV. PRAC. & REM. CODE ANN. § 31.002(b) (emphasis added).

Consistent with the statute's language, this Court held in its mandamus ruling that "[t]he statute does not allow for a determination of the parties' substantive rights." CR 399. Instead, the Court instructed that the trial court could consider only three questions:

> The only questions before a trial court at a hearing on an application for turnover are: (1) whether the judgment creditor is entitled to turnover of nonexempt assets to obtain satisfaction of a judgment; (2) whether the judgment debtor is in possession of an asset that is not exempt from attachment, execution, or seizure for the satisfaction of liabilities under the judgment; and (3) whether the trial court should appoint a receiver with the authority to take possession of the nonexempt property, sell it, and pay the proceeds to the judgment creditor to the extent required to satisfy the judgment.

CR 400.

The trial court, however, ignored these instructions, and at PASE's urging, issued a Turnover Order that, among other things

- adjudicated the merits of Oxbow's contractual suspensions of waste heat delivery, holding "Oxbow's contentions do not justify shutting off delivery of waste heat to PASE . . ."; CR 427-29;
- determined that Oxbow engaged in "dispersion techniques to try to avoid SO_2 exceedance readings at the TCEQ monitor "; CR 428; and
- determined that the HEA, the Arbitration Award, and Judgment prohibited Oxbow from shutting off delivery of waste heat to PASE, and that "[i]f Oxbow has or believes it has an actual or potential pollution problem, Oxbow is required under the Judgment and Arbitration Award to address that problem." CR 430.

By addressing the merits of Oxbow's suspensions, commercial reasonableness, and prudent operating practices, the Turnover Order disposed of a contested dispute, in violation of Texas law. *See Welch*, 783 S.W.2d at 671; CR 399.

Second, the Turnover Order appointed a receiver with powers not authorized by the Turnover Statute. Although Section 31.002(b)(3) authorizes the appointment of a receiver, it makes clear that the receiver has authority to do only three things: (1) "take possession of the nonexempt property [of the debtor]," (2) "sell it," and (3) "pay the proceeds to the judgment creditor to the extent required to satisfy the judgment." TEX. CIV. PRAC. & REM. CODE ANN. § 31.002(b)(3). Yet the Turnover Order here appoints a receiver to do far more than take possession of and sell Oxbow's property. The Turnover Order:

- authorized the receiver to "[m]onitor [Oxbow]'s operations of Kiln Nos. 3, 4 and 5 to ensure that [Oxbow] is complying with this Order";
- ordered the receiver, "[i]n the event the Receiver determines that [Oxbow] is not delivering waste heat to PASE Boiler Nos. 3, 4, and 5

as required above," to "submit a report to the Court advising the Court of that determination so that the Court may consider further orders as necessary or appropriate";

- ordered the receiver to "[m]ake monthly accounts and reports to this Court, with copies to [Oxbow] and [PASE], as to the tonnage of calcined coke produced in each of [Oxbow's] Kiln Nos. 3, 4, and 5 and the volume of waste heat delivered to [PASE's] Boiler Nos. 3, 4, and 5;" and

- ordered Oxbow to "allow the Receiver to have full and unfettered access to the [Oxbow] plant and its operational personnel to perform the Receiver's duties and obligations under this Order."

CR 432. The plain language of the Turnover Statute does not authorize the trial court to appoint a receiver with such sweeping powers, nor has PASE cited any case in which a receiver was given such authority under the Turnover Statute.

Instead, PASE has contended that the language used in subsection (b)(2) of the Turnover Statute is broad and supports the Turnover Order. *See* Stay Resp. 23. But the few courts that have applied this subsection have construed it narrowly to apply to property or money that can be readily valued. *See Associated Ready Mix, Inc. v. Douglas*, 843 S.W.2d 758, 762 (Tex. App.—Waco 1992, no writ) ("We conclude that subsection (b)(2) of section 31.002 was designed to allow the court to dispense with the formality of a sale under execution or by a receiver when dealing with money or property whose value can be determined in the hearing on the turnover application. In such an event, the exact credit against the judgment can be determined in the turnover order and the property delivered directly to the

judgment creditor.") (citation omitted). This interpretation is consistent with the statutory canon of construction of *ejusdem generis*, "which provides that when words of a general nature are used in connection with the designation of particular objects or classes of persons or things, the meaning of the general words will be restricted to the particular designation." *Hilco Co-Op., Inc. v. Midlothian Butane Gas Co.,* 111 S.W.3d 75, 81 (Tex. 2003).

Because the Turnover Statute does not authorize the resolution of substantive disputes or the appointment of a receiver to do what the Turnover Order requires here, the Turnover Order must be vacated.

2. The trial court abused its discretion in entering the Turnover Order without any evidence that the order would allow PASE to recover its Judgment.

The trial court also abused its discretion by entering the Turnover Order without any competent evidence that the order would actually assist PASE in recovering its judgment. The Turnover Statute provides that "[a] judgment creditor is entitled to aid from a court of appropriate jurisdiction through injunction or other means in order to reach property *to obtain satisfaction on the judgment*." TEX. CIV. PRAC. & REM. CODE ANN. § 31.002(a) (emphasis added). From the language of the statute, it follows that to be proper, a turnover order must actually assist a judgment creditor in obtaining satisfaction on a judgment.

Ordinarily, this requirement is not at issue, because with a typical money judgment, recovering any property from the judgment debtor will aid "in obtaining satisfaction" on a judgment. Yet the 2015 Judgment incorporating the 2011 Arbitration Award, which the Turnover Order purports to enforce, is no ordinary money judgment—in fact, it is not a money judgment at all. Rather, the panel enforced the HEA's exclusive remedy provision by expressly declining to require Oxbow to make a direct payment to PASE and instead ruling that the $3.4 million award was "not a cash award requiring Oxbow to write PASE a check" but rather was to "be handled in accordance with the specific provisions of the [HEA] regarding the heat bank as an offset." CR 36.

During the Merits Hearing, the undisputed evidence from PASE's corporate representative established that (1) since October 2011, there have been no Heat Payments to Oxbow, (2) the heat bank has accumulated a negative balance of approximately $4 million that must be reversed before Oxbow would be entitled to any such payments, to which PASE could then apply the $3.4 million credit from the 2015 Judgment, and (3) the only way to offset the 2015 Judgment is for Oxbow to produce calcined coke over the Threshold Amount defined by the HEA. *See* 2 RR 181-82, 3 RR 144; 4 RR 20. When questioned, PASE's Ted Boriack opined about the minimum amount of calcined coke production from kilns 3, 4, and 5 and the gas prices that would be necessary for the heat bank to result in Heat Payments

to Oxbow that could be offset—namely, 27,515 tons per month of calcined coke production and gas prices as high as $5 and $8.[16] *See* 3 RR 141-42, 4 RR 49-50. At that level of production, and with those gas prices, the amount of Heat Payments generated to reduce the $4 million negative balance would be only approximately $90,000 per year. *See* 4 RR 49-51. Using that figure, it would take at least *44 years* to pay off the current $4 million heat bank deficit that must be paid off before a single dollar of Heat Payments can be made and withheld by PASE to satisfy the 2015 Judgment. Because the HEA is set to expire in 2023 (or in 2025 or 2026, as PASE contends), CR 106, 129; 2 RR 122-23; it would be *impossible* to pay off the $4 million heat bank deficit during the HEA's term.

Moreover, Mr. Boriack's testimony showed that his Heat Payment opinions were generous at best:

- Oxbow's production of calcined petroleum coke from kilns 3, 4, and 5 has averaged approximately 26,000 tons per month for the past 10 years—below Mr. Boriack's 27,515 assumption and well below the 43,675 Threshold Amount required for the heat bank to remain balanced. *See* 4 RR 62-63.
- Gas future prices are estimated to be between $2.50 and $3.00—nowhere near $5 or $8. *See* 6 RR Ex. 79.

[16] Since 2015, gas prices have consistently been in the $2-3 range, with a low of $1.73 and a high of $3.87—far below the $5 and $8 assumptions by Mr. Boriack. *See* 6 RR Ex. 27. Similarly, future gas prices through the end of the HEA's term in 2023 are expected to remain in the $2-3 range. *See* 6 RR Ex. 79.

- Mr. Boriack's calculations did not take into account the $4 million negative balance in the heat bank that must be eliminated before the 2015 Judgment can be recovered. 4 RR 40-41, 49-50, 94.
- Mr. Boriack admitted he could not make a complete model of the heat bank accounting for the separate $4 million heat bank deficit. 4 RR 94.
- Mr. Boriack refused to perform calculations ordered by the Court as to the heat bank calculation and model. *See* 4 RR 45-46, 58-59.
- When asked by the trial court directly, Mr. Boriack was unable to explain how long it would take to pay off the $4 million heat bank deficit. 4 RR 90.

Because PASE offered no competent evidence establishing that the Turnover Order would actually assist PASE in "obtaining satisfaction on the judgment"—the threshold issue under the Turnover Statute—the trial court abused its discretion in entering *any* turnover order, including the Turnover Order appointing a receiver. *See Black v. Shor*, 443 S.W.3d 170, 181 (Tex. App.—Corpus Christi 2013, no pet.) ("[T]he trial court abused its discretion in granting turnover relief in the absence of evidence supporting the statutory requirements."); *Beaumont Bank*, 806 S.W.2d at 226 ("Whether there was no evidence to support the turnover award would, of course, be a relevant consideration in determining if the trial court abused its discretionary authority in issuing the order.").

PASE's "calculations" regarding the $4 million deficit in the heat bank and the impossibility of any payment to reduce the 2015 Judgment show that this proceeding was never about collecting the 2015 Judgment. Instead, it was an end-

run around the arbitration provision, designed to force Oxbow to end the contractual suspensions without giving an arbitral panel a chance to rule that the HEA authorized the suspensions. *See* 3 RR 116 ("It wasn't until [Oxbow] started terminating [PASE's] boilers [in 2017 and 2018] when we realized we were going to have to seek injunctive relief; we're going to have to get help from the Court."). The trial court erred by granting the Turnover Order in light of these realities and the evidence presented by PASE.

C. The trial court erred in granting the Turnover Order when the underlying Award and Judgment expressly denied PASE less onerous relief than that awarded in the Turnover Order.

Even if the Turnover Statute authorized the relief awarded, the Turnover Order still must be vacated because it awards relief that goes beyond what was granted in the underlying Award and Judgment. In fact, both denied less onerous relief than PASE received from the trial court.

As PASE concedes, the trial court does not have the authority to change the HEA, the 2011 Arbitration Award, or the 2015 Judgment. *See* CR 18; *see also Matz v. Bennion*, 961 S.W.2d 445, 452 (Tex. App.—Houston [1st Dist.] 1997, writ denied) ("[E]nforcement orders may not be inconsistent with the original judgment and must not constitute a *material change in substantial adjudicated portions of the judgment[.]*") (emphasis in original); *Miga v. Jensen*, No. 02-11-00074-CV, 2012 WL 745329, at *9 (Tex. App.—Fort Worth Mar. 8, 2012, orig. proceeding)

("An order that does materially change the judgment is void."). Instead, like other post-judgment enforcement orders, turnover orders must be consistent with the final judgment they enforce. *Gillet v. ZUPT, LLC*, 523 S.W.3d 749, 758 (Tex. App.—Houston [14th Dist.] 2017, no pet.). Moreover, the trial court does not have the power to impose obligations in addition to those reflected in the Arbitration Award or to "create or impose liability in a manner in which the original judgment had not." *See Custom Corps., Inc. v. Sec. Storage, Inc.*, 207 S.W.3d 835, 839-40 (Tex. App.—Houston [14th Dist.] 2006, no pet.) ("Although the trial court had the inherent power to enforce its earlier judgment, it had no power to issue an order inconsistent with that judgment or to impose obligations in addition to those reflected in the 2001 judgment.").

Here, the trial court's Turnover Order appointing a receiver goes far beyond what PASE received in the Arbitration Award and Judgment. As explained above, *see supra* p.16, in the 2010-2011 arbitration, PASE requested both declaratory and injunctive relief in the form of PASE's "proposed Joint Operating Practices as a remedy for Oxbow's bad faith and to ensure that Oxbow complies with the HEA in good faith going forward." 6 RR Ex. 3 at 39. In the Arbitration Award, however, the panel expressly denied PASE's good faith and fair dealing counterclaim and denied declaratory or injunctive relief—all of which is memorialized in Judge Engelhart's 2015 Judgment. *See* CR 35-36; 2 RR 202-05. As PASE argued in

support of its motion to confirm the Arbitration Award, "the Panel was careful not to go beyond its authority, as demonstrated *by its refusal to grant declaratory relief to either Oxbow or PASE because it found such relief improper under the [HEA]*." 6 RR Ex. 6 at 48 (emphasis added). This shows that the panel *never* ordered Oxbow to deliver waste heat in the future, nor did it take away Oxbow's contractual right to suspend, yet the Turnover Order does both of those things and appoints a receiver to make sure they happen.

Further, as PASE's corporate representative Mr. Deyoe conceded, the injunction PASE sought in this proceeding was more burdensome than the relief PASE sought (and was expressly denied) in arbitration:

> Q. Which is a bigger intrusion on Oxbow's business, the joint operating practices [sought by PASE in the arbitration] or an injunction [sought by PASE in this proceeding] telling them they've got to go out of the cold stacks?
>
> A. I'm quite certain it would be the injunction.

2 RR 211:17-21. Ignoring the limited relief awarded in the Arbitration Award, PASE asked the Jefferson County trial court to greatly expand that relief beyond anything awarded by the panel. The trial court acquiesced, entering the Turnover Order directing Oxbow to discharge waste heat through the cold stacks. CR 430-31. The trial court then compounded that error by appointing a receiver to monitor

Oxbow's compliance with that directive. CR 431-32. Such material changes to the 2015 Judgment render the Turnover Order *void*.

D. PASE waived any right to turnover relief in the HEA.

Finally, the trial court erred in entering the Turnover Order because the appointment of a receiver violates the HEA's terms. The HEA's exclusive remedy provision unambiguously states that PASE's *sole* means of recovery from Oxbow—"whether pursuant to an arbitral award . . . or pursuant to any judgment, sanction, penalty, other award or otherwise"—is to withhold amounts otherwise due to Oxbow from the heat bank. CR 138 (HEA §13.6) (emphasis added); *see also supra* pp.8-9. As PASE acknowledged, the heat bank is its sole remedy even if Oxbow's balance in the heat bank is negative, meaning no credit exists from which PASE could recover. *See* 2 RR 215. Neither the exclusive remedy provision nor any of the HEA's other provisions authorizes the appointment of a receiver, much less allows Oxbow to be forced to pay the receiver's fees and expenses. *See* CR 138-40, 432.

The HEA's arbitration provision further confirms that the HEA does not authorize appointment of a receiver. It expressly precludes the parties from "seek[ing] recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision." CR 140. And it narrows the parties' right to seek injunctive relief to two situations—(1) to compel arbitration of a dispute, or

(2) to enforce the HEA's confidentiality provision—neither of which applies here. CR 140.

By nevertheless seeking appointment of a receiver in the trial court, PASE did exactly what the HEA prohibits. And by appointing a receiver in the Turnover Order and requiring Oxbow to pay the receiver's fees and expenses, the trial court contravened and impermissibly added terms to the parties' agreement. *See, e.g.*, *In re Allstate Vehicle & Prop. Ins. Co.*, 542 S.W.3d 815, 820 (Tex. App.—Beaumont 2018, no pet.) ("[C]ourts cannot make new contracts between the parties, but must enforce the contracts as written."); *Fid. & Deposit Co.*, 607 S.W.2d at 24 ("[I]t is well established that parties having agreed upon the measure of damages for breach of their contract are accordingly bound."). These violations also require that Turnover Order be vacated.

CONCLUSION

For these reasons, Oxbow respectfully requests that the Court vacate the Turnover Order, vacate the trial court's September 12, 2018 order denying Oxbow's motion to compel arbitration, and render judgment compelling PASE to arbitrate its dispute with Oxbow. In the alternative, Oxbow requests that this Court vacate the Turnover Order and render judgment in favor of Oxbow. Oxbow also prays for such further relief to which it may justly be entitled.

Respectfully submitted,

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This brief complies with the type-volume limitations of Rule 9.4 as it contains 14,938 words, excluding the parts of the brief exempted by Rule 9.4(i)(1).

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IN THE COURT OF APPEALS
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BEAUMONT, TEXAS

OXBOW CALCINING LLC
Appellant,
v.

PORT ARTHUR STEAM ENERGY, L.P.
Appellee

On Appeal from the 172nd Judicial District Court, Jefferson County, Texas
Cause No. E-201894
The Honorable Donald J. Floyd presiding

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STATEMENT OF THE CASE

Appellee, Port Arthur Steam Energy, L.P. ("PASE"), disagrees with certain characterizations of the Nature of the Case and the Course of Proceedings in the Statement of the Case authored by Appellant Oxbow Calcining LLC ("Oxbow") and desires to address those mischaracterizations.

Oxbow filed an accelerated Interlocutory Appeal from (1) an Order Denying Oxbow's Motion to Compel Arbitration and (2) an Order Granting Post-Judgment Turnover Relief (the "Turnover Order") that entered a post-judgment injunction to assist PASE, a judgment creditor, with collecting its Final Judgment against Oxbow. The Turnover Order also appointed a receiver to monitor Oxbow's compliance with the Order and to make certain reports to the court relating to Oxbow's compliance.

Contrary to Oxbow's description of the Course of Proceedings, PASE did not "sue" Oxbow for "purportedly violating the parties' 2005 Heat Energy Agreement ("HEA") or to recoup "contractual credits under the HEA." PASE sought relief under Section 31.002(a) Tex. Civ. Prac. & Rem. Code Ann. (the "Turnover Statute") by filing a Petition and Application for Post-Judgment Enforcement Orders (the "Application") in Jefferson County. Texas. PASE's Application was assigned to the Honorable Donald J. Floyd in the 172nd District Court in Jefferson County. PASE was not "claiming to be a judgment creditor," but is, in fact, a judgment creditor who

sought orders from the District Court to assist it with collecting the Final Judgment that it obtained against Oxbow on January 8, 2015 (the "Final Judgment" or "Judgment") which, after appeal, confirmed an Arbitration Award entered by a three person panel in favor of PASE on December 9, 2011. In the Award, incorporated into the Judgment, PASE received damages of $3,409,781.57 against Oxbow, with interest, none of which has been recovered by PASE.

The Turnover Order does not "mandate how Oxbow operates its plant," but, instead, enjoins Oxbow from diverting or limiting waste heat that Oxbow delivers to PASE's steam generation plant when Oxbow operates its connected kilns so that PASE can collect the Judgment in the manner provided therein. A receiver was not appointed in the Turnover Order "to monitor Oxbow's operations" generally, but was appointed "to ensure that Oxbow Calcining LLC is complying with this Order." For these reasons, PASE objects to certain "facts" set forth in Oxbow's Statement of the Case and clarifies the misstatements as set forth herein.

STATEMENT REGARDING ORAL ARGUMENT

PASE agrees with Oxbow's Request for Oral Argument based upon the procedural and substantive complexities presented.

ISSUES PRESENTED

ISSUE ONE

Did the District Court err by not compelling a second arbitration to allow Oxbow to dispute the mechanism by which PASE would be permitted to collect its Judgment?

ISSUE TWO

Did the District Court err by not ruling that PASE's Application for Turnover Statute Orders was a new "dispute" requiring a second arbitration

ISSUE THREE

Did the District Court err by refusing to compel PASE to go to a second arbitration to enforce the Judgment that it obtained which confirmed the Arbitration Award and provided, "This Order and Final Judgment renders the Award (the Arbitration Award) incorporated herewith enforceable in the same manner as any other judgment or decree of the Court?"

ISSUE FOUR

Did the District Court err by enforcing the Texas Turnover Statute as written when the Court entered an Order Granting Post-Judgment Turnover Relief that appointed a receiver to monitor compliance with injunctive relief granted to assist PASE with collecting its Judgment?

ISSUE FIVE

Did the District Court err in determining that the Court had jurisdiction to grant the Turnover Order when the Turnover Statute allows a court of competent jurisdiction to aid a judgment creditor in the enforcement of its judgment?

PASE'S RESPONSE TO OXBOW'S "INTRODUCTION"

Oxbow's "introduction" is nothing more than an invitation for this Court to enter Oxbow's world where a 2015 Judgment (now worth more than $5 million) counts for nothing but a mere pretext to avoid a second arbitration. PASE disputes every sentence in Oxbow's Introduction which does not accurately describe the post-Judgment relief actually sought and obtained by PASE under the Turnover Statute.

Oxbow argues that the attempt by PASE to collect its Judgment "is not the reality." Oxbow ignores that the Judgment expressly states that it can be enforced in the same manner as any other Texas judgment. PASE's Judgment anticipates the use of writs and other judgment enforcement mechanisms, including a turnover order. The reality is that PASE has an unsatisfied Judgment and the property that is the subject of the Turnover Order is not exempt.

Without calling a single witness to testify, Oxbow's counsel engaged in a strategy of misleading arguments and delay tactics, in the District Court and in this Court of Appeals, to try to prevent PASE from recovering its Judgment. Oxbow's strategy is to force PASE out of business so that PASE can never recover its Judgment against Oxbow in the manner contemplated in that Judgment.[1]

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[1] Oxbow shut PASE down on June 25, 2018. PASE is losing $723,456.00 per month net of operating expenses. 2 SUPP RR 30. PASE is spending $12,000.00 per day in labor and other expenses for a non-operational plant to try to remain viable to implement the Turnover Order. 2

In its Introduction and throughout its Brief, Oxbow mischaracterizes the evidence and the relief requested and received by PASE[2]. Oxbow even resorts several times to citing "facts" from affidavits not in evidence from "witnesses," including Oxbow's own counsel, who did not testify. The Honorable Donald F. Floyd saw through Oxbow's strategy when he entered the Order Granting Post-Judgment Turnover Relief (the "Turnover Order").

When considering Oxbow's Introduction, this Court should note that Oxbow completely ignores or only makes cursory mention of the fact that: (1) PASE has a Judgment valued at $5 million dollars that Oxbow has prevented PASE from recovering; (2) Oxbow's Application only requested post-Judgment relief under the Turnover Statute to allow it to recover its Judgment in the manner prescribed therein; (3) PASE did not assert any new claims or causes of action, or seek to recover new damages, in the post-Judgment proceeding; and (4) the relief granted by Judge Floyd in the Turnover Order will assist PASE with collecting its Judgment in the manner intended in that Judgment, nothing more.

SUPP RR 37. The plant is deteriorating and PASE is on the verge of losing all necessary employees and contracts necessary for it to remain in business. 2 SUPP RR 37-42. If PASE is forced out of business, it will not be possible for PASE to collect its Judgment through the relief granted in the Turnover Order and PASE's $62 million plant will become essentially worthless. 2 RR 116.

[2] The word limitations to this Brief prevents PASE from addressing all of the inaccuracies set forth in Oxbow's Introduction and Statement of Facts; however, PASE addresses some of the more significant mischaracterizations in Response Point III.

Oxbow's arguments are not supported by the facts or law, and Oxbow's tactics should not be rewarded. This Honorable Court should affirm the Turnover Order in all respects.

STATEMENT OF FACTS

I. Overview of Oxbow's calcining plant, PASE'S steam plant, and the Heat Energy Agreement.

PASE owns and operates a steam plant that is connected to Oxbow's petroleum coke calcining plant in Port Arthur, Texas. CR 9. Pursuant to a Heat Energy Agreement ("HEA") executed in 2005 between PASE and Oxbow's predecessor-in-interest, Great Lakes Carbon, Oxbow supplies waste heat (sometimes referred to as flue gas energy) to PASE that PASE uses to generate and deliver steam which is sold to an end user, Valero Port Arthur Refinery. Oxbow operates four kilns that it identifies as Kiln Nos. 2, 3, 4, and 5. Kiln Nos. 3, 4, and 5 are connected to PASE's steam plant and deliver waste heat to PASE's Boiler Nos. 3, 4, and 5. CR 10. PASE's plant is a "green" energy facility that has no adverse impact on the environment. CR 10.

Producing steam cools Oxbow's waste heat from 2,000 degrees to approximately 400 degrees. The waste heat is discharged through three "cold stacks" at the facility. Although the HEA requires Oxbow to use prompt, substantial and persistent efforts as commercially reasonable to maximize the production and delivery of waste heat to PASE (CR 18, 38; Exh. 9 §5.1), if Oxbow desires to circumvent PASE and disregard its obligations under the HEA, Oxbow can release

its waste heat directly from its kilns through "hot stacks" and bypass PASE's steam plant altogether. In other words, Oxbow has the ability to manipulate its dampers to curtail or completely shut off waste heat to PASE. CR 10.

While Oxbow's duties under the HEA to maximize the delivery of waste heat to PASE are subject to a "Commercially Reasonable" condition set forth in Section 5.1 of the HEA and Section 3.3 requires both parties to operate and maintain their respective facilities in accordance with "Prudent Operating Practice" to comply with all applicable Laws and Permits, Oxbow's obligation to control pollution at these interrelated plants is unconditional. Oxbow's duty to control pollution is not subject to "Commercially Reasonable" or "Prudent Operating Practice" considerations or limitations. CR 18, 24, 37; Exh. 9 §4.2. Section 4.2 of the HEA provides that "[Oxbow] shall be solely responsible for all calcining flue gases emanating from the operation of its Kiln Systems 3, 4, and 5 up to the Flue Gas Points of Delivery for hot flue gas, and then beyond the Flue Gas Points of Delivery for cold flue gas. CR Exh. 9 §4.2.

II. PASE prevailed on its Counterclaim in arbitration and the Award was confirmed in a Judgment; Oxbow has sole duty to control pollution.

Despite the clear language of the HEA, Oxbow sued PASE in 2010 in arbitration to try to make PASE pay approximately $12 million for a "Baghouse Pollution Control System" that Oxbow purchased between 2010 and 2011 to control pollution from Oxbow's calcining processes. 5 RR Exh. 11, p. 301. Oxbow lost that claim. The Arbitration Panel ruled that Oxbow was solely responsible for pollution control. 5 RR Exh. 11, p. 303, 306-07.

In relevant part, the Award states, "Additionally, we find that Oxbow, which is contractually and legally responsible for complying with its air permits, bears the risk of installing and maintaining pollution control equipment that will ensure the Plant's operation in accordance with Oxbow's air permits and any other applicable environmental laws." 5 RR Exh. 11, p. 303. In its Award, the Panel defined the "Plant" as constituting *both* the Steam Plant and the "Calciner" (the defined term for Oxbow's coke calcining plant). 5 RR Exh. 11, p. 299. Oxbow's duties and obligations relating to pollution control under the HEA were fully litigated and determined in the Judgment. The Panel declared "the Heat Agreement does not obligate PASE…(ii) to install or maintain additional pollution control equipment for the benefit of Oxbow now or in the future; or (iii) to ensure that any emissions from the hot stacks or the cold stacks comply with any applicable environmental laws or permits now or in the future. 5 RR Exh. 11, p. 303.

Oxbow also claimed in arbitration that an MgO/multiclone system that PASE installed during the steam plant refurbishment failed to properly control pollution. 5 RR Exh. 11, p. 301. The Panel decided otherwise. 5 RR Exh. 11, p. 303. On page 5 of the Award, the Panel wrote:

> The preponderance of the evidence showed that the MgO/multiclone system performed its intended purpose and removed millions of pounds of particulate... We concluded from Jim McKenzie's testimony that [Oxbow] gave up on inserting a specific standard for the amount of pollution control to be achieved; in exchange for getting the control right to shut everything down if there was a pollution problem. 5 RR Exh. 11, p. 303.

The Panel also ruled in favor of PASE on PASE's counterclaim. The Panel found "that Oxbow has breached Section 5.1 of the Heat Agreement, which requires it to 'use Commercially Reasonable Efforts to maximize the production and delivery of Flue Gas Energy' to PASE." 5 RR Exh. 11, p. 305. The Panel also found that Oxbow "breached Section 3.3 of the Heat Agreement, which requires it to operate and maintain its facility 'in accordance with Prudent Operating Practice to comply with all applicable Laws and Permits, and within the design parameters and limits of the applicable materials, equipment and construction.'" 5 RR Exh. 11, p. 305.

The arbitration occurred in August of 2011 and PASE was awarded $4,515,056.00 in direct damages for lost revenue caused by Oxbow's breaches of the HEA. 5 RR Exh. 11, p. 306. An offset was applied for the cost of repairing the

cold stacks which the Panel determined were not properly installed initially and for PASE's ten percent share of certain ad valorem taxes. 5 RR Exh. 11, p. 307.

Commenting on the evidence that supported PASE's counterclaim for breach of the HEA, the Panel wrote:

> The evidence, including evidence from Oxbow's current and former employees and consultants, establishes that Oxbow employed substandard operational and maintenance practices that fail to conform to the requisite performance standards of the Heat Agreement. Specifically, Oxbow routinely has had uncontrolled openings in its pyroscrubber, inadequate instrumentation inside the pyroscrubber, leakage in damper seals, improper insulation in the pyroscrubber, and improper fan controls. The evidence of poor operations and maintenance was not only credible, it was overwhelming. Moreover, the evidence establishes that Oxbow fostered a culture that repeatedly interrupted or reduced delivery of maximum Flue Gas Energy to PASE. All of these factors contributed to PASE's decreased steam revenue. 5 RR Exh. 11, p. 305, 06.

The Panel then made findings regarding the lack of credibility of Oxbow's position in arbitration stating:

> Oxbow contends that it would be illogical for Oxbow act in such a way as to reduce its own revenue stream. PASE argued that Oxbow had a long term plan to acquire PASE's assets, and take all of the revenue for itself. PASE argues that Oxbow was willing to suffer some short term pain for long term gain. PASE presented some credible evidence to support this. 5 RR Exh. 11, p. 306.

The Panel awarded net damages to PASE of $3,409,781.57, plus interest. 5 RR Exh. 11, p. 307. The Arbitration Award states "This is not a cash award requiring

Oxbow to write PASE a check. It has to be handled in accordance with the specific provisions of the Heat Agreement regarding the heat bank as an offset." 5 RR Exh. 11, p. 307. Thus, PASE was to collect its Judgment from continued operation of PASE's steam plant which is connected to, and completely reliant upon, receipt of waste heat from Oxbow. 5 RR Exh. 11, p. 307. The Heat Bank/Heat Payment formula referenced in the Award is governed by Section 6.1 of the HEA. 5 RR Exh. 9, p. 40.

The Arbitration Award was signed on December 11, 2011. After appeal, a Judgment was confirmed and entered in favor of PASE on January 8, 2015. 5 RR Exh. 11, p. 297. The Order and Judgment confirming the Award provide that the Judgment is "enforceable in the same manner as any other judgment or decree." 5 RR Exh. 11, p. 297.

III. PASE'S Turnover Statute Application and the Court's Turnover Order; Oxbow's pollution control duties were established in the Award and Judgment.

After the Judgment, rather than operate to maximize the delivery of waste heat to PASE so that PASE could satisfy its Judgment, Oxbow began intermittently diverting waste heat from Kiln Nos. 3, 4, and 5 directly into the atmosphere through

Oxbow's hot stacks.[3] 2 RR 143-48. In 2017 and 2018, Oxbow began shutting down all waste heat delivery to PASE Boiler Nos. 3 and 4. 2 RR 143-48. Having collected nothing on its Judgment, PASE filed its Petition and Application for Post-Judgment Enforcement Orders (the "Application") asking the District Court to enjoin Oxbow from diverting waste heat through its hot stacks so that PASE could recover its Judgment in the manner contemplated under the Judgment by offsetting the 30% steam revenues otherwise payable to Oxbow through a Heat Bank formula provided in the HEA. 3 RR 117; 5 RR Exh. 9, p. 308. Shortly after learning of PASE's Application, Oxbow notified PASE that it was terminating delivery of waste heat to PASE's only boiler still receiving waste heat, Boiler No. 5, which forced PASE to completely shut down on June 25, 2018. 2 RR 152-53.

Following this Court's denial of Oxbow's Petition for Writ of Mandamus, Judge Floyd considered Oxbow's Motion to Transfer Venue, Motion to Compel Arbitration, and, finally, PASE's Post-Judgment Application on August 21, 28, and

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[3] Not coincidentally, Oxbow's actions coincided with a three year monitoring program implemented by the Texas Commission on Environmental Quality ("TCEQ") that began in 2017 whereby the TCEQ is monitoring SO_2 emissions near Oxbow's plant to determine whether Jefferson County is in "attainment" or "non-attainment" under the One Hour National Ambient Air Quality Standard ("NAAQS") for SO_2 in the atmosphere. The evidence was uncontroverted that the SO_2 monitor was placed based upon discharge of waste heat from Oxbow's "cold stacks" after the waste heat passed through PASE's steam generation facility. 2 RR 148-51; 3 RR 42-45. The evidence was also uncontroverted that Oxbow was using real time wind direction data to close its dampers to deliver waste heat to PASE, discharging that waste heat, instead, through Oxbow's hot stacks into the atmosphere to avoid the monitor. 3 RR 165-172. Though not dispositive to Judge Floyd's Order, the Offer of Proof from two experts gave further context regarding Oxbow's SO_2 emissions and how Oxbow plans to avoid detection by the TCEQ monitor. 4 RR 123-158; 1 SUPP RR Exh. 25, 26.

29, 2018. On September 12, 2018, Judge Floyd signed the Turnover Order after signing Orders denying Oxbow's Motion to Transfer to Venue and Oxbow's Motion to Compel Arbitration. CR 422, 421, 434.

The Turnover Order enforced the Judgment which incorporated the Arbitration Award. The District Court concluded that the Arbitration Award determined that it was Oxbow's responsibility to control pollution and established that Oxbow is required to purchase and maintain pollution control equipment to ensure the continued operation of Oxbow's and PASE's connected facilities. CR 429-30. The Turnover Order provides:

> The Arbitration Award is clear: Oxbow's duties and obligations under the Heat Agreement were determined for the "Plant" and those duties included bearing the risk of installing and maintaining pollution control equipment that will *ensure* the Plant's operation [i.e., Oxbow's operation *and* PASE's operation] in accordance with Oxbow's air permits and any other applicable environmental laws. If Oxbow has or believes that it has an actual or potential pollution problem, Oxbow is required under the Judgment and Arbitration Award to address the problem. That has already been judicially determined. Shutting off the delivery of waste heat to PASE's boilers and keeping PASE from operating, selling steam, and generating Heat Payments that may be offset by PASE to collect its Judgment are not actions consistent with the terms of the Arbitration Award and Judgment, particularly when Oxbow continues to operate all of its kilns. CR 430.

The Turnover Order includes a discussion of the underlying facts and the operative statute, Section 31.002 Tex. Civ. Prac. & Rem. Code Ann. (the "Turnover Statute"). Judge Floyd concluded that the evidence established each element for

relief under the Turnover Statute: (1) PASE had a Final Judgment against Oxbow; (2) PASE has not been able to collect any of the Judgment; (3) Oxbow owns and controls property that is not exempt from attachment, execution, or seizure for the satisfaction of liabilities: its coke calcining plant located in Jefferson County, Texas (the "Calciner Facility"), and, in particular, the waste heat generated by the Calciner Facility that is to be delivered by Oxbow to PASE to be used to satisfy the Judgment; and (4) PASE was entitled to aid from the Court through injunction or other means in order to reach property to obtain satisfaction on the judgment. CR 423.

The Turnover Order also states, "The Court finds that it is proper and appropriate to aid PASE in the collection of its Judgment to ensure that the property owned and controlled by Oxbow, the waste heat asset generated from Oxbow's Kiln Nos. 3, 4, and 5, be applied in such a way that will allow PASE to recover its Judgment by receiving the asset, the waste heat, that Oxbow is to deliver to PASE's Boiler Nos. 3, 4, and 5." CR 430. Judge Floyd entered a post-judgment injunction to prevent Oxbow from diverting or limiting the waste heat that it was to deliver to PASE, and appointed Pat Zummo as a receiver with narrow duties to monitor Oxbow's compliance with the injunction and to submit periodic reports. CR 431-32.

The receiver appointed by Judge Floyd has a very limited function and the injunctive relief was very specific: Oxbow cannot discharge its waste heat through

its hot stacks and circumvent PASE's steam plant except under emergent circumstances or for maintenance, and the receiver shall monitor Oxbow's compliance. CR 432. Contrary to Oxbow's characterization, the Turnover Order does *not* require Oxbow to operate any particular kilns, to produce any specific tonnage or quality of calcined coke, to deliver any minimum quantity of waste heat to PASE, or to operate any of its kilns at all. It merely provides that if Oxbow chooses to operate its Kiln Nos. 3, 4, or 5, it must deliver waste heat from those operations to PASE which PASE will then use to generate steam revenues, eliminate the Heat Bank deficit, and recover its Judgment through offsets of Heat Payments that PASE would otherwise have to make to Oxbow under the HEA, as confirmed by the Arbitration Award and Judgment. CR 430-31. When the Judgment is recovered, the Court is to be advised so that that post-Judgment injunction can be terminated. CR 433.

IV. Judge Floyd found Oxbow's pollution-related "defense" to PASE's Turnover proceeding to be unpersuasive.

During the hearing, Oxbow made arguments through its counsel in support of a pollution control "defense;" however, no sworn testimony was offered by any Oxbow witness. Oxbow's counsel argued that Oxbow's decision to incrementally curtail, and finally terminate, the delivery of waste heat to PASE was due to Oxbow's SO_2 pollution concerns and supposed desire to avoid liability under the

One Hour NAAQS SO_2 standard. 2 RR 51-54, 75-76, 186-193. However, there was no evidence of any TCEQ enforcement action against Oxbow and no testimony of any action brought or imminent by Jefferson County as Oxbow's counsel suggested. To the contrary, the evidence established that Oxbow's SO_2 emission was not an agenda item at any Jefferson County Commissioner's Court meeting. 5 RR Exh. 24, p. 328-401.

Judge Floyd did not find Oxbow's arguments to be credible or persuasive in the Order:

> Relying upon various letters and communications introduced into evidence, Oxbow's counsel argued that Oxbow indefinitely suspended delivery of waste heat to PASE because of SO_2 pollution concerns involving the TCEQ's SO_2 monitor. Oxbow's position, expressed through letters the Court received into evidence and through the argument of its counsel, was that Oxbow faces a greater likelihood of registering an exceedance of SO_2 at the monitor and facing possible governmental or regulatory action at some point in the future if waste heat is delivered to PASE and then discharged through the Cold Stacks. Oxbow's counsel argued that if Oxbow only uses its Hot Stacks and does not deliver waste heat to PASE, Oxbow can avoid registering exceedances at the monitor and can keep Jefferson County in "attainment" under the NAAQS SO_2 standard.
>
> The Court does not find the explanations and suggested extrapolations of admitted evidence offered by Oxbow's counsel to be persuasive and, in any event, such arguments cannot overcome the language of the Arbitration Award and Judgment, or PASE's clear and convincing evidence on the matters herein. Oxbow produced no witness to testify at the hearing on any matters. Thus, no testimony was received during the hearing in support of Oxbow's contentions and the Court received no test data, SO_2 emission modeling, test results, or expert testimony of

> any kind from Oxbow to support Oxbow's contentions. It is clear that Oxbow's actions of shutting off delivery of waste heat to PASE's three boilers has forced PASE out of operation and, if allowed to continue, will keep PASE from ever being able to recover its Judgment. Notably, there was no evidence presented of Oxbow taking or planning to take any corrective actions to control SO_2 pollution and restore the delivery of waste heat to PASE. Moreover, Oxbow produced no evidence of litigation or any governmental or regulatory action being pending or imminent against Oxbow for its SO_2 emissions, and Oxbow produced no evidence that it received notice from the TCEQ, the Environmental Protection Agency, or any governmental authority that it was in violation of any presently existing law relating to SO_2 emissions. CR 427-28.

It was uncontroverted that the volume of SO_2 emissions by Oxbow was the same whether it discharged waste heat through its hot stacks or the cold stacks. CR 425; 2 RR 120; 3 RR 122-23. Oxbow's motivations and intentions were also addressed in the Order:

> The Court concludes that Oxbow intends to continue to try to avoid SO_2 exceedance readings at the TCEQ monitor for the balance of the three-year monitoring program by discharging its flue gas exclusively through its Hot Stacks. It necessarily follows that if PASE remains out of business, it will never collect its Judgment. Meanwhile, Oxbow's intentions are clear: Oxbow intends to remain in business, operate its four kilns at any level it chooses by discharging flue gas through its Hot Stacks, avoid having to purchase or maintain pollution control equipment to control SO_2 emissions, and keep PASE from generating steam revenues to have Heat Payments that PASE can offset to collect its Judgment. CR 428.

STANDARD OF REVIEW

The entry of the Turnover Order is subject to review under an abuse of discretion standard. The issuance of a Turnover Order, even if predicated on an erroneous conclusion of law, will not be reversed for abuse of discretion if the judgment is sustainable for any reason. *Beaumont Bank, N.A. v. Buller,* 806 S.W. 2d 223, 226 (Tex. 1991); *Holland v. Alker*, No. 01-05-00666-CV, 2006 Tex. App. LEXIS 3125 (Tex. App. Houston 1st Dist. April 20, 2006). Under the abuse of discretion standard, the court below can only be reversed for acting in an unreasonable or arbitrary manner. *See Downer v. Aquamarine Operators, Inc.,* 701 S.W. 2d 238 (Tex. 1985).

A court presented with a motion to compel arbitration must first determine whether a dispute exists that falls within the scope of the arbitration agreement. *See, G.T. Leach Builders, LLC v. Sapphire V.P., L.P.,* 458 S.W. 3d 502, 519-20 (Tex. 2015); *Venture Cotton Coop. v. Freeman,* 435 S.W. 3d 222, 227 (Tex. 2014). As stated by the Texas Supreme Court, "We review a trial court's order denying a motion to compel arbitration for abuse of discretion. *Henry v. Cash Biz, LP,* 551 S.W. 3d 111, 115 (Tex. 2018) (citing *In Re Labatt Food Serv., L.P.,* 279 S.W. 3d 640, 642-43 (Tex. 2009). The *Henry* Court stated, "We defer to the trial court's factual determinations if they are supported by evidence, but review its legal determinations *de novo*." *Id.* A "clear failure by the trial court to analyze or apply

the law correctly will constitute an abuse of discretion." *Walker v. Packer*, 827 S.W. 2d 833, 840 (Tex. 1992).

The starting point for determining Oxbow's Motion to Compel Arbitration is to determine whether PASE pled the basis for a "dispute," i.e. whether PASE asserted any claims or causes of actions that would invoke the arbitration provision in the HEA. None of the authorities cited by Oxbow in its Standard of Review discussion involved a post-Judgment Turnover Order proceeding. To the contrary, every case cited by Oxbow involved a lawsuit where the plaintiff was asserting new claims and causes of action against the defendant. PASE did not raise a "dispute" in its Application to trigger any analysis as to the applicability of an arbitration provision and no appellate court has held that a Turnover Statute proceeding to enforce a judgment must be pursued in arbitration.

SUMMARY OF ARGUMENT

The District Court properly denied Oxbow's Motion to Compel Arbitration since it was inapplicable to PASE's Turnover Statute Application. PASE did not assert, nor did the Turnover Order decide, any new claims or causes of action, nor did the Order resolve any new "dispute" or award new damages.

The 172nd District Court had subject matter jurisdiction and properly applied the Turnover Statute to aid PASE in the collection of its Judgment by granting injunctive relief and appointing a receiver to monitor Oxbow's compliance with the Order. There was no basis to force PASE to re-arbitrate the enforcement of its Judgment.

Oxbow's arguments against the Turnover Order are based upon gross mischaracterizations of the relief requested by and granted to PASE, repeated distortions of the record, and the misapplication of authorities that have no relevance to this Turnover Statute proceeding.

The granting of the Turnover Order was proper in all respects.

ARGUMENT

I. The Trial Court properly denied Oxbow's Motion to Compel Arbitration.

Oxbow goes to exhaustive lengths to try to turn PASE's post-Judgment enforcement proceeding into something that it is not-a dispute that the parties are required to arbitrate under the HEA. PASE filed its post-Judgment Application seeking relief under the Turnover Statute to collect its Judgment. Oxbow's waste heat is the non-exempt asset that PASE must receive to collect its Judgment. Oxbow is required to deliver that waste heat to PASE pursuant to the HEA which was fully interpreted in relevant part by the Panel in the Award confirmed in the Judgment.

Judge Floyd found the terms of the unambiguous Judgment/Award to be determinative, found Oxbow's arguments to be unpersuasive, and ruled that Oxbow should deliver the waste heat asset to PASE so that PASE can satisfy its Judgment. No new "dispute" was at issue in this Turnover proceeding and there are no causes of action or disputes in this proceeding to be litigated in arbitration. There is certainly no reason to re-arbitrate the collection of the Judgment from the first arbitration.

Having lost, Oxbow wants to avoid paying the Judgment by forcing PASE into an arbitration "do-over." Oxbow claims a "dispute" exists that must be arbitrated. PASE disagrees. The Judgment provides, "This Order and Final

Judgment renders the Award (the Arbitration Award) incorporated herewith *enforceable in the same manner as any other judgment or decree of the Court*. This Order resolves all claims in this case and is intended to be a final judgment." 5 RR Exh. 11.

Under the Texas Arbitration Act and the Federal Arbitration Act, a court presented with a motion to compel arbitration must first determine whether a dispute exists that falls within the scope of the arbitration agreement. *See*, *G.T. Leach Builders, LLC v. Sapphire V.P., L.P.*, 458 S.W. 3d 502, 519-20 (Tex. 2015); *Venture Cotton Coop. v. Freeman*, 435 S.W.3d 222, 227 (Tex. 2014). PASE's post-Judgment Application did not raise a "new" dispute under the HEA that must be arbitrated. CR 6-25. The parties had a dispute which was arbitrated in 2011 that resulted in a Judgment for PASE in 2015. All that remains is for PASE to collect its Judgment in accordance with the Award using the processes afforded under the law for the collection of judgments in Texas.

Oxbow's duties and obligations under the HEA were determined in the Judgment for the "Plant" and those duties included Oxbow's responsibility to bear the risk of installing and maintaining pollution control equipment so that both entities would remain in operation and in environmental compliance. 5 RR Exh. 11, p. 303. Oxbow cannot resurrect its arguments that Oxbow is not solely responsible

for the pollution it generates and, in any event, that cannot serve as a defense to the Turnover Order.

Under Oxbow's theory, all Oxbow has to do to avoid paying a Judgment is to "suspend" the delivery of waste heat, force PASE into another arbitration, and continue in this manner until PASE no longer exists or the HEA expires. Oxbow's actions and arguments, if allowed to stand, render the Judgment meaningless.

Oxbow offers an incredulous interpretation of the claims that were litigated in the arbitration, even claiming that it was PASE, rather than Oxbow, who sought to avoid responsibility for pollution control under the HEA. Oxbow states that "In that arbitration, PASE sought to avoid any environmental responsibility-including the attendant millions of dollars in equipment costs and potential environmental risk-and to require that Oxbow assume 100% of the cost of any pollution control efforts required at Oxbow's plant and PASE's Waste Heat Facility." Oxbow Brief p. 14-15 (citing 6 RR Exh. 3 at 14-15).

In reality, Oxbow initiated the arbitration and sued PASE claiming that "PASE has breached §5.2 [of the HEA] by installing and maintaining a defective pollution control system, including boiler stacks, that fails to achieve a level of particulate matter emissions compliant with applicable permits and laws, thus requiring Oxbow to forego delivery of waste heat to the steam facility and instead diverting the heat and gasses to the kiln stacks." 5 RR Exh. 10 at para 90, p. 28.

In the arbitration, Oxbow also pled Section 12 of the HEA claiming that "Oxbow has the right to suspend the provision of waste heat to the steam facility in the event Oxbow receives a notice of an alleged violation of law or similar notice from a government or authority." 5 RR Exh. 10, para 105 at p. 31. Still further, Oxbow alleged:

> Oxbow contends that the emissions from the boiler stacks in excess of permit levels or in violation of applicable law is due exclusively to PASE's failure to install a reliable and effective pollution control system in the steam facility, pursuant to its obligations under the Agreement. Thus, suspension of the delivery of waste heat to the steam facility caused by the issuance of a notice of violation or similar notice is attributable solely to PASE's breach of its contract obligations. PASE has contended that, despite PASE's duties under the Agreement to install an effective pollution control system in the steam facility, Oxbow somehow has the obligation to ensure that emissions meet permit requirements regardless of the ineffective—indeed, harmful—operations of the PASE MgO/multiclone system. PASE's contentions have no merit. 5 RR Exh. 10, para 107 at pgs. 31-32.

In the arbitration, Oxbow asked the Panel to interpret and determine the rights of the parties under the HEA with regard to pollution control, governmental and/or environmental regulatory actions relating to Oxbow's pollution, and the respective liabilities of the parties under the HEA for the cost of installing and maintaining an effective pollution control system, with Oxbow even asking the Panel to determine the rights of the parties under Section 12 of the HEA in the event of a suspension. 5 RR Exh. 10, para 108 at p. 32.

The Panel determined that PASE had no responsibility to install or maintain pollution control equipment or to pay Oxbow's cost of installation and maintenance of a pollution control system. 5 RR Exh. 11, p. 306-07. The Panel also declared that Oxbow was "contractually and legally responsible" for complying with its air permits and "bears the risk of installing and maintaining pollution control equipment" to ensure the operation of both facilities "in accordance with Oxbow's air permits and any other applicable environmental laws." 5 RR Exh. 11, p. 303.

The Award incorporated into the Judgment is clear. Oxbow has to install and maintain pollution control equipment to ensure the operation of its calcining plant and PASE's steam generation plant. Oxbow's arguments on page 16 of its Brief: (1) that the Panel made no determination as to any amount Oxbow was obligated to spend on pollution control; (2) that Oxbow is only required to use "Commercially Reasonable Efforts;" or (3) that the Panel did not specifically preclude Oxbow from suspending delivery of waste heat to comply with emissions regulations in the future, do not overcome the rulings of the Panel confirming Oxbow's duties to control pollution under the HEA.

The HEA is dispositive with regard to Oxbow's pollution control obligations. If Oxbow believes it has an SO_2 emission problem, Oxbow has to address it in a manner that keeps both facilities operating or Oxbow has to shut everything down, including its own plant. CR 430; 5 RR 297, p. 303. There was no new "dispute" to

be determined in arbitration relating to Oxbow's "right" to keep PASE from recovering its Judgment by stopping the delivery of waste heat to PASE for a supposed pollution concern. Judge Floyd did not need to make any new findings or decide any new "dispute." He simply acknowledged that the findings in the Award were dispositive and entered Orders to assist PASE with recovering its Judgment. CR 428-30. Judge Floyd's ruling was consistent with Texas law that applies collateral estoppel/res judicata principles to arbitration awards. *See Casa Del Mar Ass'n v. Gossen Livingston Assocs,* 434 S.W. 3d 211, 219 (Tex. App.-Houston [1st Dist.] 2014). (arbitration award is conclusive on parties as to all matters of fact and law submitted).

While PASE could indeed sue Oxbow someday for post-arbitration misconduct to recover post-arbitration damages, PASE has done no such thing in this Turnover proceeding. Oxbow cannot prevent the enforcement of PASE's Judgment under the Turnover Statute by arguing that PASE must litigate claims in arbitration that were not asserted in PASE's Application to seek damages that PASE did not seek to recover. There is no basis to require PASE to re-arbitrate the collection of its Judgment and no basis to overturn the denial of Oxbow's Motion to Compel Arbitration.

A. PASE's Turnover Statute Application did not assert new claims or causes of action arising out of or in connection with the HEA.

Oxbow has created a fiction that PASE filed a new lawsuit asking the 172nd District Court to conduct a "Merits Hearing" to litigate a "new dispute" that Oxbow contends had to be arbitrated under the HEA. PASE's Application did no such thing. The Application pled and supported a basis for the Court's jurisdiction; provided background facts about the HEA, the underlying Award, and Judgment; explained that Oxbow was diverting waste heat and keeping PASE from recovering its Judgment; described the TCEQ monitoring program; described the Turnover Statute and its purpose/terms; and requested relief from the Court under the Turnover Statute through an injunction and appointment of a receiver to assist PASE with recovering its Judgment, also asking for an award of attorney's fees per the statute. CR 23-24. The prayer for relief asked that "the Court enter such orders as necessary or appropriate under Texas law, including under the Turnover Statute, to aid [PASE] in the collection and recovery of its Judgment against [Oxbow]…" and asked that the orders remain effective "until such date as the Judgment in favor of PASE is satisfied in full through PASE's offset of Heat Payments." CR 23-24.

Nowhere within the post-Judgment Application did PASE assert "new" claims or causes of action against Oxbow or seek to recover damages based upon allegations of "new" misconduct by Oxbow. PASE only asked for relief under the Turnover Statute to recover its Judgment.

B. The Court's Turnover Order did not decide a new "dispute" or resolve any new cause of action.

PASE's Application invokes the Turnover Statute. CR 6-24. PASE demonstrated the applicability of the Turnover Statute and met its burden of proof to obtain the relief granted by Judge Floyd. On the other hand, Oxbow presented Judge Floyd with various arguments under the HEA based upon supposed pollution concerns that Oxbow argued kept it from having to deliver waste heat to PASE now, and presumably ever. 2 RR 51-54, 75-76, 186-193. After introducing argument and evidence to support its supposed defense to PASE's Turnover action based upon unsubstantiated pollution concerns, Oxbow now contends that Judge Floyd somehow exceeded his authority when he didn't find those arguments to be persuasive.

Meanwhile, Oxbow omits all discussion of the ultimate basis for the Turnover Order: that the Arbitration Award, incorporated into the Judgment, fully determined Oxbow's duties to control pollution and confirmed that Oxbow is required to purchase and maintain pollution control equipment to ensure the continued operation of Oxbow's and PASE's connected facilities, or shut down. The Turnover Order confirms this. It provides:

> The Court finds that the Arbitration Award and Judgment addressed Oxbow's duties under the Heat Agreement with regard to pollution control and are determinative with regard to this Turnover Statute proceeding. CR 428.

After discussing facts "central to the issues in this Turnover proceeding," Judge Floyd stated:

> The Arbitration Award is clear: Oxbow's duties and obligations under the Heat Agreement were determined for the "Plant" and those duties included bearing the risk of installing and maintaining pollution control equipment that will *ensure* the Plant's operation [i.e., Oxbow's operation *and* PASE's operation] in accordance with Oxbow's air permits and any other applicable environmental laws. If Oxbow has or believes that it has an actual or potential pollution problem, Oxbow is required under the Judgment and Arbitration Award to address the problem. That has already been judicially determined. CR 430.

After arguing that it was justified under the HEA to terminate all waste heat to PASE as a defense to PASE's Turnover Action, Oxbow should not be heard to complain that the Order reached conclusions, if not findings, that Oxbow's contentions were unpersuasive. However, ultimately, the Court reasoned that Oxbow's arguments were determined long ago against Oxbow by the Award/Judgment which precluded Oxbow's position that it could continue in business and operate all of its kilns, but shut only PASE down because of supposed pollution concerns. Even though Oxbow's counsel tried to get PASE's witnesses to admit there was a new "dispute," PASE only sought one remedy: to restore the delivery of waste heat so that PASE could recover its Judgment from operations. 3 RR 26-28.

The Arbitration Panel had the final say on how the HEA was to be interpreted and enforced with regard to the obligations of the parties to control pollution. Nevertheless, Oxbow tries to re-litigate the arbitration through references to arguments made by PASE's counsel before the Panel made its determinations in the Award (Oxbow Brief, p. 15, 36; 6 RR Exh. 3 at 14-16) and Oxbow asks the Court to consider positions taken during negotiation of the HEA in 2004-05. Oxbow Brief p. 15-16. Oxbow's arguments have no place in this proceeding. The Panel made its rulings, interpreted and enforced the HEA, and the Award was confirmed in the Judgment. Still, Judge Floyd did not find Oxbow's arguments to be persuasive and relied, instead, upon the language in the Award when he entered the Turnover Order. CR 427.

Contrary to Oxbow's assertion, the Turnover Order is not based on the Court concluding that Oxbow breached the HEA in 2017 or 2018. It is based upon the Court's recognition that Oxbow's duties under the HEA to pay for and provide pollution control were fully litigated and fully determined in the Award/Judgment, and PASE needed assistance with collecting that Judgment under the Turnover Statute.

C. PASE did not "agree" to arbitrate its Post-Judgment Turnover Action.

Oxbow incorrectly claims that PASE does not "deny" that the dispute pled and litigated in the Turnover proceeding was "whether the HEA's suspension provision authorized Oxbow's 2017 and 2018 suspensions of waste heat delivery to PASE, and whether the HEA's 'Commercially Reasonable Efforts' obligation required Oxbow to send an estimated $56 million to install, and an estimated $10 million per year to operate, new SO_2 pollution control equipment-arises out of or in connection with the HEA." PASE disagrees. While Oxbow's counsel argued and asked PASE's witnesses about those subjects, Judge Floyd did not determine whether the HEA's suspension provision authorized Oxbow's suspensions of waste heat delivery to PASE in 2017 or 2018, nor did he determine whether the HEA's "Commercially Reasonable Efforts" obligation required Oxbow to spend money to install or operate new SO_2 pollution control equipment. It follows that Oxbow's contention that "these uncontroverted facts alone are dispositive of Oxbow's motion to compel arbitration" has no merit.

On page 29 of its Brief, Oxbow argues that the HEA mandates that "every dispute of any kind or nature between the Parties arising out of or in connection with this [HEA] shall be submitted by either Party to binding arbitration," thus arguing that such language required PASE to arbitrate its Turnover proceeding because it supposedly had a "significant relationship to the HEA that brings it within the scope of the arbitration provision." Oxbow is wrong. PASE's Turnover Statute

Application related to the enforcement of PASE's existing Judgment. There is no right to arbitrate the method of enforcement of the Judgment.

D. Mere references in PASE's Turnover Statute Application to the HEA did not create a "Dispute" to be arbitrated.

On pages 30-31 of its Brief, Oxbow "cherry picks" four statements from PASE's Application and argues that by virtue of those statements in the Application, PASE "challenges Oxbow's performance under the HEA" and thus created a new dispute that was presented to Judge Floyd. The referenced statements gave background and context to the Application, but did not constitute the assertion of any claim or cause of action by PASE against Oxbow. Moreover, these statements did not take away from the reality that PASE only sought to collect its Judgment against Oxbow through relief provided under the Turnover Statute. Interestingly, two of the four statements quoted by Oxbow specifically referenced the relief sought by PASE, i.e., to recover its Judgment (Oxbow was "keeping PASE from recovering its Judgment" and "PASE needs the aid of this Court to recover its Judgment pursuant to the Turnover Statute"). Oxbow Brief p. 31 (citing excerpts at CR 15-16).

Oxbow pulled four contextual statements from PASE's Application to argue that "the 'dispute' here involves (1) whether the HEA's suspension provision permitted Oxbow's 2017 and 2018 suspensions of waste heat delivery, and (2)

whether Oxbow's obligations under the HEA to use "Commercially Reasonable Efforts" to maximize waste heat delivery and to operate its plant in accordance with 'Prudent Operating Practice' require Oxbow to (a) operate its plant in a manner that it believes will lead to non-attainment of the SO_2 NAAQS and potential violations of laws and permits applicable to the Port Arthur facility or (b) spend tens of millions of dollars installing and tens of millions more operating pollution control equipment." Oxbow Brief p. 31. In reality, to the extent those supposed "disputes" were argued in the hearing, they were presented through Oxbow's counsel in argument and/or through cross-examination of PASE's witnesses. Ultimately however, Judge Floyd did not determine any of these supposed "disputes," nor were they relevant to the relief granted in the Turnover Order which, as the Order provides, was based upon the language of the Award incorporated into the Judgment. CR 428-29.

E. PASE's "actions" did not invoke arbitration.

Oxbow claims that "PASE specifically invoked the arbitration provision *for this very dispute*." Oxbow Brief p. 32 (citing 6 RR Exh. 8). Oxbow then argues that by giving "Notice of Failure" under the HEA of Oxbow's "interruption and suspension of waste heat delivery" and "failures to perform material obligations," that PASE somehow "admitted that those allegations" constitute a "Dispute" within the scope of the arbitration provision that governs this proceeding. Oxbow Brief p.

32. Oxbow's argument is disassociated from the specific Turnover Statute relief asserted in PASE's Application and ignores the relief granted in the Turnover Order. While PASE has been damaged by Oxbow's interruption of waste heat delivery and gave Oxbow written notice in 2017 of Oxbow's breach of the HEA, PASE did not sue Oxbow to recover those damages in this Turnover proceeding. Oxbow cannot avoid enforcement under the Turnover Statute by forcing PASE to arbitrate claims and causes of action that PASE did not assert.

F. PASE did not "admit" that PASE pled an arbitral dispute.

Oxbow contorts the testimony of PASE representative Ray Deyoe on pages 32-33 of its Brief to imply that PASE admitted that its claim was "arbitrable." Oxbow quotes a question and answer in which Mr. Deyoe responded, "We could," when asked if "You could go to arbitration to say the suspension that was done for Kilns 3 and 4 and for Kiln 5 was wrong, right? Oxbow Brief p. 33; 3 RR 122; 3-6. Oxbow mischaracterized Deyoe's testimony to try to support its flawed position. In reality, Mr. Deyoe testified that PASE was in this proceeding to recover its Judgment. Oxbow knows that PASE only pled and argued for post judgment relief under the Turnover Statute which is exactly (and only) what Judge Floyd granted under the Turnover Order. PASE's witness testified with integrity. He recognized that PASE may indeed have a claim that it could assert someday for damages caused by

Oxbow's 2017-18 conduct, but this proceeding was not where that was occurring. 2 RR 239-41; 3 RR 26-28.

G. PASE did not fail to meet its burden to defeat arbitration.

Oxbow argues that PASE "never challenged the enforceability of the HEA's arbitration provision or its reach" and thus "the trial court had no authority to hear the dispute but instead was obligated to compel arbitration." Oxbow Brief p. 33. Oxbow's argument is preposterous. PASE filed briefs and argued against the applicability of the HEA's arbitration provision to its post-Judgment Turnover Statute proceeding. *See generally* 2 RR 56-75, 80-83; CR 220-249. Whether the HEA's arbitration provision would be "enforceable" if applied in a proper context was not at issue because: (1) PASE was not asserting a new claim or cause of action against Oxbow and did not ask Judge Floyd to decide any new "dispute;" and (2) PASE merely sought the Court's assistance with collecting its existing Judgment that resulted from the arbitration that already occurred. Oxbow did not cite, and cannot cite, a case that requires a judgment creditor to re-arbitrate the collection of a judgment that resulted from an arbitration. Oxbow's argument makes no sense.

H. Oxbow's contention that the "current dispute" was not litigated in or decided by the 2010-2011 arbitration is flawed and irrelevant.

Oxbow advances various arguments to try to demonstrate that there was a "new dispute" arising from Oxbow's 2017-2018 "suspensions" of waste heat to

PASE and that PASE's claims relating to those suspensions "could not and did not arise until 2016 and 2017-years after the 2011 Arbitration Award." Oxbow Brief p. 34. Oxbow then quotes various "court papers," arguments of PASE's counsel, and testimony from PASE's witnesses that supposedly distinguish PASE's claims that were asserted in the 2011 arbitration from the claims that Oxbow pretends PASE to be asserting in this Turnover Statute proceeding. However, Oxbow's argument ignores that: (1) PASE did not assert any claims or causes of action against Oxbow or seek to recover any damages based upon Oxbow's breach of the HEA between 2016 and 2018; and (2) no such claims or causes of action were decided in the Turnover Order.

Oxbow references pre-Award arguments of PASE's counsel in the arbitration about how counsel suggested that Section 12 of the HEA, the Suspension section, should be interpreted. Oxbow Brief p. 36 (citing 6 RR Exh. 3 at 15 and 2 RR 198-200). Such documents were admitted into evidence over PASE's objections. 2 RR 198-202. Counsel for Oxbow also tried to impeach PASE's witness with a transcript of an opening statement of PASE's counsel from the arbitration over PASE's objections. 2 RR 196-200. Those efforts, ultimately, carried no weight because the Panel entered its own decision interpreting and enforcing the HEA in its Award, particularly with regard to Oxbow's pollution control obligations, as discussed in multiple places in this Response.

Oxbow repeatedly argued that under the HEA, it is only required to use "Commercially Reasonable Efforts to maximize the production and delivery of waste heat to PASE" which Oxbow claims did not require Oxbow "to expend unlimited amounts of money, but only such amounts as are commercially reasonable in the applicable circumstances." Oxbow Brief p. 37. Oxbow's argument is incorrect because it conflates unrelated duties. Oxbow's duty to use Commercially Reasonable Efforts to maximize the delivery and production of waste heat to PASE has nothing to do with Oxbow's absolute duty, as set forth in the Award, to install and maintain pollution control equipment to meet its air permits and all environmental laws so that Oxbow and PASE will both remain operational. Oxbow is certainly breaching its contractual duty to use Commercially Reasonable Efforts to maximize its delivery of waste heat to PASE, but that was not a claim presented to or decided by Judge Floyd in the Order.

Similarly, Oxbow argues that by mentioning Oxbow's duty of good faith and fair dealing under the HEA in the Application that PASE somehow *sued* Oxbow for "breach of the duty of good faith and fair dealing" and created "a new dispute." Again, Oxbow insists upon distorting PASE's Application. PASE did not assert a claim for breach of good faith and fair dealing and no such claim was decided in the Turnover Order.

I. PASE did not label a "lawsuit" as a Turnover proceeding.

Oxbow claims that PASE surreptitiously "labeled" a new lawsuit as a Turnover proceeding. On pages 39-41 of its Brief, Oxbow argues that the HEA arbitration provision "makes no exception for post-judgment proceedings or for this kind of dispute." Oxbow cites an HEA provision that states "Neither party shall seek recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision." In actuality, PASE did neither. PASE did not seek to litigate the merits of Oxbow's 2017 and 2018 suspensions of waste heat delivery "under the guise of the Turnover Statute," nor did PASE appeal from an arbitration decision. PASE sought to enforce its Judgment and the Turnover Order was entered based upon the language of the Award, incorporated into the Judgment.

Oxbow argues that no prior appellate court has used the Turnover Statute "to enforce a non-money judgment," but ignores that while the language of the award/judgment is atypical, PASE, nevertheless, has a Judgment to recover a specified sum of monetary damages that was "enforceable in the same manner as any other judgment or decree of the Court." Simply because the Judgment required PASE to recover its damages from Oxbow's continued delivery of waste heat does not render PASE's Judgment unenforceable, nor does it require re-arbitration of PASE's efforts to enforce that Judgment through the Turnover Statute.

J. The FAA and the HEA do not preempt use of the Turnover Statute.

On pages 41-43, Oxbow argues that PASE cannot avoid the arbitration provision in the HEA "because the FAA preempts any attempted use of the Turnover Statute to adjudicate the suspension dispute outside of arbitration." Contrary to Oxbow's argument, the FAA says nothing about a party's right to enforce an arbitration award that has been confirmed in a judgment through a Turnover Statute proceeding, and none of the authorities cited by Oxbow involve post-Judgment enforcement. Under Oxbow's argument, PASE would never be able to collect any judgment because it would be forced into a never-ending loop of arbitration and/or would be out of business and rendered unable to offset Heat Payments from the continued operation of its steam plant.

K. There was no basis to apply a presumption favoring arbitration.

On pages 43-45 of Oxbow's Brief, Oxbow argues that this Court must impose a presumption in favor of agreements to arbitrate and resolve any doubts about an agreement to arbitrate in favor of arbitration. The obvious flaw in Oxbow's argument is that the parties have already arbitrated and PASE won. The presumption of arbitration has no applicability when PASE did not assert a new claim or cause of action, did not seek to recover damages in the Turnover proceeding, and only sought to recover the damages awarded in the Judgment. No case requires a party to re-arbitrate enforcement of a judgment that was obtained through arbitration and no

case requires a Turnover Statute proceeding under such circumstances to be viewed as a new "claim" that invokes a presumption in favor of arbitration.

Oxbow also argues that AAA Rule R-7(a) requires the arbitrator to rule "as to the arbitrability of any claim or counterclaim." Rule R-7(a) is inapplicable. Moreover, the authorities cited by Oxbow are distinguishable because: (1) they involve interpretation of a provision in the underlying agreements that delegated "gateway issues of arbitrability" to the arbitrator to decide, thus preempting a court's role in this decision; and/or (2) they involved litigation of a new dispute in which claims/causes of action were asserted. Neither of those circumstances are present in this matter. The HEA does not delegate to an arbitrator the right to make a gateway decision as to arbitrability and, even if it did, such language would have no applicability to a post-judgment proceeding to enforce a judgment that confirmed an arbitration award.

In support of its gateway argument, Oxbow cites *Rent-A-Center Tex, L.P. v. Bell,* 2016 Tex. App. LEXIS 9358 (Tex. App-Beaumont, August 25, 2016, no pet.) and other cases for the principle that a broad contractual clause that "clearly and unmistakably" delegates gateway issues of arbitrability to the arbitrator is enforceable." *Rent-A-Center Tex., L.P.* at *7-9. What Oxbow ignores is that the HEA contains no such provision, thus Oxbow's position has no merit.

II. The Trial Court did not err by appointing a receiver to monitor Oxbow's compliance with post-judgment injunctive relief to allow PASE to enforce its Judgment.

A. The District Court had jurisdiction to enter the Order Granting Post-Judgment Turnover Relief.

i. The plain language of the Turnover Statute allows a Jefferson County District Court to enforce PASE's Judgment.

Oxbow argues as a "threshold matter," that the 172nd District Court lacked subject matter jurisdiction to enter the Turnover Order. Oxbow's argument is incorrect.

Subject matter jurisdiction concerns the kinds of controversies a court has the authority to resolve. *Davis v. Zoning Bd. of Adjustment,* 865 S.W. 2d 941, 942 (Tex. 1993). In most cases, subject matter jurisdiction is based on the amount in controversy. *Continental Coffee Prods. Co. v. Cazarez,* 937 S.W. 2d 444, 449 (Tex. 1996). A district court has jurisdiction over lawsuits in which the amount in controversy is $500 or more. Section 24.007 Tex. Gov't Code. The Texas Constitution provides, "District court jurisdiction consists of exclusive, appellate, and original jurisdiction of all actions, proceedings, and remedies, except in cases where exclusive, appellate, or original jurisdiction may be conferred by this

Constitution or other law on some other court, tribunal, or administrative body." Tex. Const. art. V, §8.

Applicable statutory construction principles are well established. As the Court noted in *In Re Akin Gump Strauss Hauer & Feld*:

> In construing a statute, our objective is to determine and give effect to the Legislature's intent. *See National Liab. & Fire Ins. Co. v. Allen,* 15 S.W. 3d 525, 527 (Tex. 2000). If possible, we must ascertain that intent from the language the Legislature used in the statute and not look to extraneous matters for an intent the statute does not state. *Id.* If the meaning of the statutory language is unambiguous, we adopt the interpretation supported by the plain meaning of the provision's words. *St. Luke's Episcopal Hosp. v. Agbor,* 952 S.W. 2d 503, 505 (Tex. 1997). We must not engage in forced or strained construction; instead, we must yield to the plain sense of the words the Legislature chose. *See Id.*

In Re Akin Gump Strauss Hauer & Feld, LLP, 252 S.W. 3d 480, 2008 Tex. App LEXIS 1329, *20; *see also*, *Iliff v. Iliff*, 339 S.W.3d 74, 79 (Tex. 2011) (in construing a statute, court's task is to give effect to Legislature's expressed intent). A court may consider the object sought to be obtained, circumstances under which the statute was enacted, and the consequences of a particular construction when construing statutes. TEX. GOV'T CODE § 311.023 (1), (2), (5); *McIntyre v. Ramirez*, 109 S.W.3d 741, 745 (Tex. 2003); *Atmos Energy Corp. v. Cities of Allen*, 353 S.W.3d 156, 160, 2011 Tex. LEXIS 870, *10-11, 55 Tex. Sup. J. 88.

With regard to PASE's Turnover Statute proceeding, PASE sought the Court's assistance with collecting a Judgment now valued at $5 million dollars. Any

district court in the State of Texas has subject matter jurisdiction to apply the Turnover Statute to assist a judgment creditor with enforcing a $5 million dollar judgment. The Turnover Statute does not state that a judgment creditor is entitled to aid exclusively from the trial court that rendered the judgment. Instead, the statute states that a judgment creditor is entitled to aid from "a" court of "appropriate jurisdiction." If the Legislature intended to provide exclusive jurisdiction in the trial court rendering the judgment, it could have done so by using clear statutory language similar to that in the Texas Family Code Ann. §9.101(a) "the court that rendered a final decree of divorce…retains continuing exclusive jurisdiction to render an enforceable qualified domestic relations order…" *Chavez v. McNeely*, 287 S.W.3d 840, 844 (Tex. App.—Houston [1st Dist.] 2009, no pet.)

The Turnover Statute gives a judgment creditor the option of seeking a court's assistance in the same proceeding or in an *independent proceeding*. The Turnover Statute was enacted to expand procedures by which diligent creditors could reach the property of their judgment debtors *Cross, Kieschnick & Co. v. Johnston*, 892 S.W.2d 435, 438 (Tex. App.-San Antonio 1994, no writ). Since the subject of the Turnover proceeding concerns PASE's request for injunctive relief and/or the appointment of a receiver in connection with Oxbow's calcining plant in Jefferson County, a district court was an appropriate court to hear this Application.

Several appellate opinions support PASE's position. In *In Re Abira Med. Labs., LLC,* the Fourteenth Court of Appeals considered the issue of subject matter jurisdiction under the Turnover Statute. *In Re Abira Med. Labs., LLC,* No. 14-17-00841-CV, 2018 Tex. App. LEXIS 1383 (Tex. App.-Houston [14th Dist.] Feb. 22, 2018, orig. proceeding). The Court ruled that a county court in Harris County with a $200,000.00 jurisdictional limit lacked subject matter jurisdiction to apply the Turnover Statute to help judgment creditors enforce a judgment obtained in an Illinois Court (domesticated in Tarrant County, Texas) and a judgment obtained in a Harris County district court, both of which were the basis for Turnover Statute relief sought in the county court. The *In Re Abira* Court cited *Colorado Cnty. v. Staff,* 510 S.W. 3d 435, 444 (Tex. 2017) for the applicable statutory construction principle: "When construing a statute, our primary objective is to give effect to the Legislature's intent…We may not look beyond its language for assistance in determining legislative intent unless the statutory text is susceptible to more than one reasonable interpretation." *Id.* at *11. The *In Re Abira* Court ruled that the county court had no subject matter jurisdiction because both judgments were for amounts well in excess of $200,000.00; however, the Court considered the plain language of the Turnover Statute and stated that both judgment creditors could file their Turnover action proceedings in a district court and did not require the judgment

creditors to return to their respective trial courts to obtain relief under the Turnover Statute. *Id.* at *6-12, fn 4.

Similarly, in *Ramirez v. Orozco,* 2005 Tex. App. LEXIS 7888 (Tex. App-San Antonio [4th Dist.] September 28, 2005), the Court ruled that the 150th Judicial District Court of Bexar County had jurisdiction under the Turnover Statute to consider orders to assist the judgment creditor with recovering a judgment that was obtained in Bexar County Court at Law No. 2. *Id.* at *4-5.

Under a plain reading of the Turnover Statute, as supported by the referenced cases, Oxbow's contention that the 172nd District Court lacked subject matter jurisdiction is incorrect.

ii. The authorities cited by Oxbow do not support Oxbow's arguments that the District Court lacked subject matter jurisdiction.

The authorities cited in Oxbow's Brief have no bearing on the jurisdiction of the 172nd District Court to consider PASE's Turnover Statute proceeding. For example, Oxbow cites *In Re Abira Med. Labs., LLC, supra,* in support of its argument that the 172nd District Court did not have subject matter jurisdiction to enter the Turnover Order. As discussed above, *In Re Abira* supports PASE's position because the intervenors were *not* directed to return to the district courts where they obtained or domesticated their respective judgments in order to seek

Turnover Statute relief, but were, instead, informed that they "may pursue their own turnover proceeding in a district court" which had subject matter jurisdiction for the higher judgment amounts. *Id.* at *12.

Oxbow also cites *Cobb v. Thurmond,* 899 S.W. 2d 18, 19-20 (Tex. App.-San Antonio 1995, writ denied) as supposedly supporting its position that no court other than a trial court can have "jurisdiction over the matter." *Cobb* has no relevance to Oxbow's jurisdictional argument relating to the Turnover Statute. In *Cobb,* a San Antonio Court of Appeals considered two turnover orders that were signed by the District Court within a four month period. The Court of Appeals issued contemporaneous opinions, the first of which affirmed the original turnover order. Since the first turnover order was already on appeal when the second turnover order was entered, the Court of Appeals ruled that the trial court was without authority to enter the second turnover order. *Id.* at 19-20.

Similarly, Oxbow cites *Ex Parte Gonzalez,* 238 S.W. 635, 636 (Tex. 1922) for its contention that "the only court with subject matter jurisdiction to enforce a Texas judgment is the Texas court that rendered the judgment." Oxbow Brief p. 47. Again, Oxbow makes a broad statement of law that is not supported by the cited authority. In *Ex Parte Gonzalez,* the Supreme Court ruled in 1922 that the district court to which a case was transferred did not have "jurisdiction to punish the relator as for contempt for acts in violation of the injunction issued by the [transferring]

district court, committed prior to the transfer of the case." *Id.* at 636. *Ex Parte Gonzalez* had nothing to do with the Turnover Statute which had not been enacted, nor did it stand for Oxbow's argument that the only court with subject matter jurisdiction to enforce a Texas judgment is the court that rendered that judgment.

Oxbow also cites *Spencer v. Spencer,* 371 S.W. 2d 898 (Tex. Civ. App.-San Antonio 1963, no writ) for its dicta statement that "It is well settled that a court rendering judgment has exclusive jurisdiction for the purpose of enforcing its prior decree;" however, Oxbow ignores that *Spencer* was an appeal from a plea of privilege in a child custody dispute involving the determination of where proper venue would lie for a change of custody determination. *Id. Spencer* has no relevance to PASE's Turnover proceeding.

Oxbow also cites *In Re Akin Gump Strauss Hauer & Feld, LLP* for the premise that "disputes regarding the interpretation, meaning, and enforcement of a judgment rendered by a Texas trial court are resolved by the presiding judge of the trial court that rendered the judgment." Oxbow Brief p. 47. At issue in *In Re Akin Gump* was whether a trial court could remand issues to the arbitration panel after the court confirmed the arbitration award and rendered final judgment thereon under circumstances where neither side argued that the award was ambiguous or incomplete. *Id.* at *27. *In Re Akin Gump* has no application to Oxbow's subject matter jurisdiction argument in this Turnover Statute proceeding. Likewise,

Oxbow's reference to *Woody K. Lesikar Special Trust v. Moon,* No. 14-10-00119-CV, 2011 WL 3447491 (Tex. App.-Houston [14th Dist.] August 9, 2011, pet. denied), as an *accord* to *In Re Akin Gump,* is not relevant to Oxbow's jurisdictional challenge. If anything, *Woody* supports Plaintiff's position because the Court noted that the Turnover Statute "allows a party who has secured a final judgment to collect the judgment through a separate court proceeding." *Id.* at *11-12.

B. The Texas Turnover Statute authorizes the relief granted in the Order Granting Post-Judgment Turnover Relief and should be enforced as written.

i. The District Court was authorized to appoint a receiver to monitor compliance with the Court's post-judgment injunction order.

On pages 49-53 of Oxbow's Brief, Oxbow argues that the Turnover Order exceeded relief authorized under the Turnover Statute in two ways. Oxbow argues that it improperly disposed of a contested substantive dispute between the parties and that it "appointed a receiver with powers not authorized by the Turnover Statute." PASE demonstrated above that the Turnover Order did not involve the determination of any new dispute or claim and, thus, the Turnover Order did not exceed the authority of the Turnover Statute. As for Oxbow's second argument, PASE relies upon the language of the Turnover Statute itself, together with the fact

that the receiver appointed by the Turnover Order was only directed to monitor compliance with the post-Judgment injunction orders and to make periodic reports. CR 432. It strains credibility for Oxbow to argue that the receiver was given "powers not authorized by the Turnover Statute."

The purpose of the Turnover Statute, as stated in the House and Senate Committee Reports, was to "put a reasonable remedy in the hands of a diligent judgment creditor, subject to supervision of the Court." *Barlow v. Lane*, 745 S.W.2d 451, 454 (Tex. App.-Waco1988); *see also*, *Associated Ready Mix, Inc. v. Douglas,* 843 S.W.2d 758, 763 (Tex. App.-Waco 1992, orig. proceeding).

Under the Turnover Statute, a judgment creditor is entitled to aid from a court of appropriate jurisdiction through injunction *or other means* in order to reach property to obtain satisfaction on the judgment. §31.002 Tex. Civ. Prac. & Rem. Code (emphasis added). Pursuant to §31.002(b), when granting turnover relief to a judgment creditor, a court may "…*otherwise apply the debtor's nonexempt property to the satisfaction of the judgment*." §31.002(b) Tex. Civ. Prac. & Rem. Code (emphasis added).The Legislature adopted Section 32.001 to enable procedures to facilitate and aid collection of a judgment beyond the limits imposed by the predecessor statute. *See Cross, Kieschnick & Co. v. Johnston*, 892 S.W.2d 435, 438 (Tex. App.--San Antonio 1994, no writ) (citing David Hittner, *Texas Post-judgment Turnover & Receivership Statutes*, 45 Tex. Bar J. 417, 417-18 (Apr. 1982) (citing

House and Senate committee reports)). Section 31.002, as a remedial statute, is to be liberally construed with a view to effect its object and to promote justice. *See Haden v. Sacks,* 332 S.W. 3d 523, 530 (Tex. App.-Houston [1st Dist.] 2009); fn 6 (comparing Turnover Statute to Texas Solid Waste Disposal Act and noting general rule that Statute is to be given the most comprehensive and liberal construction possible in furtherance of its purpose: to aid a judgment creditor in the collection of its judgment).

Judge Floyd's appointment of a receiver was appropriate. Designating a receiver to take charge of an asset is a long-recognized equitable remedy under the Turnover Statute. *See, e.g., Newman v. Toy*, 926 S.W.2d 629, 631–632 (Tex. App.—Austin 1996, writ denied); *Schultz v. Cadle Co.*, 825 S.W.2d 151 (Tex. App.—Dallas 1992), writ denied per curiam, 852 S.W.2d 499 (Tex. 1993). A court's authority to aid a judgment creditor in the collection of a judgment through injunction or other means, coupled with a court's authority to appoint a receiver or otherwise apply property to the satisfaction of a judgment under §31.002, allows a court to order a judgment debtor to turn over property directly to a receiver or place property under the control of a receiver to aid in the enforcement of a judgment. *See Burns v. Miller, Hiersche, Martens, & Hayward, P.C.* 948 S.W.2d 317, 327 (Tex. App.—Dallas 1997, writ denied) (trial court did not err in ordering turnover of property to someone other than a sheriff or constable); *Holland v. Alker*, No. 01-05-00666-CV, 2006 Tex.

App. LEXIS 3125 (Tex. App. [Houston-1st Dist.] April 20, 2006) (court has authority to appoint receiver to take possession of nonexempt property).

A turnover and receivership order under Chapter 31 can be used to reach present or future rights to property to obtain satisfaction of a judgment. Tex. Civ. Prac. & Rem. Code §31.002(a). Under the Turnover Statute, courts may appoint a receiver to facilitate the collection of a judgment without that receiver having to sell the property to recognize proceeds. *See, e.g.*, *Stanley v. Reef Secs., Inc.*, 314 S.W.3d 659 (Tex. App.—Dallas 2010, no pet.) (receiver appointed in furtherance of turnover order to monitor partnership distributions and effectuate a charging order); *Goodman v. Compass Bank*, No. 05-15-00812-CV, 2016 Tex. App. LEXIS 8338, 2016 WL 4142243, at *11 (Tex. App.—Dallas Aug. 3, 2016, no pet.) (mem. op.) (affirming order requiring turnover of property that included present and future rights to proceeds from limited partnerships, LLC, and other corporate entities); *Pajooh v. Royal W. Invs. LLC*, 518 S.W.3d 557, 2017 Tex. App. LEXIS 2759 (Tex. App. Houston [1st Dist.] Mar. 30, 2017, no pet.) (turnover and receivership order were appropriate for monitoring distributions and effectuating charging order in favor of the judgment debtor). A decision as to whether to appoint a receiver under the Turnover Statute falls within a court's discretion. *Holland v. Alker*, No. 01-05-00666-CV, 2006 Tex. App. LEXIS 3125 (Tex. App. [Houston-1st Dist.] April 20, 2006).

Contrary to Oxbow's characterization that a receiver was appointed with "sweeping powers" (Oxbow Brief p. 52), the receiver appointed in the Turnover Order has a very limited function. The receiver is to monitor compliance with the Order and make reports, duties consistent with the Turnover Statute. CR 432.

ii. The District Court did not abuse its discretion in determining that the Turnover Order would allow PASE to recover its Judgment.

Oxbow argues that PASE did not demonstrate that the Turnover Order would assist PASE in recovering its Judgment. Oxbow Brief p. 53. Oxbow refers to its cross-examination of PASE representative, Ted Boriack, but overlooks testimony from this witness that supported the Court's determination, specifically that the Heat Bank deficit can be restored and Heat Payments to Oxbow will be generated to apply to PASE's Judgment if Oxbow restores delivery of waste heat to PASE and delivers that heat in accordance with the HEA.

Boriack, an engineer, produced alternative Heat Bank models under the HEA. One of Boriack's models, Exhibit 16, was based upon a coke tonnage assumption provided to Boriack by Oxbow that Oxbow's representative stated was "something that could be done" and was "doable." 3 RR 136-37; 4 RR 43. This model was based upon 89% of the intended threshold tons of the HEA. It assumed a $3.25 per Btu gas price which Boriack stated was conservative. 2 RR 138. Performance under

Exhibit 16 would generate $230,000.00 per month in Heat Payments which would restore the Heat Bank deficit in under 1.5 years, allowing PASE to recover its Judgment from that point forward. 3 RR 138-39.

Boriack testified that "We can absolutely earn Heat Payments and make contributions to this Award." 4 RR 54. He confirmed that he has "done sufficient models to determine that recovery of all or part of that Judgment is possible" and his scenarios and assumptions were "reasonable and attainable." 4 RR 88. Boriack also "wholeheartedly disagreed" with the suggestion by Oxbow's counsel that there is no way for the Heat Bank to ever go positive so that PASE can recover its Judgment. 2 RR 134. Boriack testified that over time the $4 million deficit in the Heat Bank "can go to zero and the Heat Payments will be generated…It's very feasible." 4 RR 89-90. Judge Floyd was justified in concluding that the Turnover Order would assist PASE in recovering its Judgment and Oxbow offered no controverting witness.

On page 6 of its Brief, Oxbow claims that, "If Oxbow produces more than the 'Threshold Amount' of 43,675 tons of calcined coke per month, then it accumulates a credit in the heat bank. If Oxbow produces less than the Threshold Amount, it accumulates a deficit in the heat bank." Oxbow's statements are not accurate. Boriack explained how Heat Payments have been and can be made where coke tons produced were well below the 43,675 threshold, with Plaintiff's Exhibit 16 being an example. 2 RR 132-33;

Oxbow suggests that its failure to receive Heat Payments after 2011 was due to declining calcined coke markets and declining natural gas prices. Oxbow Brief p. 7. Oxbow ignores the testimony that Oxbow's failure to receive Heat Payments after the Award was due to Oxbow's operational decision to not maximize its delivery of waste heat to PASE at the contracted for temperatures (4 RR 83-84), and testimony that Oxbow's damper moves to divert waste heat negatively affected the Heat Bank. 2 RR 145-47; 152-53. Those decisions had nothing to do with the price of natural gas.

iii. Oxbow's argument that less onerous relief was sought and denied by the arbitration panel is irrelevant to the District Court's Turnover Order to assist PASE with collecting its Judgment.

Oxbow argues that because the Arbitration Panel supposedly denied "less onerous relief than PASE received" in the Turnover Order, the "Turnover Order appointing a receiver goes far beyond what PASE received in the Arbitration Award and Judgment." Oxbow Brief p. 57-58. Oxbow claims that since the Panel denied "declaratory or injunctive relief," this Court should deny the appointment of a receiver to be consistent with the original Judgment. Oxbow Brief, p. 57.

Oxbow states, "As PASE concedes, the trial court does not have the authority to change the HEA, the 2011 Arbitration Award, or the 2015 Judgment." Oxbow

Brief p. 57. Oxbow cites a sentence in PASE's Application and *Matz v. Bennion,* 961 S.W. 2d 445, 452 (Tex. App. Houston [1st Dist.] 1997, writ denied) for the principle that enforcement orders may not be inconsistent with the original judgment and must not materially change substantial adjudicated portions of the judgment. PASE does not dispute this principle. However, the Turnover Order is consistent with the Judgment and does nothing to materially change it. It simply enjoins Oxbow from refusing to deliver waste heat to PASE if Oxbow operates its kilns that are connected to PASE's boilers so that PASE can collect its Judgment in the manner specifically prescribed in that Judgment. It did not create or impose liability upon Oxbow "which the original Judgment had not" as Oxbow suggests in its Brief. The *Matz* opinion supports PASE's position. *Matz* at *18-19 (post-judgment orders enforce trial court's original judgment and do not constitute material change in substantial adjudicated portions of judgment; judgments confirming arbitration awards are enforced as any other judgment).

Oxbow also cites *Miga v. Jenson,* No. 02-11-00074-CV, 2012 Tex. App. LEXIS 1911 (Tex. App. Ft. Worth March 8, 2012, orig. proceeding); which supports PASE's position insofar as the Court ruled that an injunction under the Turnover Statute "does not change the judgment, but is merely a vehicle for its enforcement." *Id.* at *28. The *Miga* Court also stated, "This Court has authority to enjoin Miga from secreting or further dissipating assets pursuant to the Turnover Statute." *Id.* at

*17-18. Under any relevant analysis, the Turnover Order facilitated enforcement of PASE's Judgment. It was not inconsistent with the Judgment and it did not materially change any substantial adjudicated portions of that Judgment.

Oxbow's argument that appointing a receiver "goes far beyond what PASE received in the Arbitration Award and Judgment" misses the mark. Oxbow Brief p. 58. Oxbow claims that because the Arbitration Panel declined to enter joint operating practices in favor of reminding the parties to honor their good faith and fair dealing obligations to each other in the Award, it is somehow improper for the Court to enjoin Oxbow from diverting waste heat or appoint a monitoring receiver so PASE can satisfy its Judgment in the manner contemplated under the Judgment. Oxbow's arguments make no sense and its reliance on the cited authorities is misplaced. The receiver is simply in place to monitor Oxbow's compliance with the Turnover Order, not to takeover or operate Oxbow's plant.

C. The HEA did not waive PASE's right to enforce its existing Judgment that confirms the Arbitration Award.

On pages 60-61 of Oxbow's Brief, Oxbow argues that the appointment of a receiver violates the HEA because PASE supposedly "waived" its right to Turnover Relief in the HEA. To begin with, Oxbow's "waiver" argument, disingenuous as it may be, was not asserted at any time in the Turnover Statute hearing or in any argument to Judge Floyd; therefore, this argument is not proper to be asserted for

the first time on appeal. Nevertheless, Oxbow's proffered construction of the HEA on the issue of waiver lacks merit. The HEA does not mention, much less waive, either party's right to enforce a judgment entered by a court under the Turnover Statute.

Oxbow's "waiver" argument distorts the HEA's arbitration provision. Oxbow contends on page 60 of its Brief that the HEA precluded parties from "seeking recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision" and somehow this language "waived" the parties' right to enforce a judgment resulting from an arbitration decision. Oxbow then argues that the HEA "narrows the parties' right to seek injunctive relief to two situations-(1) to compel arbitration of a dispute, or (2) to enforce the HEA's confidentiality provision-neither of which applies here." Oxbow Brief p. 60-61. Neither argument applies. Section 14.3(g) of the HEA allows a party to commence an action in a court for the reasons stated, but it does not provide that a party "waives" its right to enforce a judgment that results from arbitration through relief granted under the Turnover Statute. Likewise, Oxbow's proffered construction is factually inapplicable as discussed in the previous sections.

Waiver is the intentional relinquishment of a known right or intentional conduct inconsistent with claiming that right. *Tenneco, Inc. v. Enter. Prods. Co.*, 925 S.W. 2d 640, 643 (Tex. 1996). The elements of waiver are (1) an existing right,

benefit, or advantage held by a party, (2) the party's actual knowledge of its existence, and (3) the party's actual intent to relinquish the right or intentional conduct inconsistent with the right. *Ulico Cas. Co. v. Allied Pilots Ass'n,* 262 S.W. 3d 773, 778 (Tex. 2008). Oxbow's argument doesn't fit. PASE did not waive its right to enforce the Judgment through a Turnover Order by executing the HEA in 2005.

D. The Turnover Order imposed appropriate post-Judgment injunctive relief.

The injunctive relief to allow PASE to recover its Judgment was the primary relief sought and obtained by PASE, and it was consistent with the purpose of the Turnover Statute. The Order provides that: Oxbow cannot discharge its waste heat through its hot stacks and circumvent PASE's steam plant except under emergent circumstances or for maintenance, and the receiver shall monitor and report on Oxbow's compliance. CR 432. Notably, the Turnover Order does *not* require Oxbow to operate any particular kilns, to produce any specific tonnage or quality of calcined coke, to deliver any minimum quantity of waste heat to PASE, or to operate any of its kilns at all. The effect of the Turnover Order is simple and direct. If Oxbow chooses to operate its Kiln Nos. 3, 4, or 5, it must deliver its waste heat from those operations to PASE which PASE will then use to generate steam revenues, eliminate the Heat Bank deficit, and recover its Judgment through offsets of Heat

Payments. When the Judgment is recovered, the Court is to be advised so that that post-Judgment injunction can be terminated. CR 433.

Injunctive relief is appropriate to aid a judgment creditor in collecting its Judgment. Texas courts have the authority to enjoin judgment debtors under the Turnover Statute. Tex. Civ. Prac. & Rem. Code §31.002; *In the Guardianship of De Villarreal*, 2009 Tex. App. LEXIS 2249 at *14 (Tex. App.—Corpus Christi 2009, pet. denied). The typical requirements for injunction are not applicable to an injunction granted to enforce a final judgment. *Roosth v. Roosth*, 889 S.W.2d 445, 460 (Tex. App.--Houston [14th Dist.] 1994, writ denied), citing *Childre v. Great Southwest Life Ins. Co.,* 700 S.W.2d 284, 288 (Tex. App.--Dallas 1985, no writ).

In *Miga v. Jensen*, 2012 Tex. App. LEXIS 1911, 2012 WL 745329 (Tex. App.—Fort Worth 2012), the court entered an injunction that prohibited the judgment debtor from spending, depleting, secreting, or transferring $21,560,150.67 plus prejudgment interest—except in the ordinary course of business or for reasonable and necessary household and living expenses or reasonable and necessary attorneys' fees-until that amount is finally paid to the judgment creditor…" The *Miga* court concluded that the judgment creditor faced the threat of imminent and irreparable harm in that any further depletion of the judgment debtor's assets could further reduce the judgment creditor's recovery, with the judgment debtor being unable to make up such loss. *Id.* at *19. The *Miga* court considered, but rejected,

an argument that the Turnover Statute does not allow a court to enter a purely prohibitive injunction against a defendant to aid a judgment creditor in the collection of his judgment. *Id.* at *27-28.

The Turnover Order granted post-Judgment injunctive relief specifically designed to aid PASE with collecting its Judgment in the manner contemplated under that Judgment. It was proper and in full accord with the Turnover Statute.

III. Oxbow's Statement of Facts contains numerous misstatements.

In its Statement of Facts, Oxbow makes numerous 'factual" statements that are either inaccurate or misleading. A discussion of some of the more notable misstatements follows.

On page 4, Oxbow states, "the HEA does not detail how Oxbow must operate its plant," with Oxbow claiming that it is only obligated to act "in accordance with Prudent Operating Practice" as defined in the HEA. This statement is misleading and not relevant to this proceeding. With regard to a pollution issue, Oxbow has two choices: address the issue or shut everything down. Oxbow's pollution control duties are not subject to a Prudent Operating Practice limitation.

In its Statement of Facts, Oxbow cites Section 12 of the HEA as giving it the right to "suspend production and delivery of waste heat in certain circumstances." Oxbow Brief p. 5. Oxbow raised this "defense" to PASE's Turnover Statute proceeding, but it was unpersuasive and not relevant because the Award determined

Oxbow's pollution control responsibilities. Furthermore, Oxbow offered no testimony to support a position that it was "suspending" performance "to mitigate the potential harm or detriment" supposedly resulting from its receipt of a "Notice of Alleged Violation of Law" or any similar notice from any Government or Authority," nor did Oxbow offer any testimony of corrective action it was taking to mitigate or address any supposed potential material harm or detriment associated with its SO_2 emissions. In fact, it was uncontroverted that no corrective action had been or was being taken. 3 RR 91. The letter from Judge Branick was admitted improperly over PASE's objection. 6 RR Exh. 17. It was unauthenticated hearsay offered for the truth of the matter asserted, i.e., to infer that Jefferson County threatened to sue Oxbow for its SO_2 emissions. 3 RR 51, 60-61. In reality, that was not the case. PASE refuted Oxbow's characterization of Branick's letter by establishing that no agenda item involving Oxbow ever appeared on the County Commissioner's Court docket and that Jefferson County had not considered, much less voted upon, any supposed legal action against Oxbow relating to its SO_2 emissions. 5 RR Exh. 24.

On page 6 of its Statement of Facts, Oxbow states that "PASE paid Oxbow only $1.00 for the Waste Heat Facility in 2005," and then stated, "PASE does not pay Oxbow anything for the waste heat Oxbow delivers." Oxbow Brief p.6. Oxbow ignores that PASE paid $1.00 in the HEA because it paid $38.5 million to refurbish

and upgrade the steam plant assets (5 RR 301) and committed to pay 30% of its steam revenues in Heat Payments to Oxbow for the full term of the HEA. Section 6.2 and 6.3 of the HEA provide for the timing of PASE's payments to *purchase* waste heat and for transfer of title for the waste heat "sold and delivered to PASE." 5 RR Exh. 9, p. 40. Testimony established that PASE paid Oxbow approximately $34 million dollars for waste heat through 2011. 3 RR 130-31.

On page 9 of its Statement of Facts, Oxbow states, "PASE has conceded that it sole remedy against Oxbow is to withhold Heat Payments in accordance with the heat bank provision." PASE agrees that the Judgment and Award specify how PASE is to recover its Judgment from Heat Payment offsets (which requires Oxbow to continue to deliver waste heat and PASE to remain in operation), but denies that PASE "conceded" to a "sole remedy," especially if Oxbow intends to infer that relief under the Turnover Statute is precluded or that PASE is limited in the future from recovering damages if PASE choses to assert a new action against Oxbow.

On pages 9-10 of its Brief, Oxbow cites various federal regulations and EPA publications, included in the Brief as in Footnote 7, that were not provided to Judge Floyd or otherwise introduced into evidence during the hearing. PASE objects to Oxbow's attempt to introduce into the record for this appeal statutes, regulations, and/or publications relating to its SO_2 emissions that were not presented to Judge Floyd for his consideration during the hearing. Oxbow followed its discussion of

these materials with another discussion of a meeting that supposedly took place in August of 2016 between Oxbow and PASE representatives "to discuss SO_2 emissions and the EPA's revised SO_2 NAAQS." Oxbow then included a discussion of what was supposedly discussed in the meeting, attributing the discussion to "CR198." Oxbow's inclusion of this discussion was highly improper. CR198 is the Affidavit of Scott Stewart, a Vice President of the "Oxbow Carbon Group of Companies" which was attached to Oxbow's Motion to Transfer Venue. Scott Stewart did not testify at the Turnover Statue hearing and his Affidavit was not offered by Oxbow for any purpose therein. Nevertheless, Oxbow discretely and improperly includes a discussion of Mr. Stewart's "testimony" in support of its contention that there was a new "dispute" that had to be arbitrated.

Oxbow continues its objectionable practice on pages 11-12 of its Brief, again discreetly referring to Mr. Stewart's Affidavit in support of Oxbow supposedly agreeing to perform tests of SO_2 emissions and taking various actions with PASE, with Oxbow stating that Oxbow did testing "which began in 2017, consistently confirming that running waste heat through the cold stacks resulted in violations of the SO_2 NAAQS" even though no one actually testified in that manner at the hearing. Oxbow Brief p.11-12 (citing CR198-99). This Court of Appeals should disregard Oxbow's Statement of Fact references to "evidence" and/or "testimony" that was

never presented to or considered by Judge Floyd when he entered the Turnover Order.

This Court should recall that Oxbow delayed the hearing under the pretense that it needed its representatives, Scott Stewart and Dan Rosendale, to testify, but then brought neither of them as witnesses. PASE presumes that Oxbow wanted to avoid subjecting them to cross-examination about Oxbow's actual SO_2 emission testing, its SO_2 modeling, its communications with the TCEQ, and other matters relevant to Oxbow's "defense" to PASE's Turnover Statute proceeding. CR 367-68.

On page 13 of its Statement of Facts, Oxbow again included "evidence" that was not presented in the hearing and that is not part of the hearing record. Specifically, Oxbow discusses supposed "extensive settlement negotiations, including a mediation in Houston on April 17, 2018," and recites that the "parties' effort to resolve the Dispute were unsuccessful." For these statements, Oxbow cites its own counsel, Kevin Jacobs, who's Affidavit was attached to Oxbow's Emergency Motion to Quash the Hearing. Mr. Jacobs did not testify in the hearing that resulted in the Turnover Order, nor was his Affidavit presented to Judge Floyd for any purpose during that hearing. In fact, Mr. Jacobs' Affidavit does not reference him even being at the mediation described by Oxbow. Yet Oxbow slips in statements from Mr. Jacob's Affidavit as support for its "factual" assertions. A few sentences

later, on page 14, Oxbow states, "Oxbow ultimately determined that it could not continue using the cold stacks associated with Kiln 5 and remain in compliance with the SO_2 NAAQS." Oxbow Brief p.14. This statement was not supported by any reference to the record, nor could it be, because Oxbow did not produce any witness to testify about any of its testing or modeling regarding SO_2 compliance or any of its efforts to meet the SO_2 NAAQS. Oxbow's tactics of mischaracterization and its repeated inclusion in its Statement of Facts of testimony or evidence not properly presented in the hearing should not be mistaken for an actual defense to the Turnover Order and such tactics should not be rewarded by this Honorable Court.

CONCLUSION

For these reasons, PASE respectfully requests that this Court vacate or withdraw its Stay of the Turnover Order entered on September 12, 2018 and affirm that Turnover Order in all respects. PASE also requests that this Court affirm the Order Denying Oxbow's Motion to Compel Arbitration and enter such other orders or grant such further relief to which PASE may be justly entitled.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of Appellee's Brief was served upon the parties shown below via e-service on October 29, 2018.

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CERTIFICATE OF COMPLIANCE

This Brief complies with the typeface requirements of Texas Rule of Appellate Procedure 9.4(e) because it is a document generated on a computer in Microsoft Word using 14-point font, except for footnotes, which are no smaller than 12-point font. This Brief contains 14,979 words, excluding the parts exempted by Texas Rule of Appellate Procedure 9.4(i)(1). This Brief complies with the maximum length requirements of Texas Rule of Appellate Procedure 9.4(i)(2)(B).

/s/ S. Loyd Neal, III

In The

Court of Appeals

Ninth District of Texas at Beaumont

NO. 09-18-00359-CV
NO. 09-18-00392-CV

OXBOW CALCINING LLC, Appellant

V.

PORT ARTHUR STEAM ENERGY, L.P., Appellee

On Appeal from the 172nd District Court
Jefferson County, Texas
Trial Cause No. E-201,894

MEMORANDUM OPINION

In cause number 09-18-00359-CV, Oxbow Calcining LLC (Oxbow or Appellant) filed an interlocutory appeal of an order denying Oxbow's motion to compel arbitration (Order Denying Motion to Compel Arbitration) related to Plaintiff's Petition and Application for Post-Judgment Enforcement Orders filed by Port Arthur Steam Energy, L.P. (PASE or Appellee). *See* Tex. Civ. Prac. & Rem. Code Ann. 51.016 (West 2015). In that same cause number, Oxbow also moved for

this Court to review the trial court's Rule 24 Order requiring Oxbow to post a $2,353,284 bond and an additional $8,979,720 bond if any appeal remains pending on February 15, 2019 (Rule 24 Order). *See* Tex. R. App. P. 24. In cause number 09-18-00392-CV, Oxbow filed an appeal of a post-judgment order granting turnover relief and appointing a receiver to monitor Oxbow's Port Arthur petroleum coke calcining plant (Turnover Order).[1]

In cause number 09-18-00359-CV, we reverse the trial court's Order Denying Motion to Compel Arbitration and remand the case to the trial court for further proceedings consistent with this opinion. We also vacate the trial court's Rule 24 Order because considering our rulings, we conclude that no appellate security is

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[1] A "turnover" order is a statutory procedural device through which judgment creditors may reach assets of a judgment debtor that are otherwise difficult to attach or levy by ordinary legal process. *See* Tex. Civ. Prac. & Rem. Code Ann. § 31.002 (West Supp. 2018); *Beaumont Bank, N.A. v. Buller*, 806 S.W.2d 223, 224 (Tex. 1991). Under the statute, a judgment creditor can apply to a court for an injunction or other means to satisfy a judgment through a judgment debtor's property, including present or future property rights. *See* Tex. Civ. Prac. & Rem. Code Ann. § 31.002(a). To obtain turnover relief, a judgment creditor must prove "the judgment debtor owns property, including present or future rights to property, that is not exempt from attachment, execution, or seizure for the satisfaction of liabilities." *Id.* Upon finding the requirements of section 31.002(a) are satisfied, a trial court has discretion to issue a range of remedies, including ordering the judgment debtor to turn over nonexempt property that is in the debtor's possession, or is subject to the debtor's control, to a designated sheriff or constable for execution, and "appoint[ing] a receiver with the authority to take possession of the nonexempt property, sell it, and pay the proceeds to the judgment creditor to the extent required to satisfy the judgment." *See id.* § 31.002(b).

necessary. In cause number 09-18-00392-CV, we reverse the trial court's Turnover Order and vacate the order.

Background Information

Oxbow owns and operates a petroleum coke calcining plant. Oxbow takes petroleum coke ("petcoke") from refineries and heats the petcoke in kilns to manufacture calcined coke. Adjacent to Oxbow's facility, PASE owns and operates a waste heat recovery facility that uses heat from three of Oxbow's four kilns to boil water to make steam that PASE sells primarily to another refinery to generate electricity. The waste heat from the three kilns can either be released (1) through three "hot stacks" directly connected to kilns or (2) through three "cold stacks" after the heat is routed through PASE's waste heat facility and cooled. PASE generates steam only when Oxbow releases waste heat through the cold stacks. According to PASE, "Oxbow has the ability to manipulate its dampers to curtail or completely shut off waste heat to PASE."

In February 2005, Oxbow's predecessor in interest, Great Lakes Carbon, LLC, and PASE entered into a Heat Energy Agreement (the HEA) to govern their relationship with respect to PASE's waste heat facility. Under the wording of the HEA, PASE paid Oxbow $1.00 for the facility in 2005, and PASE does not pay

Oxbow anything for the waste heat Oxbow delivers.[2] Instead, PASE pays Oxbow a portion of revenues from PASE's sale of steam from the waste heat facility. The HEA requires PASE to make a monthly "heat payment" to Oxbow equal to 30% of the steam revenue received by PASE for the preceding month, adjusted by a mechanism referred to by the parties as the "heat bank." The heat bank adjusts the amount of heat payments due to Oxbow based on Oxbow's calcined coke production from kilns 3, 4, and 5 and the price of natural gas. According to Oxbow, if it produces more than the "threshold amount" of 43,675 tons of calcined coke per month, then it accumulates a credit in the heat bank, but if it produces less than the threshold amount, it accumulates a deficit in the heat bank. The HEA provides the following regarding Oxbow's right to suspend performance under the HEA:

> Notwithstanding anything otherwise set forth in this Agreement, [Oxbow][3] shall have the right to suspend its performance hereunder, including by suspending production and delivery of flue gas to PASE, without liability to PASE at anytime that [Oxbow]: (a) receives a notice of alleged violation of Law or any similar notice from any Governmental Authority relating to, arising out of or in connection with the Steam Production Upgrade, the Steam Production Facility or the performance of this Agreement which, if further prosecuted or pursued,

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[2] PASE argues that "PASE paid $1.00 in the HEA because it paid $38.5 million to refurbish and upgrade the steam plant assets . . . and committed to pay 30% of its steam revenues in Heat Payments to Oxbow for the full term of the HEA." PASE also contends that "PASE paid Oxbow approximately $34 million dollars for waste heat through 2011."

[3] When quoting the HEA, we substitute "Oxbow" for "G[reat] L[akes] C[arbon]", as Oxbow is Great Lakes Carbon's successor in interest.

> may subject [Oxbow] to a material harm or detriment as reasonably determined by [Oxbow] and the suspension of its performance may be expected to mitigate the potential material harm or detriment as reasonably determined by [Oxbow], or (b) is named in, or otherwise made a party to, arising out of or in connection with the Steam Production Upgrade, the Steam Production Facility or the performance of this Agreement, the result of which might subject [Oxbow] to material harm or detriment as reasonably determined by [Oxbow]. . . .

By its written terms, the HEA requires both parties to operate and maintain their respective facilities in accordance with "Prudent Operating Practice" to comply with all applicable laws and permits and it requires Oxbow to use "Commercially Reasonable Efforts" to maximize the production and delivery of waste heat to PASE.

Section 14.1 of the HEA states that "[e]very dispute of any kind or nature between the Parties arising out of or in connection with this Agreement (each a "Dispute") shall be resolved in accordance with this Article 14, to the extent permitted by Law." Under Article 14 (the HEA's dispute resolution provisions), if a "Dispute" arises, either party may send a notice to the other party "requesting that the Dispute be referred to the senior management of the Parties." Section 14.3 provides for arbitration as follows:

> (a) Any Dispute that has not been satisfactorily resolved within 30 days of the delivery of a notice in accordance with Section 14.2(a) shall be submitted by either Party to binding arbitration pursuant to the procedures set forth in this Article and pursuant to the Arbitration Rules. If, and to the extent that, the provisions of this Section 14.3 are inconsistent with the Arbitration Rules, the provisions of this Section

14.3 shall control in any arbitration proceeding to the extent permitted by Law.

(b) A copy of the submittal to arbitration pursuant to Section 14.3(a) shall be made in writing to the other Party, and shall set forth the nature of the Dispute, the amount involved, if any, and the remedies sought. The submittal to arbitration shall be made within a reasonable time after the expiration of the 30-day period set forth in Section 14.2(a).

(c) The arbitrator shall be appointed pursuant to the Arbitration Rules provided that any such arbitrator shall be experienced generally with the subject matter(s) of the Dispute and shall not have had an affiliation with either Party or any Party's Associated Parties within the seven-year period preceding the arbitration, or have any financial interest in the Dispute.

(d) The arbitration hearing shall be held in Houston, Texas, or such other place as may be mutually agreed upon by the Parties, and shall commence not later than 60 days after the date of the original demand under Section 14.3(a), except due to unavailability of the arbitrator. The arbitrator's award shall be made not later than 45 days after the date of closing of the hearing, or if oral hearings have been waived, after the date of transmitting the final statements and proof to the arbitrator; provided, however, that in no event shall any award be made later than 180 days after the date of the original demand for arbitration under Section 14.3(a).

(e) In arriving at his decision, the arbitrator shall consider the pertinent facts and circumstances and be guided by the terms and conditions of this Agreement, and, if a solution is not found in the terms of this Agreement, the arbitrator shall apply the governing law of this Agreement as set forth in Section 19.13; provided, however, that the arbitrator shall have no authority, power or right to alter, change, amend, modify, waive, add to or delete from any of the provisions of this Agreement, and any award rendered by the arbitrator shall be consistent with the terms and conditions of this Agreement. Both Parties shall have the right to present documentary evidence, witnesses and to cross examine witnesses. The decision of the arbitrator shall be

> final and binding upon both Parties, and judgment on the arbitration award may be entered in any court having jurisdiction. Except as otherwise provided in Section 14.3(g), arbitration in accordance with this Section 14.3 shall be the exclusive means of resolving Disputes that are not resolved by negotiation or mediation, and neither Party shall seek recourse to a court or other authorities to resolve a Dispute or to appeal for revisions to an arbitration decision.
>
> (f) Except as otherwise determined by the arbitrator in the exercise of his discretion, the fees and expenses of the arbitrator shall be shared equally by the Parties, and each Party shall bear its own costs and expenses.
>
> (g) Notwithstanding the other provisions of this Section 14.3, each Party shall have the right at any time, at its option and where legally available, to commence an action or proceeding in a court of competent jurisdiction, in order to (i) compel the other Party to arbitrate a Dispute as contemplated by this Section 14.3, or (ii) seek and obtain a restraining order or injunction, but not monetary damages, to enforce the confidentiality provisions set forth in Article 17.

Furthermore, section 13.6 of the HEA provides the following regarding the limitation on Oxbow's liability as well as the source of monetary recovery from or against Oxbow:

> Notwithstanding anything otherwise set forth in this Agreement, (a) [Oxbow]'s aggregate maximum liability for monetary damages with respect to any and all Claims in connection with the performance or non-performance of this Agreement or otherwise arising out of or in connection with this Agreement, shall be limited to the aggregate amount of future Heat Payments otherwise due to [Oxbow] during the remainder of the term at the time of any such Claim, and (b) PASE's exclusive means of monetary recovery from or against [Oxbow] with respect [to] any Claim whether pursuant to an arbitral award rendered in accordance with Article 14 or pursuant to any judgment, sanction, penalty, other award or otherwise, shall be to withhold amounts

> otherwise due [Oxbow] hereunder in accordance with Article 6, with the understanding that [Oxbow] shall never be required to make any direct payment to PASE as a result of any Claim.

According to Oxbow, it received heat payments from 2005 until 2011, but Oxbow's production of calcined coke fell below the threshold amount in 2009 and its balance in the heat bank went negative in 2011 due to a decline in the market for calcined coke, and Oxbow has not received heat payments from PASE since 2011. Oxbow filed a Demand for Arbitration and a Statement of Claims in July 2010 asserting various claims against PASE, and PASE filed counterclaims against Oxbow. According to PASE, disputes about the interpretation and duties under the HEA were at issue before an arbitration panel in Houston:

> (1) the adequacy of the steam plant's pollution control equipment; (2) whether Oxbow was operating its calcining plant consistent with "prudent operating practice" as required by the Heat Agreement; (3) whether Oxbow was using "commercially reasonable" efforts to deliver flue gas energy to PASE's boilers; and (4) which party was responsible for the refurbishment and future maintenance of the cold stacks.

In December 2011, the arbitration panel concluded in its award that, among other things, the HEA does not impose on PASE any obligation to install pollution control equipment in Oxbow's portion of the Facility, Oxbow bears the risk of installing and maintaining pollution control equipment that will ensure Oxbow's operation complies with Oxbow's air permits and environmental laws, Oxbow is responsible for the maintenance of the cold stacks once properly installed, and PASE

is liable to Oxbow for $812,012 for PASE's share of the initial cost of the modification of the cold stacks to comply with HEA specifications. The arbitration award provided, however, that this amount would offset the amount awarded to PASE in the arbitration award. As for PASE's claims, the arbitration panel awarded PASE damages in the amount of $4,515,056 for lost revenue for Oxbow's breach of the sections of the HEA that required Oxbow to "use Commercially Reasonable Efforts to maximize the production and delivery of Flue Gas Energy" to PASE and to operate and maintain its facility "in accordance with Prudent Operating Practice to comply with all applicable Laws and Permits, and within the design parameters and limits of the applicable materials, equipment and construction." The Panel entered the following relief:

> [] PASE is awarded $4,515,056.00 as direct damages for the lost revenue caused by Oxbow's breaches of the Heat Agreement. This award of damages is to be offset by $812,012.00 for the costs of repairing the cold stacks, and $293,262.43 for unpaid City and County taxes for 2008-10, all in accordance with this Award. The net amount awarded to PASE against Oxbow is $3,409,781.57. PASE is entitled to pre-and post-award of interest as provided by governing law on this net amount. This is not a cash award requiring Oxbow to write PASE a check. It shall be handled in accordance with the specific provisions of the Heat Agreement regarding the heat bank as an offset.
>
> [] Oxbow did not prevail on its largest claim[] and is therefore not a prevailing party. While PASE did recover on its lost heat claim, it also lost out on several of its other claims for relief. So[,] neither party is clearly the prevailing party. The Panel declines to award either party the costs of arbitration or attorneys' fees incurred in this arbitration.

> Each party is directed to bear its own costs and attorney's fees. The administrative fees totaling $41,600 and the compensation and expenses of the panel totaling $141,577.23 shall be borne as incurred.
>
> [] This is a Final Award[] and is intended to be enforceable in any court of competent jurisdiction. All relief requested but not expressly granted herein is denied.

PASE moved to confirm the award in the 151st District Court of Harris County, and Oxbow moved to vacate the award on the ground of partiality of an arbitrator. *Port Arthur Steam Energy LP v. Oxbow Calcining LLC*, 416 S.W.3d 708, 710 (Tex. App.—Houston [1st Dist.] 2013, pet. denied). The trial court denied confirmation and granted Oxbow's motion to vacate the arbitrator's decision. *Id*. On October 22, 2013, the First Court of Appeals reversed the trial court's order vacating the arbitration award and remanded to the trial court to enter judgment to confirm the arbitration award. *Id.* at 715. Oxbow filed a petition for review with the Texas Supreme Court which was denied. *Oxbow Calcining LLC v. Port Arthur Steam Energy LP*, No. 14-0103, 2014 Tex. LEXIS 1072 (Tex. Oct. 24, 2014). On January 8, 2015, the District Court for the 151st Judicial District of Harris County signed a judgment confirming the arbitration award, and the arbitration award was attached and incorporated within the judgment. The judgment included language that it is "enforceable in the same manner as any other judgment or decree of the Court[,]" and "resolve[d] all claims in this case and is intended to be a final judgment."

According to Oxbow, in 2010 the Environmental Protection Agency (EPA) substantially lowered maximum concentration levels for the National Ambient Air Quality Standards (NAAQS) for SO_2, and in late 2016, as part of an EPA-driven monitoring program, the Texas Commission on Environmental Quality (TCEQ) began to monitor Oxbow's and PASE's facilities to determine the impact of the operations on ambient air quality. According to Oxbow, Oxbow and PASE representatives met to discuss the changes in the regulations and Oxbow explained that the new regulations would limit Oxbow's ability to supply waste heat to the cold stacks that PASE uses to generate steam unless Oxbow spent large sums of money to install pollution control equipment for PASE's benefit. The record includes a 2017 email wherein Oxbow informed PASE that it was suspending use of the cold stacks for kilns 3 and 4 to mitigate the risk of SO_2 violations and stated that it did "not have enough data necessary to draw any conclusions regarding the continued delivery of [waste heat] from Kiln 5[]" but would inform PASE "[a]s soon as Oxbow is able to make a determination regarding Kiln 5[.]" The record reflects that in April and June 2017, the TCEQ notified Oxbow that the Port Arthur SO_2 monitoring station showed exceedences of the SO_2 NAAQS, and that the TCEQ agreed that all exceedences of the SO_2 NAAQS occurred while Oxbow's plant had at least one cold stack operating.

PASE contends that "Oxbow makes numerous 'factual' statements that are either inaccurate or misleading." PASE specifically disputes Oxbow's allegations that it has the right to shut down production and delivery of waste heat under the HEA. According to PASE, "[w]ith regard to a pollution issue, Oxbow has two choices: address the issue or shut everything down." PASE further contends that "Oxbow's pollution control duties are not subject to a Prudent Operating Practice limitation." Furthermore, PASE argues that "Oxbow offered no testimony to support a position that it was 'suspending' performance 'to mitigate the potential harm or detriment' supposedly resulting from its receipt of a 'Notice of Alleged Violation of Law' or any similar notice from any Government or Authority" and Oxbow failed to "offer any testimony of corrective action it was taking to mitigate or address any supposed potential material harm or detriment associated with its SO_2 emissions."

Before filing the Application for Turnover, PASE sent Oxbow a Notice of Failure to Perform Material Obligations under the Heat Energy Agreement in which PASE stated that "[p]ursuant to Section 14.2, PASE is hereby providing notice to Oxbow of the occurrence/existence of a Dispute that should be referred to senior management of Oxbow." According to Oxbow, it responded to the notice by designating its senior management representatives in accordance with the HEA

arbitration provision, the parties engaged in settlement negotiations including mediation, and the parties were unable to resolve the dispute.

According to a letter that is dated May 7, 2018, the County Judge for Jefferson County notified Oxbow by letter that TCEQ monitoring data showed excess SO_2 NAAQS and warned Oxbow that if not corrected, such exceedences could result in Jefferson County suing Oxbow for injunctive relief to preclude further violations.[4] In June 2018, Oxbow notified PASE that it was indefinitely suspending production of waste heat from kiln 5. Oxbow contends that since it stopped all waste heat to PASE, Oxbow has operated solely through the hot stacks with no additional exceedences of the SO_2 NAAQS.

On June 8, 2018, PASE filed Plaintiff's Petition and Application for Post-Judgment Enforcement Orders (the petition), and the suit was assigned to the 172nd Judicial District Court. PASE sought "post-judgment relief and orders from [the 172nd District Court] including, but not limited to, injunctive orders and/or, in the alternative, a Turnover Order, an Order Appointing a Receiver, and/or other orders or relief under §31.002 of the Texas Civil Practice & Remedies Code against Oxbow

[4] PASE argued in its Appellate Brief that the letter from the County Judge was admitted improperly at the hearing held in the trial court. PASE filed a post-submission motion alleging the letter was "orchestrate[d]" by Oxbow "to justify discharging all of its waste heat through Oxbow's hot stacks to avoid a TCEQ monitor and put PASE out of business[.]"

[], a Judgment Debtor of PASE[.]" According to its petition, PASE sought orders "to assist PASE in collecting a Judgment entered in favor of PASE against Oxbow in the amount of $3,409,781.57, plus pre-judgment and post-judgment interest" resulting from the December 2011 Arbitration Award and that "PASE has not been able to recover a single dollar from Oxbow to apply toward the satisfaction of this Judgment." Oxbow filed a Motion to Transfer Venue, and Subject Thereto, Its Motion to Compel Arbitration and Original Answer.

After a hearing, the 172nd District Court signed orders denying Oxbow's motions to transfer venue and compel arbitration and granting PASE's proposed Turnover Order. Oxbow filed a Notice of Appeal with this Court appealing the order denying Oxbow's Motion to Compel Arbitration and appealing the Turnover Order. Oxbow also filed an emergency motion to stay all trial court proceedings and discovery during the appeals. This Court issued an order granting a temporary stay and staying the enforcement of the Turnover Order and discovery in the case until further order of this Court. In the same order, we ordered the trial court to conduct a hearing pursuant to Rules 24 and 24.2 of the Texas Rules of Appellate Procedure. The trial court held a Rule 24 hearing and the trial court signed an order requiring Oxbow to post a $2,353,284 bond and an additional $8,979,720 bond if any appeal remains pending on February 15, 2019.

Appeals[5]

In cause number 09-18-00359-CV, Oxbow filed an accelerated interlocutory appeal of the Order Denying Motion to Compel Arbitration. On appeal and in issue one, Oxbow argues the trial court erred in denying Oxbow's motion to compel arbitration because the allegations pleaded and litigated by PASE fall within the scope of the mandatory provision in the parties' HEA. Oxbow also filed with this Court a Rule 24.4 Motion to Review Amount of Appellate Security. *See* Tex. R. App. P. 24.4 (authorizing an appellate court, on motion from a party, to review the "(1) the sufficiency or excessiveness of the amount of security, . . . ; (2) the sureties on any bond; (3) the type of security; (4) the determination whether to permit suspension of enforcement; and (5) the trial court's exercise of discretion under Rule 24.3(a)."). PASE filed a response to Oxbow's Rule 24.4 Motion to Review Amount of Appellate Security.

In cause number 09-18-00392-CV, Oxbow appeals the Turnover Order. On appeal, Oxbow argues the trial court erred in entering the Turnover Order appointing a receiver to oversee Oxbow's operations when the trial court had no jurisdiction over the proceeding, the Turnover Statute does not authorize such unprecedented

[5] In each party's appellate brief, filed in both appellate cause numbers, the parties discuss both the Order Denying the Motion to Compel Arbitration and the Turnover Order.

relief, the underlying Arbitration Award and Judgment expressly rejected similar relief, and PASE waived any right to such relief in the HEA's exclusive remedy provision.

Analysis

In issue one, Oxbow argues the trial court erred in refusing to compel arbitration because PASE agreed to arbitrate this dispute with Oxbow, the allegations in PASE's petition arise out of or in connection with the HEA, PASE's actions before and after filing this lawsuit confirm that this dispute is arbitrable, and PASE failed to meet its burden to defeat arbitration. According to Oxbow, the dispute was not litigated or decided by the 2010-2011 arbitration, but instead arose years later once Oxbow began suspending waste heat delivery under the HEA's suspension provision and based on revised SO_2 NAAQS and governmental demands for Oxbow to comply with the NAAQS and its permits.

PASE contends the trial court properly denied Oxbow's motion to compel arbitration because it did not apply to PASE's Application for Turnover Order, and the Federal Arbitration Act and the HEA do not preempt the use of the Turnover Statute. According to PASE, it "did not assert, nor did the Turnover Order decide, any new claims or causes of action, nor did the Order resolve any new 'dispute' or award new damages[,]" and "[t]here is certainly no reason to re-arbitrate the

collection of the Judgment from the first arbitration." PASE further argues on appeal that "[t]he presumption of arbitration has no applicability when PASE did not assert a new claim or cause of action, did not seek to recover damages in the Turnover proceeding and only sought to recover the damages awarded in the Judgment." In response to Oxbow's argument that PASE's claims in its petition were not litigated or decided by the 2010-2011 arbitration, PASE argues that it did not assert any new claims or causes of action against Oxbow or seek to recover any damages based on Oxbow's actions in 2016 or 2018, and no such claims or causes of action were decided in the Turnover Order.

We first address PASE's argument that it is merely seeking the trial court's assistance in enforcing the 2011 Arbitration Award and is not alleging a dispute. The judgment confirming the Arbitration Award incorporates the award and states it is "enforceable in the same manner as any other judgment or decree of the Court[]" and "resolves all claims in this case and is intended to be a final judgment." Despite this language, the Arbitration Award incorporated by the judgment stated the damages for lost revenues awarded to PASE was not a cash award requiring Oxbow to write a check, but "shall be handled in accordance with the specific provisions of the Heat Agreement regarding the heat bank as an offset." In other words, the Arbitration Award invoked the HEA and required the HEA to continue to provide

the parameters for the offset in the future. PASE's Petition and Application for Post-Judgment Enforcement alleges the following in part:

> . . . PASE was not to recover a monetary payment for damages directly from Oxbow, but was, instead, to recover the damages awarded in the Judgment by offsetting "Heat Payments" that the [arbitration] panel anticipated PASE would be making to Oxbow under Section 6 of the Heat Agreement over the next twelve or more years. Implicit in the Award was the assumption that from December of 2011, forward, Oxbow would honor its duties under the Heat Agreement to maximize the delivery of flue gas energy to PASE so that Heat Payments would be generated that PASE would offset to recover its Judgment. The Award also made clear that Oxbow was to meet its obligation to control pollution while simultaneously fulfilling its obligations to PASE under the Heat Agreement[.]
>
> . . . .
>
> [] Since the Award was decided, and particularly after the Award was upheld on appeal and became incorporated into the Judgment, Oxbow has continuously operated its calcining plant in a manner to insure that PASE will never receive enough flue gas energy to generate Heat Payments that PASE can offset to recover its Judgment. Oxbow accomplishes this objective by discharging waste heat through Oxbow's hot stacks to circumvent PASE in a manner intended to force PASE out of business and keep PASE from ever recovering its Judgment. Oxbow has stopped delivering flue gas energy to PASE's Boiler Nos. 3 and 4 completely and has been fluctuating its delivery of flue gas energy to Boiler No. 5 to the point that it is often barely operational. . . . Oxbow confirmed to PASE that the abatement of flue gas energy to Boiler Nos. 3 and 4 is permanent, with PASE not knowing if or when Oxbow will stop its delivery of flue gas energy to Boiler No. 5 altogether. . . .
>
> [] Like it did when it launched its failed arbitration claims in 2011, Oxbow now "justifies" its actions by claiming that it is curtailing and/or abating the delivery of flue gas energy to PASE due to pollution

> concerns. In reality, Oxbow's position is based upon a thinly disguised pretext for a non-existent legal "obligation" to control ambient Sulphur Dioxide (SO_2) emissions. . . . Oxbow, rather than proactively implement any pollution control measures (to the extent it has any "concern" over possible future SO_2 regulations), has used the [NAAQS SO_2] monitoring process as a pretext to shut PASE down and keep PASE from ever recovering its Judgment. . . .
>
> . . . .
>
> . . . Oxbow cannot meet its obligations under the Heat Agreement, including its duties of good faith and fair dealing to PASE, by refusing to install SO_2 pollution control equipment or taking other pollution control measures while simultaneously stopping the delivery of flue gas energy to PASE and keeping PASE from recovering its Judgment under the guise of supposed SO_2 "compliance."
>
> . . . .
>
> [] As a result of Oxbow's continued failures to comply with the Heat Agreement, PASE needs the aid of this Court to recover its Judgment pursuant to the Turnover Statute, Tex. Civ. Prac. & Rem. Code §31.002.

In summary, PASE's Petition and Application for Post-Judgment Enforcement asserts that since the Arbitration Award, Oxbow has failed to comply with the HEA by suspending waste heat delivery to PASE. PASE further alleges that Oxbow claims its suspension is the result of the new emissions standards. The petition also asserts that Oxbow's refusal to install pollution control equipment or take other pollution control measures while stopping the delivery of waste heat constitutes a breach of Oxbow's duties of good faith and fair dealing under the HEA, even though

the arbitration panel expressly denied PASE's claim for breach of the duty of good faith and fair dealing in the prior arbitration. We conclude that the matters asserted in PASE's Petition and Application for Post-Judgment Enforcement constitute a dispute not litigated in the prior arbitration.[6]

We review a trial court's denial of a motion to compel arbitration for an abuse of discretion. *In re Labatt Food Serv., L.P.*, 279 S.W.3d 640, 642-43 (Tex. 2009) (orig. proceeding). A party attempting to compel arbitration under the FAA must establish that there is a valid arbitration agreement and show that the claims raised are within the scope of that agreement. *In re Rubiola*, 334 S.W.3d 220, 223 (Tex. 2011) (orig. proceeding). There is a presumption favoring agreements to arbitrate under the FAA, but the presumption arises only after the party seeking to compel

---

[6] We note that in an April 8, 2017 letter from the PASE Manager to an Oxbow Vice-President with the subject line "Notice of Failure to Perform Material Obligations under the Heat Energy Agreement[,]" admitted at the hearing on the Turnover proceeding, the PASE Manager advised the following:

> Oxbow's interruption and suspension of Flue Gas delivery to PASE and its refusal to replace the stack, are failures to perform material obligations under Section 13.1(b) and a breach of the duty of good faith and fair dealing under the Heat Energy Agreement. Pursuant to Section 14.2, PASE is hereby providing notice to Oxbow of the occurrence/existence of a Dispute that should be referred to senior management of Oxbow. PASE hereby designates Ted Boriack and Ray Deyoe as its senior management representative(s) who will meet with Oxbow's senior management regarding this Dispute.

arbitration proves that a valid arbitration agreement exists. *In re Kellogg Brown & Root, Inc.*, 166 S.W.3d 732, 737-38 (Tex. 2005) (orig. proceeding). If the party seeking to compel arbitration proves that a valid arbitration agreement exists, the burden shifts to the party opposing arbitration to raise an affirmative defense to enforcement of the agreement. *J.M. Davidson, Inc. v. Webster*, 128 S.W.3d 223, 227 (Tex. 2003).

In the trial court, Oxbow and PASE agreed that the arbitration provision in the HEA is valid. They disagree on whether the petition PASE filed should be governed by the arbitration clause. Oxbow argues that the trial court abused its discretion in determining arbitrability because the HEA states the AAA Rules apply and AAA Rule R-7(a) says the arbitrator shall have the right to determine the arbitrability of any claim.

"The determination of whether the arbitration agreement imposes a duty to arbitrate the claims in a particular dispute is a matter of contract interpretation." *See T.W. Odom Mgmt. Servs., Ltd. v. Williford*, No. 09-16-00095, 2016 Tex. App. LEXIS 9353, at *7 (Tex. App.—Beaumont Aug. 25, 2016, no pet.) (mem. op.) (not designated for publication). If the agreement clearly and unmistakably demonstrates that the parties intended to confer on the arbitrator the power to determine what disputes are arbitrable, the trial court lacks the power to decide that issue. *Id.* at **9-

10 (citing *First Options of Chicago, Inc. v. Kaplan*, 514 U.S. 938, 943 (1995) (concluding the question of determining primary power to decide arbitrability turns upon what the parties agreed to on the matter)). "Thus, when an arbitration agreement clearly and unmistakably demonstrates the parties' intent to confer on the arbitrator the power to determine substantive arbitrability, questions regarding gateway issues that are normally decided by the court will be submitted to the arbitrator." *Id.* at *10 (citing *Kaplan*, 514 U.S. at 943.).

The arbitration clause in the HEA provides that the parties shall resolve "[e]very dispute of any kind or nature between the Parties arising out of or in connection with this Agreement (each a "Dispute") . . . in accordance with Article 14 [titled "Dispute Resolution and Arbitration"], to the extent permitted by Law." The HEA also provides that "[a]ny Dispute that has not been satisfactorily resolved within 30 days of the delivery of a notice in accordance with Section 14.2(a) shall be submitted by either Party to binding arbitration pursuant to the procedures set forth in this Article and pursuant to the Arbitration Rules." The HEA provides that "'Arbitration Rules' shall mean the commercial arbitration rules of the American Arbitration Association." Rule R-7(a) of the American Arbitration Association Commercial Arbitration Rules states:

> The arbitrator shall have the power to rule on his or her own jurisdiction, including any objections with respect to the existence,

> scope, or validity of the arbitration agreement or to the arbitrability of any claim or counterclaim.[7]

The HEA provides that each dispute of any kind or nature between PASE and Oxbow arising out of or in connection with the HEA, if not resolved within thirty days of the delivery of the required notice, shall be submitted by either party to binding arbitration pursuant to the AAA Commercial Rules, which provide in Rule R-7(a) that the arbitrator has the power to rule on his or her own jurisdiction and on arbitrability of any claim or counterclaim. The HEA, with its broad arbitration clause and incorporation of the AAA Commercial Rules, clearly and unmistakably shows that PASE and Oxbow intended to delegate gateway issues, such as jurisdiction and arbitrability, to the arbitrator. *See, e.g.*, *Trafigura Pte. Ltd. v. CNA Metals Ltd.*, 526 S.W.3d 612, 616-18 (Tex. App.—Houston [14th Dist.] 2017, no pet.) (finding persuasive and applying reasoning of other Texas appellate courts and federal cases holding that express incorporation of the AAA rules constitutes clear and unmistakable evidence of the parties' intent to delegate issues of arbitrability to the arbitrator); *Schlumberger Tech. Corp. v. Baker Hughes Inc.*, 355 S.W.3d 791, 802-03 (Tex. App.—Houston [1st Dist.] 2011, no pet.) (broad arbitration clause and

[7] American Arbitration Association, Commercial Arbitration Rules and Mediation Procedures, Rule R-7(a), p. 13, (Rules amended and effective October 1, 2013), https://www.adr.org/sites/default/files/CommercialRules_Web.pdf.

incorporation of AAA Commercial Arbitration Rules by reference in the arbitration agreement sufficient to show parties intended the arbitrator to decide arbitrability); *Saxa Inc. v. DFD Architecture Inc.*, 312 S.W.3d 224, 229-31 (Tex. App.—Dallas 2010, pet. denied) (broad arbitration clause that explicitly incorporated AAA rules served as clear and unmistakable evidence of parties' intent to delegate question of arbitrability to arbitrator); *Rio Grande Xarin II, Ltd. v. Wolverine Robstown, L.P.*, Nos. 13-10-00115-CV & 13-10-00116-CV, 2010 Tex. App. LEXIS 5189, at **20-23 (Tex. App.—Corpus Christi July 6, 2010, pet. dism'd) (mem. op.) (not designated for publication) (arbitration clause in earnest money contract stating that arbitration would be conducted "in accordance with the Commercial Arbitration Rules of the American Arbitration Association[]" clearly and unmistakably showed intent that arbitrator determine arbitrability); *see also Crawford Prof'l Drugs, Inc. v. CVS Caremark Corp.*, 748 F.3d 249, 262-63 (5th Cir. 2014); *Petrofac, Inc. v. DynMcDermott Petroleum Operations Co.*, 687 F.3d 671, 675 (5th Cir. 2012) ("We agree with most of our sister circuits that the express adoption of [the AAA] rules presents clear and unmistakable evidence that the parties agreed to arbitrate arbitrability.") We conclude the trial court abused its discretion when it denied Oxbow's Motion to Compel Arbitration. Issue one is sustained.

In issue two, Oxbow argues the trial court erred in entering the Turnover Order. We review orders under the turnover statute for an abuse of discretion and will reverse the trial court only if we determine that it acted in an unreasonable or arbitrary manner or without reference to any guiding rules and principles. *See Beaumont Bank, N.A. v. Buller*, 806 S.W.2d 223, 226 (Tex. 1991). In light of our rulings in cause number 09-18-00359-CV, the trial court had no jurisdiction and abused its discretion in entering the Turnover Order challenged in cause number 09-18-00392-CV. Issue two is sustained.

In cause number 09-18-00359-CV, we reverse the trial court's order denying Oxbow's Motion to Compel Arbitration, and we remand the cause to the trial court for further proceedings consistent with this opinion. Accordingly, we also vacate the trial court's Rule 24 Order because no appellate security is necessary. *See* Tex. R. App. P. 24. In cause number 09-18-00392-CV, we reverse the trial court's Turnover Order and vacate the order.

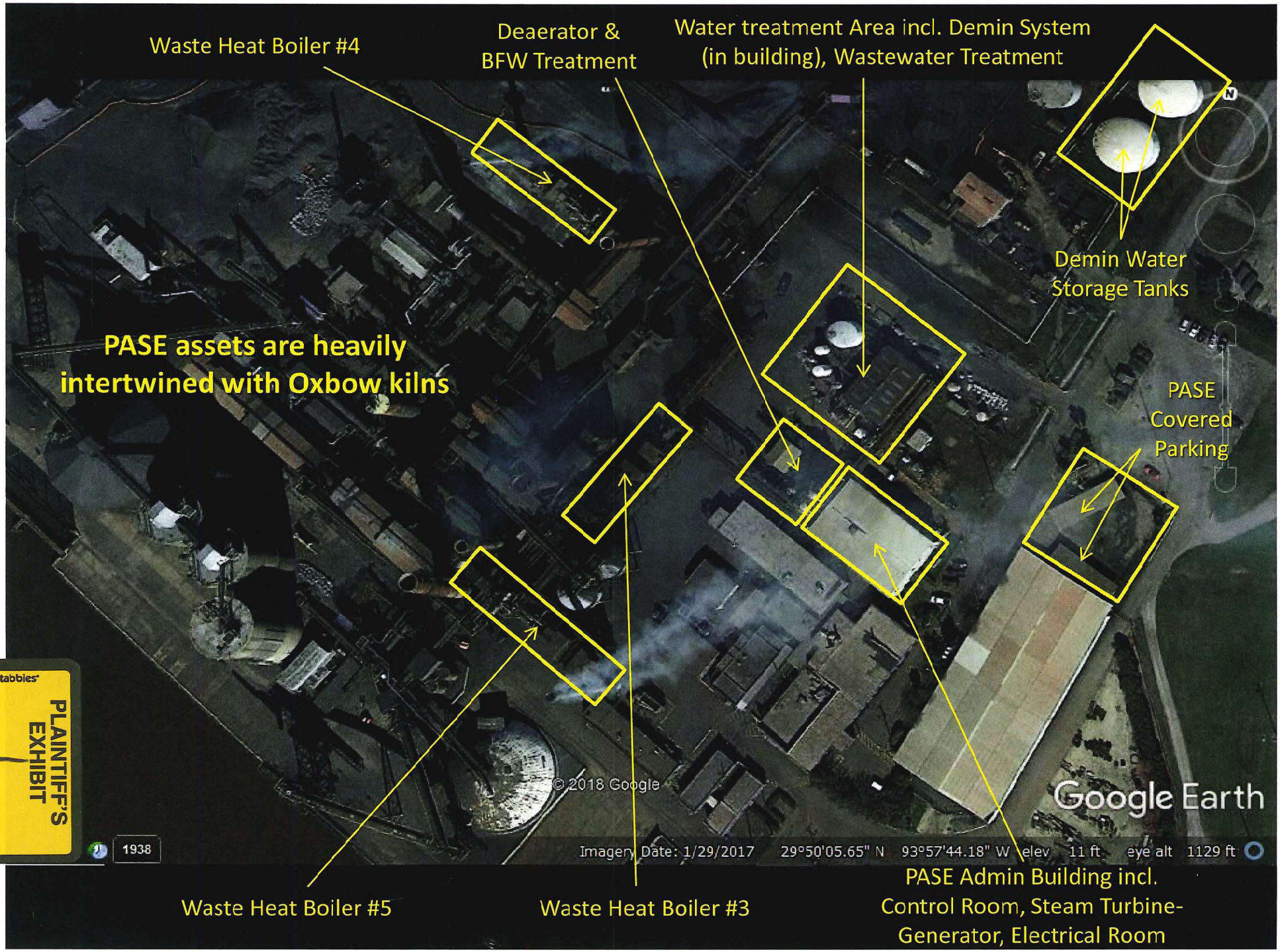
REVERSED AND REMANDED; REVERSED AND RENDERED.

_____

LEANNE JOHNSON
Justice

Submitted on November 19, 2018
Opinion Delivered December 13, 2018

Before McKeithen, C.J., Kreger and Johnson, JJ.



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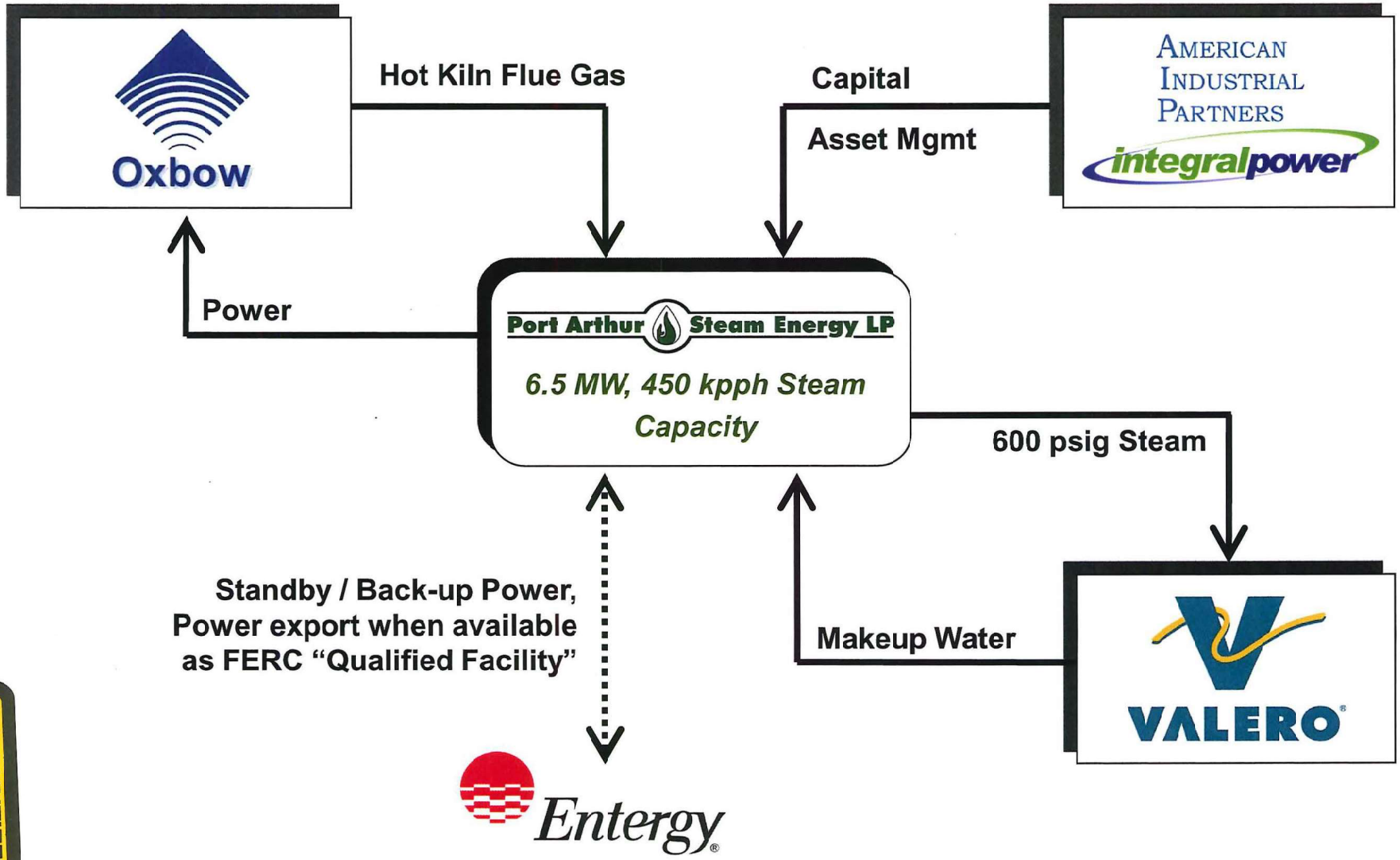
PLAINTIFF'S EXHIBIT
1

PASE Basic Structure and Counterparties



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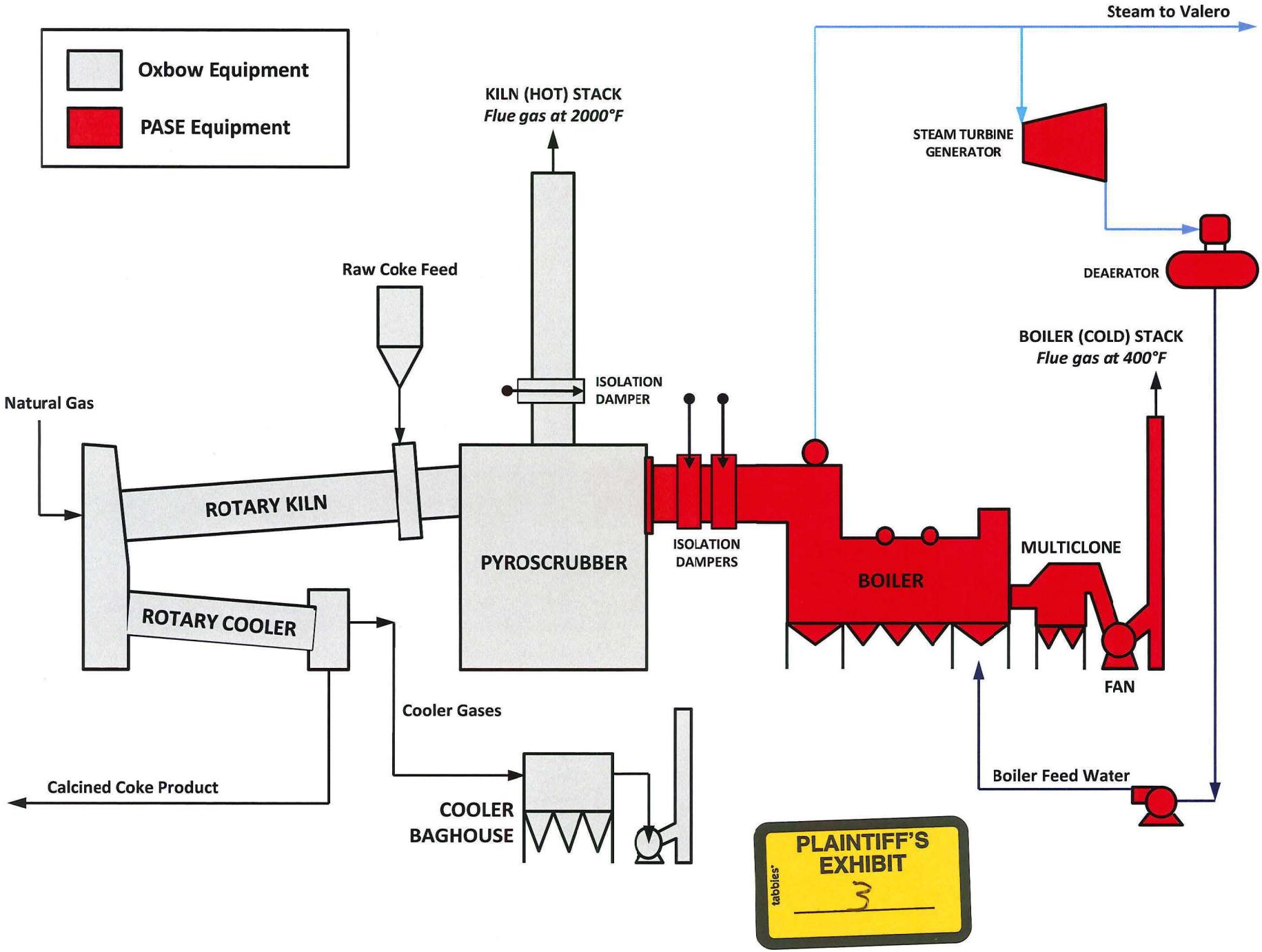
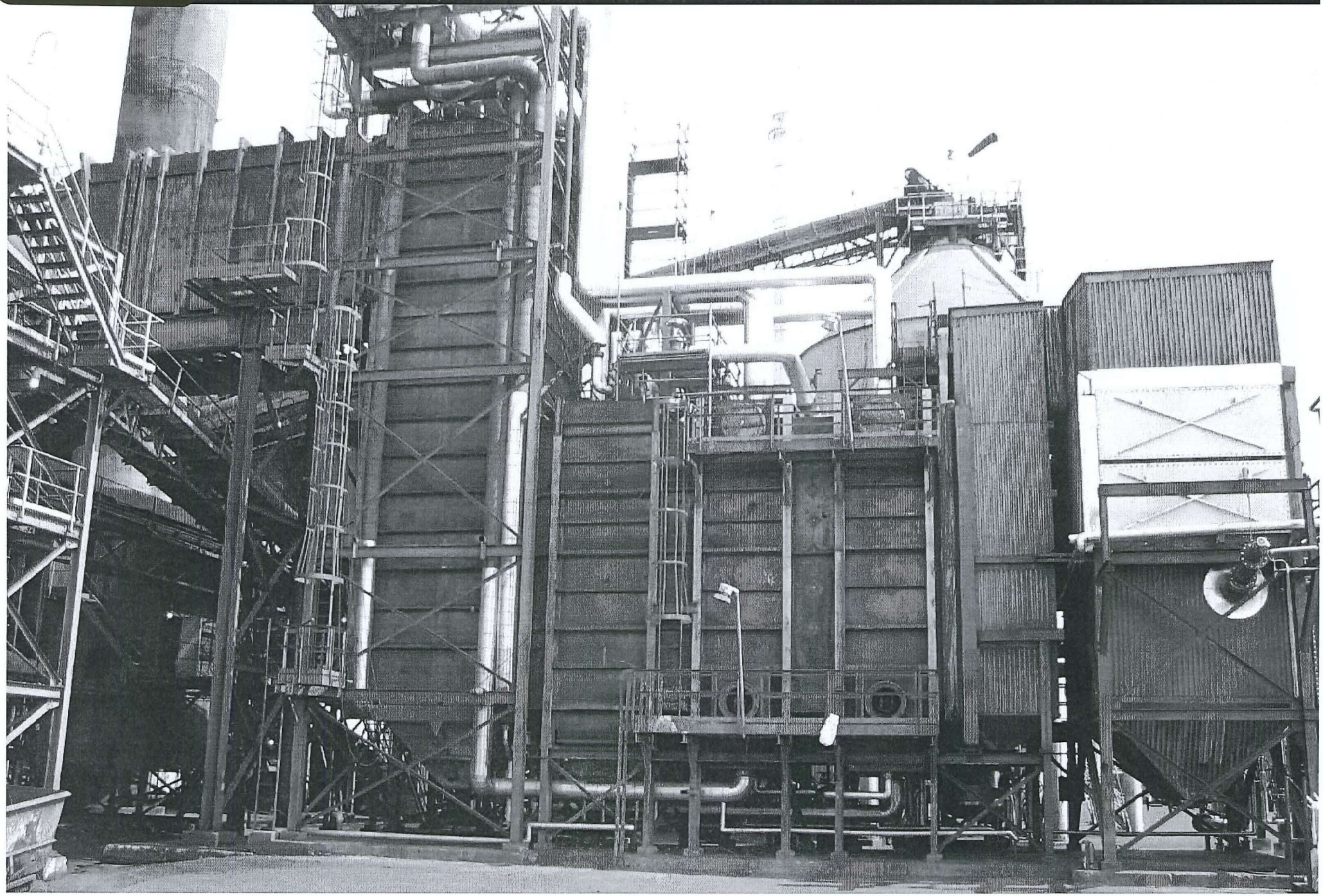
PLAINTIFF'S EXHIBIT

PASE - Oxbow Equipment Arrangement



PLAINTIFF'S EXHIBIT 4

PASE Waste Heat Recovery Boiler (1 of 3)



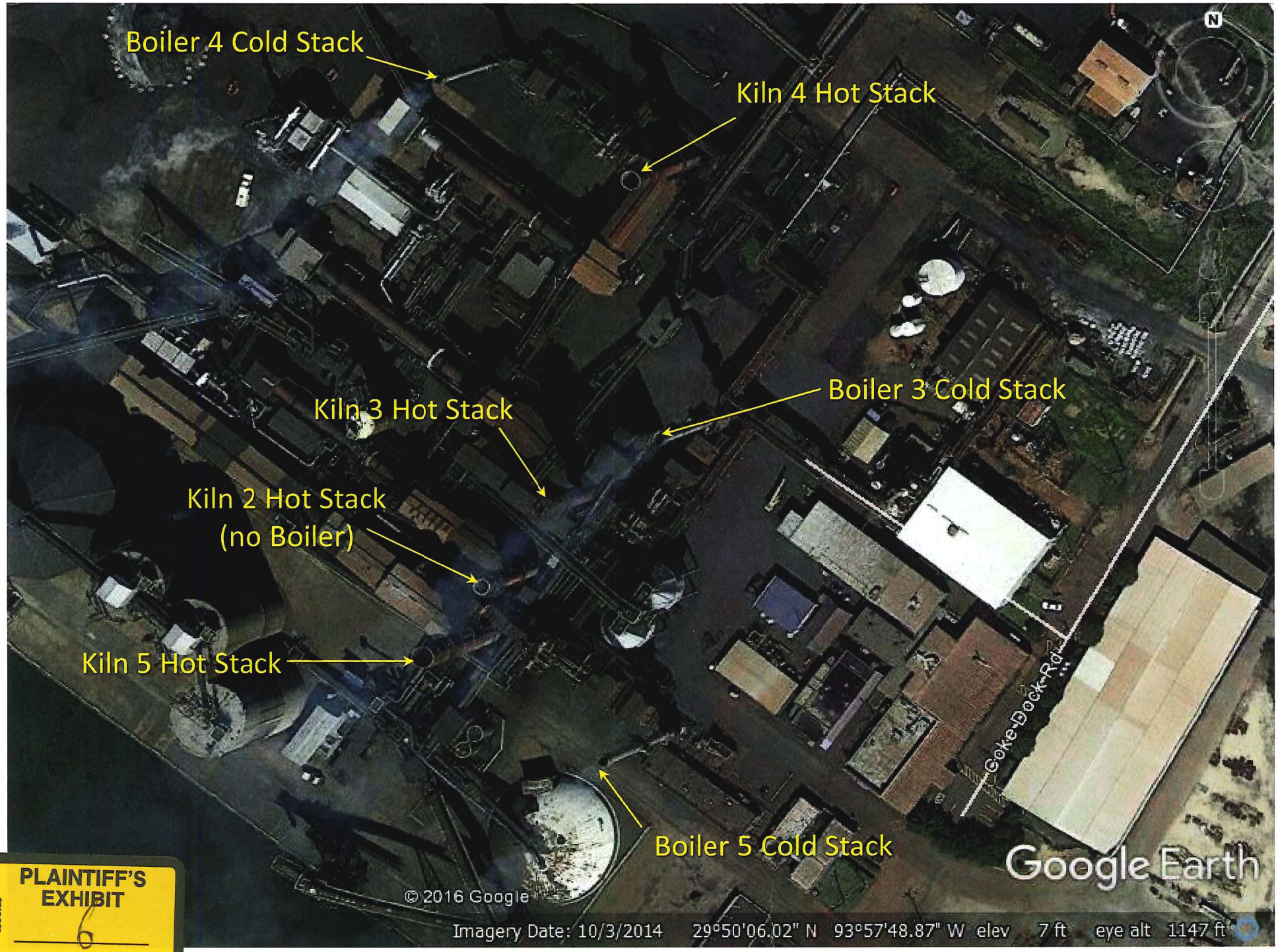
PLAINTIFF'S EXHIBIT 5

Multiclone, Induced Draft Fan & Cold Stack follow each Boiler

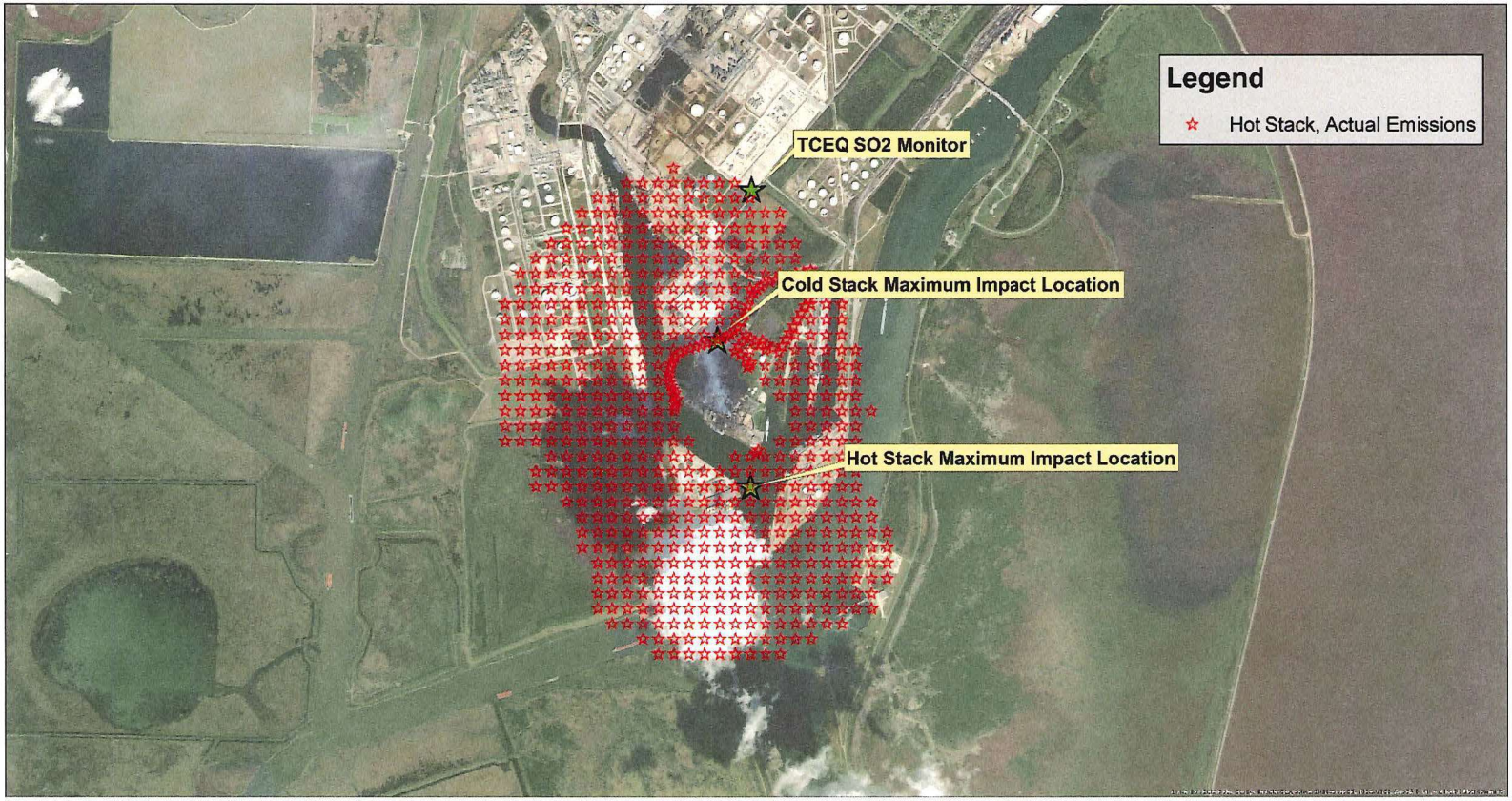
PASE Admin Building incl. Electrical Room, Control Room and Steam Turbine-Generator

6.5MW Steam Turbine-Generator & Boiler Feedwater Pumps

PASE Distributed Control System



PLAINTIFF'S EXHIBIT
6



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N W E S

Sheet No.

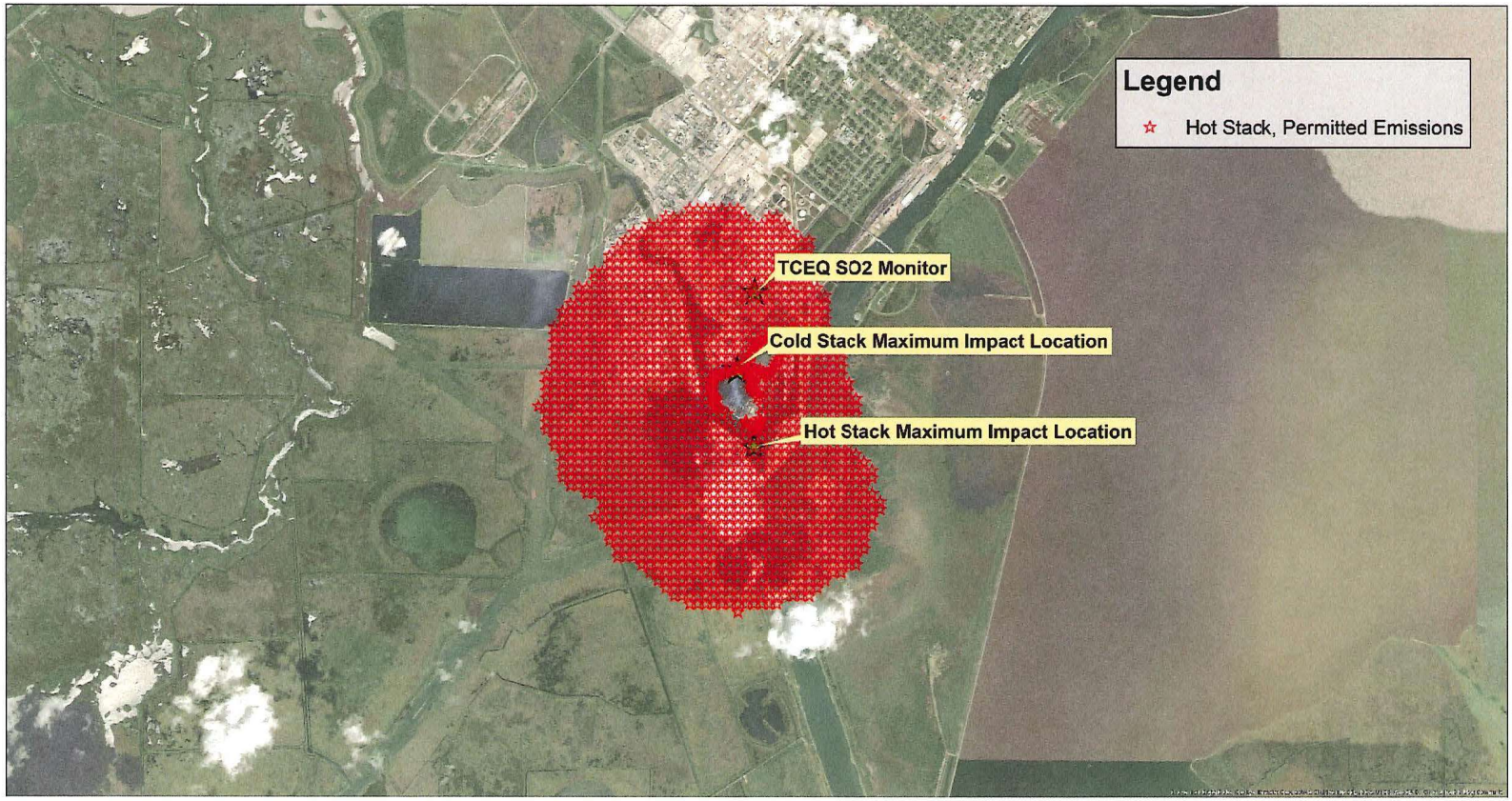
Drawn By:

Checked by:

Date:

Locations of Modeled 1-hr SO_2 National Ambient Air Quality Standard Exceedances with Actual Emissions and Hot Stack Operation

PLAINTIFF'S EXHIBIT 25



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Sheet No.

Drawn By:

Checked by:

Date:

Locations of Modeled 1-hr SO_2 National Ambient Air Quality Standard Exceedances with Permitted Emissions and Hot Stack Operation

PLAINTIFF'S EXHIBIT 26

tabbies

From:	Isabel Segarra
To:	MONOPS
Subject:	Public comments and hearing request for 2019 Annual Monitoring Network Plan
Date:	Tuesday, May 21, 2019 4:44:06 PM
Attachments:	image001.gif

Hello Holly,

Please find our attached comments and hearing request. Nine attachments accompany this set of comments, I have attached three here and will send the others in separate emails.

Thank you,

Isabel G. Segarra Treviño
Associate Attorney
Earthjustice
1625 Massachusetts Avenue, N.W., Suite 702
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Because the earth needs a good lawyer

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May 21, 2019

Holly Landuyt, MC-165
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711

monops@tceq.texas.gov

Submitted via email

Re: Public comment and public hearing request on proposed 2019 Annual Monitoring Network Plan by Texas Environmental Justice Advocacy Services, Coalition of Community Organizations, Achieving Community Tasks Successfully, and Sierra Club

On behalf of members, constituents, and supporters who live, work, worship, and recreate in Texas, Texas Environmental Justice Advocacy Services, Coalition of Community Organizations, Achieving Community Tasks Successfully, and Sierra Club ("Commenters") respectfully submit these comments regarding the Texas Commission on Environmental Quality ("TCEQ") proposed 2019 Annual Monitoring Network Plan.

Because the proposed 2019 Annual Monitoring Network Plan is a revision to Texas's State Implementation Plan, it should be subject to notice and comment rulemaking. Commenters request that TCEQ remand the proposal to allow the public to participate through notice and comment rulemaking. Further, Commenters request that TCEQ hold public hearings in Houston and El Paso.

While Commenters appreciate additional monitoring sites proposed, there is a pressing need for additional monitoring stations across Texas. Due to concentrated industrial operations and persistent unauthorized emissions, Houston Ship Channel communities urgently need enhanced volatile organic compound air quality monitoring. Other Houston communities, such as Fifth Ward and Pleasantville, face historic pollution that is little understood, in part, because of a lack of air quality data. Similarly, west Texas communities know they are subject to ozone and sulfur dioxide pollution but lack air quality data to protect their health and to require stronger protections from polluting industries.

Impressive growth in San Antonio and El Paso has exacerbated ozone, carbon monoxide, and nitrogen dioxide pollution – these Texas communities need more air quality data, too. Lastly, staggering known sulfur dioxide emissions across Texas pose a serious public health threat that warrants not just enhanced monitoring, but a reconsideration of Texas' sulfur dioxide modeling. Commenters urge the TCEQ not simply to look at federal standards, which provide mere minimum criteria, but also pressing public health threats to assess the air quality monitoring needs of all Texans.

For questions or additional information, please contact Isabel Segarra Treviño at isegarra@earthjustice.org or (202)745-5219.

Respectfully submitted,

Rev. James Caldwell
Executive Director
Coalition of Community Organizations

Bridgette Murray, RN
Executive Director
Achieving Community Tasks Successfully

Joshua Smith
Staff Attorney
Sierra Club

Isabel Segarra Treviño
Associate Attorney
Earthjustice

Juan Parras
Executive Director
Texas Environmental Justice Advocacy Services

Dr. Robert D. Bullard
National Environmental Justice Leader

David Baake
Attorney
Baake Law LLC

I. Clean Air Act background.

A. Texas must maintain an air quality monitoring network.

The federal Clean Air Act ("CAA" or "Act") requires Texas to establish and maintain an air quality monitoring network. States implement Act requirements such as air quality monitoring plans through State Implementation Plans ("SIPs"). 42 U.S.C. § 7410(a)(2)(B). To this end, Texas's network must meet three criteria: "(a) Provide air pollution data to the general public in a timely manner … (b) Support compliance with ambient air quality standards and emissions strategy development … (c) Support for air pollution research studies…" 40 C.F.R. Part 58 App. D ¶ 1.1.

Crucially, monitoring data are used to determine whether areas are in compliance with National Ambient Air Quality Standards ("NAAQS"). 40 C.F.R. Part 58 App. A ¶ 1.1(a). The U.S. Environmental Protection Agency ("EPA") has established NAAQS for only six criteria pollutants: ozone (O_3), particulate matter ($PM_{2.5}$ and PM_{10}), carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2). To determine whether an area meets a NAAQS, EPA typically compares monitoring data to the NAAQS. 40 C.F.R. Part 58 App. D ¶ 1.1(b). Areas that fail to meet a NAAQS are subject to more stringent public health protections under the Act. For example, monitoring data demonstrate that the Houston area failed to meet its deadline for attaining the 2008 ozone standard. 83 Fed. Reg. 56,781 (Nov. 14, 2018). As a result, more major sources of ozone-forming pollution in Houston will have to obtain federal operating permits, and these polluters will have to reduce their ozone-forming emissions or secure offsets to more than offset the new pollution they will emit. 42 U.S.C. §§ 7503, 7511a.

Each year, Texas must demonstrate compliance with federal minimum monitoring requirements. 40 C.F.R. § 58.10(a)(1), (b). The monitoring network plan must include detailed information about the network's design, including the exact location of each monitor in the network, how each monitor operates, and proposed changes to individual monitors. 40 C.F.R. § 58.10(b)(1)-(5), Part 58 App. D. EPA determines whether the plan meets minimum network design criteria, and the Regional Administrator may require additional information. 40 C.F.R. § 58.10(a)(1). EPA also has authority to order changes to a plan. 40 C.F.R. § 58.14(b). Plans that propose new monitoring sites or other modifications, like the TCEQ plan here, must be approved or denied by the Regional Administrator within 120 days of submission. 40 C.F.R. §§ 58.10(a), (e), 58.11(c), 58.14. Thus, after this comment period, TCEQ must submit the plan to EPA for authorization.

Federal regulations prescribe only minimum design criteria for State and Local Area Monitoring Stations ("SLAMS") networks to monitor for criteria pollutants, leaving room for states to establish enhanced air monitoring as areas in their states may require. *See* 40 C.F.R. § 58.1; *see also* 40 C.F.R. Part 58 App. D ¶¶ 4.1-4.8.1 (establishing "Pollutant-Specific Design Criteria" for monitoring networks). SLAMS networks are a collection of devices in various locations that sample the ambient air (or outdoor air) to detect the level of a particular

pollutant.[1] The design of a monitoring network—the number of monitors, their specific placement, how frequently they take samples—is critical to getting accurate and representative results. *See generally* 40 C.F.R. Part 58 App. D (establishing mandatory "Network Design Criteria for Ambient Air Quality Monitoring"). Because different pollutants and standards are especially sensitive to particular design criteria, such as the choice of monitor location, EPA provides monitoring network design guidance documents.[2] In part, the purpose of the network is "to provide support to the [SIP], national air quality assessments, and *policy decisions*." 40 C.F.R. § 58.2(a)(5) (emphasis added).

States with areas out of compliance with federal ozone standards, like Dallas and Houston, are subject to enhanced monitoring, otherwise known as Photochemical Assessment Monitoring Stations ("PAMS"). 40 C.F.R. § 10(a)(11), Part 58 App. D ¶ (5)(h). Among other heightened requirements, PAMS networks also require air quality monitoring for volatile organic compounds ("VOCs") and require monitoring outside of the ozone season. *Id.* Thus, network design and operating procedures, including enhanced monitoring in especially polluted areas, are critical to assessing compliance with the public health goals of the Clean Air Act and for state and regional air quality planning efforts.

Apart from Act compliance, there are other uses for air quality data that call on Texas to enhance its monitoring network for the protection of public health. Federal regulations envision members of the public making use of publicly available air quality data—the regulations themselves require data dissemination in urban centers, 40 C.F.R. § 58.50, and EPA maintains daily reports via AirNow, available at https://airnow.gov/.[3] Because air quality data from Texas's network is publicly available near real-time,[4] it is crucial to community groups responding to disaster, such as the recent ITC and KMCO fires in the Houston area.

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[1] A map of the Texas air monitoring network is available here: https://tceq.maps.arcgis.com/apps/webappviewer/index.html?id=ab6f85198bda483a997a6956a8486539.

[2] *See*, e.g., EPA, Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10} at 2-7 (1997) ("A PM sampler location, especially its proximity to local sources, can play a large role in its ability to assess spatial variability and source contributions") (available at https://www3.epa.gov/ttn/amtic/files/ambient/pm25/network/r-99-022.pdf); *see also* EPA, Guidance for Using Continuous Monitors in $PM_{2.5}$ Monitoring Networks at 6-1 to 6-2 (1998) (discussing the difference between Community Representative or "CORE" $PM_{2.5}$ monitors located where people live, work and play in comparison to hot spot monitor sites "located near an emitter with a microscale or middle-scale zone of influence" and Special Purpose Monitors ("SPMs") "used to understand the nature and causes of excessive concentrations measured at [CORE] or hot spot compliance monitoring sites.") (available at https://www3.epa.gov/ttnamti1/files/ambient/pm25/r-98-012.pdf); *see also* EPA, Photochemical Assessment Monitoring Stations Implementation Manual at 2-6 (1994) ("Site selection is one of the most important tasks associated with monitoring network design and must result in the most representative location to monitor the air quality conditions being assessed.") (available at https://www3.epa.gov/ttn/amtic/files/ambient/pams/b93-051a.pdf).

[3] AirNow data is also shared with and broadcast by major media outlets that disseminate air quality forecasts to individuals. *See* https://www.airnow.gov/index.cfm?action=ani.airnowUS (AirNow "[d]istributes air quality forecasts and data with The Weather Channel, USA Today, CNN, weather service providers, NOAA National Weather Service").

[4] TCEQ, AutoGC Data by Day by Site (all parameters), https://www.tceq.texas.gov/cgi-bin/compliance/monops/agc_daily_summary.pl.

B. The public process afforded to the proposed Monitoring Network Plan violates the Clean Air Act.

TCEQ's proposed Monitoring Network Plan is a SIP revision that should be subject to notice and comment rulemaking pursuant to the Administrative Procedure Act ("APA"). As described above, Texas' plan must comply with EPA regulations, which state that the plan must, among other things identify the exact location of each monitor, describe how it will operate, and makes clear that the monitoring plan is part of the SIP.[5] Though not for this Plan, TCEQ adheres to APA rulemaking procedures, 30 Tex. Admin. Code § 20.1. As a SIP revision, federal law requires TCEQ to provide "reasonable notice and public hearing" prior to sending this proposal to EPA for authorization. *See* 42 U.S.C. § 7410(a)(2). Though EPA's regulations do not fully comply with the statutory requirements, they expressly require, for monitoring network plans, that a plan "must be made available for public inspection and comment for at least 30 days prior to submission to the EPA and the submitted plan shall include and address, as appropriate, any received comments." 40 C.F.R. § 58.10(a)(1).

On its webpage, TCEQ solicits public comment for the proposed Plan but does not explain whether it will respond to comments or make changes in response to any comments. It also appears that TCEQ did not and will not hold any public meetings or hearings to explain this Plan to the public. "[N]otice and comment helps to prevent mistakes, because agencies receive more input and information before they make a final decision." *Ivy Sports Medicine v. Burwell*, 767 F.3d 81, 87 (D.C. Cir. 2014).

Indeed, not only is notice and comment for the Plan required by law and a basic value of American administrative law, TCEQ's lack of outreach continues to disenfranchise Texas communities long deprived of proportionate representation in environmental regulation. As discussed below, many low-income communities of color throughout Texas suffer from poor air quality and would benefit from greater air quality monitoring in their area. However, due to TCEQ's failure to publish notice and conduct public outreach regarding its proposed Plan, Texans in these communities may be wholly unaware of Texas' air quality monitoring network or that it changes every year.

Commenters request that TCEQ remand this Plan and revise it through APA notice and comment rulemaking. Further, that TCEQ hold a public hearing, with Spanish interpretation services available, in Houston and El Paso to afford the public an opportunity to ask questions about the Plan of TCEQ staff responsible for its creation and implementation.

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[5] 40 C.F.R. §§ 51.190, 58.2(b), 58.10(b). Historically, too, EPA has consistently required that monitoring network plans include these core details and be part of the SIP. 40 C.F.R. § 51.17(b)(1)-(6) (1972); *see also* 59 Fed. Reg. 41,626 (Aug. 12, 1994) (revisions to Part 58 leaving SIP requirement untouched and finding that "[t]he Clean Air Act, as amended in 1990 (Act), requires that States establish an air monitoring system as part of their State implementation plan (SIP).").

II. Public health warrants enhanced air quality monitoring in Houston and surrounding communities.

A. Houston Aldine and Clinton Monitors

TCEQ proposes to relocate the Houston Aldine $PM_{2.5}$ speciation monitor to the Clinton site by December 31, 2019 and states that a $PM_{2.5}$ federal reference method ("FRM") monitor and a non-NAAQS comparable $PM_{2.5}$ tampered element oscillating microbalance ("TEOM") monitor will remain at the Aldine location after the modification. TCEQ Annual Monitoring Network Plan 22. Using the Texas Air Monitoring Information System ("TAMIS") public database, Commenters could only locate the $PM_{2.5}$ speciation monitor and the $PM_{2.5}$ TEOM monitor.[6] The Houston Aldine $PM_{2.5}$ speciation monitor is located by a constant source of $PM_{2.5}$ pollution, Interstate 69, and provides valuable information to protect the safety of students at Hambrick Middle School, Douglas MacArthur Senior High School, and the MacArthur Ninth Grade School where the monitor is located. To the extent the $PM_{2.5}$ FRM data are not publicly available, not reported to the EPA, or the monitor is not functional, Commenters oppose the relocation of the Houston Aldine $PM_{2.5}$ speciation monitor to Clinton. Commenters support installing a new speciation monitor at Clinton, but not at the expense of less $PM_{2.5}$ monitoring at Aldine.

TCEQ also proposes to reduce sampling frequency at Clinton to every 12th day for PM_{10} by December 31, 2019. TCEQ Annual Monitoring Network Plan 17. TCEQ gives no other reason for the reduced monitoring frequency other than the collocation of another monitor. However, TCEQ is well aware that monitors experience malfunctions, such as during the recent ITC fires that deprived the public of valuable information. As discussed below, the Houston Ship Channel is an area of concentrated operations – it is in need for *more* monitoring not *less*. Commenters oppose the reduction in PM_{10} frequency at the Clinton site.

B. Houston's Fifth Ward

Fifth Ward is a predominantly low-income African American community in east Houston that is home to the Many Diversified Interests, Inc. ("MDI") Superfund site.[7] MDI is a nuisance to its community and a constant source of offsite, onsite, and residential lead contamination, among other pollutants. Despite ongoing remediation efforts, a new housing development is underway atop the MDI property.[8] Fifth Ward is also home to another nuisance; creosote

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[6] TCEQ, TAMIS, Houston Aldine Monitoring Information, https://www17.tceq.texas.gov/tamis/index.cfm?fuseaction=report.view_site&siteID=137&siteOrderBy=name&showActiveOnly=0&showActMonOnly=1&formSub=1&tab=mons (last viewed May 21, 2019).

[7] EPA, Superfund Site: Many Diversified Interests, Inc. Houston, Texas, available at https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.contams&id=0605008.

[8] Houston Business Journal, *Houston's Fifth Ward Redevelopment Efforts Continue With Plans for Single-Family Homes*, (Mar. 3, 2014), https://www.bizjournals.com/houston/morning_call/2014/02/houstons-fifth-ward-redevelopment-efforts-continue.html.

contamination at the former Union Pacific Houston Wood Preserving Works facility.[9] Every time it rains and in hot weather, residents report strong chemical smells from this only partially remediated site.

There is mounting evidence of public health threats in Fifth Ward from lead and other contaminants. A 2014 study reports that almost all of Fifth Ward experiences amongst the highest probabilities for very low birth weights.[10] Even in 2019, Fifth Ward is a lead poisoning hot spot. The Agency for Toxic Substances and Disease Registry recognizes that lead can be released into the air from windblown dust and the weathering of lead-painted surfaces.[11] Earlier this year, the Houston Health Department, Bureau of Community and Children's Environmental Health was awarded a grant "to expand a recent and successful place-based lead poisoning prevention pilot to the Fifth Ward, a lead poisoning hot spot."[12]

Fifth Ward residents need air quality data to better protect their health from contamination in their community that exists through no fault of their own. Currently, there are no lead or VOC air quality monitors in Fifth Ward. TCEQ's belief that meeting certain *minimum* federal requirements is enough to meet VOC monitoring requirements is unsupported, TCEQ Annual Monitoring Network Plan 24: one of the purposes of the air monitoring network is provide data for policy decisions, 40 C.F.R. § 58.2(a)(5), Commenters request that TCEQ place a lead and VOC monitor in Fifth Ward. Fifth Ward is within Harris County, which is out of compliance with the 2008 and 2015 ozone NAAQS and subject to enhanced PAMS monitoring for ozone and VOCs. Federal regulations contemplate additional monitors in areas like Fifth Ward, including "[a]dditional speciated VOC measurements including" data gathered outside of ozone season and in areas beyond federally prescribed siting requirements. 40 C.F.R. Part 58 App. D ¶ (5)(h). Lead and VOC monitors in Fifth Ward will allow residents not only to access "air pollution data…in a timely manner," 40 C.F.R. Part 58 App. D ¶ 1.1(a), but will inform public health policy decisions affecting Fifth Ward.

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[9] Union Pacific has recently applied for a modification and renewal of its remediation permit; affected residents have objected to Union Pacific's proposed cost-cutting measures. TCEQ, Notice of Receipt of Application and Intent to Obtain Hazardous Waste Permit/Compliance Plan/Major Amendment/Renewal Permit/Compliance Plan No. 50343 (Mar. 13, 2015), available https://www14.tceq.texas.gov/epic/eNotice/index.cfm?fuseaction=main.PublicNoticeDescResults&requesttimeout=5000&CHK_ITEM_ID=963382312015077.

[10] Thompson, J.A., et al., *Evaluating geostatistical modeling of exceedance probability as the first step in disease cluster investigations: very low birth weights near toxic Texas sites* 607-611 (2014), available https://www.ncbi.nlm.nih.gov/pubmed/24906417, Attachment 1.

[11] Agency for Toxic Substances & Disease Registry, Public Health Statement for Lead (Aug. 2007), available https://www.atsdr.cdc.gov/phs/phs.asp?id=92&tid=22.

[12] National Environmental Health Association, NEHA and Partners Award HiAP and Lead Poisoning Prevention Funds (Jan. 18, 2019), https://www.neha.org/news-events/latest-news/neha-and-partners-award-hiap-and-lead-poisoning-prevention-funds.

C. Portland-Gregory Area

While Commenters appreciate enhanced PM_{10} monitoring in the Portland-Gregory Area, recent permitting actions by TCEQ urgently warrant enhanced VOC monitoring as well. TCEQ cites recent industrial and population growth in the Portland/Gregory area as justification for the new PM_{10} monitor location. TCEQ Annual Monitoring Network Plan 17. However, a forthcoming permitting action by TCEQ will permit VOC emissions that greatly surpass PM_{10} emissions in the area.

The contested case hearing recently concluded for Gulf Coast Growth Ventures Asset Holding LLC ("GCGV"), an ExxonMobil and SABIC joint venture, for the construction of the largest ethane cracker in North America to be sited in Gregory, Texas—a predominantly low-income Latino community.[13] The Administrative Law Judge has issued a Proposal for Decision recommending issuance of the permits and the TCEQ General Counsel is accepting exceptions to the Proposal until May 29, 2019. At the hearing, consulting engineering expert Dr. Ranajit Sahu testified that plant wide allowable emission totals for this facility will be:[14]

Pollutant	Tons per year (tpy)
Volatile organic compounds	976.33
Nitrogen dioxide	525.03
Particulate matter	185.82
Particulate matter of 10 micrometers or less	176.35
Particulate matter of 2.5 micrometers or less	167.51
Sulfur dioxide	38.49

Further, that permitted limits for this facility alone were very close to exceeding their respective NAAQS, especially the nitrogen dioxide standard.[15] New emissions of VOCs will far exceed new emissions of PM_{10} by a factor of greater than five. Based on this information, it is possible that emissions from this facility alone will cause exceedances of applicable NAAQS. Because one of the purposes of the air monitoring network is to "[s]upport compliance with ambient air quality standards and emissions strategy development," 40 C.F.R. Part 58 App. D ¶ 1.1(b), the TCEQ should install new VOC monitors in the Gregory-Portland Area in addition to new PM_{10} monitoring.

D. Houston Ship Channel

The Commission has a duty "to protect the public from cumulative risks in areas of concentrated operations" and "give priority to *monitoring* and enforcement in areas in which

[13] Application of GCGV Asset Holding, LLC, for Air Quality Permit Nos. 146425/PSDTX1518 & 146459/PSDTX1520 in San Patricio County, Texas, SOAH Docket Nos. 582-18-4846, 582-18-4847; TCEQ Docket Nos. 2018-0899-AIR, 2018-0900-AIR.
[14] *Id.*, Direct Testimony of Ranajit Sahu, PH.D., QEP, CEM (Nevada) at 21-22 (Dec. 7, 2018), Attachment 2.
[15] *Id.* at 12, 33.

regulated facilities are concentrated." Tex. Water Code § 5.130 (emphasis added). The Houston area is home to the Houston Ship Channel – a highly populated area of concentrated industrial operations. As discussed above, Texas's monitoring network must "[p]rovide air pollution data to the general public in a timely manner." 40 C.F.R. Pt. 58 App. D ¶ 1(a). Monitor siting locations must be designed "to measure typical concentrations in areas of high population density" and "to determine the impact of significant sources or source categories on air quality." *Id.* ¶ 1.1.1(b), (c). There is a compelling need for additional VOC monitors along the Houston Ship Channel.

Recent data demonstrate that there are likely systematic underreporting errors with existing air emissions reporting at facilities along the Channel. For example, testing for VOCs and benzene along the Channel, researchers found far higher emissions levels than the estimates produced and reported by the operators themselves.[16] In fact, the study found that VOC emissions were 41% higher than emissions inventories reported, and benzene emissions were 94% higher.[17] This means that operators along the Channel are exceeding their permitted limits, reported VOC emissions are underestimated because of the lack of VOC monitors on the Channel, and impacted communities are deprived of air quality information to protect their health.

The problem of unauthorized emissions is not evenly distributed; some communities along the Channel are exposed to far greater pollution than others. Recent data demonstrate a greater total emissions burden from unauthorized emissions borne by Manchester, Pasadena, Deer Park, and Baytown—all along the Channel.[18] When compared to other Channel communities, Manchester exhibited far greater emissions density, meaning that it is a Channel community at greatest vulnerability from its surrounding industrial polluters.[19] Indeed, a 2016 study found 26 Risk Management Plan facilities sited within Manchester.[20] Risk Management Plan facilities are facilities that handle extremely hazardous substances and must register with EPA and report emissions to the Toxic Rerelease Inventory public database.

Daily unauthorized emissions are compounded by the steady stream of preventable plant disasters at Channel facilities. For example, the recent ITC fire in Deer Park exposed local

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[16] Daniel Hoyt & Loren H. Raun, *Measured and Estimated Benzene and Volatile Organic Carbon (VOC) Emissions at a Major U.S. Refinery/Chemical Plant: Comparison and Prioritization*, 65 J AIR & WASTE MGMT. ASS'N 1020, 1021 (2015), available https://www.tandfonline.com/doi/pdf/10.1080/10962247.2015.1058304?needAccess=true, Attachment 3.
[17] *Id.* at 1029.
[18] Sustainable Systems Research, LLC, *Evaluation of Vulnerability and Stationary Source Pollution in Houston* at 25 (Feb. 8, 2019), Attachment 4.
[19] *Id.* at 25.
[20] Union of Concerned Scientist & Texas Environmental Justice Advocacy Services, *Double Jeopardy in Houston, Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities* at 19 (Oct. 2016), available https://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf, Attachment 5.

residents to unhealthy levels of benzene.[21] To inform the public of air quality conditions during the ITC fire, TCEQ relied on the air monitoring network for data. In Harvey's wake, a tank at Valero's refinery also released benzene and dozens of other pollutants into Manchester, but not due to hurricane damage – Valero's storage tank had previously failed an inspection and should have been decommissioned.[22] Unfortunately, TCEQ shut down the monitoring network, so the public was deprived of invaluable information regarding this and other releases during Harvey. Chronic allowable emissions exceedances render the TCEQ air permit review process incapable of protecting public health because the technical assumptions upon which air permits are issued likely greatly underestimate actual pollution levels. As such, enhanced VOC monitoring in Houston Ship Channel communities is necessary to fill this regulatory gap.

There is a compelling need for additional VOC monitors along the Houston Ship Channel because of the staggering number of air polluting facilities there, and the high toxicity of emissions from those facilities. Currently, there are no VOC monitors along the Channel on the southbound side of IH 610, an area that is home to the Pleasantville community. Pleasantville is a predominantly low-income African American community within the IH 610 loop and along the Channel. There are 37 Risk Management Plan facilities within one mile of this community – yet there is not a single air quality monitor sited in Pleasantville. It is hard to see how Texas is meeting its PAMS obligations under 40 C.F.R. § 10(a)(11) in Houston when areas like Pleasantville and Fifth Ward—predominantly African American communities—lack air monitoring entirely. A VOC monitor is also particularly needed to provide warning against dangerous toxic exposures at or near J.R. Harris Elementary School—a public school where nearly all of the children are racial minorities and over two-thirds of the students are English Language Learners. For similar reasons, additional VOC monitoring is needed in Manchester, Pasadena, Deer Park, and Baytown, due to the concentration of major emitting industries in or near those communities.

Elevated $PM_{2.5}$ levels also threaten the health and safety of Houston Ship Channel residents. TCEQ plans to decommission the Houston Deer Park #2 $PM_{2.5}$ non-NAAQS comparable continuous monitor effective December 31, 2019 and states that a $PM_{2.5}$ FRM non-continuous and a $PM_{2.5}$ FEM continuous monitor will continue to operate at this site. TCEQ Annual Monitoring Network Plan 21. As discussed above, this monitor is at the site of a recent chemical disaster and in an area with facilities that experience constant malfunctions and accidents. In fact, the VOC monitor located in Deer Park malfunctioned and ceased to collect data during the ITC fire, even as benzene was released into neighboring communities.[23] Collocated $PM_{2.5}$ monitors are not just important to prevent data gaps during emergencies, but also for data

[21] TCEQ, High levels of benzene detected at ITC fire site (Mar. 21, 2019), https://www.tceq.texas.gov/news/releases/high-levels-of-benzene-detected-at-itc-fire-site.
[22] TCEQ, Investigation Report, Valero Energy Partners LP, Investigation No. 1408309 (Oct. 5, 2017 to Nov. 15, 2017), Attachment 6.
[23] Jon Niermann, Chairman, TCEQ, Letter to Hon. Adrian Garcia, Harris County Commissioner (Mar. 28, 2019), available https://www.tceq.texas.gov/assets/public/response/smoke/correspondence/response-from-Niermann-to-Adrian-Garcia.pdf.

verification.[24] Deer Park needs more monitoring and higher quality verified data. Commenters oppose the decommissioning the Houston Deer Park #2 $PM_{2.5}$ monitor.

III. TCEQ must increase monitoring of ozone pollution in the Greater San Antonio Area.

A. Ozone is a serious public health problem in the Greater San Antonio Area.

San Antonio is currently violating the 2015 ozone NAAQS. San Antonio's unhealthy air quality has consequences for the more than 1.9 million Texans who live in Bexar County, including approximately 505,510 children and 106,686 adults suffering from asthma.[25] Recent epidemiological studies suggest that even modest reductions in ozone levels, which could be achieved by reducing pollution from a handful of large sources, would save hundreds of millions of dollars in avoided public health costs, premature deaths, and lost work and school days in the San Antonio area. Indeed, a recent report, conducted using an EPA-approved modeling platform, concluded that compliance with the 2015 ozone NAAQS would prevent 24 premature deaths each year in Bexar County alone, resulting in approximately $220,000,000 in avoided public health costs.[26] The study also estimated that a modest drop in ozone levels would prevent over 38,000 lost school and work days annually in the San Antonio area. *Id.*

B. Additional monitoring is necessary to ensure San Antonio's smog problem is resolved in a prompt and cost-effective manner.

On July 25, 2018, EPA designated Bexar County as a non-attainment area for the 2015 ozone NAAQS. 83 Fed. Reg. 35,136. EPA designated Atascosa, Comal, and Guadalupe Counties as attainment/unclassifiable, even though EPA determined that these three counties were responsible for approximately 31 percent of the total ozone precursor emissions in the San Antonio area, that air-flow modeling showed air moving from these counties to violating monitors in Bexar County on exceedance days, and that these counties had no ozone monitors of their own, and thus might themselves be violating the NAAQS. EPA's decision to designate these counties as attainment/unclassifiable is currently the subject of litigation before the U.S. Court of Appeals for the Fifth Circuit. *See Texas v. EPA*, No. 18-60606 (5th Cir.).

Regardless of how this litigation is resolved, TCEQ must add additional ozone monitors in the San Antonio area. Among other things, TCEQ's monitoring network must be designed to "[p]rovide air pollution data to the general public in a timely manner" and "[s]upport compliance with ambient air quality standards and emissions strategy development." 40 C.F.R. Pt. 58 App. D

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[24] EPA, Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10} at 2-12 ("Monitors are operated on collocated scales to evaluate the equivalence of different measurement methods and procedures and to quantify the measurement accuracy and precision of the same measurement methods and procedures.").

[25] *See* American Lung Assoc., State of the Air, Texas: Bexar, https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/states/texas/bexar.html.

[26] *See* How Ozone Pollution Affects Public Health in San Antonio: An Analysis Commissioned by the City of San Antonio, Final Report (Sept. 2017), https://www.sanantonio.gov/Portals/0/Files/Sustainability/OzoneHealth/final-report.pdf.

¶ 1 (a), (b). Monitoring sites "*must* be capable of informing managers about . . . air pollution transported into and outside of a city or region." *Id.*, ¶ 1.1.1. Sites must also be designed "to determine the impact of significant sources or source categories on air quality." *Id.*
To support these goals, and to ensure that emission control strategies designed for the greater San Antonio area *solve* the region's smog problem—rather than simply causing industries to migrate from Bexar County to areas that are currently designated as attainment—TCEQ should add ozone monitors in surrounding counties. At minimum, monitors must be added in New Braunfels—to ensure that the approximately 300,000 people who live in Guadalupe and Comal counties have localized air quality data. Adding an additional monitor in New Braunfels is especially warranted given that Comal County had the second highest growth rate of any county in the United States between 2017 and 2017, increasing by 5.4 percent.[27]
In addition, TCEQ should add an additional monitor north of the San Miguel Electric Plant, to help evaluate this plant's impact on Bexar County's ozone levels. According to EPA's 2014 National Emission Inventory, this 500 MW coal-fired power plant is responsible for nearly 2,400 tons of NOx a year. Consistent with its obligation to "determine the impact of significant sources or source categories on air quality," TCEQ should install an ozone monitor north of the San Miguel plant to help assess the impact of this plant on Bexar County's air quality.

IV. TCEQ should deploy a near-road NO_2/CO monitor at Zavala Elementary School in El Paso.

EPA regulations require "one near-road NO_2 monitoring station in each [core-based statistical area] with a population of 1,000,000 or more persons to monitor a location of expected maximum hourly concentrations sited near a major road with high [annual average daily traffic] counts . . . ." 40 C.F.R. Part 58 App. D ¶ 4.3.2(a). In selecting the appropriate site for this station, a monitoring agency must rank all road segments and "identify[] a location or locations adjacent to those highest ranked road segments, considering fleet mix, roadway design, congestion patterns, terrain, and meteorology, where maximum hourly NO_2 concentrations are expected to occur . . . ." *Id.* If there are multiple acceptable candidates, the agency "shall consider the potential for population exposure" as a tie-breaking factor. *Id.* The monitor should be designed to reflect "the maximum expected NO_2 concentration . . . [at] the microscale." *Id.*, ¶ 4.3.5(a). A CO monitor must generally be collocated with any near-road NO_2 site. *Id.*, ¶ 4.2(b).

El Paso does not currently have a near-road monitoring station, and TCEQ lists the required number of near-road monitors as zero in Appendix D of this proposal. TCEQ has misread the regulations. The El Paso-Las Cruces CBSA, which includes El Paso and Hudspeth Counties, Texas, and Dona Ana County, New Mexico, has a population in excess of 1,000,000.[28]

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[27] *See* U.S. Census Bureau, *New Census Bureau Estimates Show Counties in South and West Lead Nation in Population Growth* (Apr. 18, 2019), https://www.census.gov/newsroom/press-releases/2019/estimates-county-metro.html.
[28] EPA, El Paso, Texas and Doña Ana County, New Mexico, Intended Area Designations for the 2015 Ozone National Ambient Air Quality Standards Technical Support Document (TSD) at 15, https://www.epa.gov/sites/production/files/2017-12/documents/nm_tsd_final.pdf; U.S. Dept. of Commerce, Texas

At minimum, TCEQ must install one near-road monitor in this CBSA.

A natural candidate for such a monitor would be Zavala Elementary School. The school is located directly adjacent to the Interstate 110 spur, which connects Interstate 10 with the Cordova International Bridge. This spur has an Annual Average Daily Traffic ("AADT") value of 70,997 in 2017, while I-10 itself—less than a mile away—had an AADT value of over 175,000.[29] Heavy-duty trucks often idle on this spur for an extended period of time. Monitoring the emissions at this location would provide important data to residents in the Chamizal community who are concerned about the impact of these vehicle emissions on their children.

V. There is a pressing need for additional air quality monitors in west Texas.

A. TCEQ must add two ozone monitors for the Midland-Odessa Combined Statistical Area.

The Midland-Odessa Combined Statistical Area ("CSA") is one of the fastest growing regions in the United States. According to the U.S. Census Bureau, Midland experienced the greatest percentage growth from 2017 to 2018 of any metropolitan area in the nation—growing by 4.3 percent and adding 7,383 people.[30] Odessa was the fifth fastest growing area, experiencing a growth rate of 3.2 percent and adding 4,951 people. *Id.* As of July 1, 2018, Midland's population was 178,331, and Odessa's was 162,124. *Id.* Together, the CSA's population as of that date was 340,455, and it was growing at a rate of 3.6 percent. Assuming growth rates remained constant through the second half of 2018 and into 2019, the population of Midland-Odessa CSA will be 359,179 by July 1, 2019.

At present, TCEQ does not have a single ozone monitor in the Midland-Odessa area. That must change. EPA regulations require at least one ozone monitor in any metropolitan statistical area ("MSA") with a population greater than 350,000. 40 C.F.R. Part 58 App. D Table D-2. An MSA with a population greater than 350,000 must have two monitors if its most recent 3-year design value concentration was greater than or equal to 85 percent of any ozone NAAQS. *Id.* An MSA with a population of less than 350,000 but greater than 50,000 must have at least one ozone monitor if its most recent 3-year design value was greater than or equal to 85 percent of any ozone NAAQS. *Id.*

TCEQ should treat the Midland-Odessa CSA as if it were a single MSA for purposes of Table D-2. As explained, the two cities have a combined population of about 359,179. Together, the Midland-Odessa CSA includes three counties—Martin, Midland, and Ector Counties—which have an area of about 2,700 square miles. Odessa's north-east border (near Mission Blvd) is

– Core Based Statistical Areas (CBSAs) and Counties (CBSAs Feb. 2013, other boundaries Jan. 1, 2012), https://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_TX.pdf.

[29] Texas Dept. of Transportation, Annual Average Daily Traffic map, http://www.arcgis.com/home/webmap/viewer.html?url=https://services.arcgis.com/KTcxiTD9dsQw4r7Z/ArcGIS/rest/services/TxDOT_AADT_Annuals_viewer/FeatureServer/0&source=sd.

[30] *See* U.S. Census Bureau data, *supra* fn.27.

about 3 miles away from the Midland airport—which is incorporated within the city limits of Midland. About 20 miles separate the centers of each city.

The Houston MSA spans nine counties, has an area of 9,444 square miles, and has a population of nearly 7 million people. One can drive for 110 miles along I-10 (from Sealy to Winnie) without leaving the MSA. By contrast, the Dallas-Fort Worth-Arlington MSA is over 9,000 square miles, has a population of approximately 7.4 million people. About 30 miles separate downtown Dallas from downtown Fort Worth. The San Antonio MSA includes eight counties and has an area of 7,340 square miles.

Regardless of why the U.S. Census Bureau decided not to include Midland-Odessa in the same MSA, it would be flagrantly unreasonable for TCEQ to apply Table D-2 in such a way that Midland and Odessa are treated separately for air monitoring purposes, while Dallas and Fort Worth are treated as a single unit. The only rational approach is to treat the Midland-Odessa CSA as if it were an MSA for purposes of Table D-2. Because the Midland-Odesa CSA has a population in excess of 350,000, it is automatically required to have at least one ozone monitor. That application of Table D-2 is also the only one consistent with the Clean Air Act's purpose of promoting "efficient and effective air quality management," 42 U.S.C. § 7407(e)(1), and EPA's admonition "[t]he total number of monitoring sites . . . will be substantially higher than these minimum requirements provide." (40 C.F.R. Part 58 App. D ¶ 1.1.2). *See also id.*, ¶ 4 ("The total number of [ozone] sites needed to support the basic monitoring objectives of public data reporting, air quality mapping, compliance, and understanding [ozone]-related atmospheric processes will include more sites than these minimum numbers required in Table D-2").

Ironically, regardless of whether TCEQ treats Midland and Odessa as separate units for purposes of Table D-2, the end result is the same: two ozone monitors must be added in the area. That is because both the Midland MSA and the Odessa MSA have more than 50,000 people. As explained, neither city has an existing ozone monitor. As such, TCEQ must look to data that is available at the regional scale—which, pursuant to EPA's regulations, may require looking at "areas with dimensions of as much as hundreds of kilometers." *Id.*, ¶ 4(c)(3). The nearest monitor is in Hobbs, New Mexico, which, like Midland-Odessa, is located in the Permian Basin region. The most recent, 3-year design value for this monitor is 0.067 ppm—96 percent of the 2015 eight-hour ozone NAAQS.[31] Absent some other data for Midland-Odessa—and TCEQ has none—TCEQ must use this data as the best estimate available for Midland-Odessa's design value.

Applying Table D-2, the result is the same regardless of whether the cities are treated as belonging to the same MSA or not. If the two cities are treated as one MSA, the combined population is greater than 350,000; accordingly, Table D-2 requires two ozone monitors. If the cities are treated as separate MSAs, each with a population greater than 50,000 but less than

[31] New Mexico Envtl. Dept., 2015 Ozone NAAQS, Designation Recommendation Report (Sept. 2, 2016), https://www.env.nm.gov/aqb/documents/2015OzoneDesignationRequest.pdf.

350,000, each must have one monitor. At the end of the day the result is the same: TCEQ must install at least two ozone monitors in the Midland-Odessa area.

B. Unauthorized SO_2 emissions in the Permian Basin also warrant further air quality monitoring.

Additional modeling, potentially supplemented by monitoring, for SO_2 in the Permian Basin is also necessary. A recent report by the Environmental Integrity Project finds that, based on industry's self-reported data on unauthorized releases of air pollution, levels of SO_2 pollution in much of Ector County exceed the SO_2 NAAQS.[32] The nearest SO_2 monitor is about 60 miles from Odessa, Ector County. *Id.* at 2, 9. Thus, the existing monitoring network is plainly inadequate to assess SO_2 levels in Ector County, to say nothing of other portions of the Permian Basin. TCEQ must model SO_2 levels in Ector County and the remainder of the Permian Basin and site monitors at expected SO_2 hotspots to serve the purposes of air pollution monitoring. If those modeling and monitoring efforts reveal violations of the NAAQS, TCEQ must take action to fix them, including requesting designation as nonattainment if the data so show.

VI. Statewide SO_2 modeling and monitoring.

A. There is a compelling need for additional source-oriented SO_2 modeling and monitoring in Texas.

1. The public health impacts of SO_2 emissions are significant.

Sulfur dioxide pollution causes numerous harmful human health and environmental effects. EPA has determined that exposure to SO_2 on time scales as short as five minutes can cause decrements in lung function, asthma attacks, and respiratory and cardiovascular morbidity.[33] Children and adults with asthma are particularly at risk for adverse health effects from short-term SO_2 exposure.[34] Exposure to SO_2 can also aggravate existing heart disease, leading to increased hospitalizations and premature death.[35] According to EPA, fossil fuel combustion at electric utilities contributes the majority of anthropogenic SO_2 emissions.[36]

Unfortunately, a considerable portion of Texas's residents can be categorized as at-risk, and many of these at-risk populations live near some of the state's largest stationary sources of SO_2 emissions.

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[32] *See* Envtl. Integrity Project, *Sour Wind in West Texas* 2, 10-12 (May 9, 2019), available at https://www.environmentalintegrity.org/wp-content/uploads/2019/05/West-Texas-Air-Pollution-Report-5.9.19.pdf, Attachment 7.
[33] *See* Primary National Ambient Air Quality Standard for Sulfur Dioxide Final Rule, 75 Fed. Reg. 35,520, 35,525 (June 22, 2010).
[34] *See id.* at 35,525-26.
[35] EPA, Sulfur Dioxide, http://www.epa.gov/oaqps001/sulfurdioxide/health.html.
[36] EPA, Our Nation's Air: Status and Trends Through 2008, 6, Fig. 2 (2010).

2. Nearly all SO_2 pollution comes from a handful of large coal-fired sources.

Sulfur dioxide is somewhat unique as a criteria pollutant in that the vast majority of all SO_2 emitted in the United States comes from large industrial sources that combust coal. In fact, according to the 2011 National Emissions Inventory ("NEI"), fully 91% of all U.S. SO_2 emissions come from coal-fired sources. In the 2011 NEI, this group of sources was responsible for 5.2 million of the 6.4 million total tons of SO_2 emitted, or about 82%.

Although there are now fewer coal-fired power plants than 2011, Texas is still home to many of the largest emitters of sulfur dioxide pollution in the country. Indeed, in 2018, ten of the top 50 emitters of sulfur dioxide in the United States were in Texas, including the two largest sources in the country: Martin Lake and W.A. Parish.[37] In all, Texas sources emitted more sulfur dioxide pollution than any other state. In fact, Texas sources *doubled* the pollution for the next highest state; the state emitted approximately 50,000 more tons sulfur dioxide pollution in 2018 than Arkansas, Louisiana, Oklahoma, Arizona, Colorado, Kansas, New Mexico, and Mississippi, *combined*.[38] Nearly all of that SO_2 comes from a small number of large coal-burning power plants.

3. EPA's 2010 SO_2 NAAQS and the Data Requirements Rule.

To reflect the most current science on SO_2 impacts, in 2010, EPA set the new ambient standard at 75 ppb (196 µg/m3) as an hourly average.[39] Due both to its shorter averaging time (1-hour versus 24-hour) and significantly lower allowable concentration (75 ppb versus 140 ppb), the new standard is considerably more stringent than the prior SO_2 NAAQS and promises significant public health benefits.

In adopting the 1-hour SO_2 NAAQS, EPA recognized the "strong source-oriented nature of SO_2 ambient impacts." 75 Fed. Reg. at 35,370. Unlike regional pollution problems, short term SO_2 air pollution problems are caused by single sources and occur in the near vicinity of that source. Thus, EPA concluded that the appropriate methodology for purposes of determining compliance, attainment, and nonattainment with the new NAAQS is *modeling*, since it would be virtually impossible to site sufficient monitors around each individual source of SO_2 pollution. *See* 75 Fed. Reg. at 35,551 (describing dispersion modeling as "the most technically appropriate, efficient, and readily available method for assessing short-term ambient SO_2 concentrations in areas with large point sources."). EPA also determined in the final SO_2 NAAQS rule that it did "not expect monitoring to become the primary method by which ambient concentrations are compared to the new 1-hour SO2 NAAQS."[40]

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[37] Eight other coal-fired power plants in Texas are among the top 50 emitters in the country: J.T. Deely, Welsh, Coleto Creek, Harrington, San Miguel, Tolk, Limestone, and Oak Grove, https:/ampd.epa.gov/ampd/.
[38] *Id*.
[39] 40 C.F.R. § 50.17(a); Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35520, 35520-21 (June 22, 2010).
[40] 75 Fed. Reg. at 35,551.

On August 10, 2015, EPA finalized the Data Requirements Rule ("DRR") for the 2010 one-hour SO_2 primary standard, which requires TCEQ to provide data to characterize air quality around many major sources of SO_2.[41] In particular, the rule requires the state to characterize the air quality around sources that emit 2,000 tons per year (tpy) or more of SO_2 and that are not located in an area already designated nonattainment. In Texas, there are 25 major sources of SO_2 meeting the DRR emissions applicability threshold.[42]

The DRR set explicit deadlines for states to submit source-oriented monitoring or modeling to characterize ambient air quality impacts from major sources of SO_2 that meet the 2,000 tpy threshold. Under the Rule the state had three clearly defined options to demonstrate attainment with the 2010 NAAQS. For each source meeting the DRR criteria, the state was required to notify EPA by July 1, 2016, whether it intends to:

(1) characterize air quality through ambient monitoring;

(2) characterize air quality through air quality modeling; or

(3) whether it will be subjecting the pertinent source or sources to enforceable emission limits that will keep the source below this rule's 2,000 tpy threshold.

If the state intended to rely on monitoring to demonstrate attainment for a specific source, it was required to include information about the planned new monitors in the annual monitoring plan that the air agency must submit to the EPA by July 1, 2016; and the air agency was required to ensure that the new monitors are operational by January 1, 2017.[43] Moreover, if the state's new monitors are not approved and operational by January 1, 2017, the state ***must*** demonstrate attainment with air dispersion modeling.[44]

Additionally, to use monitoring to characterize air quality at a specific facility, states must take appropriate steps to identify, relocate and/or install new ambient SO_2 monitors that would characterize peak 1-hour SO_2 concentrations in areas around or impacted by identified SO_2 sources.[45] In determining where to locate monitors, the Data Requirements Rule's Technical

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[41] Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard (NAAQS), 80 Fed. Reg. 51,052 (Aug. 21, 2015) (to be codified at 40 C.F.R. § 51, Subpart BB).

[42] 2016 Air Monitoring Network Plan at 7; *see also* https://www3.epa.gov/airquality/sulfurdioxide/drr/drr-source-list-epa.pdf.

[43] *See* 40 C.F.R. § 12.03.

[44] *Id.*; *see also* 80 Fed. Reg. at 51,074, 51,087-88.

[45] *See generally*, 80 Fed. Reg. 51,085-88. In the Data Requirements Rule's companion Technical Assistance Document ("TAD"), EPA offers the following guidance on how air agencies might satisfy the SO_2 data requirements in order to determine compliance with the NAAQS:

> The EPA expects monitoring conducted in response to [an anticipated] future data requirements rule to be targeted, source-oriented monitoring, for which the primary objective would be to identify peak SO_2 concentrations in the ambient air that are attributable to an identified emission source or group of sources.

Assistance Document indicates that states should take into account all existing data in determining where to site monitors, including "existing modeling results."[46] Air agencies that choose to use monitoring as a means of satisfying the Data Requirements Rule are thus required to develop a network proposal, in which it demonstrates (based on all available modeling) that the area characterized around an identified SO_2 source (or sources) includes the locations where peak 1-hour SO_2 concentrations are expected to occur.[47]

B. TCEQ's SO_2 monitoring network is insufficient to support compliance with the 1-Hour SO_2 NAAQS.

Before discussing specific inadequacies in Texas's SO_2 monitoring network, it must be noted that Texas cannot use its monitoring network as the primary means of evaluating SO_2 NAAQS compliance but, instead, should rely on lower-cost and more accurate air dispersion modeling.

1. Texas was required to comply with the Data Requirements Rule for all sources that emit more the 2,000 tons per year threshold.

To support its area designations under the 2010 SO2 NAAQS, Texas submitted modeling data for only seven of the 25 sources subject to the Data Requirements Rule.[48] Texas now suggests that it can demonstrate attainment for the other sources through monitoring. But the final DRR provides:

> each source area subject to requirements for air quality characterization, the air agency shall notify the EPA *by July 1, 2016*, whether it has chosen to characterize peak 1- hour SO2 concentrations in such area through ambient air quality monitoring; characterize peak 1-hour SO2 concentrations in such area through air quality modeling techniques; or provide federally enforceable emission limitations by *January 13, 2017*, that limit emissions of applicable sources to less than 2,000 tpy, in accordance with paragraph (e) of this section, or provide documentation that the applicable source has permanently shut down.

40 C.F.R. § 51.1203 (emphasis added). Because the state failed to meet those deadlines for demonstrating attainment through monitoring, the state ***must*** demonstrate attainment through modeling and cannot rely on monitoring for any of the 18 sources for which the state did not submit modeling demonstrations, including the largest sources of SO2 pollution in the state: Martin Lake and W.A. Parish.

See SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, U.S. EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division (Dec. 2013 Draft), http://www.epa.gov/airquality/sulfurdioxide/pdfs/SO2MonitoringTAD.pdf.

[46] TAD at 2.

[47] TAD at 16 ("The primary objective is to place monitoring sites at the location or locations of expected peak concentrations.").

[48] 2019 Air Monitoring Network Plan, App. F, Sulfur Dioxide Ongoing Data Requirements Annual Report.

Air dispersion modeling demonstrates that sulfur dioxide ("SO_2") emissions from the Martin Lake Generating Station causes downwind SO_2 ambient air concentrations as high as 347 $\mu g/m^3$—well above the 196.2 micrograms per cubic meter ("$\mu g/m^3$") limit.[49] Modeling also demonstrates that exceedances in the areas surrounding these facilities are even greater when nearby sources of SO_2 are taken into account. EPA relied on that modeling data to designate a portion of Rusk County as being in nonattainment with the NAAQS, and that designation is still in effect.[50] While TCEQ may dispute the designation, its failure to develop a monitoring plan for those sources precludes it from attempting to demonstrate attainment through monitoring.

2. Monitors alone cannot accurately evaluate compliance with the SO_2 NAAQS.

As EPA explained in the final 2010 SO_2 NAAQS Rule, "even if monitoring does not show a violation," that absence of data is not determinative of attainment status absent modeling, and that monitoring in general is "less appropriate, more expensive, and slower to establish."[51] TCEQ's plan to deploy a more extensive monitoring network as part of the NAAQS implementation process suffers from a number of drawbacks that render this approach too slow, too impractical, and too ineffective for monitoring to replace modeling as the primary means of implementing the 1-hr SO_2 NAAQS.

First, a single monitor may not be sufficient to characterize SO_2 air quality or to determine compliance with the 1-hr SO_2 standard. For any area with fewer than three SO_2 monitors positioned to capture peak concentrations from a large SO_2 source, monitoring will be inadequate to establish 1-hr SO_2 compliance. If only one monitor is located near a large source, that source has a clear invitation to game the system by, for example, slightly adjusting its stack or operating parameters to ensure that high impacts will not occur at the one monitor.

Second, even if TCEQ were to have the resources to deploy a sufficient number of monitors, the state may not be able to locate a monitor where the modeling indicates the highest impacts are likely to occur for technical reasons, such as an inability to gain physical or legal access to the site, or lack of access to power supply.[52]

Third, even if a sufficiently extensive monitoring network were established, full implementation of the NAAQS through monitoring would take up to a decade, which presents unacceptable risk to vulnerable Texans. Not only would this delay be a disservice to the public, it would also be a disservice to the regulated entities, especially owners of coal-fired power plants,

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[49] Martin Lake Generating Station, Tatum, Texas, Evaluation of Compliance with the 1-hour NAAQS for SO_2 (Mar. 31, 2016), Attachment 8.
[50] 81 Fed. Reg. 89,870 (Dec. 13, 2016).
[51] 75 Fed. Reg. at 35,551.
[52] An inability to place monitors at appropriate locations is another argument in favor of a modeling approach, as EPA has long recognized: "Although siting criteria may preclude the placement of ambient monitors at certain locations, this does not preclude the placement of model receptors at these sites." U.S. EPA 1994 SO_2 Guideline Document ("1994 SO_2 Guideline Document") at 2-6, available at http://www.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19940201_oaqps_epa-452_r-94-008_so2_guideline.pdf.

which must make critical decisions now about future operations. Many of these sources are already in distress due to a number of factors, including low natural gas prices, declining demand for energy, an increasing availability of zero- or low- SO_2 generating sources, and the age of the existing coal-fired power plant fleet. Evaluating and achieving compliance through more expeditious and cost-effective air dispersion modeling can thus provide requisite regulatory clarity to make prudent decisions about those plants now that reliance on increased monitoring alone cannot.

Finally, EPA itself has acknowledged that, for medium to large sources, monitoring is "less appropriate, more expensive, and slower to establish."[53] This has been EPA's position for decades. For example, in 1994, EPA explained:

> *A small number of ambient SO_2 monitors usually is not representative of the air quality for an area*. Typically, modeling estimates of maximum ambient concentration are based on a fairly infrequent combination of meteorological and source operating conditions. To capture such results on a monitor would normally require a prohibitively large and expensive network. Therefore, *dispersion modeling will generally be necessary to evaluate comprehensively a source's impacts* and to determine the areas expected high concentrations.[] Air quality modeling results would be especially important if sources were not emitting at their maximum level during the monitoring period or if the monitoring period did not coincide with potentially worst-case meteorological conditions.[54]

EPA has also explained:

> *Monitoring is not more accurate than computer modeling*, except for determining ambient concentrations under real-time conditions at a discrete location. Monitoring is limited in time as well as space. Monitoring can only measure pollutant concentrations as they occur; it cannot predict future concentrations when emission levels and meteorological conditions may differ from present conditions. Computer modeling, on the other hand, can analyze all possible conditions to predict concentrations that may not have occurred yet but could occur in the future.[55]

The cost of modeling compliance with the SO_2 NAAQS is modest, particularly in comparison to the costs of installing and operating an adequate SO_2 monitoring network. This is particularly true where, as here, the vast majority of SO_2 pollution comes from a relatively small group of very large sources. If TCEQ does not have sufficient in-house modeling resources, the agency would incur some costs charged by third-party modelers, but even these costs are comparatively nominal. Independent third-party modelers could conduct AERMOD time series

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[53] 75 Fed. Reg. at 35,570.
[54] 1994 SO_2 Guideline Document at 2-5 to 2-6 (emphasis added).
[55] 67 Fed. Reg. 22,168, 22,185 (May 2, 2002) (emphasis added).

modeling for SO2 for less than $5,000 per source, and in most instances less than $3,000. In stark contrast, simply purchasing and installing a single monitor can cost upwards of $100,000 per site. By focusing on modeling the sources subject to the DRR, TCEQ could ensure that the protections promised by the NAAQS are met in a cost-effective and expeditious manner.

3. TCEQ's proposed SO_2 monitoring network is inadequate to determine whether some of the largest pollution sources are causing unhealthy levels of SO_2.

In 2018, Texas power plants emitted more than 210,000 tons of sulfur dioxide—more than all of the sources in Arkansas, Louisiana, Oklahoma, Arizona, Colorado, Kansas, New Mexico, and Mississippi, *combined*.[56] This is due primarily to the fact that Texas's aging coal plants lack the type of cost-effective, modern pollution controls installed at many other plants around the country.[57]

Despite the massive amount of SO_2 emitted by the numerous sources subject to the Data Requirements Rule, TCEQ operates SO_2 ambient air monitors in the vicinity of only nine of the state's 25 power plants subject to the Data Requirements Rule.[58] And two of those plants—Big Brown and Monticello—have ceased operations. As a result, instead of providing the public with helpful data about pollution from Texas's largest sources of SO_2, as required by EPA's regulations, the TCEQ monitoring plan serves only to distort and minimize the extent of SO_2 pollution in Texas. By focusing on a subset of sources that is responsible for only a fraction of Texas's staggering SO_2 emissions, TCEQ undermines the core purposes of EPA's monitoring regulations: provide the public with accurate data on air pollution[59]

Even if TCEQ's monitoring plan accurately represented Texas SO_2 emissions (which it does not), the agency's monitoring plan fails to demonstrate that the current SO_2 monitors are placed in a location and manner that captures the peak predicted emissions concentrations, as required by EPA regulations.[60] By way of example, air dispersion modeling conducted according to EPA's SO_2 modeling protocol demonstrates that TCEQ's monitoring placements for the Martin Lake power plant does *not* capture peak predicted impacts from that source. Instead, the modeling demonstrates that the highest SO_2 concentrations—concentrations that violate the 2010 SO_2 NAAQS—caused by emissions from Martin Lake are in significantly different areas than the existing monitors. *Compare* Attachment 8 at 1-2 *with* 2019 Air Monitoring Plan App. B at B-37 (location of the Martin Lake monitor at 32.2778 N, -94.5708 W). Indeed, air dispersion modeling indicates that location of peak impacts from Martin Lake are more than a half mile from TCEQ's location. Similarly, air dispersion modeling conducted according to EPA protocol demonstrates that the location of peak impacts for the Harrington power plant is also approximately a half mile

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[56] *Id*.
[57] *See* NRDC, *Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the U.S., 2014*, available at http://www.nrdc.org/air/pollution/benchmarking/.
[58] TCEQ has SO2 monitors near Harrington, Gibbons Creek, Big Brown, Martin Lake, Welsh, J.K. Spruce, J.T. Deely, Monticello, and Sandow.
[59] 40 C.F.R. Pt. 58 App. D ¶ 1.1.
[60] *Id.* at ¶ 1.1(c).

away from TCEQ's monitor location. *Compare* Attachment 9 at 3-4 *with* 2019 Air Monitoring Plan App. B at B-1 (location of the Harrington monitor at 35.3165 W, -101.7418 N).

As discussed, to demonstrate attainment with the NAAQS, EPA regulations require TCEQ to use modeling and place monitors in a location that will capture the peak pollution concentrations caused by a particular source.[61] The attached modeling, which EPA concluded was conducted according to agency protocol and used recent actual emissions,[62] shows that TCEQ's monitors are *not* sited in locations with the highest predicted concentration of SO_2 pollution from the respective sources. And Texas has failed to conduct modeling to demonstrate otherwise. As a result, TCEQ *cannot* rely solely on data from those misplaced monitors to demonstrate attainment with the SO_2 NAAQS.

Even if TCEQ correctly sited its SO_2 monitors in locations with the highest predicted concentration of SO_2 pollution from the respective sources (and it is not clear from the record that the agency did so), recent *monitoring* data indicates that air quality at multiple monitors located near very large coal-burning power plants is regularly exceeding the health-based SO_2 NAAQS. Indeed, reported monitoring data indicates that in 2018, hourly SO_2 concentrations near the Martin Lake power plant were as high as 159.7 ppb—more than *double* the limit EPA has determined is safe to breathe.[63] The 99th percentile in 2018 was 109 ppb. Although the 99th percentile in 2017 was somewhat lower, 2019 monthly values have already exceeded 257 ppb and 180.2 pbb,[64] suggesting that the three-year average for the monitor will, in fact, violate the standard. Similarly, reported 2018 monitoring data for the Harrington coal-burning power plant near Amarillo, Texas shows hourly SO_2 concentrations as high as 166.4 ppb; the 99th percentile for 2018 was 133 ppb.[65] Thus, both the monitoring and modeling data for Martin Lake and the Harrington power plants suggest those areas are violating the health-based NAAQS, exposing those communities to significant risk.

If air quality monitoring in 2019 continues to demonstrate violations of the standard, TCEQ must take steps to redesignate those areas as being in nonattainment with the 2010 SO_2 NAAQS. At a minimum, TCEQ must conduct additional modeling and reevaluate its monitor placement to ensure that its proposed monitoring network captures peak SO_2 impacts, as required by the DRR. Sierra Club also urges TCEQ to install additional air quality monitors in those areas to properly characterize ambient air quality near those plants and to inform the affected communities.

4. TCEQ should conduct additional modeling to reevaluate compliance with the SO_2 NAAQS at W.A. Parish, San Miguel, and Coleto Creek, or adopt enforceable emissions limitations to ensure attainment.

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[61] *Id.* at ¶ 1.1.

[62] *See generally* 81 Fed. Reg. 89,870 (Dec. 13, 2016).

[63] Data available using the EPA Outdoor Air Quality Data Monitoring Values Report database, available at https://www.epa.gov/outdoor-air-quality-data/monitor-values-report.

[64] Data available using the TCEQ Data by Month by Site by Parameter database, available at https://www.tceq.texas.gov/cgi-bin/compliance/monops/monthly_summary.pl.

[65] Data available using the EPA Outdoor Air Quality Data Monitoring Values Report database, *supra* fn.63.

In its Sulfur Dioxide Ongoing Data Requirements Annual Report, TCEQ notes that total SO2 pollution from the San Miguel Electric Plant, W.A. Parish Electric Generating Station, and Coleto Creek Power Station have increased significantly since 2016—by several thousand tons per year, in each case.[66] Indeed, San Miguel, W.A. Parish, and Coleto Creek emissions increased by 1,770, 3,514, and 3,971 tons per year, respectively.

Under 40 C.F.R. §51.1205(b), TCEQ is required to provide EPA with an assessment of the cause of such emissions increase and a recommendation as to " whether additional modeling is needed to characterize air quality in any area to determine whether the area meets or does not meet the 2010 SO2 NAAQS." Although TCEQ acknowledges the emissions increases, it asserts that no further evaluation is needed because "the original designation modeling evaluated higher emissions for each area. Since higher emissions were evaluated, the original designation modeling provides reasonable assurance that the areas continue to meet the 2010 one-hour SO2 primary NAAQS."[67] That conclusory assertion is not supported by the record, and in any event, does not support TCEQ's conclusion that additional evaluation is not necessary.

As an initial matter, the modeling analyses supporting the original area designations for San Miguel, W.A. Parish, and Coleto Creek are not actually in TCEQ's monitoring network rulemaking record, and there is no support for TCEQ's assertion that the emissions evaluated in those earlier modeling analyses were actually higher than 2018 emissions. Moreover, those air dispersion modeling analyses do not actually reflect total annual emissions for any of the three plants. Instead, the reports reflect emission rates that each company evaluated to demonstrate compliance with the hourly standard.

In any event, even if the earlier modeling evaluated higher total annual emissions for each plant, that does not ensure compliance with the *one-hour* NAAQS. In setting the 2010 standard, EPA explicitly recognized that short-term exposure to SO2 concentrations above 75 ppb were harmful to human health. Accordingly, the 2010 standard imposes a shorter averaging time (1-hour versus 24-hour), which is designed to protect against dangerous short-term exposure. TCEQ's facile observation that total annual emissions are lower than those modeled period does not adequately protect the surrounding communities against periods of high utilization and the associated concentration of SO2 pollution from these essentially uncontrolled coal plants. And TCEQ's reference to total annual emissions does not ensure—nor is it even relevant to—compliance with the *hourly* standard. TCEQ should conduct additional modeling, based on the most-recent three years of actual hourly emissions and meteorological data to ensure compliance with the NAAQS at San Miguel, W.A. Parish, and Coleto Creek. Alternatively, TCEQ should impose more stringent emissions limitations under 40 C.F.R. § 1204 to ensure compliance with the standard.

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[66] 2019 Air Monitoring Network Plan, App. F, Sulfur Dioxide Ongoing Data Requirements Annual Report.
[67] *Id*.

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ENVIRONMENTAL HEALTH

METHODOLOGY Open Access

Evaluating geostatistical modeling of exceedance probability as the first step in disease cluster investigations: very low birth weights near toxic Texas sites

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Abstract

Background: The first step in evaluating potential geographic clusters of disease calls for an evaluation of the disease risk comparing the risk in a defined location to the risk in neighboring locations. Environmental exposures, however, represent continuous exposure levels across space not an exposure with a distinct boundary. The objectives of the current study were to adapt, apply and evaluate a geostatistical approach for identifying disease clusters.

Methods: The exceedance probability for very low birth weight (VLBW; < 1.5 kg) infants was mapped using an Intrinsic Conditional Autoregressive model. The data were applied to a 20 by 20 grid of 1 km^2 pixels centered on each of the 13 National Priority List Superfund Sites in Harris County, Texas.

Results: Large clusters of VLBW were identified in close proximity to four of the 13 Superfund Sites. Three of the Superfund Sites, associated with disease clusters, were located close together in central Houston and these sites may have been surrounded by a single, confluent disease cluster.

Conclusions: Geostatistical modeling of the exceedance probability for very low birth weights identified disease clusters of varying size, shape and statistical certainty near Superfund Sites in Harris County, Texas. The approach offers considerable potential as the first step for investigating potential disease clusters.

Background

The National Center for Environmental Health (NCEH) defines a cluster as a greater-than-expected number of cases that occurs within a group of people in a geographic area over a defined period of time. The Centers for Disease Control and Prevention (CDC) provide guidelines for investigation of potential clusters but, in the United States, the investigation usually falls to the state health department. The first step, in the investigation, is usually a statistical evaluation of the likelihood of the disease distribution. Commonly the state health agency examines its health registry data and performs statistical testing comparing incidence rates among arbitrary geographic areas [1]. Once a significant statistical association is established, the latter steps are committed to identification of a cause for the disease cluster. However, most investigations end with the first step because of a failure to identify a critically small p-value [2,3].

Instead of investigating a risk boundary and estimating fixed risks on either side of the boundary, there could be advantages to evaluating a more continuous geographic risk using geostatistical modeling. By definition, geostatistical modeling collects data based on sampling coordinates then fits both a local risk estimate and a spatial covariance allowing for near neighbors to be more similar in risk. The estimated risks and spatial covariance enable the prediction of risk at un-sampled locations thus filling in the complete risk surface. When implemented using a fully Bayesian approach, the risk surface can be plotted using any estimate from the posterior, including the posterior probability that the relative risk (RR) estimate is greater

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than one [4]. This is often called the exceedance probability (EP). The EP is affected by both the magnitude and the precision of the relative risks which, in turn, are largely determined by the extent of spatial correlation. A geostatistical model of the EP could provide a powerful tool evaluating flexible cluster shapes and sizes and could estimate the risk and the risk uncertainty for those living near the site.

Abnormal birth conditions are among the most frequently investigated health conditions for suspected geographic clustering. Fetuses are known to be especially susceptible to environmental toxins and the public often perceives clusters of preterm births and frequently blames local pollution. Very low birth weights (VLBW; birth weight < 1500 g) and very preterm delivery (VPTD; gestational periods of less than 32 weeks) are common conditions that have been studied extensively. The two conditions contribute markedly to neonatal morbidity and mortality and lifelong health care costs [5]. The two conditions are very highly correlated but many consider VPTD as the outcome of more biologic interest [6]. However, VLBW has often been studied as a surrogate for VPTD because of how objectively birth weight is measured relative to the estimation of gestational length [7].

The objectives of this study were to adapt, apply and evaluate geostatistical modeling of exceedance probability for VLBW near specific toxic sites, in Harris County, Texas. Harris County, located within the Houston–The Woodlands–Sugar Land metropolitan area, is the third most populous county in the United States and has 13 National Priority List (NPL) Superfund Sites, the sixth most of any county in the nation. Harris County has a diverse population, including large groups of disadvantaged residents that live near toxic sites and have high birth rates.

Methods

The use of protected health information from the birth certificate database was approved by two Institutional Review Boards, the Texas Department of State Health Services (TDSHS) and Texas A&M University. Birth records, including health related fields, were retrieved from TDSHS for the period January 1, 1990 to December 31, 2002. Geocoding was performed by the TDSHS, based on street addresses, and was 87 percent complete. The latitude and longitude of birth locations were projected into Universal Transverse Mercator 1983 (UTM83), Zone 14 units. All births were located using the mothers address at birth and rounding the geocoordinates to the nearest 1 km unit.

The identities and locations of the 13 National Priority List Superfund Sites were first identified using latitude and longitude given on the Texas Site Status Summaries on the EPA Program Region 6 Superfund website (http://www.epa.gov/region6/6sf/6sf-tx.htm). The Superfund sites were then visually identified on satellite imagery and the apparent centroid was used as the location.

The Intrinsic Conditional Autoregressive (ICAR) model was used to model the relative risk (RR), defined as the number of cases divided by the number of expected cases [8]. Besag et al. [8] referred to the smallest geographical areas as pixels and we adopt that terminology. The UTM83 coordinate system was used with a distance scale of 1 km between coordinates and modeled the 20 by 20 grid surrounding each of the toxic sites. Each x,y coordinate represented the centroid of a 1 km x 1 km pixel. For each of the i = 400 pixels, the number of cases (Y_i) was counted and the expected number of cases (E_i) was the product of the number of births, over the 12-year study period and the overall expected morbidity ratio for VLBW. In some locations E_i was zero because there were zero births, thus creating a "structural" zero. To accommodate the structural zeros, a zero-inflated Poisson, using a two group mixture model recommended by Lunn et al., [9] was adapted as follows: For $i = 400$ spatial locations and for $j = 2$ groups,

$$Y_i \sim Poisson\ (m_i)$$

Where

$$m_{i=} group_j * mu_i$$

and

$$group_j \sim Bernoulli\left(p_j\right)$$

Where p takes a value of 0 when no births were located within the pixel and a value of 1 when 1 or more births were observed within the pixel. The log(mu_i) was then modeled linearly as a function of the expected rate of VLBW, an intercept (α) and Spatial term (S_i).

$$\text{Log}\ (mu_i) = \text{Log}\ (E_i) + \alpha + S_i$$

All models employed Bayesian inference, with vague or flexible prior beliefs and a Markov Chain Monte Carlo (MCMC) implementation. The MCMC implementation was performed by use of WinBUGS version 1.4.3 [10]. The initial 5,000 iterations were discarded to allow for convergence and every hundredth of the following 500,000 iterations were sampled for the posterior distribution. Observing convergence of two chains with widely different initial values checked convergence to the posterior distribution.

The parameterization used for Geographical Information System (GIS) evaluation was the exceedance probability defined as the likelihood that the spatial RR estimate was greater than one and was taken directly from the full posterior distributions of the relative risk estimates. Initial GIS evaluation was performed on GeoBUGS version 1.2 and further GIS analysis was performed using ArcMap 10.

Three hierarchical priors were used and the results compared. The priors were gamma (0.5, 0.0005) for the

variance; gamma (0.01, 0.01) for the variance and the uniform standard deviation prior (0, 100). The evaluation of these priors was performed in two steps. Maps of the risk surface for exceedance probability were compared using GIS and the full posteriors of the standard deviation of the spatial effects were also compared. Very low birth weight was the primary outcome of interest. For the purpose of sensitivity analyses, three other outcomes were evaluated: low birth weight (LBW; < 2500 g), preterm delivery (PTD; < 37 weeks gestation) and very preterm delivery (VPTD; < 32 weeks of gestation).

Results

VLBW

For the 12-year study period there were 777,553 births in Harris County, including 10,803 with VLBW (1.4%). The area of Harris County was 4410 pixels, for average birth rate and average VLBW rate of 176.3 and 2.4 per pixel, respectively.

Cluster detection

Large clusters, with clusters defined as multiple adjacent pixels with EP > 99%, were identified within the study windows at six of the 13 Superfund Sites. Three of the sites were located close together in central Houston within the 610 Loop Interstate. These sites were the Many Diversified Interests, Inc., North Cavalcade Street and South Cavalcade Street Superfund Sites. The GIS layer centered at Many Diversified Interests, Inc. but also including the South Cavalcade Street and North Cavalcade Street Superfund Sites is presented in Figure 1. The Sol Lynn/Industrial Transformers Superfund Site had a large area of EP > 99%, extending to the east of the Superfund Site (Figure 2). Two other maps showed locations of very EP > 99% distal to the Superfund Sites, including 5-10 km southeast of the Crystal Chemical Co. Superfund Site and 5 km west of Geneva Industries/Fuhrman Energy Superfund Site. The latter cluster was confluent with the cluster detected near the Sol Lynn/Industrial Transformers Superfund Site.

Standard deviation of neighborhood effects

The standard deviation (SD) among the pixels within a neighborhood is an essential parameter for modeling a risk gradient. The posterior for the SD was similar for the three Superfund Sites that were in close proximity in central Houston. For the seven locations without large clusters of high EP, the standard deviations were smaller, thus supporting more spatial homogeneity in the risks.

Sensitivity analyses

The locations of large high EP clusters were very similar, for size, shape and location for LBW, PTD and VPTD. Sensitivity analyses, for the choice of priors, showed that the exceedance probabilities for VLBW were not sensitive to choice of priors.

Discussion

The current standard is to compare disease rates using arbitrary boundaries like census tracts or political units when investigating potential disease clusters [1]. For example, a recent Endicott, NY investigation of low and very low birth weights and other birth disorders defined exposed and unexposed subjects using complex polygons defined by boundaries along city streets. The population on one side of the street was classified as exposed and the population on the other side as unexposed. The authors were investigating concern for Soil Vapor Intrusion following a large spill of toxic chlorinated hydrocarbons, trichloroethylene and perchloroethylene [11]. Soil Vapor Intrusion is a complex process in which contaminants move into the air from the soil creating an air-borne plume and exposure. This exposure process is certain to be continuous and not a process with a clear spatial boundary [12]. This type of exposure should also a concern for residents living near Texas Superfund sites. Other approaches to defining a cluster have been proposed including novel approaches that address flexibility in cluster shapes [13,14]. These approaches offer advantages over Kulldorff's original spatial scan statistic [15] but still rely on a risk boundary. When the process is a continuous spatial one, the risks near the boundary but on opposite sides will be more alike than due to chance thus muting the risk estimate. For example, in the Endicott, NY study [11], it was unrealistic to model risks for subjects on opposite side of the street as belonging in either a full risk or no risk category. Models that are more continuous across space can estimate a gradient of risk and using the EP would offer the advantage of estimating and reporting the risk and risk certainty to those living near the investigated hazard.

Diggle and Ribeiro introduced Bayesian Kriging in which to covariance between sampled locations is estimated as a function of distance between all pairs of locations [16]. These linear geostatistical models have proven very useful in veterinary disease mapping because farms are not arranged in regular patterns and distances among the farm pairs can form the basis of the covariance [17-19]. Bayesian Kriging was a potential alternative for the current study but, the practical implementation using currently available computer resources is limited to rather small numbers of georeferenced locations. This limitation has been described by WinBUGS developers to be the result of the size of the covariance matrix [20]. The current study reduced the complexity of the spatial covariance matrix by using 1 km by 1 km pixels. The approach first projected the data from latitude and longitude to the UTM83 coordinate system. A coordinate system is needed because a degree of latitude consistently measures a distance of 111 km north to south but a degree of longitude measures a distance of 111 km east to west at the equator but 0 km at the north and south poles. In Houston, Texas a degree of longitude measures a

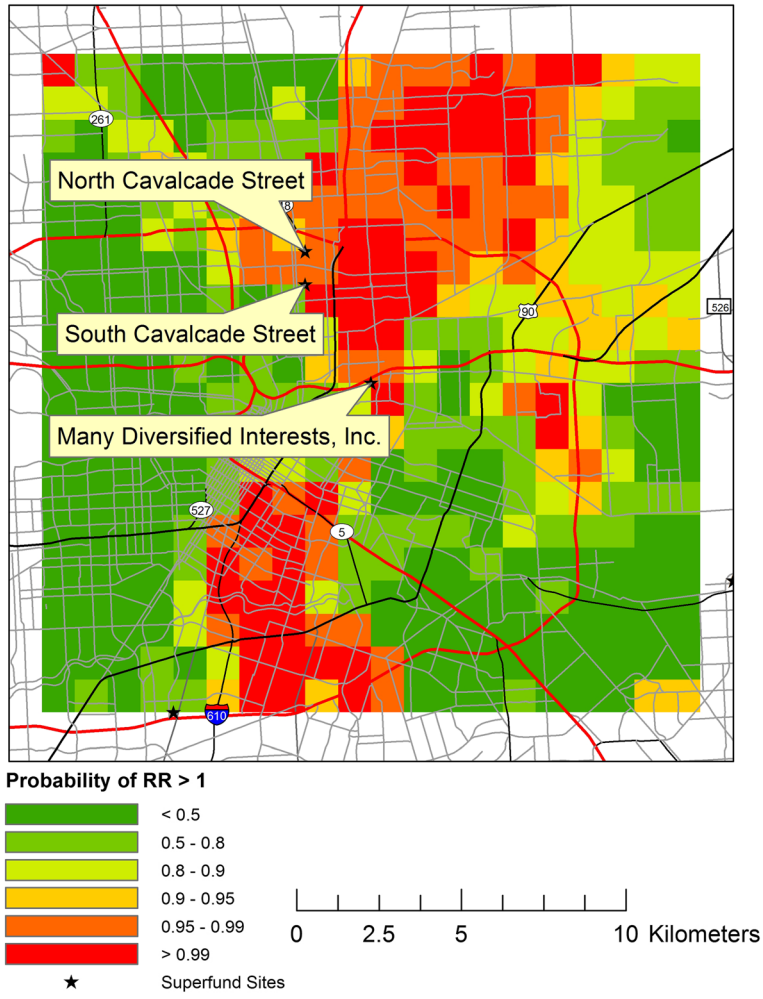

Figure 1 Downtown Houston. The exceedance probability for very low birth weights is plotted on the 20 km by 20 km grid centered at the Many Diversified Interests, Inc. Superfund Site but also including the North Cavalcade Street and South Cavalcade Superfund Sites.

distance of 97 km. The coordinate system is very important in estimating distance-based covariance but less important with ICAR modeling because correlation is identified among neighboring pixels without using distance measurements. The alternative of using latitude and longitude, in decimal degrees with geocoordinates rounded to the second decimal would produce very similar pixels that would measure approximately 1.10 km north to south and 0.97 km east to west when modeling central Texas health data. The projection and binning reduced the data complexity and as an additional advantage, protected individual patient identities. The criticism of the approach would include that the edges of the pixels were arbitrary and mothers located near but on opposite sides of the boundary would be more alike than by chance, similar to the criticism for large arbitrary locations. This concern is mitigated as the pixels become smaller and, also, the model specifically accounts for similarity of risk among neighboring pixels. Geostatistical modeling is intended for continuous space and the current "binning" procedure enabled a nearly continuous approach. The continued development of capacity for personal computing could render this adaptation unnecessary.

Spatial covariance should be considered dependent upon the existence of one or more spatially oriented causes. The search for local clusters, based on local spatial covariance, is considered both more useful and also more specifically addresses public concerns [21]. The current study deals with local spatial covariance by restricting the modeling of spatial covariance to locations very near the putative toxic source. The estimation of the spatial correlation is typically based on the data and an uninformative prior and the estimated spatial correlation determines the extent of spatial smoothing. In this context, spatial correlation refers to the similarity of map units that are being considered within the same "neighborhood." This estimate can also be parameterized as the standard deviation (SD) or the variance of the units within a neighborhood. For consistency, we refer to

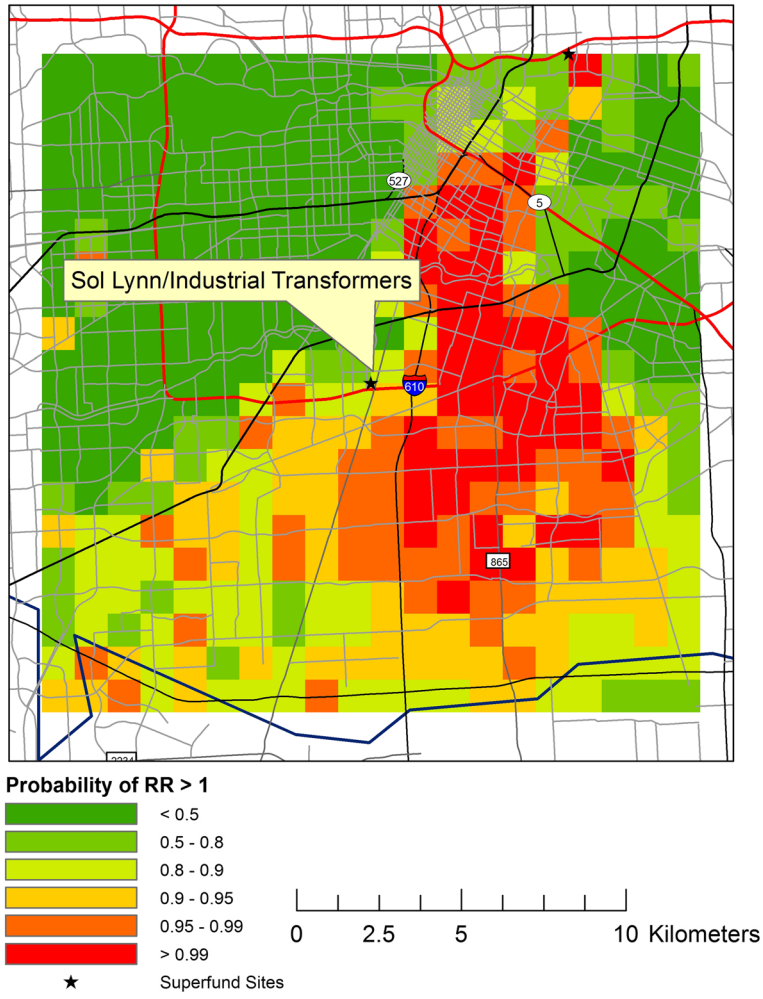

Figure 2 Sol Lynn/Industrial transformers. The exceedance probability for very low birth weights is plotted on the 20 km by 20 km grid centered on the Sol Lynn/Industrial Transformers Superfund Site.

the SD. The SD estimate can extend from zero, producing a map with the risk of each location being the same to a large standard deviation producing a mottled or more random map. Each study window consisted of 400 pixels. The spatial modeling considers each of the 400 pixels is as the center of a "neighborhood." For pixels not on the boundary, the neighborhoods consist of nine, 1 km by 1 km pixels. The variation, for the SD estimate, among the 13 sites demonstrates the need to restrict the size of the study window when potential clusters are being evaluated because locations far from the cluster will have small SD estimates. In the current study, the seven study windows without clusters had a lower estimate for the SD which in turn produced a more uniform risk across the study window. The prior selected for the neighborhood effects also has the potential to obscure actual risk gradients. The current study compared three of the commonly recommended hierarchal variance priors. The gamma(epsilon, epsilon) prior was originally recommended in the WinBUGS manual as a precision prior [20]. The gamma (0.5, 0.0005) prior for the precision was recommended by Kelsall and Wakefield for situations in which the SD was poorly identifiable, the prior would not induce spatial structure by pulling the posterior of the SD away from zero [22]. This recommendation was in the context of larger map units and an objective of comparing risks among locations. In the current context of evaluating gradients of risk, it is important for the prior not to influence the posterior distribution of SD toward zero. Gelman promoted a variance prior that is uniform over a broad range on the standard deviation scale [23]. This prior is the most consistent with the prior beliefs of the investigators for the described approach to investigate risk gradients near a putative toxic source. The current study evaluated common conditions in a densely populated setting and the results were not sensitive to the prior selected. Future investigations should continue this sensitivity analysis. Much rarer

diseases or very small spatial units, like those used in the current study may result in models with less identifiable standard deviations of neighborhood effects.

The first stage of cluster investigation is primarily statistical and evaluates the likelihood of a case excess. Once a case excess has been evaluated and the statistical certainty established, the objective becomes to identify the cluster cause. The identification of high risk locations does not provide sufficient evidence to implicate the suspected toxic source, but the results do support further investigation. Further investigation of potential causes should evaluate personal level covariates as causes ot the cluster. When personal attributes, like race, or personal exposure assessments can explain the geographic risk then the personal-level covariate should be considered the more specific cause of the cluster. The approach, presented here, can be extended by adjusting for personal-level covariates and then re-evaluating the GIS-based exceedance probabilities. This can be done without an ecologic bias. In contrast, cluster detection methods that model the risk as constant within a fixed cluster boundary are subject to an ecologic bias when the confounding between geographic risk and personal-level risks is assessed.

Conclusions

Geostatistical modeling of the exceedance probability for very low birth weights identified disease clusters of varying size, shape and statistical certainty near Superfund Sites in Harris County, Texas. The approach offers potential as the first step for investigating potential disease clusters.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JAT carried out the modeling and GIS-evaluation and drafted the manuscript. WTB participated with the geographic modeling and GIS analysis and drafting the manuscript. AMS participated with epidemiologic advising and in drafting the manuscript. All authors read and approved the final manuscript.

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SOAH DOCKET NOs. 582-18-4846, 582-18-4847

TCEQ DOCKET NOs. 2018-0899-AIR, 2018-0900-AIR

APPLICATION OF GCGV ASSET HOLDING, LLC, FOR AIR QUALITY PERMIT NOs. 146425/PSDTX1518 & 146459/PSDTX 1520 IN SAN PATRICIO COUNTY, TEXAS	§ § § § §	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

DIRECT TESTIMONY

OF

RANAJIT SAHU, PH.D., QEP, CEM (NEVADA)

December 7, 2018
Redacted

Upload Date: 20181218111111 Account Number: 4014 Upload Description: 2018.12.18RedactedTestimonyofRonSahu

1 INTRODUCTION

2 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

3 A. My name is Ranajit (Ron) Sahu. My business address is 311 North Story Place,
4 Alhambra, CA, 91801.

5 **Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.**

6 A. I received a Doctorate in Mechanical Engineering from the California Institute of
7 Technology (Caltech) in Pasadena in 1988. I had previously received a Master of
8 Science degree from Caltech in 1984. My undergraduate degree was also in
9 Mechanical Engineering at the Indian Institute of Technology in Kharagpur, India.

10 **Q. DO YOU HAVE ANY PROFESSIONAL CERTIFICATIONS?**

11 A. I am a Certified Permitting Professional at the South Coast Air Quality Monitoring
12 District. This district is the air pollution control agency for all of Orange County
13 and the urban portions of Los Angeles, Riverside and San Bernardino counties.

14 I hold credentials as a Qualified Environmental Professional (QEP) from the
15 Institute of Professional Environmental Practice (IPEP). The QEP credential has
16 been granted full accreditation by the Council of Engineering and Scientific
17 Specialty Boards.

18 I am also a Certified Environmental Manager in the state of Nevada. This
19 designation is required by the Nevada Division of Environmental Protection for
20 consultants engaged in certain environmental remediation projects specified by
21 rule.

22 **Q. WHAT IS YOUR OCCUPATION AND HOW ARE YOU EMPLOYED?**

23 A. I am an engineer by training and a consultant on environmental and energy
24 matters. I am self-employed as an independent consultant on environmental and
25 energy issues.

26 **Q. PLEASE DESCRIBE YOUR OCCUPATION.**

A. I provide project management, air quality consulting, waste remediation and management consulting, and regulatory and engineering support consulting to a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and public interest group clients.

Q. HOW LONG HAVE YOU BEEN AN INDEPENDENT CONSULTANT?

A. Since 2000.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

A. I have over have over twenty-eight years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources including stationary and mobile sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

I have over twenty five years of project management experience and have successfully managed and executed numerous projects. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

1 I have provided consulting services to numerous private sector, public sector and
2 public interest group clients. My major clients over the past twenty five years
3 include various trade associations as well as individual companies such as steel
4 mills, petroleum refineries, cement manufacturers, aerospace companies, power
5 generation facilities, lawn and garden equipment manufacturers, spa
6 manufacturers, chemical distribution facilities, and various entities in the public
7 sector including EPA, the US Dept. of Justice, several states, various agencies
8 such as the California DTSC, various municipalities, etc. I have performed
9 projects in all 50 states, numerous local jurisdictions, and internationally.

10 As a consulting engineer for private sector clients, I have prepared, or consulted
11 on, several applications for air permits that have included engineering analysis and
12 demonstrations required to meet applicable BACT and MACT standards.

13 I am familiar with the design, operation and technical aspects of petrochemical
14 plants and refineries, including air pollution control equipment. I have completed
15 engineering projects and reviewed numerous air quality permits relating to
16 petrochemical plants. I have evaluated and provided comments on several
17 applications for Best Available Control Technology (BACT), as well as case-by-
18 case Maximum Achievable Control Technology (MACT) determinations.

19 I have and continue to provide expert witness services in a number of
20 environmental areas discussed above in both state and Federal courts as well as
21 before administrative bodies. My resume or "curriculum vitae" reflects me work
22 as an expert witness.

23 In addition to consulting, I have taught numerous courses in several Southern
24 California universities including UCLA (air pollution), UC Riverside (air
25 pollution, process hazard analysis), and Loyola Marymount University (air
26 pollution, risk assessment, hazardous waste management) for the past seventeen
27 years. In this time period I have also taught at Caltech, my alma mater (various

1 engineering courses), at the University of Southern California (air pollution
2 controls) and at California State University, Fullerton (transportation and air
3 quality).

4 **Q. HAVE YOU PREPARED A TRUE AND CORRECT COPY OF YOUR**
5 **CURRICULUM VITAE FOR USE IN THIS PROCEEDING?**

6 A. Yes. It is the CV in Appendix A.

7 **Q. ARE YOU FAMILIAR WITH THE VARIOUS FEDERAL STATUTES AND**
8 **RULES THAT APPLY TO THE TYPES OF AIR QUALITY PERMITS**
9 **THAT ARE SOUGH IN THIS APPLICATION?**

10 A. Yes, I am.

11 **Q. ARE YOU FAMILIAR WITH THE VARIOUS STATUTES AND RULES IN**
12 **TEXAS THAT APPLY TO THE TYPES OF AIR QUALITY PERMITS**
13 **THAT ARE SOUGHT IN THIS APPLICATION?**

14 A. Yes, I am.

15 **II. PURPOSE OF YOUR TESTIMONY**

16 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

17 A. The purpose of my testimony is to provide information about the Application of
18 Gulf Coast Growth Ventures Asset Holding LLC ("GCGV" or "Applicant"), a
19 joint venture between ExxonMobil ("Exxon") and a Saudi company, SABIC, for
20 Texas air quality permit No. 146425/PSDTX1518 ("Application") and about the
21 air quality impacts and issues related to this permit,[1] including the emission
22 calculations and BACT analysis.

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[1] The permit concerns a chemical plant, for which operations are described in the TCEQ Preliminary Determination Summary (PDS), p. 1.

"GCGV, a joint venture between ExxonMobil Chemical Company (XOM) and Saudi Basic Industries Corporation (SABIC), proposes to construct a new organic chemicals manufacturing complex ("the GCGV complex") in San Patricio county. As proposed, the complex will consist of the following production units: a steam cracking plant ("Ethylene Plant" or "Olefins Plant") for production of ethylene, using ethane as feedstock; a monoethylene glycol (MEG) plant, employing ethylene oxide (EO) as an intermediate; and two linear low density polyethylene (LLDPE) plants. The complex will also include the following utilities and logistical operations: boilers for plant steam needs, a wastewater treatment plant, and truck and railcar loading racks for transfer of liquids (MEG and Olefins plant by-products."

1 **Q. WHAT HAS BEEN THE SCOPE OF YOUR WORK IN THE PRESENT**
2 **PROCEEDING?**
3 A. I was asked by the Texas Campaign for the Environment and Sierra Club to
4 review the Applications, Draft Permits, administrative record, and the discovery
5 documents. I was asked to determine if the Applications and Draft Permits meet
6 all applicable state and federal requirements for air quality permits of the types
7 sought in the Application. GCGV has applied for a permit to construct and operate
8 an olefins and derivatives manufacturing complex and a railyard. In my
9 testimony, I will use the terms facility, site, or complex when I refer to the entire
10 complex covered by the Draft Permits and Applications at issue.

11 **Q. HOW DID YOU CONDUCT THAT REVIEW?**
12 A. I reviewed the public and confidential versions of the Applications, including the
13 various supplements to it. I reviewed the TCEQ documents generated during the
14 TCEQ's review process; these are in the administrative record provided the parties
15 by the Applicant (usually bearing an "APPM" prefix). I reviewed the state and
16 federal regulations and guidance documents that are applicable to the permits
17 requested in the Applications; these documents have generally been cited in this
18 report, where they have some bearing on the report matters, but I have been
19 working in this field for decades, so I have earlier reviewed documents in other
20 contexts that inform my opinions, here. I reviewed information in the various data
21 sets that are maintained by EPA to assist the public in the "best available control
22 technology" (BACT) determination, such as the RACT/BACT/LAER database. I
23 have in the past reviewed other applications, permit decisions and emissions data
24 of other similar sources. And I reviewed and relied on the types of technical
25 publications and information sources that an air quality permitting specialist
26 normally relies upon. If this reliance had a noticeable impact on my thinking
27 regarding this particular proposed facility, I have included a citation in this report.
28 I focused on the application and draft permit for the main site, as opposed to the

Railyard.

Q. BEFORE WE GET INTO YOUR SPECIFIC CONCLUSIONS, WOULD YOU PLEASE GIVE THE COMMISSION A BRIEF SUMMARY OF YOUR FINDINGS FOR CONTEXT?

A. Yes, here is a brief summary of what I found:

(i) that the design of the facility is preliminary and not sufficiently advanced to allow proper permitting, and this is particularly so, because so many of the modeled off-site impacts are so close to regulatory thresholds;

(ii) the emissions presented in the Application and the limits in the draft permit, as well as the Executive Director's conclusions in the Preliminary Determination Summary and technical support documents accompanying the draft permit, rely on many input assumptions (which may change when the design progresses further) and that are not enforceable under the permit, thus making the likely-underestimated emissions presented in the record unreliable – this, in turn, makes the ambient air quality impacts analysis also unreliable and is likely to underestimate impacts;

(iii) the emissions calculations often use methodologies that are unreliable, casting further doubt on the reliability of the analyses presented, which are likely to underestimate impacts from the facility once it is built and operational;

(iv) many proposed permit limits are unenforceable, because the limits are derived from calculations for which the input values are, themselves, not monitored and, occasionally, are unfounded assumptions.

(v) BACT for certain pollutants/sources is not well supported and there is no discussion of why certain emissions cannot be further reduced – specifically NOx from the furnaces and boilers; various pollutants from the flares, including NOx, and VOCs; VOC emissions from the cooling tower; and fugitive VOC emissions from the many components at the facility, which may change with further design;

(vi) the results of the ambient impacts analyses are underestimates of actual impacts; and

(vii) the permit does not incorporate current-day verification technologies, such as property line or fenceline monitoring and optical gas imaging (OGI) that would assure that emissions from the facility do not adversely affect the public.

FACILITY DESIGN IS NOT COMPLETE

Q. LET'S TAKE THE FIRST CRITICISM YOU IDENTIFY, THE LEVEL OF

DESIGN DETAIL FOR THE FACILITY. WHAT IS YOUR CRITICISM, HERE?

A. First, it is important to note that under the federal Clean Air Act, it is the Applicant's burden to demonstrate that the emissions from the facility will not cause impermissible ambient impacts. In other words, it is the Applicant's burden to demonstrate that the emissions will not cause or contribute to exceedances of EPA's health-based national ambient air quality standards (NAAQS), exceedances of EPA's Prevention of Significant Deterioration ("PSD") increment standards, and any other applicable standard under the federal Clean Air Act. These demonstrations are done through the use of EPA-approved air dispersion models designed to predict the air pollution impacts from the proposed site. Second, under the federal Clean Air Act for major sources such as the GCGV (for several pollutants), it is the Applicant's burden to demonstrate that the proposed facility will meet the "best available control technology" (BACT) standard for each PSD-triggering pollutant, which ultimately translates into the emission limitations and permit conditions. It is clear that facility design is incomplete in significant aspects – i.e., the design is not sufficient to allow one to properly estimate emissions and determine if BACT has been achieved. The Application including all the supporting materials I reviewed simply does not have the requisite level of engineering design detail to satisfy either of those two foundational permitting requirements.

Q. CAN YOU PUT SOME MEAT ON THAT CRITICISM? WHAT IS AN EXAMPLE?

A. Certainly, take the example, the March 28, 2018, Draft Permit (APPM-02462, at 02466):

> "Added0020[para]2 specifying DRE requirement for catalytic oxidizer. <u>Since limited information is available about the device at</u>

this stage."[2] (emphasis added)

Q. ARE THERE OTHERS?

A. Yes. Consider the March 7, 2018, Air Quality Analysis (APPM-00902, at 00963, note 1). It includes a Table 6-1, GEP stack heights for eight (8) olefin furnaces. These are not really the stack heights, however, but are, really, "current proposed stack heights based on preliminary design information."

Q. LET ME STOP YOU A MOMENT. WHY IS STACK HEIGHT IMPORTANT, FROM A POLLUTION-IMPACT PERSPECTIVE?

A. Stack height is important because it has a significant impact on the off-site air quality impacts. Generally, the taller the stack, the greater the dispersion of the pollutants of concern. This is also true for the flares. Stack height, along with the temperature of the emission stream, the exit velocity, and the diameter of the stack (or flare tip) are all important factors that determine the off-site air quality impacts.

Q. HOW ABOUT ANOTHER EXAMPLE?

A. OK. The May 9, 2018, Preliminary Determination Summary (APPM-03528, at internal p. 10), discussing the storage tanks, of which there are dozens divided into three categories (floating-roof, fixed-roof and pressurized), the TCEQ Executive Director notes:

> GCGV has not finalized the storage capacities of the storage tanks. The permit requires that an alteration be obtained prior to the start of operations which specifies as-built capacities and individual emission limits for each storage tank.

Q. HOW ABOUT ANOTHER EXAMPLE?

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2 APPM-002466

1 A. Sure. The Application contains a table, which TCEQ commonly calls "Table 1(a),
2 Emission Point Summary." This table contains the maximum hourly and annual
3 emissions from each and every emission point at the site. Hourly and the annual
4 emissions represented in this table make their way into the permit itself – they are
5 the "maximum allowable emission rates" listed in the permit. In other words,
6 Table 1(a) in the Application is the basis for actual hourly and annual emission
7 limits for the site, and these emission rates are used to model the off-site impacts.
8 Table 1(a) shows that the stack parameters for the flares (including the ground
9 flare, and the elevated flares), thermal oxidizers, the cooling tower, and other
10 sources [redacted]
11 [redacted] APPM-005327

12 **Q. HOW DO YOU KNOW THE TABLE 1(a) YOU ARE REFERRING TO IS**
13 **THE MOST UP-TO-DATE VERSION OF THE APPLICATION?**

14 A. The Applicant provided an index when they filed the administrative record, and in
15 that index, designated as exhibit number 104, dated April 26, 2018, the "GCGV -
16 Updated Application – Confidential Information," are the application materials
17 numbered as "APPM – 005308 – 5334.

18 **Q. CAN YOU GIVE ANOTHER EXAMPLE?**

19 A. Yes. I reviewed the modeled emission rates that were used in the Applicant's air
20 dispersion modeling report, or air quality analysis. That report is required by
21 TCEQ as part of the application process, and it is the basis for the erroneous
22 determination that the emissions from the site meet the Clean Air Act's
23 requirements. The report is dated March 2018. (Beginning APPM-00903.)
24 Appendix A to that report contains the modeled emission rates that the Applicant
25 used in its attempt to demonstrate that the site will not violate the federal
26 Prevention of Significant Deterioration ("PSD") standards. APPM-001029, dated

March 2018. The design parameters for multiple sources at the site are essentially placeholders, as shown in the excerpts below.

Here is an excerpt showing that the modeled emission rates for the federally regulated pollutant NO_2 – which are the same emission limits found in the draft permit – are not reflective of actual design, and instead are pseudo parameters.

								NO2	Oxides of Nitrogen (NOx)	
								Model	Table 1(a)	Table 1(a)
Source Type	Description	UTM-X (m)	UTM-Y (m)	Height (ft)	Temp. (F)	Vel. (ft/s)	Diam (ft)	Rate (lb/hr)	Rate (lb/hr)	Rate (tpy)
Heater	Olefins Furnaces Cap	665045.50	3090377.88	215.00	282.00	49.80	8.00	53.70	53.70	196.22
Flare	Multi-point Ground Flare (Intermittent)	665329.80	3090511.00	45.00	[redacted]	984.00	94.99	2,757.32	2,757.32	167.88
Flare	Multi-point Ground Flare (Continuous)	665329.80	3090511.00	45.00	[redacted]	[redacted]	1.73	0.85	0.85	3.71
Flare	Shared Elevated Flare (Intermittent)	665015.35	3090768.66	199.00	[redacted]	[redacted]	21.72	64.04	64.04	12.17
Flare	Shared Elevated Flare (Continuous)	665015.35	3090768.66	199.00	[redacted]	[redacted]	6.27	4.62	4.62	10.61
Flare	Shared Elevated and Ground Flare Cap	665329.80	3090511.00	45.00	[redacted]	[redacted]	1.73	-	-	-
Flare	Glycols Elevated Flare (Intermittent)	664284.64	3090902.29	165.00	[redacted]	[redacted]	22.09	59.07	59.07	12.36
Flare	Glycols Elevated Flare (Continuous)	664284.64	3090902.29	165.00	[redacted]	[redacted]	4.05	1.96	1.96	8.57
Flare	Glycols Elevated Flare	664284.64	3090902.29	165.00	[redacted]	[redacted]	4.05	-	-	-
TO	Glycols Thermal Oxidizer	664358.47	3090835.11	75.00	230.00	43.51	3.50	8.00	8.00	25.79

Notes:

[redacted] LDEQ Flare or Pseudo-point Parameters.

Here is an excerpt showing that the modeled emission rates used to meet the federal fine particle ($PM_{2.5}$) standards are not reflective of actual design, and are instead pseudo parameters.

Description	UTM-X (m)	UTM-Y (m)	Height (ft)	Temp. (F)	Vel. (ft/s)	Diam (ft)	PM25_ST Model Rate (lb/hr)	Fine Particulate (PM2.5) Table 1(a) Rate (lb/hr)	Fine Particulate (PM2.5) Table 1(a) Rate (tpy)
Olefins Furnaces Cap	665045.50	3090377.88	215.00	282.00	49.80	8.00	34.53	34.53	92.85
PE Vents Cap - Particulate Matter	665100.59	3090967.96	18.00	140.00	87.90	0.33	2.52	2.52	5.56
Glycols Thermal Oxidizer	664358.47	3090835.11	75.00	230.00	43.51	3.50	1.00	1.00	3.23
Utilities Cooling Tower	664716.38	3090875.42	45.00	105.00	30.00	29.00	3.39	3.39	13.26
Utilities Boiler Cap	665163.26	3090538.66	190.00	350.00	54.14	10.00	23.47	23.47	47.57
Shared Thermal Oxidizer Cap	665182.45	3090667.75	190.00	1,100.00	55.00	12.35	2.34	2.34	3.61
Emergency Generator No. 1	664699.96	3090737.01	10.00	400.00	225.00	0.70	0.02	0.02	0.01
Emergency Generator No. 2	664932.95	3090686.43	10.00	400.00	225.00	0.70	0.07	0.07	0.01
Emergency Generator No. 3	664699.96	3090737.01	10.00	400.00	225.00	0.70	0.03	0.03	0.01
Emergency Generator No. 4	665078.22	3090608.31	10.00	400.00	225.00	0.70	0.03	0.03	0.01
Emergency Generator No. 5	665592.19	3090096.09	10.00	400.00	225.00	0.70	0.09	0.09	0.01
Glycols Generator No. 1	664699.96	3090737.01	10.00	400.00	225.00	0.70	0.02	0.02	0.01
Generator Engine Cap	665078.22	3090608.31	10.00	400.00	225.00	0.70	-	-	-
Firewater Pump No. 1	664566.23	3091031.93	10.00	400.00	225.00	0.70	0.53	0.53	0.03
Firewater Engine Cap	664566.23	3091031.93	10.00	400.00	225.00	0.70	-	-	-
Wastewater Equalization Tanks (Controlled by Catalytic Oxidizer)	664642.61	3090408.15	12.00	375.00	11.49	0.50	0.01	0.01	0.03
Tank Maintenance Control (Control Device)	664859.13	3090541.54	12.00	1,400.00	63.01	3.34	0.15	0.15	0.02
MSS PE Area - Catalyst Handling	665100.59	3090967.96	20.00	[redacted]	[redacted]	[redacted]	0.061	1.46	0.01
MSS Olefins Area - Catalyst Handling	664859.13	3090541.54	20.00	[redacted]	[redacted]	[redacted]	0.100	2.40	0.03
MSS Glycols Area - Catalyst Handling	664539.75	3090725.67	20.00	[redacted]	[redacted]	[redacted]	0.380	9.12	0.04
MSS Site Cap - Portable Control	664859.13	3090541.54	12.00	1,400.00	63.01	3.34	0.15	0.15	0.01
MSS ILE - Filter/strainer changeouts	664859.13	3090541.54	20.00	[redacted]	[redacted]	[redacted]	0.02	0.02	0.01
Railcar Loading Cap - Particulate Matter	665231.06	3091114.58	80.00	[redacted]	26.34	2.00	0.19	0.19	0.84
MSS ILE for Railyard - Bag Filter changeouts	665045.56	3091302.73	10.00	[redacted]	[redacted]	[redacted]	0.02	0.02	0.01
ASU Cooling Tower	664069.51	3091096.69	18.00	105.00	30.00	8.00	0.02	0.02	0.06
ASU Generator (1340-hp)	664088.22	3090986.67	10.00	400.00	225.00	0.70	0.09	0.09	0.01

Notes:

[redacted] LDEQ Flare or Pseudo-point Parameters

Q. ARE THERE OTHER EXAMPLES, TOO?

A. Certainly, there are numerous such examples.

Q. DOES THIS LACK OF DETAIL HAVE REAL-WORLD CONSEQUENCES OR ARE WE QUIBBLING ABOUT ANGELS ON THE HEADS OF PINS?,

A. Mature design is critical, because without knowing the actual design of the sources it is not possible for an Applicant to demonstrate that the site meets the "best available control technology" standard. Nor is it possible for an Applicant to demonstrate the site will not impermissibly degrade the air quality (i.e., the ambient impacts analyses). Consider this comment from TCEQ (March 29, 2018, revised draft permit, APPM-2462, at 2463):

> "...Basically, there are two rounds of engineering for major construction projects: FEED (Front-End Engineering and Design) and EPC, which are customarily contracted out to different firms. Typically our permit applicants will submit permit applications based on information provided by the FEED contractor; <u>and frequently have to amend the permit if the more detailed work performed by the EPC contractor shows that some relevant plan can't be used. A statement from the EPC contractor is more "firm" since it usually reflects the final design specs for the equipment</u>." (emphasis added)

The problem with reliance on the FEED engineering for permitting is that when the designs do change later during EPC, the analyses supporting the project – the analyses on the bases of which the permits were issued – are not revised, and the public does not get a chance to review the changes. An implicit assumption that there are no significant or material changes from FEED to EPC is simply incorrect. And, when significant changes do occur to projects during EPC, it is not sufficient to simply "amend the permit." Changes can affect BACT determinations and the off-site air quality impacts. The emissions, locations of sources, source geometries and characteristics (such as release heights, temperatures, velocities, etc.) – all will affect the modeled air impacts from the facility.

This is not just quibbling over trivial details, because the site's air quality impacts are shown to be very close to several health-based (NAAQS) and significant deterioration (PSD Increments) thresholds.

<u>MODELED IMPACTS ARE CLOSE TO THRESHOLDS</u>

Q. YOU JUST MENTIONED THE NARROW MARGINS BY WHICH THE APPLICANT'S AIR QUALITY ANALYSES PURPORTS TO SHOW VARIOUS IMPACT THRESHOLDS ARE AVOIDED. TELL US MORE ABOUT THAT.

A. OK. For example, Table 3 (table numbering as in the original), below, from the ED's Air Quality Analysis Audit (APPM-03142, at 03144) and Preliminary Determination Summary (APPM-03258, at internal p. 15, 03272) shows the total ground level concentrations of $PM_{2.5}$, as measured against the 24-hour and annual NAAQS, and of NOx, as measured against the 1-hour NO_2 NAAQS, are very close to the standards. Thus, the accuracy of the underlying emissions estimates for $PM_{2.5}$ and NOx, as well as other modeling assumptions are paramount.

Fine particles ($PM_{2.5}$) are not only emitted directly from the site, but are also formed via what is termed "secondary formation," when some gaseous emissions of SO_2 and NOx form into fine particles (essentially nitrates and sulfates). So, to truly demonstrate that this site will not violate federal ambient standards for $PM_{2.5}$, the Applicant should have modeled the primary (or direct) $PM_{2.5}$ emissions and the secondarily formed $PM_{2.5}$ from the NOx and SO_2 emissions. In this case, the Applicant elected to disregard in its off-site impacts modeling the $PM_{2.5}$ component that forms from SO_2 emissions at the Applicant's site and at surrounding sites, that increases the risk that the modeled off-site $PM_{2.5}$ concentrations are inaccurately understated. (The SO_2 emission rate, per the Applicant, is 38.49 TPY, which is just below the 40 ton per year threshold for deeming the site a "major source" under federal law. This is significant because the Applicant is trying to show that its emissions will not exceed the applicable limits. See, the Air Quality Analysis Report, APPM-03142, at 01012.)

Table 3. Total Concentrations for PSD NAAQS (Concentrations > De Minimis)

Pollutant	Averaging Time	GLCmax (µg/m³)	Background (µg/m³)	Total Conc. = [Background + GLCmax] (µg/m³)	Standard (µg/m³)
PM_{10}	24-hr	8.4	67	75.4	150
$PM_{2.5}$	24-hr	5.1	22	27.1	35
$PM_{2.5}$	Annual	1.3	9	10.3	12
NO_2	1-hr	102.2	61	163.2	188
NO_2	Annual	3.7	11.6	15.3	100

Q. CAN YOU GIVE US ANOTHER EXAMPLE?

A. Certainly. The EPA sets ambient limits which are commonly called Prevention of Significant Deterioration (PSD) "Increments," and no new source is allowed to be constructed if it is shown to exceed any of these PSD Increments. These limits are set at levels intended to prevent the impermissible degradation of air quality, and new or modified sources are prohibited from "consuming" all the available increment. In lay terms, these are ambient concentrations that the Applicant must demonstrate will not be met or exceeded. Below is a comparison of the $PM_{2.5}$ PSD increment that is proposed to be consumed by the GCGV project. As Table 5, below (table numbering in original)(APPM-03258, at 03275), shows, out of the 9 micrograms per cubic meter (ug/m3) increment for 24-hour $PM_{2.5}$, this project expects to consume 8.95 ug/m3. Not only is the proposed project very close to the increment, the two values are not statistically different. Just like in the example above, and even more so, the accuracy of $PM_{2.5}$ emissions and all of the modeling assumptions that have been relied upon are obviously paramount.

Table 5. Results for PSD Increment Analysis

Pollutant	Averaging Time	GLCmax (µg/m³)	Increment (µg/m³)
PM_{10}	24-hr	9.8	30
PM_{10}	Annual	1.5	17
$PM_{2.5}$	24-hr	8.95	9
$PM_{2.5}$	Annual	1.35	4
NO_2	Annual	4.1	25

Q. ANY MORE?

A. Yes. Consider the impacts due to SO_2. As I discuss later, relying on a set of unenforceable assumptions and inputs, the Applicant represents that the site's SO_2 potential annual emissions are 38.5 tons per year, which is just under the federal "major source" threshold of 40 tons per year – making SO_2 emissions from the site subject to so-called "minor new source review" as opposed to major new source review. This is a fundamental error which I discuss later. But for purposes of this section of my testimony, even under the assumption that SO_2 is subject to minor new source review, its impacts, as modeled by the Applicant are shown in the Table 7, below (table numbering in original) (APPM-03258, at 03277).

Table 7. Modeling Results for Minor NSR De Minimis

Pollutant	Averaging Time	GLCmax (µg/m³)	De Minimis (µg/m³)
SO_2	1-hr	7.77	7.8
SO_2	3-hr	6.7	25
SO_2	24-hr	4.1	5
SO_2	Annual	0.2	1

The fact that modeled impacts are so close to the applicable threshold is obvious when comparing the 1-hour SO_2 GLCmax value of 7.77 ug/m3 to the *de minimis*

value of 7.8 ug/m3 – which is, in fact the same as the GLCMax, when rounded. Additionally, the 24-hour comparison is also close in my opinion.

My point, like in the examples above, is that there must be high confidence in the emissions estimates of SO_2 as well as all of the modeling inputs (including the design parameters and the emissions those design decisions will yield) for these results to be meaningful – which is not the case.

Yet another example is the prediction of ambient ozone after the project shown in Table 7-30, below (table numbering in original)(APPM-00902, at 01018). As shown, the predicted ozone impact of 68.30 ppb is only slightly below the current ozone NAAQS of 70.00 ppb. VOC and NOx are precursor emissions that create ozone in the atmosphere, under proper conditions. In this case, the applicant, improperly, did not conduct the photochemical modeling for ozone – relying instead on a draft EPA methodology called MERP to estimate ozone impacts. I discuss, later, the inappropriateness of using MERP in this instance. Regardless, the closeness of the estimated impact to the applicable NAAQS is undeniable.

Table 7-30
Ambient Ozone Impact Analysis

Monitor Number	Post Project, Ambient Ozone Concentration (ppb) [01]	Current Ozone NAAQS (ppb)
483550025	68.30	70.00

Note(s):
[01] For the Ozone (O_3) analysis, the modeled concentration should be truncated to a whole number. For conservatism, the modeled concentration was used without truncating

Yet another example is the prediction of cumulative ozone impacts (as opposed to just the ozone impacts due to the facility and background, noted in the previous example). This is predicted to be 69.44 ppb, as compared to the ozone NAAQS of 70.00 ppb.[3] Given the scaling Modeled Emission Rate Precursors ("MERP")

[3] APPM-002618, at 02652 and 02653 (April 2018 SAGE response to Jamieson March 2018 comments).

methodology, discussed later in these comments (which used the entire Harris County as a "similar" facility to the GCGV Main Site), underlying this "analysis" I question the robustness of this prediction.

Q. YOU HAVE BEEN DISCUSSING THE IMPACTS ASSOCIATED WITH THE SO-CALLED CRITERIA POLLUTANTS SUCH AS SULFUR DIOXIDE, FINE PARTICLES, AND NITROGEN OXIDES. WHAT ABOUT THE HEALTH EFFECTS FROM THE SO-CALLED AIR TOXICS?

A. Texas has what are called "Effects Screening Levels" (ESL), which are guidelines for the Administrative Law Judge to consider when deciding if this project will be protective of the public's health and welfare. ESLs are established for many of the most dangerous toxic pollutants, including known carcinogens.

As Table 8, below, (table numbering in original)(APPM-03258, at 03277), shows, the predicted short-term (i.e., 1-hour) impacts of toxic air contaminants exceeds (often by wide margins) the applicable TCEQ ESL concentrations.

Table 8. Minor NSR Site-wide Modeling Results for Health Effects

Pollutant & CAS#	Averaging Time	GLCmax ($\mu g/m^3$)	ESL ($\mu g/m^3$)
Ammonia 7664-41-7	1-hr	310	180
Ammonia 7664-41-7	Annual	0.5	92

Pollutant & CAS#	Averaging Time	GLCmax (µg/m³)	ESL (µg/m³)
Benzene 71-43-2	1-hr	876	170
Benzene 71-43-2	Annual	0.7	4.5
Naphthalene 91-20-3	1-hr	265	440
Styrene 100-42-5	1-hr	152	110
Styrene 100-42-5	Annual	0.5	140
1,3-Butadiene 106-99-0	1-hr	522	510
1,3-Butadiene 106-99-0	Annual	0.6	9.9
Ethylene 74-85-1	1-hr	10694	1400
Ethylene 74-85-1	Annual	3	34
1-Hexene 592-41-6	1-hr	11204	1700
1-Hexene 592-41-6	Annual	6	170
n-Hexane 110-54-3	1-hr	15611	5600
n-Hexane 110-54-3	Annual	8	200
Dimethyl sulfide 75-18-3	1-hr	29.3	7.6
Dimethyl sulfide 75-18-3	Annual	0.01	25
Ethylene oxide 75-21-8	1-hr	94	20
Ethylene oxide 75-21-8	Annual	0.7	2
Acetaldehyde 75-07-0	1-hr	117	120
Ethylene glycol 107-21-1	1-hr	4273	450
Ethylene glycol 107-21-1	Annual	0.2	4.5

Pollutant & CAS#	Averaging Time	GLCmax ($\mu g/m^3$)	ESL ($\mu g/m^3$)
Diethylene glycol 111-46-6	1-hr	482	400
Diethylene glycol 111-46-6	Annual	0.02	40
Heavy coker gas oil 64741-81-7	1-hr	617	1000
Monoethanolamine 141-43-5	1-hr	114	97
Monoethanolamine 141-43-5	Annual	0.04	7
Sodium hydroxide 1310-73-2	1-hr	83	20
Sodium hydroxide 1310-73-2	Annual	0.02	2
Formaldehyde 50-00-0	1-hr	31.4	15
Formaldehyde 50-00-0	Annual	0.3	3.3
Dicyclopentadiene 77-73-6	1-hr	111	60
Dicyclopentadiene 77-73-6	Annual	0.01	27
Alkenes NA	1-hr	20066	5800
Alkenes NA	Annual	10	580

The highest concentrations of several of these dangerous air toxics – specifically, benzene, ethylene oxide, ethylene, formaldehyde, ethylene glycol, sodium hydroxide – are predicted to occur well beyond the plant's fenceline. (GCGV-EXP-0000006 –GCGV-EXP-00000027)

The ED simply dismisses these exceedances as not being of any concern, "based on its review."[4] I am not a toxicologist, and my testimony in this regard is simply that this qualitative review of the predicted impacts relies on the underlying emissions estimates and modeling input assumptions to be valid. Therefore, if the emissions estimates are understated and the modeling assumptions (relating to source geometries, release heights, and the like) are incorrect because the design is simply not fully developed, then the ED's dismissal of these large short-term exceedances, is premature.

Q. WHAT COULD THE ALJ RECOMMEND TO HELP PROTECT THE PUBLIC HEALTH AND WELFARE CONSIDERING THE APPLICANT'S PREDICTED OFF-SITE TOXIC IMPACTS?

A. Additional monitoring would help ensure the public is protected. Stationary air monitors, mobile monitors, and passive fenceline monitors are all readily available and have been demonstrated to be effective ways to monitor emissions and to sample the air to ensure that people are not breathing unsafe levels of pollutants. For example, EPA has required refineries to install fenceline monitors for benzene as part of a 2015 federal rule to reduce cancer risks in neighborhoods near oil refineries. Shell agreed to install these benzene fenceline monitors at their new ethane cracker facility, which is similar to the GCGV project in Beaver County, Pennsylvania. I will elaborate on various monitoring options later in my testimony.

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[4] "Predicted GLCmax and hours of exceedance values for the constituents identified in Table 9 were reviewed by TCEQ Toxicology Division. Based on its review of the predicted impacts, Toxicology Division does not anticipate any short- or long-term adverse health effects to occur among the general public as a result of exposure to the proposed emissions from this facility." APPM-03280.

1

2 SUMMARY OF SIGNIFICANT EMISSIONS FROM THE PROJECT

3

4 **Q. I AM GOING TO ASK YOU NEXT ABOUT THE EMISSIONS**
5 **CALCULATIONS THAT THE APPLICANT RELIED ON, AND BEFORE I**
6 **DO THAT WILL YOU PLEASE SUMMARIZE THE EMISSIONS FROM**
7 **THIS PROJECT?**

8 A. Yes.

9 As I have noted above, emissions estimates are a critical input parameter that feed
10 into all aspects of the permit issuance, including the BACT determination and the
11 ambient air quality analyses (modeling). Before I discuss the many significant and
12 material short-comings of the emissions estimates the Applicant and ED relied on,
13 I provide below a summary of the more significant emissions from the various
14 sources. Here, I am not using the terms "major" or "significant" as terms of art,
15 but I am simply trying to point out for the ALJ the biggest sources of air pollutants
16 from the planned complex.

17 Summary of Largest Emission Sources and Activities for the Major Pollutants

Source/Activity	Emissions Detail	VOC (tpy)	NO_x (tpy)	$PM/PM_{10}/PM_{2.5}$ (tpy)	SO_2 (tpy)
Allowable Emissions – Plantwide Totals		**976.33**	**525.03**	**185.82 // 176.35 // 167.51**	**38.49**
Pyrolysis Furnaces A-H	APPM-005516, -005517	67.2	196.22	92.85 // 92.85 // 92.85	7.33
Utility Boilers A-C	APPM-005556 to -005563	34.43	69.02	47.57 //47.57 // 47.57	5.18

Shared Elevated and Ground Flare	APPM-005521 to -005530	320.06	149.36		23.57
Glycol Elevated Flare	APPM-005535 to -005541	17.66	17.84		
Glycol Thermal Oxidizer	APPM-005542 to -005544	41.43	25.79		
Shared Thermal Oxidizers A-B	APPM-005564 to -005565	63.33	29.11		1.49
Cooling Tower	APPM-005552	91.13		31.56 // 22.09 // 13.26	
Olefin Fugitives	APPM-005532	55.81			
EPE Vents	APPM-005610	37.08			
CPE Vents	APPM-005614	37.08			
EPE+CPE Fugitives	APPM-005611, -005615	19.17			
Glycol Fugitives	APPM-005547, -005549	9.73			

[1] Allowable emissions for the respective pollutants are taken from TCEQ Preliminary Determination Summary (PDS), p. 3.

[2] In some cases, the emissions shown in the Application is different than what is shown in the MAERT Tables accompanying the permit. However, the methodology appears to generally be the same.

I will reference this summary table later in my testimony. I have not included emissions during shakedown of the flares, although they are significant as shown in the MAERT table. The summary table above only shows the significant

emissions estimated by the Applicant. As I will show in later testimony, it is my opinion that, by relying on optimistic and unsupported assumptions, the emissions above are more likely than not to be underestimated.

UNSUPPORTED EMISSION CALCULATIONS AND LACK OF ENFORCEABILITY

Q. YOU HAVE STATED THAT YOU QUESTION THE RELIABILITY OF THE FOREGOING EMISSION ESTIMATES, THAT YOU CONSIDER THEM UNDERSTATED. WHY DO YOU BELIEVE THAT?

A. First, while my table lists only annual rates, let me be clear that I consider many of the hourly rates also to be understated. To the question you just posed: To ensure that these "maximum allowable" emission rates mean anything (i.e., actual emissions stay below these levels), they have to be enforceable, and far too many of the emission limits specified in the permit are not enforceable.

Q. CAN YOU BE MORE SPECIFIC BY WHAT YOU MEAN WHEN YOU SAY "ENFORCEABLE?"

A. Yes. In this context enforceability, as a practical matter, means the following:

(i) that the emissions can be continuously monitored, such as *via* a continuous emissions monitoring system (CEMS); or

(ii) regularly tested, such as *via* a stack test, along with parametric monitoring to ensure that emissions stay below required levels; or

(iii) rely on the enforceability of the inputs, or assumptions, that the Applicant used in calculating the emission levels. This assumes that the methodology used to estimate emissions is reliable and that regulators and the public have access to these inputs, or assumptions upon which the emission limits are based.

Q. I TAKE IT YOU BELIEVE A NUMBER OF EMISSION LIMITS ARE NOT RE-ENFORCED BY MONITORING MECHANISMS SUCH AS YOU JUST LISTED, IS THAT CORRECT?

A. Yes. I have carefully reviewed various permit conditions with an eye to their enforceability and found them not backed up by monitoring that would demonstrate compliance with (or reveal violations of) the permit conditions.

Q. PLEASE EXPLAIN EACH OF THOSE THREE METHODS TO ENSURE COMPLIANCE.

A. First, with regards to continuous monitors, or CEMS, the permit only requires NOx and CO CEMS (as well as ammonia CEMS, which I do not discuss in detail in this testimony) for the pyrolysis furnaces, the utility boilers, and the shared thermal oxidizers, as shown in Permit Condition 65. With regard to stack testing, Permit Condition 62.G shows the following table for sources/pollutants that are proposed to be stack tested.

EPN	Source Name	Pollutant (required sampling indicated by X; conditional sampling indicated by †)					
		VOC	CO	NO_X	NH_3	PM_{10}	SO_2
O_FAF01	Pyrolysis Furnace A		X	X	X	†	
O_FBF01	Pyrolysis Furnace B		X	X	X		
O_FCF01	Pyrolysis Furnace C		X	X	X		
O_FDF01	Pyrolysis Furnace D		X	X	X		
O_FEF01	Pyrolysis Furnace E		X	X	X		
O_FGF01	Pyrolysis Furnace F		X	X	X		
O_FHF01	Pyrolysis Furnace G		X	X	X		
USSG01A	Utilities Boiler A		X	X	X		X
USSG01B	Utilities Boiler B		X	X	X		
USSG01C	Utilities Boiler C		X	X	X		
UFF01_A	Shared Thermal Oxidizer A	X	X	X			X
UFF01_B	Shared Thermal Oxidizer B	X	X	X			
GX202	Glycol Thermal Oxidizer	X	X	X			
WWTPEQTKS	Wastewater Equalization Tanks Catalytic Oxidizer	X					
E_MPPS_002	E-line Pellet Dryer Vent 1	X					
E_MPPS_003	E-line Pellet Dryer Vent 2						
C_MPPS_002	C-line Pellet Dryer Vent 1	X					
C_MPPS_003	C-line Pellet Dryer Vent 2						

Even assuming that each of the sources listed in the table above has supporting permit language assuring compliance (such as, short-term emissions levels) between stack tests, it is clear that stack testing is not proposed for many sources and pollutants. Examples include the flares (all pollutants, including NOx, VOC, PM, SO_2), PM/PM_{10}/$PM_{2.5}$ emissions from any source (the table above shows PM_{10} but does not define what conditional sampling means for that pollutants), cooling tower VOC emissions, and all of the fugitive VOC emissions from leaking components, etc.

For all of these pollutants that are not CEMS-monitored, it is clear that the only practical method to ensure compliance is to make enforceable each and every assumption on which the development of the emission estimates relied. Yet, the permit does not do that.

Q. DR. SAHU, CAN YOU UNPACK THIS A BIT? WHAT ARE SOME EXAMPLES OF ASSUMPTIONS HAVING BEEN MADE FOR WHICH THE PERMIT FAILS TO PROVIDE A RELIABLE CHECK, A MEANS OF VERIFICATION, DURING OPERATIONS?

A. Certainly. Consider $PM_{2.5}$ emissions from the olefin furnaces and utility boilers. For this example, I first note that neither CEMS nor stack testing is proposed for $PM_{2.5}$ from these sources. As you may recall, modeling for NAAQS and PSD Increment for $PM_{2.5}$ showed levels very close to the respective thresholds.

$PM_{2.5}$ Emissions from the Olefins Furnaces are shown in Table A.3-1a (APPM-005517).

[redacted]

The applicant assumed that $PM/PM_{10}/PM_{2.5}$ emissions are all equal from these furnaces.

The Furnace Emission Factor for PM referenced above is derived in Table A.3-1.

[redacted]

$PM_{2.5}$ (again, assumed to be the same as PM/PM_{10}) emissions from the utility boilers are provided in Tables A.3-13a through A.3-13d, depending on whether the boiler will use natural gas, blend gas, or vent gas. An excerpt from Table A.3-13a is shown below.

[redacted]

The Emission factor used for natural gas is discussed in Table A.3-13b below. Similar assumptions are used for blend and vent gas in Tables A.3-13c and A.3-13d, respectively.

[redacted]

In notes provided at the end of each of these tables, the application states:

> Information utilized in the enclosed calculated emissions represent [redacted] compliance shall be based.

First, as to the disclaimer above, I believe it is inappropriate. As I have shown, above, for $PM_{2.5}$, a major pollutant, whose predicted impacts are very close to applicable thresholds and whose impacts are driven by emissions estimated in the tables above, the permit does not contain any means of compliance assurance other than the emissions calculations and their input assumptions. Therefore, compliance with the estimated $PM_{2.5}$ values from the Olefin Furnaces and Utility Boilers has to be based on making the assumptions listed in the tables above, enforceable.

Tracking the emissions calculations in each of the cases above, it is clear that the emission factors (in Tables A.3-1b and A.3-13b) and all of the assumptions made in deriving the emission factors need to be made enforceable. These include:

> For the Olefin Furnaces:
> - the basic AP-42 Emission Factor of 7.6 lb/MMscf taken from AP-42 Table 1.4-2.
> - the natural gas higher heating value of [redacted], attributed to "process knowledge"
> - the blend gas higher heating value of [redacted], attributed to "process knowledge"
> - the blend gas hydrogen factor of [redacted] attributed to "process knowledge"
> - total hours of natural gas firing, assumed to be [redacted] hours/year
> - total hours of blend gas firing, assumed to be [redacted] hours/year

Therefore, just for $PM_{2.5}$, the calculations rely on all 5 (in reality 5 and not 6, since the total of the hours firing blend and natural gas are constrained by 8760 hours/year) of the assumptions above. Clearly, given the precision used in the assumptions for the higher heating values for natural and blend gas (both of which can vary, depending on composition), above, and with no assurance that these assumed values will always result in the higher emission factors, they need to be made enforceable. Same with the blend gas hydrogen factor.

As to the first and basic AP-42 Factor of 7.6 lb/MMscf, the excerpt below shows the source:[5]

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_x burner)	0.64	E
PM (Total)[c]	7.6	D

Regarding this, I make two points.

First, as a general matter, I note that like all AP-42 Factors, the emission factor used is an average and not a maximum emission factor.

> "In most cases, these factors are simply <u>averages</u> of all available data of acceptable quality, and are generally <u>assumed to be representative of long-term averages</u> for all facilities in the source category (i. e., a population average)."[6] (emphasis added)

5 https://www3.epa.gov/ttn/chief/ap42/ch01/index.html

> "Emission factor ratings in AP-42 (discussed below) provide indications of the robustness, or appropriateness, of emission factors for estimating average emissions for a source activity."[7] (emphasis added)

Thus, in each instance that GCGV or TCEQ rely on AP-42 emission factors to estimate Maximum emissions, they are simply wrong and the resultant emissions (all other criticisms, aside) are all underestimated and should not have been used in the modeling.

Second, I point to the emission factor rating of D for this particular factor.AP-42 uses a rating system from A through E, with factors rated A having the highest reliability and E the lowest. D rated factors are described as follows in AP-42:

> D — Below average. Factor is developed from A-, B- and/or C-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.[8]

Thus, the basic AP-42 emission factor used by the Applicant is not reliable and has high variability. This is especially important for short-term emission estimates, such as over 24 hours, which was used in the modeling for 24-hour NAAQS and PSD Increment.

My criticisms for the PM2.5 emissions from the Utility Boilers is similar to that for the Olefin Furnaces, focusing on the assumptions made in Tables A.3-13a through A.3-13d for the emission factor. The emissions rely on:

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6 AP-42 Introduction, p. 1. Available at https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors

7 *Ibid.*, p. 2.

8 https://www3.epa.gov/ttn/chief/ap42/c00s00.pdf

- the AP-42 factor of 7.6 lb/MMscf
- higher heating values for natural gas, blend gas, and vent gas
- the assumption (in Table A.3-13a) that for the hourly emissions, the boilers will fire [redacted] gas and [redacted] gas;
- the assumption (also in Table A.3-13a) that for the annual emissions, the boilers will fire a [redacted] and will fire a [redacted] for the remaining hours in the year.

Like in the case of the Olefins Furnaces, the AP-42 emission factor used in not reliable. And, none of the additional assumptions listed above are enforceable under the permit.

It is clear, therefore, that PM2.5 emissions from the Olefin Furnaces and Boilers are simply not enforceable.

Q. WHAT OTHER UNENFORCEABLE EMISSION LIMITS DO YOU SEE IN THE DRAFT PERMIT?

A. The VOC emission limits for those units (olefin furnaces and utility boilers) are unenforceable under the proposed permit. The same tables referenced above indicate that the VOC emission calculations from the Olefin Furnaces (APPM-005519) and Utility Boilers (APPM-005558, -005560, -005562) rely on an AP-42 factor of 5.5 lb/MMscf, rated "C" in AP-42. While this is a little better than the D rated value, its reliability is questionable. Even this value is not made enforceable via CEMS or stack testing in the permit.

The VOC Emissions from the Shared Elevated and Ground Flares are also not enforceable. Like in the case of the Olefin Furnaces and Utility Boilers above, the same generic disclaimer is also provided for each of the flare emission calculations. And, for the same reasons as I noted above (i.e., no other means of compliance demonstration of any of the flare pollutant emissions), I reject that disclaimer.

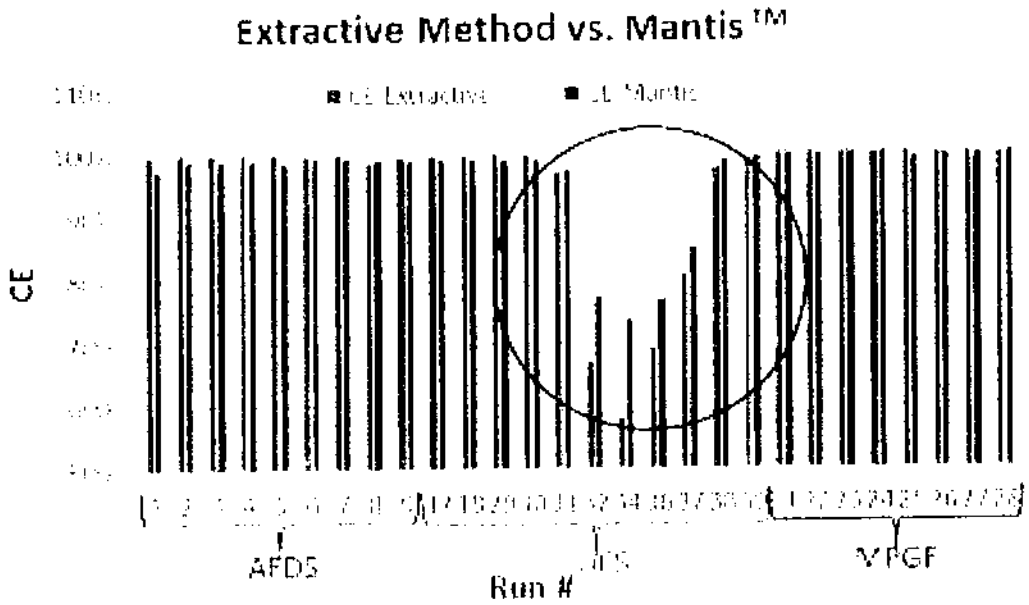
Emissions from the flares are shown in several tables in the Application, depending on the flare and the operating scenario (continuous, intermittent, etc.). I will use Table A.3-2b (APPM-005523), for the intermittent emissions from the Ground Flare.

First, VOC emissions, both hourly and annually, rely on a specific flare gas composition shown in Table A.3-2b. This composition, while used in the emission calculations, is not enforceable under the permit.

Second, the Application assumes a destruction efficiency of either 98% or 99% of VOCs depending on their size, relying on TCEQ guidance. But, there is no requirement to verify these high values of destruction efficiency, assumed to occur, in the annual case, occur at all times.

I note the sensitivity of the estimated emissions to these assumed high values of destruction efficiency. In Table A.3-2b, using the Application's assumptions for Intermittent VOC emissions from the Ground Flare, the estimated VOC emissions are calculated to be 239.87 tons/year. This assumes that C2 (ethane) and C3 (propane) molecules will have 99% destruction efficiency and that all of the C4 (butane) and larger molecules in the flare gases will have 98% destruction efficiency. If one assumes that the C2/ethane molecule destruction efficiency drops from 99% to 98%, the additional VOC emissions would be 156.98 tons/year – making the total 396.85 tons/year – keeping all of the assumptions exactly the same. This is an increase of 65% in estimated VOC emissions, just for this one change at this one flare for intermittent operation. Given this extreme sensitivity of the assumptions of destruction efficiency on the estimated VOC emissions (for all of the flares and not just this one), it is imperative that the permit should require a method to assure compliance with the permit by verification of the destruction efficiency assumption.

Given the many parameters that affect destruction efficiency[9] (and a related term, combustion efficiency, which is also used in assessing flares), both CE and DE can vary widely, even under control conditions. The chart below is excepted from some controlled testing done on flares to compare CE using two techniques – extractive sampling and Video Imaging Spectral Radiometry (VISR), using a product called MANTIS.[10]



As the chart shows CE (and DE which closely tracks CE), even under controlled conditions can drop from high values to very low values. In my example discussion above, I only addressed the estimated emissions increase when DE dropped from 99% to just 98%. Obviously emissions increases would be dramatically higher if the DE dropped to levels like 55%.

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9 See, for example, https://www3.epa.gov/airtoxics/flare/2012flaretechreport.pdf. See also, -00003333, quoted later.

10 https://www.providencephotonics.com/events

I should also add that GCGV itself (and rightly so) recognizes the flimsy nature of the vendor guarantee that underlies these high 98/99 (and even 99.5%) destruction efficiencies used for flare VOC emissions calculations. For example, in a response to TCEQ NOD3 dated October 2, 2017, GCGV states:[11]

> *Vendor guarantees for control devices are based on specific vent stream parameters. Those guarantees may not be met when the source operates outside ofthe specific operating condition that the vendor guarantee is based upon. When a vendor guarantees a performance level in one instance, it does not mean that the guarantee is valid for all cases. In the example of a flare, the destruction efficiency can be impacted by multiple variables, including the types of hydrocarbons, the quantity of hydrocarbons, the heating value of the stream, and the type and quantity of inerts in the vent gas stream. GCGV flares will have periods with high nitrogen and longer chain hydrocarbons. Both of these are expected to be outside typical flare vendor guarantees.*

The permit should include direct verification of the flare destruction efficiency using VISR or similar approaches. And, the permit should make all of the other assumptions such as flare gas composition and heating values, used in the calculations.

Estimates of NOx Emissions from Flares, as provided in the application, rely on the heating values and composition of the flare gases and NOx emission factors, both on a short-term and a long-term basis.

Remember, the short-term 1-hour NOx impact from the facility was very close to the applicable NAAQS and the flares are large sources of NOx emissions at the proposed facility. For example, the Ground Flare Intermittent NOx emission factor (Table A.3-2b) is simply stated as [redacted] Curiously, the same exact factor is used as [redacted] in Table A.3-2a for the Ground Flare Continuous case. The steam assisted NOx factors of [redacted] are used for the shared elevated flare calculations in Tables A.3-3a and A.3-3b.

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However, none of these NOx emission factors, which depend on the nitrogen content of the flared gases (since that nitrogen can and will convert to NO in the flare), discuss the flare gas composition and its impact on the NOx emission factor.

Yet, the record is clear that flare gases will contain nitrogen. See the response by GCGV to the TCEQ's third Notice of Application Deficiency (NOD3) dated September 15, 2017 below.[12]

> NOD3 to TCEQ on September 15, 2017
> *Response:*
> *15A: The drawing is provided in Confidential Attachment B.*
>
> *15B: Normal disposition is for the vent gas to flow through the flare gas recovery system. When the flare gas recovery system is offline, assist gas will be added to maintain heating valve at the elevated flare tip. Nitrogen will be used as sweep gas when the vent gases are recovered and no vent gases are routed to the flare.*

And, see the earlier quote from GCGV's response to TCEQ NOD3 dated October 2, 2017, which also confirms "that flares will have periods of high nitrogen."

It is my opinion that when nitrogen is present in the flare gases, NOx emissions will be significantly greater than what has been assumed by the Applicant and accepted by the ED. Thus, NOx emissions from flares are substantially underestimated. It is also my opinion that this is a material flaw because, as it is, 1-hour NOx impacts predicted from the facility are very close to the federal 1-hour national ambient standard (NAAQS) . If the high NOx emissions due to "periods of high nitrogen" had been modeled, it is likely that the analysis would have shown exceedances of the 1-hour NOx NAAQS. Having failed to undertake that analysis, or at least having failed to include it as part of the Application, the Applicant has not satisfied the Clean Air Act's requirements.

Fugitive VOC Emissions from leaks at the facility are larg.

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12 GCGV-EXP-00003332.

Emissions estimates for fugitive emissions rely on the following three general types of information:

- a count of each of the various components such as valves, pumps, connectors, etc. As I have noted earlier, these count estimates are simply guesses at this point, without completion of design;

- an assumed emission factor, for each component, depending on the component and its service (light or heavy hydrocarbon, etc.). Crucially, the emission factors are average and not maximum, thereby underestimating the emissions significantly; and

- an assumed reduction efficiency, based on TCEQ guidance, in turn based on the type of "leak detection and repair" (LDAR) program used. As far as I can tell, the basis for these LDAR-based reduction percentages are unsupported.

All of this makes the entire set of fugitive emission calculations from all parts of the proposed facility a vast underestimate of the likely actual VOC emissions from fugitives.

Consider this example, set out below, for Olefins Fugitives, shown in Table A.3-5 (APPM-005532).

First, the component counts are as below:

[redacted]

It is simply unlikely that the counts will remain as shown when the design is finalized.

Next, the fact that average emission factors are used, is made clear:

[redacted]

Thus, maximum emissions are not calculated, but instead only the average emissions are.

And, lastly, the unsupported values of very high control efficiency that have been used is also clear:

[redacted]

Crucially, there is no discussion of the connection between the assumed LDAR program and these levels of control efficiency, especially the [redacted] used in many cases.

In an audit conducted by EPA of LDAR programs, which I discuss later in the BACT analysis critique, the audit found that actual levels of leaking fugitive components were much higher than expected.

> "These investigations have shown a pattern of significantly higher equipment leak rates (5%) than what the refineries reported (1.3%)."[13]

[13] EPA, Leak Detection and Repair, A Best Practices Guide, p. 15. Available at https://www.epa.gov/sites/production/files/2014-02/documents/ldarguide.pdf

I note that refineries have similar fugitive components (valves, connectors, compressors, flanges) as petrochemical plants such as the one in this case. In summary, as these examples have shown, it is my opinion that there are significant flaws in the emissions estimates, and that they underestimate likely maximum emissions from the facility. Thus, the modeling analysis, which relies on these emission estimates, is flawed on just this count alone.

DEFICIENT BACT ANALYSIS

Q. ARE YOU FAMILIAR WITH BACT ANALYSES?

A. Yes.

Q. WHAT IS A BACT ANALYSIS?

A. **Federal BACT analysis**. Section 165(a)(4) of the Clean Air Act ("CAA") provides that a new major source of air pollution proposed to be constructed in an area that is in attainment with all National Ambient Quality Standards ("NAAQS") is subject to Prevention of Significant Deterioration ("PSD") permitting requirements. One of the principal requirements of the PSD regulations is that the major source must achieve Best Available Control Technology ("BACT") -level emissions control. Under federal law, BACT is an emissions limitation, which is defined broadly to include not only the "technology" (i.e., the most modern pollution controls and equipment), but also the permit limitations, operating specifications, and compliance methods that attach to the specific sources. A common way to express a BACT limit for a boiler or furnace, for example, is pounds of pollutant per unit of heat input, expressed as "X lbs/MMBTU."[14]

[14] 42 U.S.C. § 7497(3), in part, reads: "The term 'best available control technology' means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and

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Measured and estimated benzene and volatile organic carbon (VOC) emissions at a major U.S. refinery/chemical plant: Comparison and prioritization

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TECHNICAL PAPER

Measured and estimated benzene and volatile organic carbon (VOC) emissions at a major U.S. refinery/chemical plant: Comparison and prioritization

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Estimates of emissions for processes and point sources at petroleum refineries and chemical plants provide the foundation for many other environmental evaluations and policy decisions. The most commonly used method, based on emission factors, results in unreliable estimates. More information regarding the actual emissions within a facility is necessary to provide a foundation for improving emission factors and prioritizing which emission factors most need improvement. Identification of which emission factors both perform poorly and introduce the largest error is needed to provide such a prioritization. To address this need, benzene and volatile organic compound (VOC) emissions within a major chemical plant/refinery were measured and compared with emission factor estimates. The results of this study indicate estimated emissions were never higher and commonly lower than the measured emissions. At one source location, VOC emissions were found to be largely representative of those measured (i.e., the catalytic reformer), but more often, emissions were significantly underestimated (e.g., up to 448 times greater than estimated at a floating roof tank). The sources with both the largest relative error between the estimate and the measurement and the largest magnitude of emissions in this study were a wastewater treatment process, an aromatics concentration unit and benzene extraction unit process area, and two sets of tanks (sets 7 and 8). Emission factors for these sources are priorities for further evaluation and improvement in this chemical plant/refinery. This study presents empirical data that demonstrate the need to validate and improve emission factors. Emission factors needing improvement are prioritized by identifying those that are weak models and introduce the largest error in magnitude of emissions. The results can also be used to prioritize evaluations of the emissions sources and controls, and any operational conditions or erroneous assumptions that may be contributing to the error.

Implications: Emissions measured at processes and point sources at a major petrochemical plant complex were compared to emission factor estimates. The results of this study indicate estimated emissions were never higher and commonly lower than the measured emissions. The comparison was used to prioritize emission factors needing improvement by identifying those that were weak representations and that introduce the largest error in emissions. The results can also be used to prioritize evaluations of the emissions sources and controls, and any operational conditions or erroneous assumptions that may be contributing to the error.

Introduction

Emission estimation methods for specific processes and point sources (Environmental Protection Agency [EPA], 1995) provide the foundation for many environmental evaluations and policy decisions. These estimates have many uses, including support for permit decisions and evaluation of the efficacy of control technologies. They also provide the input data for modeling of criteria pollutant emissions and estimating emissions impacts on public health. The current method of estimating source emissions is largely through the use of emission factors. Emission factors relate readily available process information, such as throughput, to mass emission rates using physical and/or chemical characteristics of the substances being stored or processed, with consideration for the characteristics of equipment and the efficiency of emissions controls, if present. The emission factor estimate is a simple proxy for a complicated process with multiple variables. Emissions factors are used in lieu of measured data because it is too expensive to measure everything all the time. However, the results of this project indicate there is clearly a need to periodically go through a process to evaluate the emissions estimates in use. According to a report by the Environmental Protection Agency (EPA) Inspector General, the emission factor method results in a large degree of error and many emissions factors are unreliable. Misuse of emissions factors resulted in significant

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underestimates of actual emissions from major industry sectors, including petroleum refining. Therefore, the Inspector General recommended improved management of emissions factor usage. The report recommendations included improving the planning and prioritization of emissions data collection, as well as improving emissions factor guidance and increasing the funding for EPA's emissions factor program (EPA, 2006b). This error identified by the EPA Inspector General directly propagates through to other evaluations or decisions relying upon these results.

Measurements of emissions are needed to assess the accuracy and quantify the uncertainty of the emissions estimates derived from use of emission factors. When the uncertainty is expressed in terms of relative error, it provides an indication of how close an estimate is to the magnitude of the measured value. This error value may be used in conjunction with the emission estimate creating the largest under- or overestimation error (i.e., pounds per hour [lb/hr] underestimated) to prioritize which emission factors, when refined, would be most beneficial.

This paper presents a case in point, in which emissions of benzene and other volatile organic compounds (VOC) from sources at a combined petroleum refinery and chemical plant complex were measured using Differential Absorption Light Detection and Ranging (DIAL). Subsequently, these measured emissions were compared with emission factors for specific processes. The complex represents one plant and focuses on the units in that plant that already have high emissions as identified in a prescreening process.

The DIAL method has been used to measure mass flux of benzene and VOC from refineries and other benzene sources in Canada and Europe, and has recently been applied in the United States. The results from the use of DIAL in Canada and Europe indicate measured VOC emission rates were 5 to 20 times higher than reported by the same refineries using standard emission factors and estimating techniques (Cuclis, 2012; Frisch, 2003; Robinson et al., 2011; Chambers, 2006; Chambers et al., 2006; Chambers et al., 2008; Moncrieff, 2007; Ramsey and Hashmonay, 2009; Chereisinoff and Rosenfeld, 2009). Although this project did include other measurement technologies that in many instances confirmed data used for the DIAL-based emission rate estimates, the plume locations and scan planes dictated by wind directions, and space limitations at the site precluded using much of the data from these other measurement technologies to directly validate DIAL-based data, except as noted in Innocenti et al. (2010), where Differential Optical Absorption Spectroscopy (DOAS) benzene measurements agreed well with DIAL benzene measurements. This paper focuses only on the DIAL measurements. Details of the other results of other methods and how they compare with the DIAL results are outlined in (Raun and Hoyt, 2011).

Study site

The subject 1,500-acre site (Shell, 2014a), located on the Houston Ship Channel (HSC) in Houston, TX, includes a refinery with an atmospheric crude oil distillation capacity of 340,000 barrels per day (U.S. Department of Energy, 2013), and integrated chemical manufacturing facilities that produce approximately 8,000 tons of chemicals and petrochemicals per day (EPA, 2013). The site produces a variety of fuels, including gasoline, diesel, jet fuel, and petroleum coke, and a variety of base chemicals, including ethylene, propylene, butylene, isoprene, butadiene, benzene, toluene, xylene, phenol, acetone, and cumene (Shell, 2014b).

The study site is one of the largest petrochemical complexes in the world, situated in an ozone nonattainment area among many other large petrochemical complexes, which makes predicting emissions in this area particularly difficult. Stationary source emission estimates in the area are fraught with uncertainty. Air quality studies conducted beginning in 2000 (Cowling et al., 2007; Allen et al., 2003; Johansson et al., 2014; Karl et al., 2003; Parrish et al., 2009; Mellqvist et al., 2010; Washenfelder et al., 2010; Wert et al., 2003; Ryerson et al., 2003; Cuclis, 2012) have measured ambient VOC concentrations in the vicinity of this site and similar sites at levels as much as one to two orders of magnitude greater than the levels predicted by modeling the reported emissions inventory estimates (Cuclis, 2012). The emission inventory estimates indicate that Harris County, where the site is located, was exposed in 2012 to more than 11 million lb of hazardous air pollutants, including 327,275 lb of benzene (EPA, 2012). In addition, local researchers and the EPA National-Scale Air Toxics Assessment (NATA) indicate that ambient air concentrations of benzene exceed acceptable health levels in the area (EPA, 2014). Given the potential public health risks, it's important to accurately characterize emissions here and at other sites. The complicated mix of multiple petrochemical complexes each consisting of many point sources highlights the need for accuracy and identification of unknown/underestimated emission sources to effectively prioritize emission reduction measures and protect public health. The DIAL study was conducted by the City of Houston Bureau of Pollution Control and Prevention and the EPA in collaboration with site management. Representatives of the site provided the emission factor estimates for comparison with the DIAL measurements and reviewed the report from the study. This paper focuses on presenting a methodology to evaluate the effectiveness of the use of emission factors based on data taken at the site and provided in the report. The site management was provided a copy of the paper.

Differential absorption light detection and ranging

DIAL, the measurement method used, is a laser-based remote monitoring technique that enables range-resolved concentration measurements to be made of a wide span of atmospheric species. While other measurement methods were available, DIAL was selected for this study for a variety of reasons. DIAL was selected because of its long history dating back more than 30 years in Europe that demonstrates it is a reliable way to measure emissions, especially from a wide-area emissions source. DIAL allows for upwind and downwind measurements, in certain circumstances without even moving the measurement apparatus. DIAL measures the pollutants of interest, namely, VOC and benzene, which are particularly

relevant for the selected site. DIAL does not require retro-reflectors, which are cumbersome and would need to be moved around the site and elevated above ground level to ensure that all emissions are measured. And lastly, DIAL does not require controlled releases to estimate emission rates.

In the DIAL technique, the laser is operated alternately at two adjacent wavelengths. One of these, the "on-resonant wavelength," is chosen to be at a wavelength that is absorbed by the target species. The other, the "off-resonant wavelength," is chosen to be at a wavelength that is not absorbed significantly by the target species, and is not interfered with by other atmospheric constituents. Pairs of on- and off-resonant signals are then acquired and averaged separately until the required signal-to-noise ratio is achieved. The range-resolved concentration is derived by differentiating the path-integrated concentration along the line-of-sight, averaged over the spatial resolution (typically in increments of 3.75 m). This technique provides the concentration gradient across a plane. For a detailed description of the technique refer to Robinson et al. (2011), and for general validation and verification of DIAL results refer to Smithers et al. (1995), the Chief Engineer's Office of the Texas Commission on Environmental Quality (2010), Spectrasyne (2007), and Ramsey and Hashmonay (2009).

Methods

DIAL was used to measure emissions of alkane VOCs and benzene from various industrial areas. A detailed accounting of this DIAL campaign measurements and related assumptions and calculations is available at Innocenti et al. (2010). The DIAL service provider helped identify the likely sources. Our analyses were rigorous in an attempt to identify only the most likely sources, conservatively including data that is likely biased low, excluding data that could be considered to be extreme outliers, and correcting emissions estimates based on upwind measured emissions. Wind speed and direction shifts may have caused the plume size and location to change, causing the scan plane to potentially miss some of the plume or the entire plume. This can bias the measurements low. When we identified wind conditions, or plume elevations that may have caused some or the entire plume to be missed, we conservatively kept those data in the analysis. A description of the emission points and the chemical emissions measured at each one is provided in Table 1. These areas were targeted after an initial screening of the entire site indicated that these locations had the most significant emissions. Measurements of these emission points that would be evaluated by this study were then conducted multiple times within 6- to 8-hr periods.

Measurements occurred along a vertical plane, perpendicular to the predominant wind direction and downwind from the source(s) of interest. This provided spatial plume attributes including either alkane VOC or benzene concentrations along the plane. Benzene and VOC emissions rates were estimated by integrating DIAL measured concentrations along the vertical plane with the wind data. Wind speed attributes were measured primarily with a fixed mast in an open field adjacent to the site at elevations of 3 and 11 m. Wind direction attributes were primarily based on the wind direction measurements made at an elevation of 12 m at the DIAL unit. If the wind

Table 1. Industrial areas targeted for DIAL measurements of alkane VOC and benzene emissions and their descriptions.

Industrial area	Description	Emissions measured
Aromatics Concentration Unit (ACU)	Distillation and extraction equipment for producing benzene, toluene, and xylenes from reformate and benzene concentrates.	Alkane VOC, benzene
Benzene Extraction Unit (BEU)	Distillation and extraction equipment for recovering benzene and toluene from benzene concentrate and for producing solvent-grade benzene and aromatic-free, high-naphtha-content raffinate.	Alkane VOC, benzene
Catalytic Reformer (CR)	Produces reformate from light naphtha, thereby increasing the octane rating.	Alkane VOC
Wastewater 1	Trickling filter, dissolved air floatation unit, and aeration basins for wastewater treatment.	Alkane VOC, benzene
Wastewater 2	Various tanks, clarifiers, and aeration basins for wastewater treatment.	Alkane VOC
Tank Set 1	Two internal floating roof tanks storing benzene column tops from the BEU.	Benzene
Tank Set 2	One internal floating roof tank storing benzene column tops from the BEU.	Benzene
Tank Set 3	Two internal floating roof tanks storing off-specification benzene.	Benzene
Tank Set 4	Two internal floating roof tanks storing pyrolysis gasoline (36% benzene by weight) and recovery oil (15% benzene by weight).	Benzene
Tank Set 5	Three external floating roof tanks storing Maya Crude Oil.	Alkane VOC
Tank Set 6	Two external floating roof tanks storing Maya Crude Oil.	Alkane VOC
Tank Set 7	Two internal floating roof tanks storing high-sulfur catalytic cracker feed.	Alkane VOC
Tank Set 8	Four fixed roof tanks—two storing distilling kerosene and two storing hydrocracker feed or gas oil.	Alkane VOC
Tank Set 9	Two external floating roof tanks storing Bonga Crude Oil.	Alkane VOC

direction and speed data were determined to be not representative of the winds at the location of the plume measurements because of wind obstructions, the most representative wind data were used, including consideration of wind data collected at the DIAL unit (12 m elevation) or by a portable 2-m mast placed along the DIAL line of site.

Typically the DIAL can distinguish sources by measuring along a line of site upwind and downwind. One of the issues inside a dense structured refinery is obstruction to the line of sight. In order to confirm the source locations, the DIAL was moved to different locations as wind directions changed. The DIAL configuration used during this study does not accommodate taking upwind measurements simultaneously with downwind measurements, which would be ideal. The limited resources associated with this project required careful selection of locations where repeat measurements were conducted. As a result, the ratio of upwind to downwind scans may be small, especially if both the upwind and downwind sides of a source cannot be scanned from the same location.

DIAL VOC measurements were based on the spectral characteristics of carbon–hydrogen (C-H) bonds associated with alkane hydrocarbons with three or more carbons. The alkane C-H bond measurements were used to estimate a mass concentration based on an assumed molecular mass and optical absorption coefficient of the measured species.

Each day of DIAL VOC measurements also included pumped Perkin Elmer Automatic Thermal Desorption (ATD) tube samples, collected where DIAL and photoionization detector monitoring indicated the plume was located. The ATD samples were analyzed by gas chromatography and mass spectrometric or flame ionization detector methods. The ATD sample results and the molecular mass and optical absorption coefficient of each component in the samples were used to calculate an average molecular mass (75.1 ± 10.1) and an average optical absorption coefficient (1.23 ± 0.31 (ppm km)$^{-1}$) for the entire VOC monitoring campaign. The calculated averages compared well to the vapor molecular mass and absorption coefficient for gasoline (73.3 and 1.47, respectively), indicating that the use of the gasoline absorption coefficient and molecular mass for the VOC emissions calculations was appropriate.

The DIAL measurements were validated for alkane VOC using an inline gas calibration cell audit, where the calibration cell was filled with a specific concentration of propane, unknown to the DIAL team. The DIAL team then estimated the propane concentration using the DIAL equipment. DIAL measurements of benzene were validated using simultaneous ultraviolet differential optical absorption spectroscopy (UV DOAS) measurements along a similar linear path common to both the DIAL and UV DOAS measurements (Innocenti et al., 2010).

Emissions measurements that appeared anomalous were differentiated from routine emissions via interpretation of the DIAL emission results in comparison to process/management details supplied by site representatives. Important process/management details provided by the site representatives that correlated with elevated emissions rates included tank filling, equipment malfunctions, and maintenance activities. Both the routine and anomalous emissions provide important information.

The measured concentrations were converted by calculation to mass rates, which were then compared to emissions calculated using EPA-approved emission factors. The emission factor emission estimates were calculated by engineers at the site. Where multiple emissions factor estimates are calculated for a single tank or process area because of varying temperatures and/or throughput data, only the emissions factor estimate with the highest emissions rate is used for the comparison with the DIAL measured emissions.

Process area emissions factor estimates include the sum of all sources in the area (e.g., tanks, flares, fugitive emissions, cooling water tower), and used the approved EPA methodologies and the monthly average ambient temperature for the month when the DIAL measurements were made. Emissions from tanks in the process areas were calculated using EPA's Tanks 4.0. Emissions from flares relied on measured flow and composition of waste gas routed to the flare during the DIAL measurements, assuming a 98% combustion efficiency. Fugitive emissions were estimated using leak monitoring data recorded with data-logging software. Cooling water tower emissions were based on measured inlet and outlet cooling water concentration data. Wastewater emissions factor estimates were calculated with factors from EPA-approved wastewater protocols that consider the physical characteristics of the equipment, flow rates, temperatures, and composition data.

The emissions factor estimate for each tank set is a sum of the individual estimates of each tank in the set. The emissions factor estimates for each tank used EPA's Tanks 4.0 method, including actual physical characteristics, storage temperatures, and movement data for the tanks. Vapor pressure estimates were based on each tank's maximum actual storage temperature for each period of DIAL measurements, and external solar absorption factors were obtained from EPA's Tanks 4.0. Fixed roof tank emissions factors estimates accounted for breathing losses and, except for one fixed roof tank that was static, working losses. Floating roof tank emissions estimates accounted for rim seal losses, deck fitting losses, deck seam losses (where applicable), and, except for one floating roof tank that was static, withdrawal losses.

Summary statistics of the measured emissions were calculated at each emission location. EPA ProUCL software version 4.1 (EPA, 2010) was used to evaluate the sample distribution shape and the associated 95th percentile upper confidence limit (UCL) of the mean. The emission factor estimates were statistically compared with the measured emissions to test the null hypothesis that the measured emissions were equal to or less than the emission factor derived emission estimate. The comparison was conducted using either a one-sample *t*-test if the data were considered normally distributed or the nonparametric Wilcoxon signed rank test for other distributional shapes.

Next, the underestimation error and relative error between the DIAL measurements and the estimate from the emission factor were calculated. The relative error provides a measure the representativeness of the estimate (eq 1) and the bulk error indicates the magnitude of underestimated emissions (eq 2). The measured emissions are represented with the 95th percentile upper confidence limit (UCL) of the mean.

$$\text{Relative error} = Emissions_{estimated} - Emissions_{measured} / Emissions_{measured} \quad (1)$$

$$\text{Underestimation error} = Emissions_{estimated} - Emissions_{measured} \quad (2)$$

The two errors for each emission location were graphically assessed to prioritize those emission factors most in need of further evaluation. Finally, the measured average total emission rate of VOC and benzene combined was compared with the estimate reported to the emission inventory for this facility for year 2010 (Texas Commission on Environmental Quality [TCEQ], 2014).

Results and Discussion

Figures 1 and 2 provide examples of DIAL emission scan measurements, one at Wastewater Process 1 (for alkane VOC) and one at Tank Set 4 (for benzene) (Innocenti et al., 2010). The following DIAL measurements were excluded from the evaluation presented in this paper. Study measurements considered to be extreme outliers or with background emissions contributions were excluded from further analysis of measurements compared with estimated emissions by location. Study measurements were not compared with emissions inventory estimates when equipment problems were identified by site representatives. In the emissions inventory comparison, extreme outliers were excluded, such as a single scan during tank cleaning that measured 4,000 lb/hr of alkane VOC.

Statistical summary of measured emissions

The valid emission measurements which represented routine operations were aggregated by process emission location for statistical analysis. Tables 2 and 3 list the statistics of the benzene emissions and VOC emissions, respectively.

The highest and most variable benzene emissions were measured at Tank Set 3. An emission estimate outlier of 140.9 lb/hr was measured at this location (and excluded from the data analysis). The 95th percentile UCL of the mean of benzene emissions ranged from a high of 26.20 lb/hr, based on a normal distribution, at Tank Set 3 to a low of 6.44 lb/hr at the Wastewater Process 1 area, based on a normal distribution. The results for Tank Set 4 are likely biased low because lower elevation scan angles were partially blocked by structures during 28 of the 58 measurements.

The highest and most variable VOC emissions were measured at the Wastewater Process 1 area with a maximum of 1,420 lb/hr and a 95th percentile UCL of the mean of 964.60 lb/hr, based on a nonparametric distribution estimate. Unfavorable winds caused the emissions plume from Tank Set 8 to pass too close to the DIAL unit, resulting in 14 measurements that likely did not measure the entire plume. These measurements were conservatively included in the analysis, even though they were likely biased low.

Comparison of emission factor estimates to measured emissions

The emission factor estimates were statistically compared to the measured emissions to determine if the measured emissions

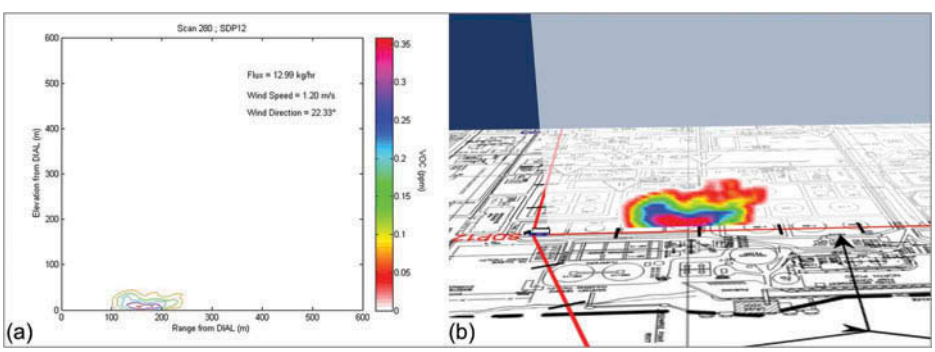

Figure 1. Wastewater 1 unit: (a) Contour plot of DIAL concentration profile. (b) Visualization of the flux measurement.

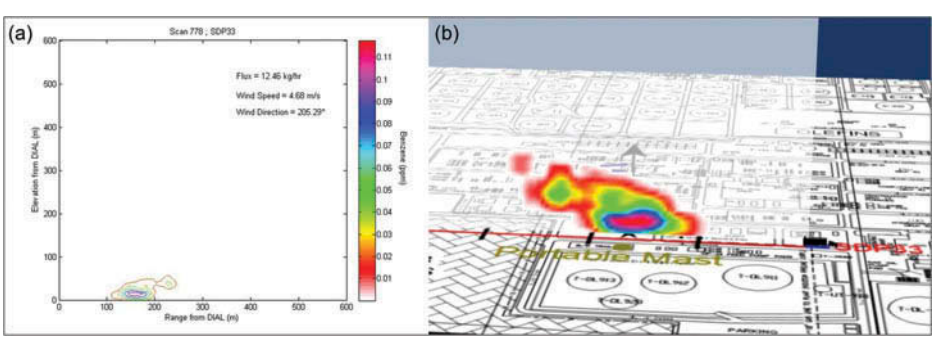

Figure 2. Tanks Set 4: (a) Contour plot of DIAL concentration profile. (b) Visualization of the flux measurement.

Table 2. Summary statistics of measured benzene emissions by emission location (lb/hr).

Emission location	ACU/BEU process	Wastewater process 1	Tank Set 1	Tank Set 2	Tank Set 3	Tank Sets 1, 2, 3	Tank Set 4
n	22	20	3	6	8	17	58
Number of days	2	2	1	1	1	3	3
Minimum	3.16	2.55	19.80	2.68	–7.51	–7.51	0.06
Maximum	23.65	10.29	21.97	11.70	42.01	42.01	32.50
Mean	12.47	5.69	20.62	5.07	14.42	12.21	11.01
Median	12.04	5.04	20.09	3.78	11.54	10.05	6.06
SD	6.95	1.95	1.18	3.44	17.58	13.19	10.66
5%ile	4.60	3.68	19.83	2.69	–5.41	–2.71	0.19
25%ile (Q1)	5.56	4.46	19.95	2.92	0.72	2.71	2.58
50%ile (Q2)	12.04	5.04	20.09	3.78	11.54	10.05	6.06
75%ile (Q3)	17.51	6.74	21.03	5.31	26.23	20.09	21.52
95%ile	23.48	9.35	21.78	10.21	39.31	35.84	29.31
Distribution[a]	Normal	Normal	NA	Gamma	Normal	Gamma	None
95th Percentile UCL of mean[a]	15.02	6.44	NA	8.96	26.20	17.80	17.12

Notes: SD: standard deviation. NA: not enough data.
[a]Distribution and 95th upper confidence limit of the mean calculated using EPA ProUCL version 4.1.

Table 3. Summary statistics of measured alkane VOC emissions by emission location (lb/hr).

Emission location	ACU/BEU process	CR	Wastewater Process 1	Wastewater Process 2	Tank Set 5	Tank Set 6	Tank Set 7	Tank Set 8	Tank Set 9
n	16	22	34	18	19	9	8	23	11
Num of days	1	2	3	1	1	1	1	2	2
Min	4.69	2.10	1.76	16.17	9.89	6.18	32.62	17.74	9.48
Max	72.21	35.98	1420.00	32.38	29.82	14.71	68.52	42.61	23.24
Mean	58.18	18.04	503.10	25.35	17.97	10.90	48.41	32.43	15.88
Median	63.44	18.76	469.80	26.37	18.68	10.96	46.48	32.79	15.11
SD	17.71	11.48	430.80	4.92	5.54	3.62	14.50	7.04	4.49
5%ile	20.90	5.10	2.06	18.73	11.44	6.34	32.85	20.55	10.54
25%ile (Q1)	58.36	7.17	27.94	21.45	12.94	7.21	36.47	27.37	12.74
50%ile (Q2)	63.44	18.76	469.80	26.37	18.68	10.96	46.48	32.79	15.11
75%ile (Q3)	67.70	29.33	677.40	29.50	22.48	14.28	59.94	37.40	18.40
95%ile	70.62	34.82	1355.00	32.25	24.70	14.57	66.85	42.29	23.06
Distribution[a]	None	Gamma	None	None	Normal	Normal	Normal	Normal	Normal
95th Percentile UCL of mean[a]	77.48	23.89	964.60	27.37	20.18	13.15	58.12	34.95	18.34

Notes: SD: standard deviation.
[a]Distribution and 95th upper confidence limit of the mean calculated using EPA ProUCL version 4.1.

were less than or equal to the emission factor derived emission estimate. Analyses were conducted using either the one-sample *t*-test or the Wilcoxon signed rank test as appropriate based on distribution shape.

The hypothesis test results for benzene emissions are shown in Table 4. The results indicate that the measured benzene emissions are statistically higher ($P < 0.0001$, compared with Bonferroni corrected significance level of 0.0083) than the benzene emission factor estimate at three process areas. The table also includes summary statistics and statistics for comparing the measured estimates with the emission factor: a multiplier, underestimation error, and percent relative error. The multiplier, how many times higher the measured emission is to the estimated emission, indicates that the measured benzene emissions are between approximately 4.40 and 448.00 times higher than the emission factor estimate, depending upon the process area. At the Tank Set 2 area, Tank Set 3 area, and Tank Set 1,2,3 area, the relative error is highest (>97%). The emission factor underestimates the benzene emissions between 6.24 lb/hr at the Wastewater Process 1 area to 25.65 lb/hr at Tank Set 3. The distribution of the benzene emissions in relation to the emission factor estimate (black triangle) is shown in Figure 3.

Table 4. Comparison of benzene emission factor emission estimate and measured emissions of by emission location (lb/hr).

Emission location	ACU/BEU process	Wastewater process 1	Tank Set 1	Tank Set 2	Tank Set 3	Tank Sets 1, 2, 3	Tank Set 4
Mean	12.47	5.69	20.62	5.07	14.42	12.21	11.01
Median	12.04	5.04	20.09	3.78	11.54	10.05	6.06
Distribution[a]	Normal	Normal	NA	Gamma	Normal	Gamma	None
95th Percentile UCL of mean[a]	15.02	6.44	NA	8.96	26.20	17.80	17.12
Emission factor estimate[b]	3.41	0.20	0.12	0.02	0.55	0.44	2.00
Ho: measured emission ≤ EF estimate	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	NA	Reject ($P < 0.002$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)
Multiplier[c]	4.40	32.20	NA	448.00	47.64	40.45	8.56
Underestimation error	11.61	6.24	NA	8.94	25.65	17.36	15.12
Relative error (%)	77.30	96.89	NA	99.78	97.90	97.53	88.32

Notes: NA: not enough data.
[a]Distribution and 95th percentile upper confidence limit of the mean calculated using EPA ProUCL version 4.1.
[b]Estimate emission from emission factor.
[c]Multiplier is 95th percentile upper confidence limit of the mean/estimate from emission factor.

Similar analyses were conducted for the VOC measurements. The statistics and hypothesis test results for VOC emissions are shown in Table 5. The results indicate that the measured VOC emissions are statistically higher ($P < 0.001$ to $P < 0.0001$, compared with Bonferroni corrected significance level of 0.0083) than the emission factor estimate at each process area except the CR process area. The multiplier indicates that the measured VOC emissions are between approximately 1.15 to 145.30 times higher than the emission factor estimate, depending upon the process area. Of the 10 emission locations evaluated, six areas exhibited relative error greater than 90%. The largest underestimation from the emission factor occurred at the Wastewater Process 1 area. The distribution of the VOC emissions in relation to the emission factor estimate (black triangle) is shown in Figure 4.

Prioritization of emission factors to be refined

To achieve optimal reduction in error, refinement of emission factor estimates should be prioritized by both underestimation error and relative error. First, locations where the emission underestimation errors are highest are identified. Those identified with high underestimation error are then ranked by high relative error. Emission locations with a high underestimation error but low relative error may not be as easily refined. Low relative error indicates an estimate is good relative to the magnitude of the measured emissions. In these cases, refinement may not be easy to achieve since the emission factor estimate, a simple proxy for a complicated process with multiple variables, may be as good as could be expected. There is a greater need to refine emission factors with

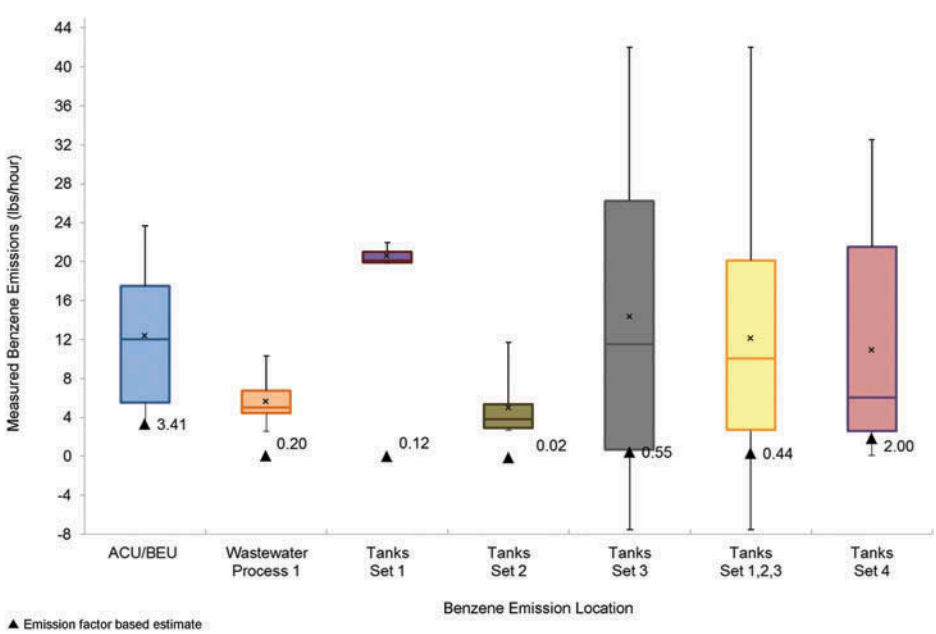

Figure 3. Distribution of measured benzene emissions in relation to emission factor estimate (lb/hr).

Table 5. Comparison of alkane VOC emission factor emission estimate and measured emissions of by emission location (lb/hr).

Emission location	ACU/BEU process	CR	Wastewater process 1	Wastewater process 2	Tank Set 5	Tank Set 6	Tank Set 7	Tank Set 8	Tank Set 9
Mean	58.18	18.04	503.10	25.35	17.97	10.90	48.41	32.43	15.88
Median	63.44	18.76	469.80	26.37	18.68	10.96	46.48	32.79	15.11
Distribution[a]	None	Normal	None	None	Normal	Normal	Normal	Normal	Normal
95th Percentile UCL of mean[a]	77.48	23.89	964.60	27.37	20.18	13.15	58.12	34.95	18.34
Emission factor estimate[b]	2.50	20.70	11.00	5.90	2.20	0.60	0.40	1.12	0.40
Ho: Measured emission ≤ EF estimate	Reject ($P < 0.0001$)	Fail to Reject ($P = 0.855$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)	Reject ($P < 0.0001$)
Multiplier[c]	30.99	1.15	87.69	4.64	9.09	21.92	145.30	31.21	21.92
Underestimation error	74.98	3.19	953.60	21.47	17.80	12.55	57.72	33.83	17.94
Relative error	96.77	13.35	98.86	78.44	89.00	95.44	99.31	96.80	97.82

Notes: [a]Distribution and 95th percentile upper confidence limit of the mean calculated using EPA ProUCL version 4.1.
[b]Estimate emission from emission factor.
[c]Multiplier is 95th percentile upper confidence limit of the mean/estimate from emission factor.

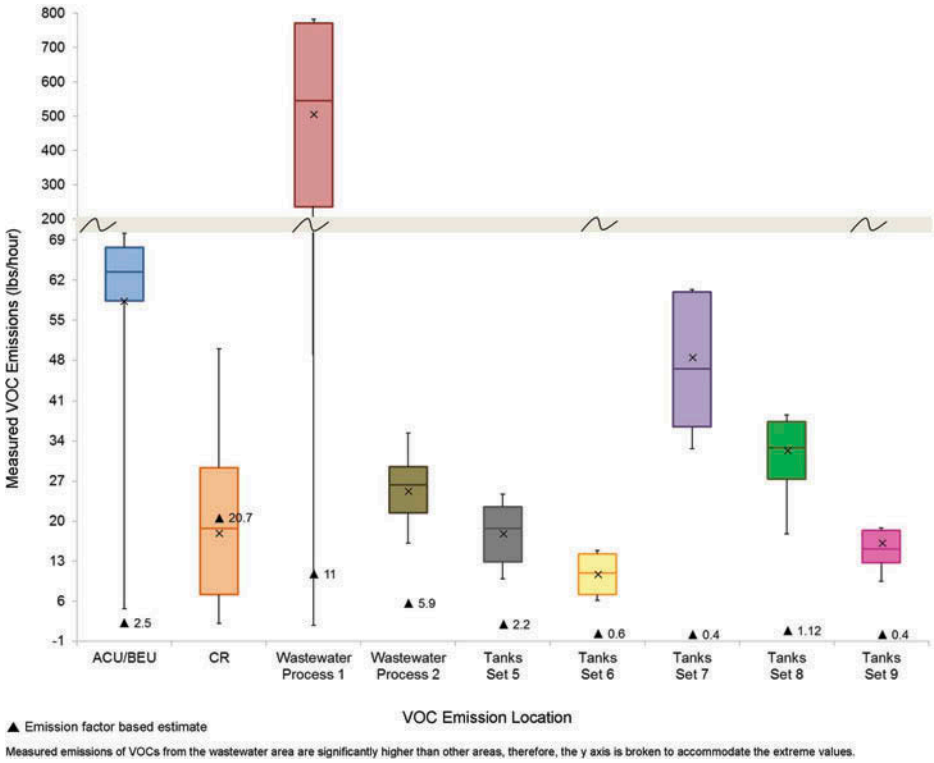

Figure 4. Distribution of measured VOC emissions in relation to emission factor estimate (lb/hr).

high relative error because high relative error is an indication that the current method used to develop the emission factors is not representative of the process. In this study, the emission factors with both the largest underestimation error and relative error are ranked as high priority, followed by moderate and low priority (Figure 5). The emission factors for VOCs associated with the Wastewater Process 1, ACU/BEU process area, and Tank Set 7 and the emission factor for benzene for Tanks Set 7 are designated as highest priority because they produce the greatest underestimation error and the greatest relative error.

A simple comparison of the DIAL emissions estimates to the emissions factors is not appropriate for the purpose of improving or evaluating the emissions factors, until the root cause of the emissions is fully evaluated. Verification of represented emissions estimates is clearly needed, to promptly find, prioritize, and fix equipment problems, when the emissions estimates are not consistent with what is really happening. Only after no equipment issues are discovered is it appropriate to rigorously evaluate the emissions factors and their application.

The first step in evaluating potential issues with emissions factors is ruling out equipment problems. For example, equipment problems were identified with the tanks in Tank Set 4, where significant gaps in the internal floating roof seals were subsequently found to be larger than the assumed seal gap sizes associated with the emissions factor estimation. These equipment problems explain the differences between the emissions factor estimate and the DIAL-based emissions; therefore, corrective action regarding the equipment problem is necessary, but further evaluation of the emissions factor is not.

The data associated with this project point to potential issues with emissions factors and/or their application. For example, for crude oil, the use of EPA Tanks 4.0 software's Reid vapor pressure (RVP) default of 5.0 psi may not be appropriate. The RVP of crude oil can vary substantially from this default value, and can, depending on the type of crude and how it's been handled and processed, be more than twice as much as the default (Eastern Research Group, Inc., and The TGB Partnership, 2012).

Another area for evaluation is how the true vapor pressure (TVP) of materials, used for tank emissions factor estimates, is determined, especially when very low vapor pressures are assumed. Higher vapor pressure cutter stock may be added to heavy, high-molecular-weight materials to lower viscosities and facilitate pumping. The methodology for testing vapor pressures of heavy, high-molecular-weight materials, ASTM D2789, may be inadequate because light, high-vapor-pressure compounds may not be accounted for (Eastern Research Group, Inc., and The TGB Partnership, 2012). Very low vapor pressures were used for the emissions factor estimates that were much lower than the DIAL-based emissions estimates in this project for the catalytic cracker feed in Tank Set 7 (0.06 to 0.56 psia), and for the distilling kerosene and hydrocracker feed/gas oil in Tank Set 8 (0.01 psia or less).

Another area for evaluation of the emissions factors that were used includes investigating how wastewater composition data is collected and what analyses are used. Samples should be collected with precautions that prevent splashing, turbulence, and head space in the sample bottle. The analyses used should be appropriate for low-molecular-weight

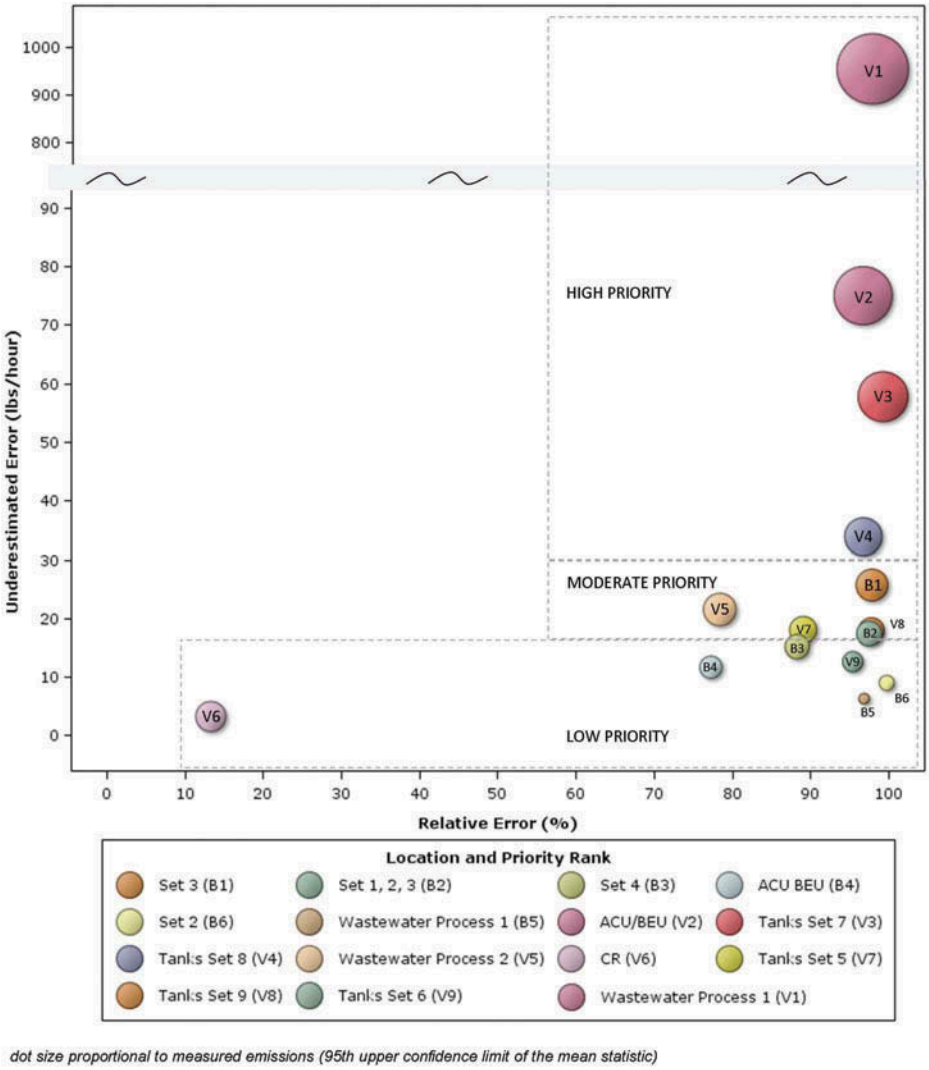

Figure 5. VOC and benzene emissions: underestimation and relative error, magnitude of measured emissions, and revision prioritization.

species, and there should be quality control steps like a total organic carbon analysis, to ensure that all of the species with significant concentrations in the wastewater are accounted for. Some of the wastewater analyses that may have been used include an air purging step prior to the analysis, which would not be appropriate because the most volatile, light hydrocarbon species would not be accounted for. Sampling and analysis procedures should be selected and followed to ensure that all compounds present in significant concentrations are accounted for, and so that volatilization of lower molecular weight species is minimized prior to and during the analysis.

Emission inventory impact

After excluding maintenance and malfunction emissions, the average total emissions rate measured during the project were 586 lb/hr VOC, 105 lb/hr benzene, and an average total emissions rate for all species of 691 lb/hr. Extrapolated to an annual figure, the rate is 2,567 tons per year (tpy) for VOC and 460 tpy for benzene. In comparison, the 2010 emissions inventory reported 1,505 tpy VOC and 28.7 tpy benzene for this location (TCEQ, 2014). Figure 6 presents the relative error in the inventory emissions as 41% and 94% for VOC and benzene, respectively.

Although the measured emissions significantly exceeded reported emissions, the amounts by which the reported emissions appear to be underestimated are less than those documented in other studies conducted in Europe and Canada (Cuclis, 2012). However, the measured emissions are potentially biased low because the DIAL method is expected to slightly underestimate hydrocarbon mass flux. DIAL validation studies conducted using a known mass release have confirmed this slight underestimation (by 3–12%), based on six separate studies conducted in Europe (EPA, 2006b; Spectrasyne, 2007; Raun and Hoyt, 2011; Ramsey and Hashmonay, 2009). The alkane VOC measurements are also biased low because they only include alkane VOC, whereas the VOC emissions estimates for the emissions inventory include all VOC, including alkane VOC as well as many

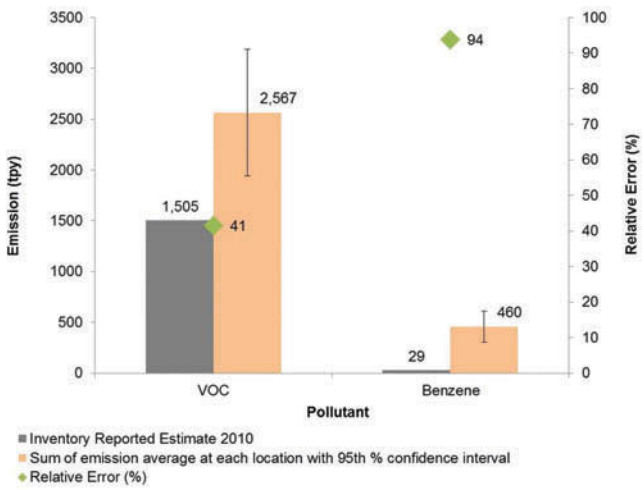

Figure 6. Measured vs. emission inventory reported site emissions.

other types of VOC, such as olefins, aromatics, alcohols, and so on.

The largest factors impacting DIAL-based emissions rate data uncertainty involve a potential failure to accurately characterize the wind field, including turbulent eddies, and variations in wind speed and direction. As an example, if measurements are too close to a large obstruction, the circular motion associated with turbulent eddies could result in the same vapor molecules passing through the scan plane multiple times. Despite the dense structures at the site, care was taken to locate scan planes as far away as possible from large obstructions to minimize the impacts of turbulent eddies. The characterization of the wind field could have been improved had the wind speed and direction been measured at multiple locations in the scan plane. However, limited project resources precluded this option for the project. Another source of uncertainty for the alkane VOC measurements is the varying combination of chemicals being measured, spatially and temporally. These changes cause the molecular weight, the optical absorption coefficient, and DIAL detection limits to vary. Innocenti et al. (2010) present the data regarding the variability of alkane VOC species being measured so that the molecular mass and optical absorption coefficient assumptions could be evaluated for each measurement location, but that is beyond the scope of this analysis. Innocenti et al. (2010) do, however, confirm that the assumed molecular weight and optical absorption coefficient that were used for the VOC alkane measurements are appropriate when all of the data from the various measurement locations are evaluated together. Also, because the DIAL sensitivity for benzene is around 10 parts per billion by volume (ppbv) and about 40 ppbv for alkane VOC, many of the smaller emissions sources are not detected and therefore not included in the DIAL measurements.

The DIAL measurements, especially tank emissions, driven by evaporative losses could be biased high because measurements were only conducted during daylight hours. Collection of data over a finite time period of hours to days and then annualizing to compare to the annual emissions inventory data could also bias the data. However, previous studies indicate DIAL measured emissions do not vary significantly at nighttime (EPA, 2006a; Bosch, 2008; Cuclis, 2012; TCEQ, 2010; Robinson et. al., 2011). These biases are not likely to greatly change the overall finding that emission factors underestimate the measured emissions and the relative priority of emission factors needing refinement.

Conclusions

The results of this study add to the scientific literature in two main ways. First, these results add empirical evidence regarding the degree of underestimation of estimates of emissions by emission source area. This information is necessary to revise the emission factor process and identify which emission factors are based on the weakest models. It is also important information for the facility studied and may inform managers of other facilities with similar processes about potential areas of concern. Second, the introduction of prioritization based on underestimation error and relative error provides a useful tool for emission factor revision plans. Both of these findings can be used to reduce error in the emission inventory and improve regulatory tools which rely on it.

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Evaluation of Vulnerability and Stationary Source Pollution in Houston

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Introduction

Houston's energy, chemical, and industrial facilities contribute to elevated air pollution levels in the region, including volatile organic compounds (VOCs), particulate matter (PM), and a variety of toxic air pollutants. Much of Houston's industrial activity occurs in the area around the Port of Houston and the Houston Ship Channel, which carries Port traffic from the Gulf of Mexico to and from Houston Port terminals. In areas with numerous pollution sources emitting different types of pollution, the accumulation of risks are of greater concern than the risks posed by each individual pollution source.

Elevated air pollution is of concern when it poses a health risk, particularly in areas where residents are be exposed to several sources of pollution, which makes characterizing and mitigating health risks more challenging. In many regions air pollution burdens have been found to disproportionately affect disadvantaged residents, such as people of color and low income households. This type of environmental injustice is exacerbated when these populations face vulnerability to pollution exposures.

SSR has been asked to characterize the potential for environmental justice concerns associated with stationary source emissions in the Houston area. We first discuss discuss key concepts from cumulative risk assessment and cumulative impacts literature and their intersection with environmental justice concerns. We then evaluate stationary source pollution emissions and demographic vulnerability across the Houston region and the degree to which they converge, posing potential environmental justice concerns. We highlight results in five communities located along the Houston Ship Channel: Manchester, Magnolia Park, Pasadena, Baytown, and Deer Park. We also discuss the potential for environmental justice concerns related to unauthorized air pollution emissions from stationary sources.

Background: Cumulative Risks, Cumulative Impacts, and Environmental Justice

The incremental risks of an activity are of greater concern when the overall risk of many activities in an area is significant. The US EPA's 2003 Framework for Cumulative Risk Assessment defines cumulative risks as "the combined risks from aggregate exposures to multiple agents or stressors".[1] According to the 2003 Framework, cumulative risks can result from exposure to multiple pollutants from multiple sources and may occur over a long period of time. While traditional risk assessment focuses on exposure to one chemical (often from one source), cumulative risk assessments can be helpful in settings where the effects of multiple exposures and multiple sources can result in greater risks to human health or the environment. The evaluation of cumulative risks is not simply the addition of the risks from different chemicals or sources; it includes an assessment of how these stressors interact. Additionally, cumulative risk assessment emphasizes actual

[1] EPA,2003. "Framework for Cumulative Risk Assessment," May 2003, EPA/630/P-02/001F

people that can be affected, rather than theoretical populations. It can also consider a wider array of stressors (including non-pollutant stressors such as a lack of health care or car crashes) and their interactive effects.

EPA's 2007 Cumulative Health Risk Assessment guidance indicates that one situation which might indicate a need for a health risk assessment is the existence of multiple pollution sources or chemical releases.[2] In order to conduct a cumulative risk assessment in that case, the first step would be to identify all the relevant (present and future) chemical releases and exposure pathways that can affect the population of concern. In particular, chemicals with high potential for health risks and similar effects are of interest. Once the sources and chemicals that will be assessed have been identified, the analysis follows exposure assessment steps of characterizing the sources, determining the spatial scope of analysis, evaluating the fate of emissions, determining who could be exposed, and quantifying their exposures.

Consideration of cumulative risks has become more common in a number of environmental evaluation settings. A handful of states and localities have begun to require cumulative risk assessments. For example, a 2008 Minnesota statute requires that cumulative effects are evaluated and considered before air permits are issued in the Phillips Communities in South Minneapolis.[3] Similarly, under a 2009 ordinance in Cincinnati, Ohio, facilities seeking a new or expanded permit are required to show that they will not have a "cumulative adverse impact" on the environment or the community's health.[4] Health Impact Assessments (HIAs), which have been conducted in a variety of jurisdictions and situations, often include an evaluation of cumulative risks.[5]

An important factor when evaluating cumulative risks is understanding the vulnerability of at-risk populations. EPA outlines four areas of vulnerability that should be assessed in cumulative risk assessments: differential exposure, susceptibility/sensitivity, differential preparedness, and differential ability to recover.[6] Children, the elderly, and people with existing health conditions are particularly vulnerable to inhalation of pollution[7] [8]. Additionally, low-income

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[2] EPA, "Concepts, Methods, and Data Sources for Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects: A Resource Document," August 2007, EPA/600/R-06/013F
[3] See EPA, "Cumulative Risk Webinar Series: What We Learned," July 2014, EPA/600/R-14/212.
[4] Rachel Morello-Frosch, Miriam Zuk, Michael Jerrett, Bhavna Shamasunder and Amy D. Kyle. Understanding The Cumulative Impacts Of Inequalities In Environmental Health: Implications For Policy. Health Affairs, 30, no.5 (2011):879-887.
[5] For more information about Health Impact Assessments, see http://www.cdc.gov/healthyplaces/hia.htm
[6] EPA, "Framework for Cumulative Risk Assessment," May 2003, EPA/630/P-02/001F; "Concepts, Methods, and Data Sources for Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects: A Resource Document," August 2007, EPA/600/R-06/013F
[7] Ibid. 4
[8] "Concepts, Methods, and Data Sources for Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects: A Resource Document," August 2007, EPA/600/R-06/013F.

households and people of color can be more vulnerable to the effects of pollution exposure for a number of reasons, including greater rates of preexisting health conditions, greater exposure to a number of environmental hazards, greater social vulnerability (including stress), and limited access to health care.[9] [10]

"Cumulative impacts" are a related concept that is an important part of Environmental Impact Assessments (EIAs) of Federal projects conducted under the National Environmental Policy Act (NEPA). Consideration of cumulative impacts in EIAs was first required in 1979. Consideration of a community's vulnerability is also an important part of evaluating cumulative impacts.[11]

Both the cumulative risk and cumulative impact literature point to the importance of understanding the overlap between heightened *exposure* to health risk as a result of multiple stressors and heightened *vulnerability* to that exposure. Populations and communities with this combination of factors can also be examined through the lense of environmental justice. The US EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[12] Concerns about environmental justice have grown out of a number of studies that indicate that in many cases the burdens of environmental harms fall disproportionately onto people of color and low-income people, while environmental benefits often fail to serve those people.[13] While environmental justice concerns can stem from pollution of a single chemical or from a single type of pollution source (e.g. landfills), disadvantaged populations and communities often face the cumulative risks caused by numerous pollution sources and chemical exposures. Concepts that underpin cumulative risk assessment and cumulative impacts can broaden our understanding environmental justice concerns in vulnerable populations and communities.

Data and Methods

In order to better understand the potential for environmental justice concerns related to stationary source pollution in the Houston region, this analysis focuses on three questions:

1. Are total stationary source air pollution burdens in the Houston region greater for vulnerable groups (including people living in poverty, limited-english speaking households, and people of color)?
2. How do total stationary source emissions burdens and vulnerability in communities near the Ship Channel compare to the rest of the region?
3. Do unauthorized emissions burdens pose additional concerns?

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[9] Ibid. 4
[10] Ibid. 8
[11] These factors are outlined in relation to NEPA document evaluation in EPA, "Consideration of Cumulative Impacts in EPA Review of NEPA Documents," May 1999, EPA 315-R-00-002.
[12] See http://www.epa.gov/environmentaljustice/.
[13] Ibid. . 4

This analysis examines stationary source emissions and demographic vulnerability across the region in order to shed light these questions.

Emissions Data

The TCEQ maintains a point source emissions inventory (PSEI) for a number of pollutants and provides detailed data upon request[14]. All sources that emit or have the potential to emit quantities of criteria pollutants, VOCs, or hazardous air pollutants that exceed reporting requirements (as described in 30-TAC 110.10) are required to report emissions of authorized emissions, which include annual routine and authorized scheduled maintenance, startup, and shutdown emissions. Reporting facilities are also required to report their unauthorized emissions, which include emissions events and unauthorized scheduled maintenance, startup, and shutdown emissions.[15]

Demographic Data

Demographic data are obtained from the US Census. Measures of vulnerability were identified by community partners, and include people of color (POC), people living in poverty (POV), and limited english households (LEH). The 2010 decennial census provides people of color data (including all Hispanic and/or non-white residents). The population living at or below the poverty level and the number of limited english households (no one age 14 and over speaks English "very well" or speaks English only) are obtained from the 2016 5-year American Community Survey (ACS) data. The total population estimate is also from the 2016 5-year ACS data. Decennial census data were obtained at the block, tract, and place level and ACS data were obtained at the block-group, tract, and place level for use at different scales of analysis, as described further below. We also present a vulnerability index, calculated as the average of the percent people of color, percent living in poverty, and percent limited-english.

Analysis Areas

This analysis examines emissions, demographic vulnerability, and the potential for environmental justice concerns across the Houston region. In addition, community partners have expressed interest in characterizing vulnerability and emissions in several communities adjacent to the Houston Ship Channel.

In this analysis we evaluate data over two spatial scales as shown in Figure 1:

1. **Eight County Houston Region:** we evaluate emissions and demographic vulnerability at the Census tract-level across the eight-county Houston region. The 8 county area provides a second site for examining larger scale trends, as well as a point of reference to which we can compare the communities of interest. It includes Brazoria, Chambers, Fort Bend,

[14] https://www.tceq.texas.gov/airquality/point-source-ei/psei.html

[15] See the January 2017 document entitled "TCEQ 2016 Emissions Inventory Guidelines" (RG-360-16, available at https://www.tceq.texas.gov/publications/rg/rg360-16/), for more information on emissions reporting requirements.

Galveston, Harris, Liberty, Montgomery, and Waller Counties. These eight counties are in ozone nonattainment and therefore have more consistent (more stringent) emissions reporting requirements for the TCEQ's PSEI than other counties in the region. This area includes the communities of interest.

2. **Communities of Interest:** We also evaluate emissions and demographic vulnerability at the community-level for neighborhoods and cities in the region. Community partners have expressed interest in characterizing vulnerability and emissions in several communities that are in the vicinity of the Houston Ship Channel, including the Harrisburg / Manchester and Magnolia Park neighborhoods as well as the cities of Pasadena, Baytown, and Deer Park.

Pollutants

SSR was asked to evaluate emissions of a number of air pollutants of interest in the region. These include 16 EPA prioritized polycyclic aromatic hydrocarbons (PAHs), as well as a 12 other pollutants identified as of concern based on a recent Union of Concerned Scientists / Texas Environmental Justice Advocacy Services Report[16] and one additional pollutant identified by community partners. Our evaluation includes 19 of 29 of these pollutants; those for which PSEI data are available. In order to chracterize overall trends, we combine these 19 pollutants into a pollution index. Additionally, we evaluate emissions of three broader categories of pollutants that overlap with several pollutants of concern. Pollutants that are included in this analysis are listed in Table 1.

Time periods

We evaluate total emissions over three time periods: the most recently available year (2016), the most recent five year period (2012 to 2016), and the most recent ten year period (2007 to 2016). Evaluating all three time periods provides insight into the consistency of emissions over time.

[16] See "Double Jeopardy in Houston: Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities", October 2016. Pollutants of concern were identified based on the risks indicated in US EPA's Risk-Screening Environmental Indicators (RSEI) and National Air Toxics Assessment (NATA) datasets.

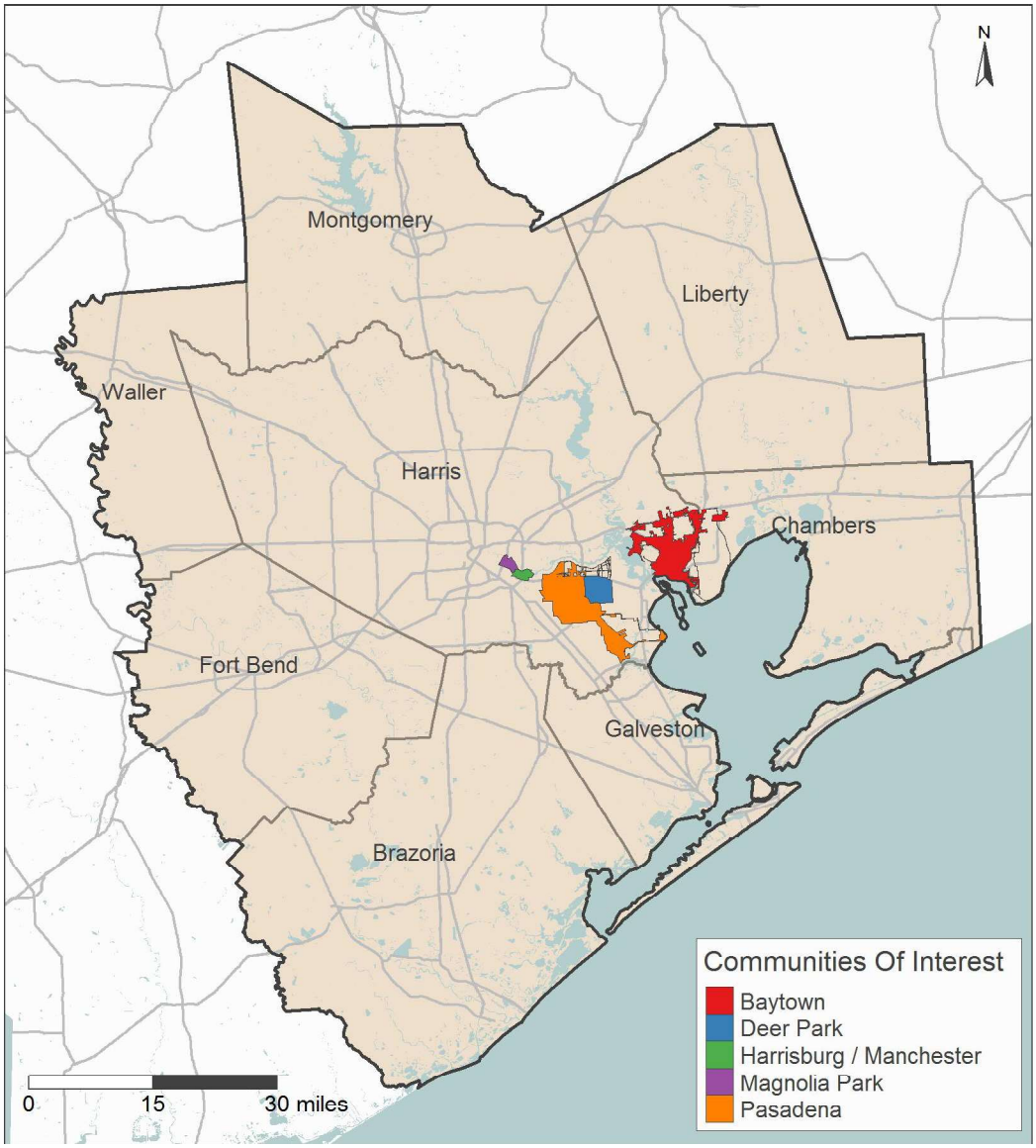

Figure 1: Map of the Eight-County Houston Region and Communities of Interest

Table 1: Air Pollutants of Interest[17]

Pollutants of interest in study area	Available in TCEQ PSEI data?
Broad pollution categories	
Fine particulate matter <2.5 µm diameter (PM2.5)	✓
Particulate matter <10 µm diameter (PM10)	✓
Volatile organic compounds (VOCs)	✓
Polycyclic aromatic hydrocarbons (PAHs)	
Naphthalene	✓
Acenaphthene	
Acenaphthylene	✓
Anthracene	✓
Benz[*a*]anthracene	
Benzo[*a*]pyrene	✓
Benzo[*b*]fluoranthene	
Benzo[*ghi*]perylene	
Benzo[*k*]fluoranthene	
Chrysene	
Dibenz[*a,h*]anthracene	
Fluoranthene	✓
Fluorene	
Indeno[1,2,3-*cd*]pyrene	
Phenanthrene	✓
Pyrene	✓
Other pollutants of concern	
Chromium and chromium compounds	✓
1,3-Butadiene	✓
Acetaldehyde	✓
Acrolein	✓
Benzene	✓
Carbon Tetrachloride	✓
Chlorine	✓
Diaminotoluene (mixed isomers)	✓
Diesel PM	
Formaldehyde	✓
Hydrogen Chloride	✓
Hydrogen Cyanide	✓
Hydrogen Sulfide	✓

[17] Pollutants that are available in PSEI data are evaluated in this memo. The PAHs and other pollutants of concern are combined in a 19-pollutant index in this report, with detailed results presented in the Appendices.

Data analysis

In order to understand the potential for disproportionate emissions burdens in vulnerable populations and communities, this analysis focuses on whether there are patterns of pollution in the region. Thus, this report focuses on broad pollution categories (PM2.5, PM10, VOCs, and an index of the remaining 19 pollutants of concern). The distribution of emissions of any single pollutant may also be of concern, so additional information each of the 19 pollutant categories is provided in the Appendices.

We first evaluate each pollutant's emissions density (annual quantity emitted divided by land area) at the tract level across the eight-county region and for each of the three time periods. We present total emissions (which are the sum of authorized emissions and unauthorized emissions.) We then estimate the emissions density as the total emissions per year divided by the tract's land area. Examining emissions density allows us to compare emissions rates across tracts.

We then calculate an index of the 19 pollutants of concern (these are the pollutants listed in the PAH and other pollutants of concern sections of Table 1.) The index is a sum of the scaled burden of each of these pollutants.[18]

Once we have tract-level emissions densities for the pollutants and the 19-pollutant index value, we combine these with tract-level measures of vulnerability obtained from the US Census. For each of the three vulnerable populations (living in poverty, people of color, limited english households), we compare emissions densities to the corresponding advantaged populations (above poverty, non-Hispanic white, and english proficient). We evaluate the emissions density burdens for each population using three metrics:

1. **Average emissions density for the entire population.** This is the average tract-level emissions density experienced by all individuals of the population. This is a measure of the average emissions burden on each population.
2. **Percent living near emissions.** This is the share of the population that lives in a tract with an emissions density greater than zero. This is a measure of how widespread the emissions are.
3. **Average emissions density for those living near emissions.** This is the average tract-level emissions density experienced by all individuals of the population that live in a tract with an emissions density greater than zero. This is a measure of how severe the emissions are for those living near them.

[18] First, the tract-level emissions densities of each of the 19 pollutants is linearly scaled from 0 to 1. In other words, the minimum tract-level emissions density (zero in all cases) is set to 0 and the maximum emissions density is set equal to 1, with the intervening emissions densities linearly interpolated. These scaled values are then summed across the 19 pollutants to arrive at the pollution index value for each tract. Note that this index does not weight the potential health impacts of each pollutant equally – a more complex analysis that accounts for the pollution dispersion and toxicological properties would be required to turn the emissions densities into health risks.

We also present maps of the region showing the percent of the population that is vulnerable and emissions densities.

We then evaluate the quantity of emissions that are unauthorized (emissions events and unauthorized scheduled maintenance, startup, and shutdown emissions) for each analysis area and time period for one example pollution category (VOCs). As with total emissions, unauthorized emissions are estimated as an emissions density (tons per year per square mile).

Finally, we examine emissions and vulnerability for communities in the region. We first map emissions and vulnerability at the tract-level in the Ship Channel area, highlighting the communities of interest. We then quantify vulnerability and emissions densities at the city and neighborhood scales.[19] Emissions estimates are evaluated as total emissions per year per square mile, as above. Demographic estimates at the city level are obtained directly from the US Census. For the neighborhood level analysis, demographic data are obtained at the smallest scale available and assigned to the corresponding neighborhood.[20] As part of the community-scale analysis we also evaluate the vulnerability and emissions densities for three reference areas: the eight-county region, Harris County, and the City of Houston. The eight-county and Harris County vulnerability estimates are obtained by summing tract-level populations to those areas, while the City of Houston estimates are obtained directly from the US Census.

Results

We focus our evaluation of emissions on comparisons of the relative magnitudes of emissions experienced by different populations and communities. The relative health risks experienced by different groups is partly a function of the relative quantities of emissions in their area (presented here), although the specific health risks experienced in a given location depend on each pollutant's fate and transport characteristics, toxicity, the location of potentially exposed populations, and the vulnerability of the population.

Regionwide

We first compare the emissions burdens of vulnerable populations (vs their advantaged counterparts) across the eight county region.

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[19] We use 2016 US Census "Place" boundaries to identify city boundaries and City of Houston "Super Neighborhood" boundaries (from https://cohgis-mycity.opendata.arcgis.com/) to identify neighborhoods in the City of Houston, which is the largest city in the region.

[20] Decennial census data is available at the block level while ACS data are available at the block-group level. The block level POC/non-POC population is assigned to the neighborhood in which the block centroid falls. The total number of POC/non-POC is then summed for all blocks in the neighborhood to arrive at the neighborhood-level populations. The block-group level POV/non-POV and LEH/non-LEH populations are assigned to each block they encompass in proportion to the share of the block-group's population that the block comprised in the 2010 decennial Census. These populations are then assigned to neighborhoods based on the block centroid.

What is the average emissions burden?

Table 2 shows the average emissions density experienced by each population living in the eight-county Houston region. The "% Difference" columns indicate the percent difference between each vulnerable population (e.g. people of color, or POC) relative to its advantaged counterpart (e.g. non-POC, or non-Hispanic white residents.) A percent difference equal to zero indicates that on average the two populations live in areas with the same emissions density. These columns are highlighted to indicate the level of disparity. Bright red indicates greater levels of disparity for vulnerable populations, white highlighting indicates equal burdens, and bright green highlighting indicates emissions burdens that disproportionately fall on advantaged populations. Note that the values in Table 2 all reflect disparate burdens for vulnerable populations, so they are highlighted in varying degrees of red.

For example, on average limited english households live in tracts with 0.81 tons of 2016 PM2.5 emissions per year per square mile, whereas households with some english proficiency live in tracts with 0.4 tons of 2016 PM2.5 emissions per year per square mile. Thus, limited english households have 101% greater 2016 PM2.5 emissions densities. In other words, on average limited english households live in tracts with 2016 PM2.5 emissions densities that are about twice as high as english proficient households.

Looking at the percent difference across demographic groups (which indicates the disparity in average emissions), we see that on average people of color, people living in poverty, and limited english households live in tracts with higher emissions densities than their more advantaged counterparts. This finding is consistent across all four pollution categories examined (VOCs, PM10, PM2.5 and the 19-pollutant index) and across all three time periods. Disparities are greatest for VOCs, PM10, PM2.5 for all vulnerable population definitions. Disparities are also greater for people of color and limited english households than for households living in poverty. Disparities for PM2.5 and PM10 decrease slightly in more recent time periods for people of color and people living in poverty. Results for each of the 19 pollutants of concern are more mixed, as shown in Appendix A.

Looking at the average emissions burden for each population we see that emissions for PM2.5, PM10, and VOCs are relatively consistent or modestly decreasing across the three time periods. The 19-pollutant index shows modest reductions in the 2012 to 2016 period and then modest increases in 2016. These trends are similar for vulnerable populations and their more advantaged counterparts.

How widespread are emissions?

Table 3 shows the share of each population living in tracts with emissions that are greater than zero in the eight-county Houston region. As above, the "% Difference" columns indicate the percent difference between each vulnerable population relative to its advantaged counterpart. These columns are again highlighted to

indicate the level of disparity, where bright red indicates greater levels of disparity for vulnerable populations and bright green highlighting indicates emissions burdens that disproportionately fall on advantaged populations.

For example, on average11% of limited english households live in tracts with 2016 PM2.5 emissions, whereas 12% of households with some english proficiency live in tracts with 2016 PM2.5 emissions. Thus, limited english households are 8% less likely to live in tracts with 2016 PM2.5 emissions than english proficient households.

Looking at the percent difference across demographic groups (which indicates the disparity in average emissions), we see that on average people of color, people living in poverty, and limited english households are less likely to live in tracts with emissions than their more advantaged counterparts, although the differences are modest. This finding is consistent across all four pollution categories examined (VOCs, PM10, PM2.5 and the 19-pollutant index) and across all three time periods. In more recent analysis years (2012 to 2016 and 2016), the modest differences between populations in poverty and limited english household and their more advantaged counterparts shrink slightly. Results for each of the 19 pollutants of concern are again mixed, as shown in Appendix A.

Looking at the share of each population that lives in a tract with emissions, we see that the scopes of emissions for the three broad pollution categories (PM2.5, PM10, and VOCs) and the 19-pollutant index are modestly decreasing across the three time periods. These trends are similar for vulnerable populations and their more advantaged counterparts.

How severe are emissions for those living near them?

Above we observed that vulnerable populations experience greater emissions densities (on average) than their more advantaged counterparts, although they are also modestly less likely to live in tracts with emissions. These seemingly conflicting accounts of disparity are reconciled when we examine the severity of emissions burdens that vulnerable populations bear when they live in tracts with emissions.

Table 4 shows the severity of the emissions burdens for residents of tracts with emissions. As above, the "% Difference" columns indicate the percent difference between each vulnerable population relative to its advantaged counterpart. These columns are again highlighted to indicate the level of disparity, where bright red indicates greater levels of disparity for vulnerable populations and bright green highlighting indicates emissions burdens that disproportionately fall on advantaged populations.

For example, looking at limited english households living in tracts with 2016 PM2.5 emissions that are greater than zero, we see that these households live in tracts with an average of 7.1 tons of 2016 PM2.5 emissions per year per square mile, versus 3.3

tons of 2016 PM2.5 emissions pre year per square mile for english proficient households. Thus, limited english households that live in tracts with 2016 PM2.5 emissions have 119% greater 2016 PM2.5 emissions densities.

Looking at the severity of emissions burdens for people of color, people living in poverty, and limited english households living in tracts with emissions live in tracts with higher average emissions densities than their more advantaged counterparts. This finding is consistent across all four pollution categories examined (VOCs, PM10, PM2.5 and the 19-pollutant index) and across all three time periods. Disparities are generally greater for VOCs, PM10, PM2.5 for all vulnerable population definitions. Disparities are also greater larger for people of color and limited english households than for households living in poverty. Disparities for PM2.5 and PM10 decrease slightly in more recent time periods for all three vulnerable populations. Results for each of the 19 pollutants of concern are again mixed, as shown in Appendix A.

Looking at the severity of emissions for each population we see that emissions for PM2.5, PM10, and VOCs are increasing across the three time periods, particularly for the 19-pollutant index. These trends are similar for vulnerable populations and their more advantaged counterparts.

Table 2: Average Emissions Burden for Residents of the Eight County Houston Region

		Average Burden: Average Emissions Density (tons / year / sq mile estimated at the census tract level)								
Pollutant	**Year range**	**People of Color (POC)**	**Non POC**	**% Difference (POC - NonPOC) / NonPOC**	**People Living in Poverty (POV)**	**Non POV**	**% Difference (POV - NonPOV) / NonPOV**	**Limited English Household (LEH)**	**Non LEH**	**% Difference (LEH - NonLEH) / NonLEH**
PM2.5	2007 - 2016	0.67	0.33	103%	0.68	0.46	50%	0.85	0.42	99%
	2012 - 2016	0.65	0.32	102%	0.66	0.45	47%	0.83	0.41	102%
	2016	0.62	0.33	90%	0.63	0.44	45%	0.81	0.40	101%
PM10	2007 - 2016	1.02	0.46	122%	1.06	0.67	60%	1.3	0.62	114%
	2012 - 2016	0.95	0.42	127%	0.99	0.62	60%	1.3	0.57	121%
	2016	0.81	0.40	100%	0.83	0.55	52%	1.1	0.51	107%
Total VOCs	2007 - 2016	3.1	1.4	122%	3.1	2.1	47%	3.5	1.9	81%
	2012 - 2016	2.9	1.3	128%	2.8	1.9	46%	3.2	1.8	82%
	2016	2.5	1.2	113%	2.6	1.7	52%	2.9	1.5	87%
19-pollutant index	2007 - 2016	0.023	0.020	17%	0.027	0.019	40%	0.028	0.019	48%
	2012 - 2016	0.022	0.017	28%	0.024	0.018	34%	0.027	0.017	64%
	2016	0.026	0.024	9%	0.028	0.024	17%	0.032	0.022	43%

Table 3: Scope of Emissions in the Eight County Houston Region

Emissions Scope: Share of Population Living in Tracts with Emissions (%)										
Pollutant	**Year range**	**People of Color (POC)**	**Non POC**	**% Difference (POC - NonPOC) / NonPOC**	**People Living in Poverty (POV)**	**Non POV**	**% Difference (POV - NonPOV) / NonPOV**	**Limited English Household (LEH)**	**Non LEH**	**% Difference (LEH - NonLEH) / NonLEH**
PM2.5	2007 - 2016	17	19	-9%	18	18	-4%	15	18	-17%
	2012 - 2016	15	17	-11%	15	16	-3%	13	15	-14%
	2016	13	13	-5%	13	13	2%	11	12	-8%
PM10	2007 - 2016	18	19	-9%	18	19	-5%	15	18	-17%
	2012 - 2016	15	17	-10%	16	16	-4%	13	16	-15%
	2016	13	13	-5%	13	13	2%	12	13	-9%
Total VOCs	2007 - 2016	19	21	-8%	20	20	-2%	17	20	-13%
	2012 - 2016	17	19	-10%	17	18	-1%	15	17	-12%
	2016	15	15	-5%	15	15	3%	13	14	-6%
19-pollutant index	2007 - 2016	15	18	-18%	15	16	-9%	12	16	-23%
	2012 - 2016	12	15	-22%	13	14	-8%	10	13	-24%
	2016	9	12	-23%	10	11	-7%	8	10	-22%

Table 4: Severity of Emissions Burdens for Residents Living in Tracts with Emissions in the Eight County Houston Region

Emissions Severity: Average Emissions Density for People Living in Tract with Emissions (tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
PM2.5	2007 - 2016	3.9	1.7	123%	3.9	2.5	56%	5.8	2.4	140%
	2012 - 2016	4.4	1.9	128%	4.3	2.8	52%	6.4	2.7	136%
	2016	5.0	2.5	100%	4.8	3.4	43%	7.1	3.3	119%
PM10	2007 - 2016	5.8	2.4	144%	6.0	3.6	69%	8.9	3.4	159%
	2012 - 2016	6.2	2.4	152%	6.3	3.8	67%	9.5	3.7	160%
	2016	6.3	3.0	111%	6.2	4.2	49%	9.2	4.1	127%
Total VOCs	2007 - 2016	16	6.6	141%	15	10	50%	20	10	109%
	2012 - 2016	17	6.7	153%	16	11	48%	22	10	108%
	2016	17	7.6	124%	17	11	47%	22	11	100%
19-pollutant index	2007 - 2016	0.16	0.11	42%	0.18	0.12	53%	0.23	0.12	93%
	2012 - 2016	0.18	0.11	63%	0.19	0.13	45%	0.27	0.13	116%
	2016	0.29	0.20	42%	0.28	0.23	26%	0.40	0.22	83%

Mapping Vulnerability and Emissions Burdens

To get a better understanding of demographic vulnerability and emissions burdens across the region, we also present maps of tract-level vulnerability and emissions densities. We present 2007 to 2006 emissions burdens in this section. Maps of emissions burdens in the 2012 to 2016 and 2016 time periods show similar spatial patterns and are included in Appendix B. Maps of each of the 19 pollutants of concern are included in Appendix C.

Figure 2 shows demographic vulnerability across the eight county Houston region. The share of the population that is in poverty and of color is generally greater in more centrally located tracts than in outlying areas, with the exception of parts of the west central area. The share of households that are limited-english is greater in the north central and parts of the east and southwest central areas. Accordingly, the vulnerability index (which is an average of the three vulnerability shares) is greater in more centrally located tracts (with the exception of parts of the west central area).

Emissions densities for the three broad categories of pollutants and the 19-pollutant index are generally greatest in tracts in the vicinity of the Ship Channel (Figure 3). This is consistent across most pollutants and study years (Appendices B and C).

Overlaying emissions densities and the vulnerability index (Figure 4) reveals that the confluence of pollution and vulnerability occurs along the Ship Channel, particularly in centrally-located tracts. This is consistent across the three broad pollution categories and the 19-pollutant index.

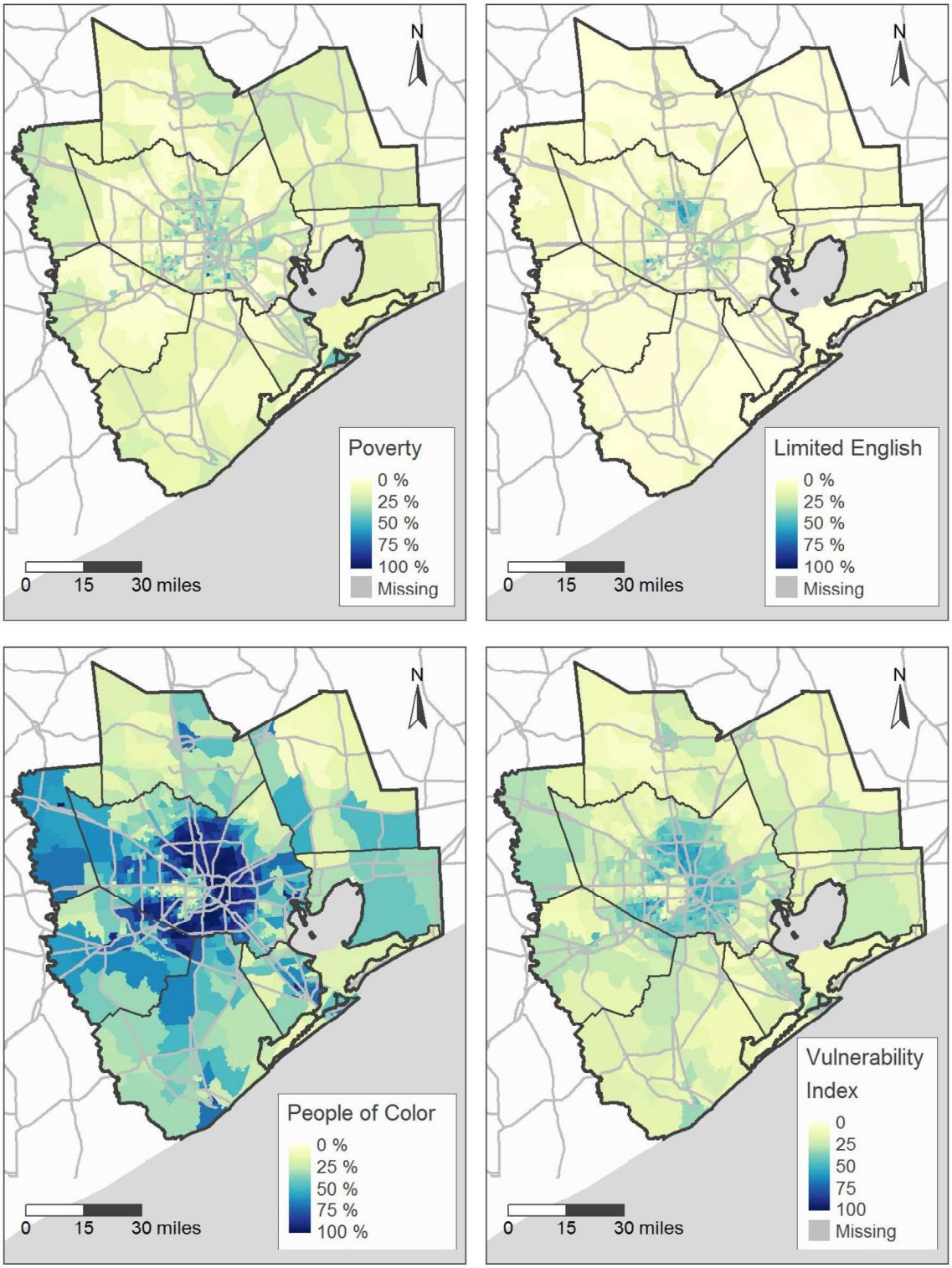

Figure 2: Vulnerability in the Eight County Houston Region[21]

[21] The Vulnerability Index is an average of % Poverty, % Limited English, and % People of Color.

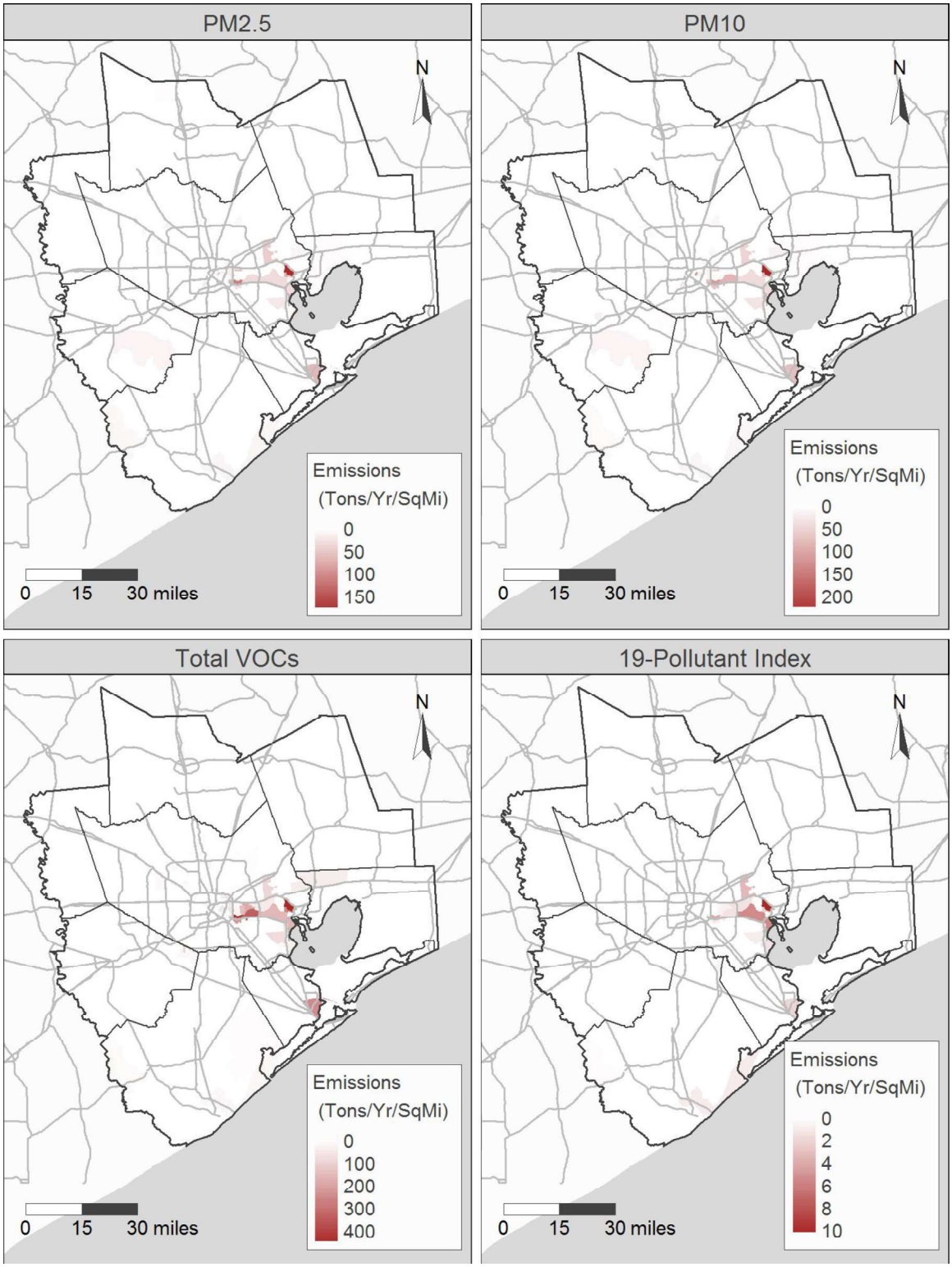

Figure 3: 2007 to 2016 Emissions in the Eight County Houston Region

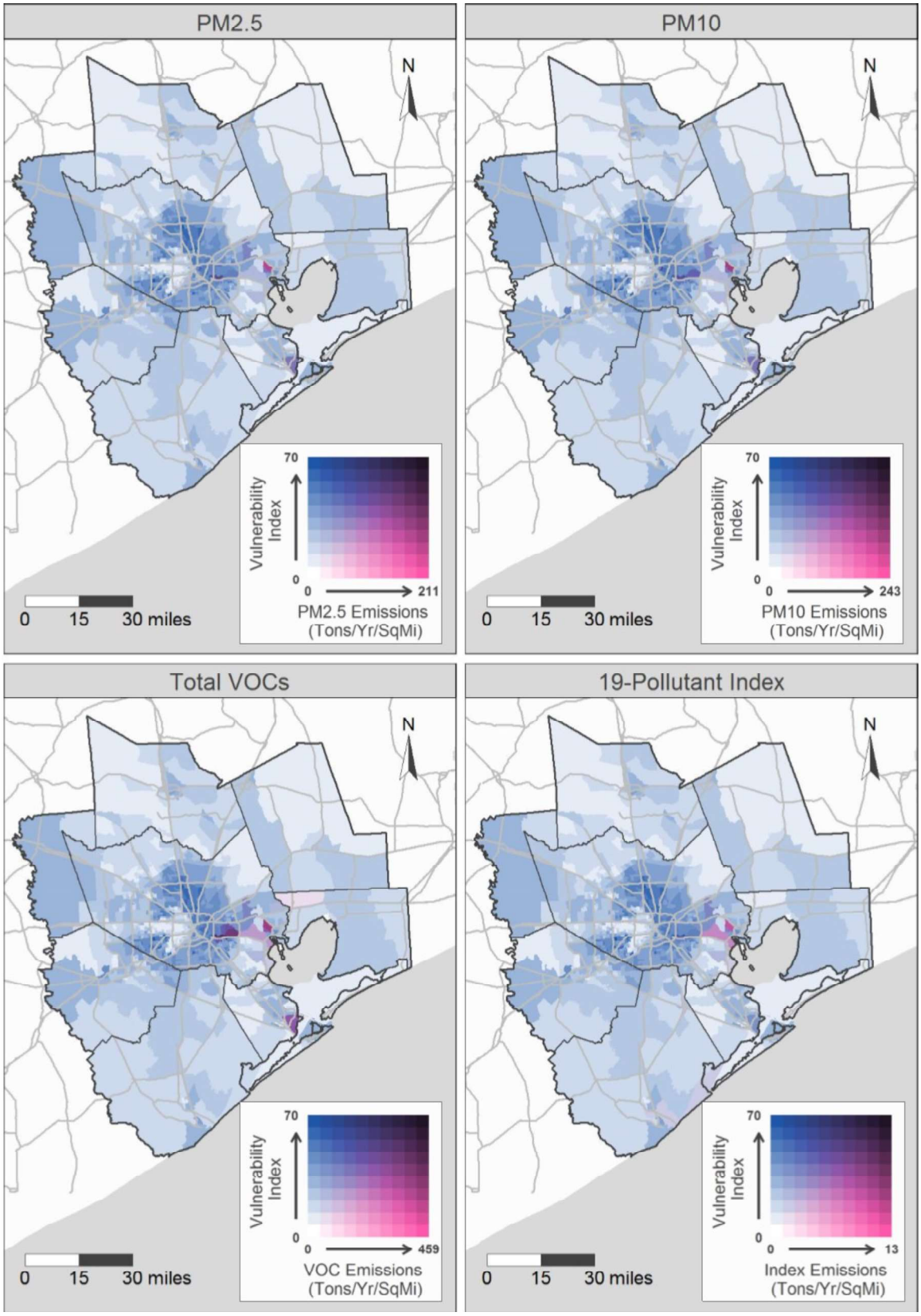

Figure 4: 2007 to 2016 Emissions and Vulnerability in the Eight County Houston Region

Unauthorized Emissions

The analysis above focuses on total emissions, which include both authorized and unauthorized emissions. Because the unauthorized emissions are not permitted in advance, it is also of interest to examine unauthorized emissions alone. Note that these emissions may be more likely to be uncontrolled, so may occur over short periods of time, potentially leading to spikes in pollution concentrations and contributing to acute and chronic health risks.

Table 5 shows the average emissions burden (average emissions density), the scope of emissions (share of population living in tracts with emissions greater than zero), and the severity of emissions for those that are exposed (average emissions density for those that live in tracts with emissions greater than zero). As in Tables 2 to 4, columns are highlighted to indicate the level of disparity, where bright red indicates greater levels of disparity for disadvantaged populations and bright green highlighting indicates emissions burdens that disproportionately fall on advantaged populations.

Table 5 shows that vulnerable populations experience greater emissions densities (on average) than their more advantaged counterparts, although they are also modestly less likely to live in tracts with emissions. This is due to the greater severity of emissions burdens that vulnerable populations bear when they live in tracts with emissions. These findings are consistent with emissions of total VOCs (shown in Tables 2 to 4). The average burden and severity of emissions of unauthorized VOCs are approximately an order of magnitude smaller than for total VOCs. At the same time, the shares of the populations living in tracts with unauthorized VOC emissions are approximately half to two thirds of the shares living in tracts with emissions of total VOCs. Disparities in the severity of emissions experienced by people living in poverty are more modest for unauthorized VOC emissions than for total VOC emissions. Disparities in the average emissions burden and the severity of emissions experienced by people of color and limited english household are greater for unauthorized emissions in the 2007 to 2016 time period, but these disparities appear to trend downward in the more recent time periods evaluated.

Looking at the magnitude of the average emissions burden and the scope and severity of emissions, we see that emissions burdens and the scope of emissions decrease in more recent time periods when compared with the 2007 to 2016 time period for all populations. The severity of emissions increases slightly for people of color and people living in poverty and decreases for limited english households, while it increases for all three of the corresponding advantaged populations.

Figure 5 shows the location of unauthorized VOC emissions across the region. These emissions are most prevalant in the area around the Ship Channel, similar to the four pollution categories shown in Figure 3.

Table 5: Unauthorized VOCs in the Eight County Houston Region: Average Burden, Scope, and Severity

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Average Burden: Average Emissions Density (tons / year / sq mile estimated at the census tract level)										
VOCs (unauthorized emissions only)	2007 - 2016	0.19	0.072	167%	0.17	0.13	29%	0.25	0.10	143%
	2012 - 2016	0.14	0.059	130%	0.11	0.09	22%	0.18	0.08	126%
	2016	0.11	0.054	97%	0.10	0.08	30%	0.10	0.07	38%
Emissions Scope: Share of Population Living in Tracts with Emissions (%)										
VOCs (unauthorized emissions only)	2007 - 2016	9.1	11.6	-22%	10.2	9.9	3%	7.8	9.8	-20%
	2012 - 2016	6.9	8.9	-23%	7.9	7.7	3%	5.9	7.6	-22%
	2016	5.0	6.1	-18%	5.7	5.3	8%	4.5	5.3	-15%
Emissions Severity: Average Emissions Density for People Living in Tract with Emissions (tons / year / sq mile estimated at the census tract level)										
VOCs (unauthorized emissions only)	2007 - 2016	2.1	0.62	241%	1.7	1.3	25%	3.2	1.1	203%
	2012 - 2016	2.0	0.66	198%	1.5	1.2	19%	3.0	1.0	190%
	2016	2.1	0.89	140%	1.8	1.5	21%	2.2	1.4	62%

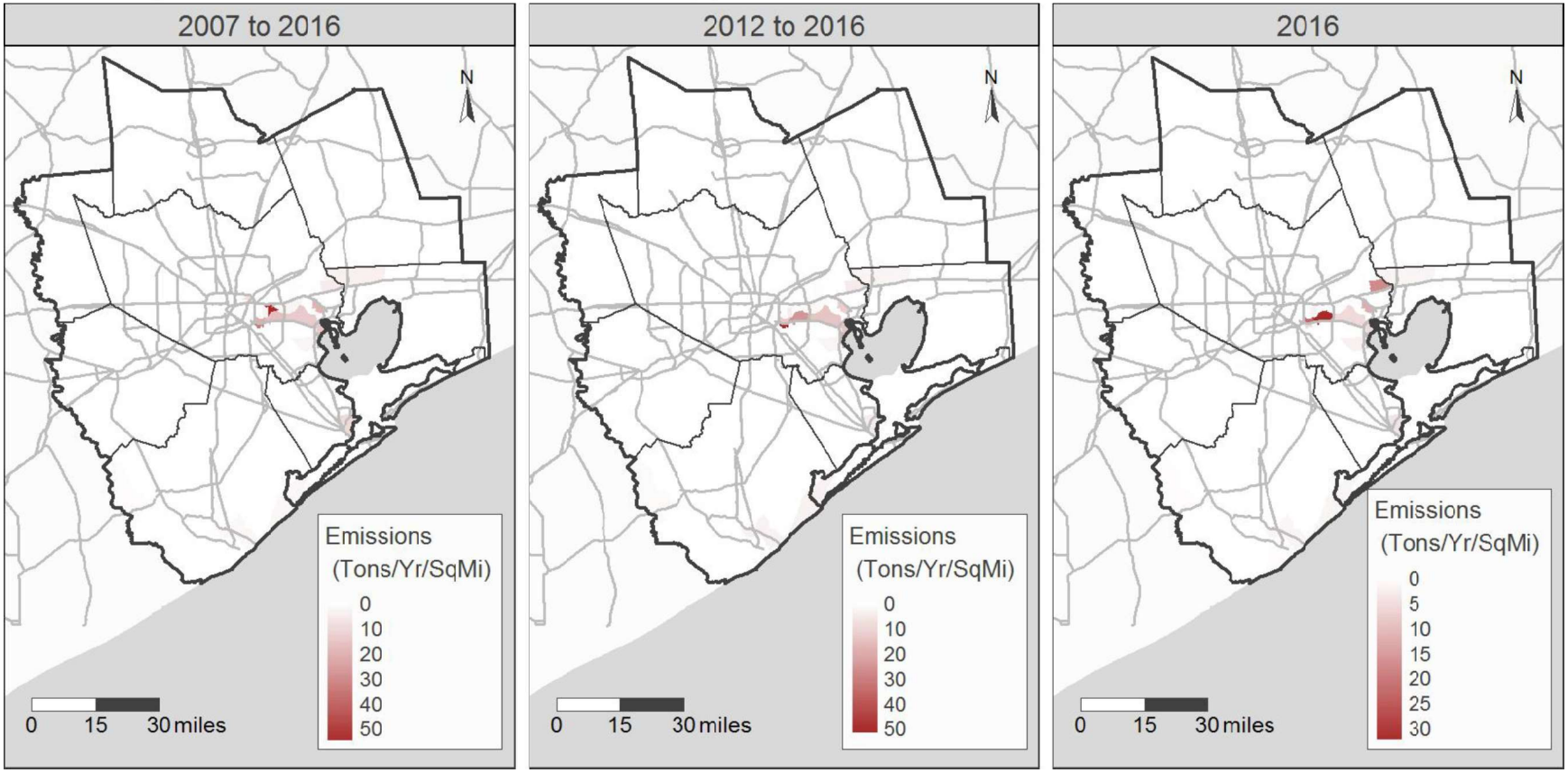

Figure 5: Unauthorized VOC Emissions in the Eight County Houston Region

The Ship Channel and Communities of Interest

In light of the interest in several Ship Channel communities expressed by community partners and the findings of the previous sections, in this section we examine vulnerability and emissions burdens in the Ship Channel area.

We first zoom in on the vulnerability and emissions maps. Figure 6 shows demographics in the Ship Channel Area, with the communities of interest highlighted. Magnolia Park, Harrisburg / Manchester, and northwest part of Pasadena exhibit greater vulnerability than outlying areas, particularly in terms of the share of people of color. At the same time, areas along the Ship Channel (including Harrisburg / Manchester, the northern edges of Pasadena and Deer Park, and the southwest of Baytown) exhibit greater total emissions burdens in the 2007 to 2016 period than most other areas (Figure 7). These findings are consistent in the other time periods examined (see Appendix D) and for unauthorized emissions (Figure 8). Additional maps of each of emissions of the 19 pollutants are included in Appendix E. The confluence of vulnerability and emissions burdens is greatest in the Harrisburg / Manchester community and along the northern edges of Pasadena and Deer Park (Figure 9). The differences observed are substantial. For example, the vulnerability measures in Harrisburg / Manchester range from 1.6 to 3.1 times the values for the eight-county region, while the pollution measures shown range from 28 to 61 times the values for the eight-county region.

We then summarize vulnerability and 2007 to 2016 emissions by community in order to quantify the patterns shown in the maps described above. We also present comparable information for three reference areas: the eight-county Houston area, Harris County, and the City of Houston (Figure 10).[22] Looking at Figure 10a, we see that when compared with the reference areas, Harrisburg / Manchester and Magnolia Park exhibit greater vulnerability, Deer Park exhibits less vulnerability, and Baytown and Pasadena are approximately on par with the reference areas. Figure 10b shows that when compared with the references areas, Harrisburg / Manchester exhibits far greater emissions density, Baytown, Deer Park, and Magnolia exhibit smaller emissions densities, and Pasadena exhibits emissions densities that are approximately on par with the reference areas. These findings are consistent in the two other time periods evaluated (Appendix F.)

[22] The 19-pollutant index is not included in this part of the analysis because it is not comparable across analysis scales.

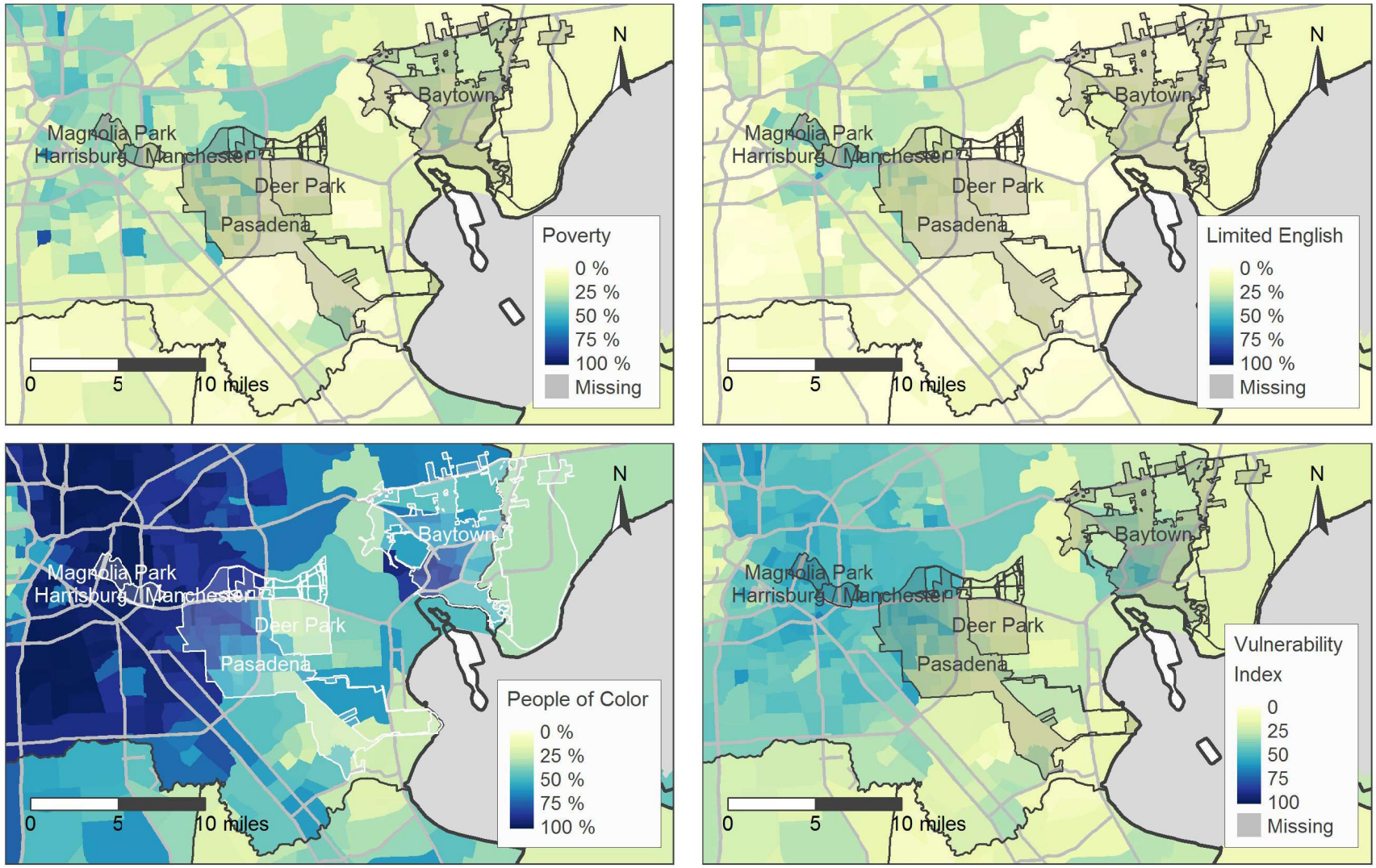

Figure 6: Vulnerability in the Ship Channel Area

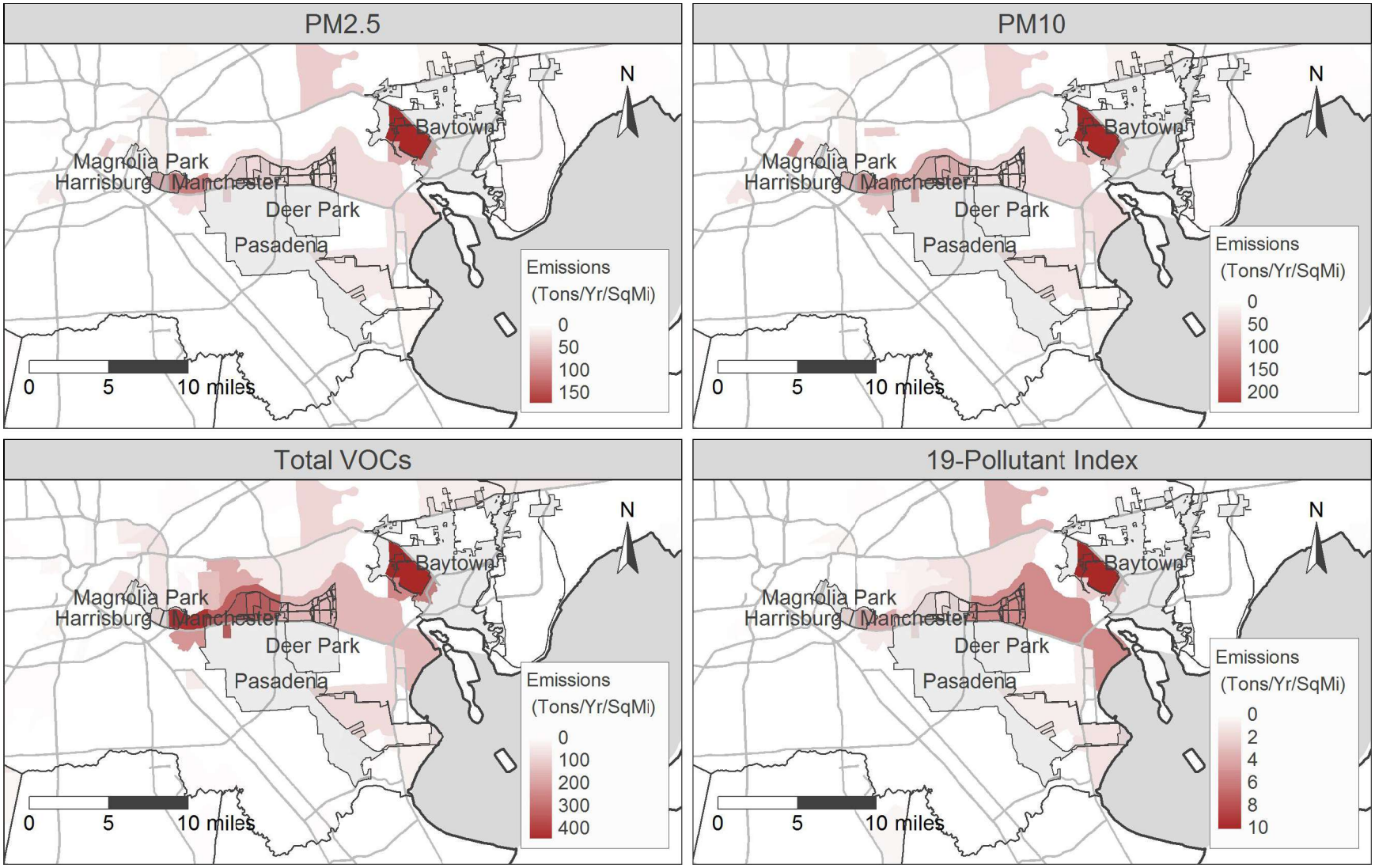

Figure 7: 2007 to 2016 Emissions in the Ship Channel Area

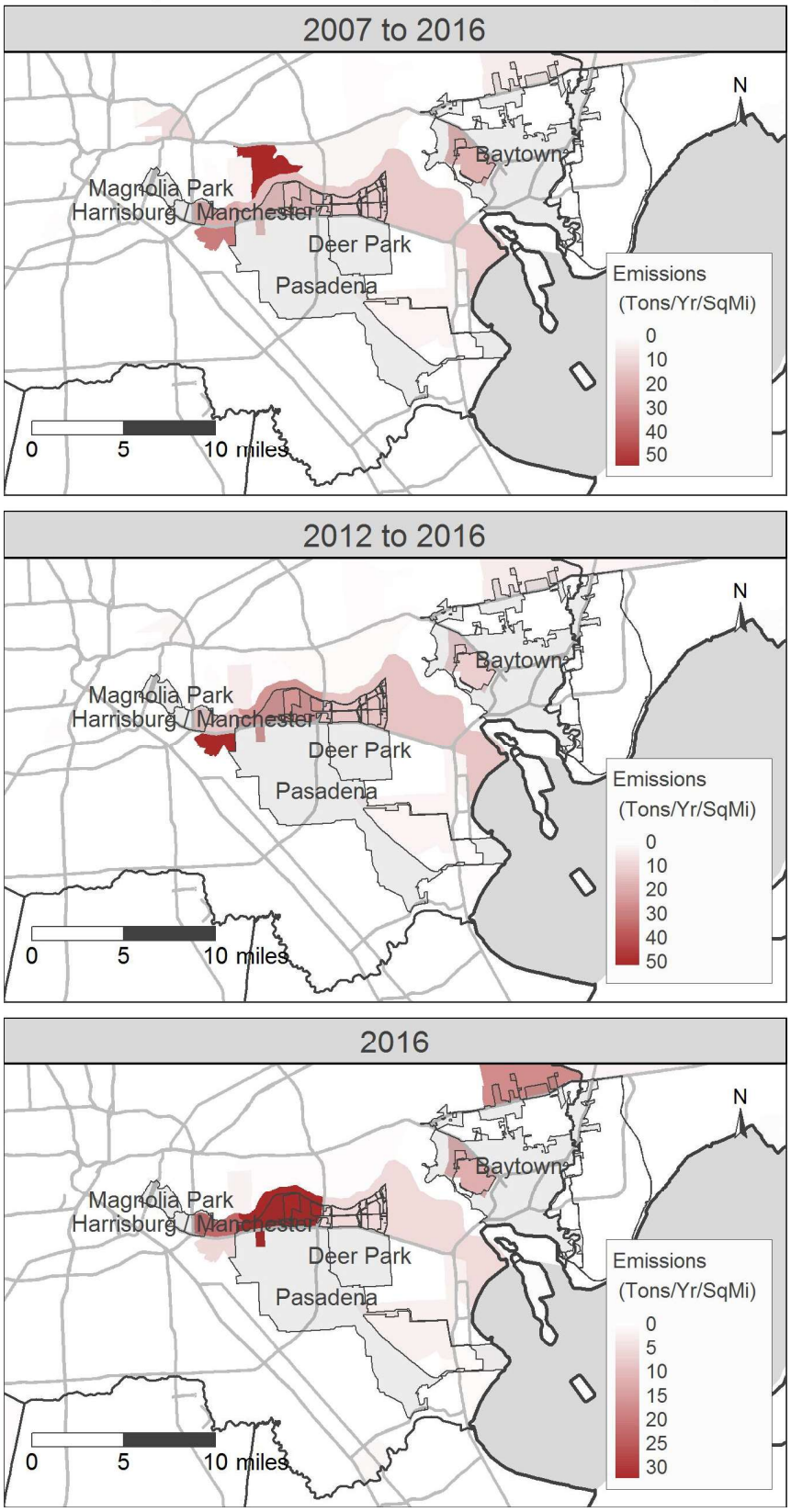

Figure 8: Unauthorized VOC Emissions in the Ship Channel Area

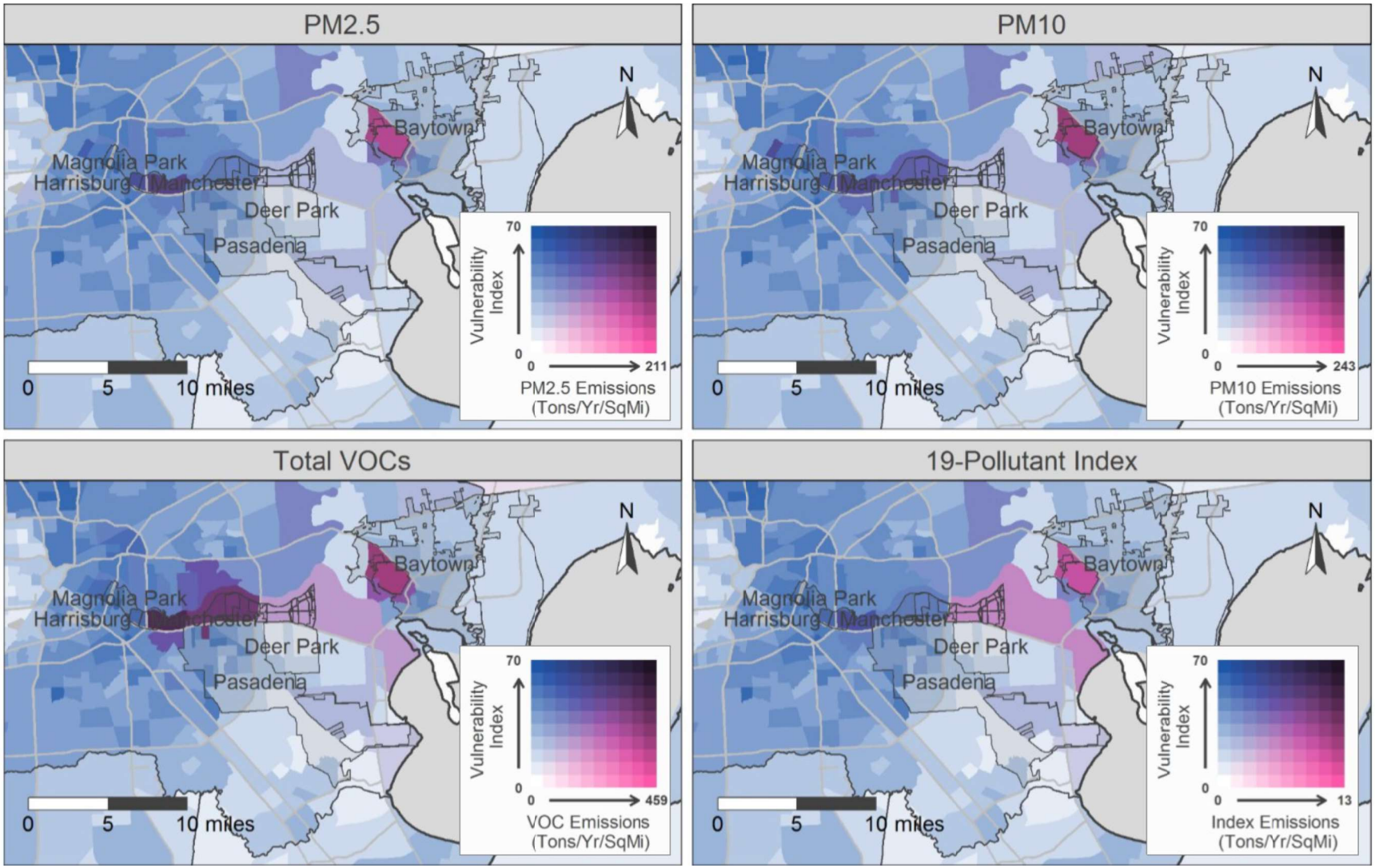

Figure 9: 2007 to 2016 Emissions and Vulnerability in the Ship Channel Area

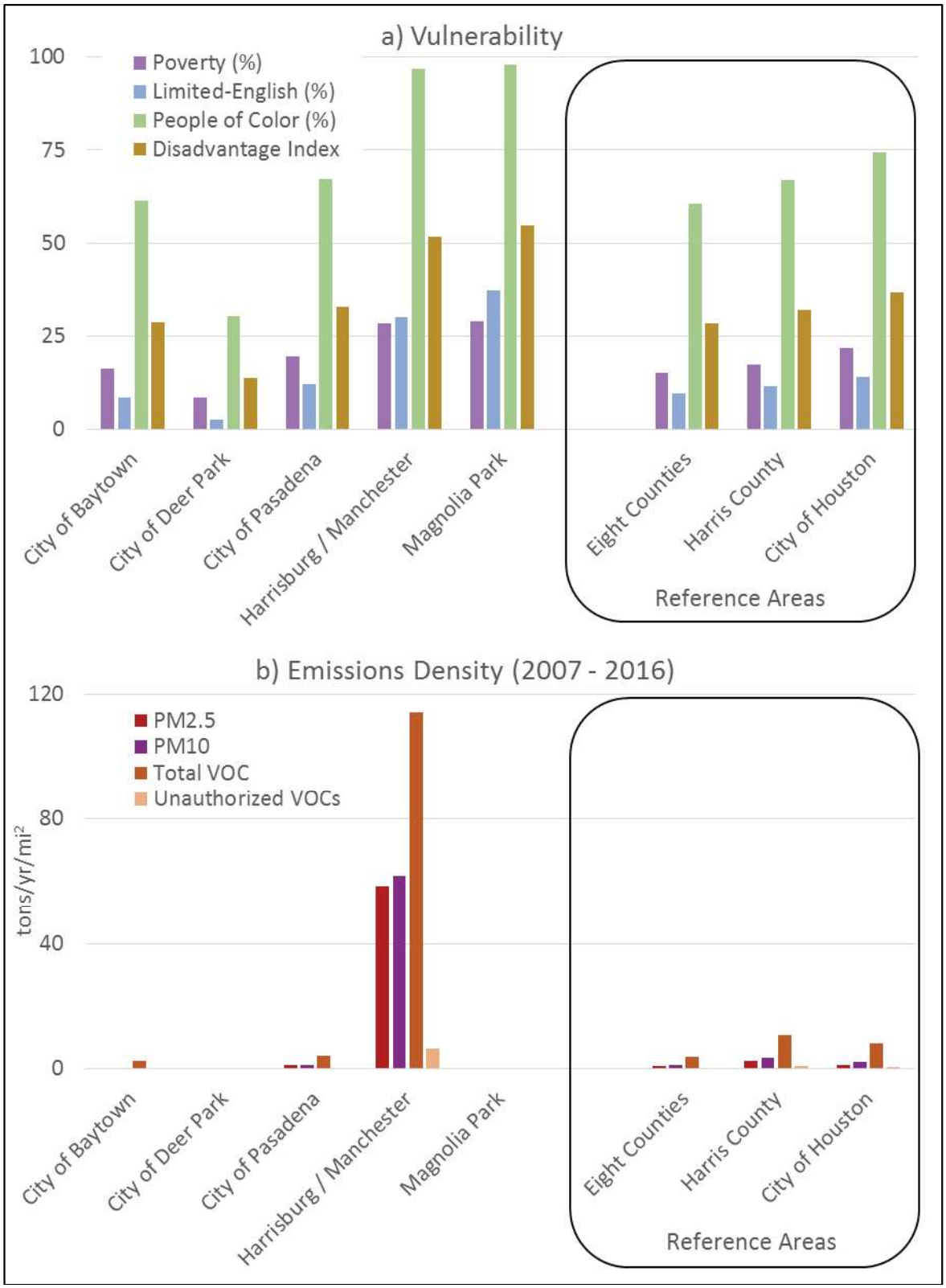

Figure 10: Vulnerability and Emissions in Communities of Interest

Discussion

This analysis evaluates vulnerability and stationary source emissions in the Houston region. The regional-level analysis indicates that the share of vulnerable populations living in tracts where pollution is emitted is modestly smaller than for more advantaged populations. However, vulnerable populations living in tracts where emissions occur are in proximity to greater levels of pollution than more advantaged populations living in tracts where emissions occur. The overall effect of these two patterns is that the overall average emissions burdens of vulnerable populations are greater than for more advantaged populations. These findings are consistent themost pollution categories and time periods examined. Disparities are greater for people of color and limited english households than for people living in poverty.

The regional-scale analysis also points to greater levels of emissions in the Ship Channel area. A closer examination of tracts and communities in that area confirms that many areas along the Ship Channel exhibit greater levels of vulnerability and emissions burdens than the rest of the region. This is particularly true in the Harrisburg / Manchester community.

As with any study, this analysis is limited in scope. We evaluated emissions densities but did not evaluate pollution transport in the environment, residents' exposure to pollution, or health risks associated with that exposure. As a result we do not evaluate the relative quantities of emissions of different pollutants. This is because the toxicity and fate and transport characteristics of each pollutant vary, so the relative health risks posed by each pollutant cannot be evaluated by comparing their emissions quantities.

By examining the intensity of emissions in different communities and where different populations live, we are able to identify areas where emissions are greater. Where and when stationary sources emit different types of pollution is of interest both because of the potential for health risks and because of the regulatory context. The authorized emissions included here undergo a permitting process while the unauthorized emissions are reported but are not permitted. In other words, emissions density is closely linked to regulatory decisions.
This study focuses on average emissions burdens for different populations and communities. This does not characterize

Comparisons between time periods point to slight to moderate temporal trends for some pollution categories, but the periods of analysis used in this report were not designed to characterize trends over time. Further study would be required to identify trends of increasing or decreasing pollution levels in different populations or communities. Additional avenues for future study include characterizing pollution magnitudes or time trends from different sizes or types of sources, or characterizing the populations that live in areas at these extremes – e.g. those with pollution levels that far exceed the regional average.

Conclusions

In this memo we have evaluated demographic vulnerability and point source emissions in the Houston region. Key findings include:

Pollution burdens are disproportionately shouldered by vulnerable populations (people of color, people living in poverty, and limited-English households.)

- Vulnerable populations experience greater emissions densities (on average) than their more advantaged counterparts, although they are also modestly less likely to live in tracts with emissions. These seemingly conflicting accounts of disparity are explained by the greater severity of emissions burdens that vulnerable populations bear when they live in tracts with emissions.
- Disparities are substantial, with average burdens for vulnerable populations ranging from 9% to 127% greater than their advantaged counterparts.

Vulnerability and emissions densities vary greatly across the region.

- More centrally located areas are home to residents with greater vulnerability than outlying areas, with the exception of the west central part of the region.
- Areas with greater emissions burdens are largely located in the vicinity of the Ship Channel.
- The confluence of pollution and vulnerability occurs along the Ship Channel, particularly in areas that are closer to the center of the region.
- Variation is substantial. For example, the vulnerability measures in Harrisburg / Manchester range from 1.6 to 3.1 times the values for the eight-county region, while the pollution measures range from 28 to 61 times the values for the eight-county region.

Unauthorized emissions of VOCs exhibit similar trends to other pollution categories.

- Vulnerable populations experience greater emissions densities (on average) than their more advantaged counterparts, although they are also modestly less likely to live in tracts with emissions. This is due to the greater severity of emissions burdens that vulnerable populations bear when they live in tracts with emissions.
- Unauthorized emissions of VOCs are largely located in the vicinity of the Ship Channel.

Disparities are consistent across the pollution categories and time periods evaluated.

- Findings of population- and community- level disparities are consistent across the four pollution categories (PM2.5, PM10, total VOCs, and a 19-pollutant index) and the three time periods evaluated (2007 – 2016, 2012 – 2016, and 2016).

Appendices

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Appendix A: Regionwide Analysis of 19 Pollutants of Concern by Population

Average Burden: Average Emissions Density (1 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Acenaphthylene	2007 - 2016	1.0E-05	1.9E-05	-47%	1.4E-05	1.2E-05	14%	1.3E-06	1.6E-05	-92%
	2012 - 2016	2.3E-07	4.8E-07	-53%	1.8E-07	2.8E-07	-37%	2.9E-07	2.8E-07	4%
	2016	2.7E-07	4.3E-07	-38%	1.3E-07	2.8E-07	-54%	3.5E-07	2.6E-07	31%
Acetaldehyde	2007 - 2016	4.1E-03	3.5E-03	17%	5.5E-03	3.4E-03	60%	5.5E-03	3.3E-03	66%
	2012 - 2016	4.3E-03	3.7E-03	16%	6.0E-03	3.7E-03	63%	6.7E-03	3.5E-03	94%
	2016	6.1E-03	5.2E-03	17%	9.1E-03	5.2E-03	74%	1.1E-02	4.7E-03	137%
Acrolein	2007 - 2016	4.0E-04	5.9E-04	-32%	2.7E-04	5.5E-04	-52%	3.5E-04	4.9E-04	-27%
	2012 - 2016	3.6E-04	5.6E-04	-36%	2.8E-04	5.9E-04	-53%	3.6E-04	5.1E-04	-29%
	2016	3.5E-04	5.3E-04	-33%	2.3E-04	6.5E-04	-64%	3.5E-04	5.4E-04	-34%
Anthracene	2007 - 2016	2.8E-05	2.8E-05	2%	4.4E-05	2.3E-05	86%	5.3E-05	2.2E-05	136%
	2012 - 2016	5.1E-06	5.0E-06	1%	6.7E-06	4.3E-06	56%	7.8E-06	4.2E-06	84%
	2016	3.8E-06	3.6E-06	6%	5.6E-06	3.1E-06	81%	7.7E-06	2.8E-06	176%
Benzene	2007 - 2016	3.0E-02	1.9E-02	57%	3.3E-02	2.2E-02	51%	3.6E-02	2.0E-02	78%
	2012 - 2016	2.4E-02	1.7E-02	48%	2.7E-02	1.9E-02	45%	2.8E-02	1.7E-02	65%
	2016	2.3E-02	1.6E-02	45%	2.4E-02	1.8E-02	29%	2.5E-02	1.7E-02	47%
Benzo[a]pyrene	2007 - 2016	3.7E-07	7.4E-08	406%	2.5E-07	2.0E-07	26%	6.2E-07	1.3E-07	362%
	2012 - 2016	1.1E-07	8.7E-08	30%	4.9E-08	8.2E-08	-40%	1.7E-07	6.8E-08	141%
	2016	9.8E-08	8.3E-08	18%	3.9E-08	7.4E-08	-46%	1.4E-07	6.3E-08	124%
1,3-Butadiene	2007 - 2016	3.0E-02	1.3E-02	129%	2.5E-02	2.1E-02	21%	4.9E-02	1.6E-02	212%
	2012 - 2016	2.7E-02	1.3E-02	114%	2.3E-02	1.9E-02	19%	4.4E-02	1.4E-02	206%
	2016	2.1E-02	1.1E-02	92%	1.9E-02	1.5E-02	21%	3.4E-02	1.2E-02	186%
Carbon tetrachloride	2007 - 2016	5.8E-05	7.0E-05	-17%	1.2E-04	4.7E-05	157%	7.1E-05	5.7E-05	24%
	2012 - 2016	5.1E-05	5.5E-05	-8%	1.0E-04	3.9E-05	167%	6.3E-05	4.5E-05	39%
	2016	1.7E-05	4.8E-05	-64%	3.7E-05	2.7E-05	38%	1.4E-05	3.4E-05	-59%
Chlorine	2007 - 2016	1.6E-03	9.1E-04	79%	2.5E-03	1.1E-03	134%	2.1E-03	1.1E-03	98%
	2012 - 2016	1.3E-03	7.2E-04	83%	2.1E-03	8.2E-04	150%	1.7E-03	8.7E-04	92%
	2016	1.3E-03	7.1E-04	78%	2.0E-03	7.9E-04	146%	1.5E-03	8.6E-04	78%

Average Burden: Average Emissions Density (2 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Chromium and compounds	2007 - 2016	4.5E-05	4.8E-05	-6%	3.4E-05	4.4E-05	-24%	5.0E-05	4.2E-05	18%
	2012 - 2016	3.1E-05	3.2E-05	-4%	1.2E-05	2.6E-05	-53%	3.7E-05	2.4E-05	53%
	2016	4.1E-05	4.6E-05	-10%	1.5E-05	3.5E-05	-57%	5.0E-05	3.3E-05	54%
Diaminotoluene (mixed isomers)	2007 - 2016	2.4E-07	1.1E-06	-78%	6.0E-07	6.1E-07	-2%	1.1E-07	6.6E-07	-83%
	2012 - 2016	4.7E-08	2.7E-08	75%	6.2E-08	3.3E-08	87%	6.2E-08	3.2E-08	96%
	2016	1.5E-09	5.6E-09	-73%	1.8E-09	3.5E-09	-48%	2.6E-09	3.2E-09	-18%
Fluoranthene	2007 - 2016	7.6E-07	1.4E-06	-45%	9.2E-07	8.6E-07	7%	1.9E-07	1.1E-06	-83%
	2012 - 2016	1.4E-07	1.7E-07	-17%	3.8E-08	1.3E-07	-70%	1.9E-07	1.1E-07	61%
	2016	1.5E-07	1.7E-07	-13%	5.0E-08	1.2E-07	-59%	1.8E-07	1.2E-07	57%
Formaldehyde	2007 - 2016	8.4E-03	1.1E-02	-23%	7.4E-03	9.8E-03	-25%	6.6E-03	9.5E-03	-31%
	2012 - 2016	7.4E-03	9.5E-03	-22%	7.0E-03	8.7E-03	-19%	6.1E-03	8.3E-03	-26%
	2016	6.3E-03	8.4E-03	-25%	5.9E-03	8.5E-03	-31%	6.1E-03	7.8E-03	-21%
Hydrogen chloride	2007 - 2016	1.1E-02	4.0E-03	183%	9.6E-03	7.0E-03	38%	6.8E-03	7.0E-03	-2%
	2012 - 2016	1.1E-02	3.6E-03	199%	9.3E-03	6.3E-03	47%	6.6E-03	6.4E-03	3%
	2016	4.8E-03	3.1E-03	54%	4.9E-03	3.5E-03	40%	3.1E-03	3.7E-03	-18%
Hydrogen cyanide gas	2007 - 2016	1.5E-02	3.5E-03	318%	1.1E-02	7.9E-03	43%	2.2E-02	6.1E-03	263%
	2012 - 2016	2.9E-02	6.3E-03	357%	2.2E-02	1.5E-02	43%	4.4E-02	1.2E-02	278%
	2016	3.5E-02	8.1E-03	336%	2.7E-02	1.9E-02	46%	5.3E-02	1.5E-02	259%
Hydrogen sulfide	2007 - 2016	7.4E-03	4.2E-03	77%	6.4E-03	4.8E-03	35%	7.6E-03	4.7E-03	64%
	2012 - 2016	7.3E-03	3.9E-03	87%	6.3E-03	4.7E-03	35%	7.5E-03	4.5E-03	65%
	2016	7.6E-03	3.4E-03	123%	6.6E-03	4.7E-03	41%	8.2E-03	4.5E-03	82%
Naphthalene	2007 - 2016	4.2E-03	2.2E-03	87%	4.7E-03	2.8E-03	69%	5.6E-03	2.6E-03	117%
	2012 - 2016	4.0E-03	2.4E-03	68%	4.4E-03	2.7E-03	64%	5.4E-03	2.5E-03	111%
	2016	2.6E-03	1.9E-03	38%	3.2E-03	1.9E-03	70%	3.9E-03	1.8E-03	117%
Phenanthrene	2007 - 2016	1.5E-04	1.7E-04	-11%	6.2E-05	1.3E-04	-53%	2.0E-04	1.2E-04	68%
	2012 - 2016	2.8E-04	3.3E-04	-14%	9.8E-05	2.4E-04	-60%	3.7E-04	2.2E-04	69%
	2016	2.6E-04	3.0E-04	-14%	9.3E-05	2.3E-04	-59%	3.5E-04	2.0E-04	72%

Average Burden: Average Emissions Density (3 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Pyrene	2007 - 2016	2.1E-06	3.9E-06	-45%	2.7E-06	2.5E-06	10%	4.0E-07	3.2E-06	-87%
	2012 - 2016	2.4E-07	2.9E-07	-18%	5.9E-08	2.1E-07	-72%	3.1E-07	1.9E-07	62%
	2016	2.2E-07	2.7E-07	-18%	5.7E-08	1.9E-07	-70%	2.8E-07	1.8E-07	62%

Emissions Scope: Share of Population Living in Tracts with Emissions (%) (1 of 3)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Acenaphthylene	2007 - 2016	0.07	0.17	-58%	0.10	0.10	-2%	0.04	0.12	-62%
	2012 - 2016	0.03	0.09	-67%	0.04	0.05	-18%	0.04	0.05	-24%
	2016	0.03	0.09	-67%	0.04	0.05	-18%	0.04	0.05	-24%
Acetaldehyde	2007 - 2016	4.36	5.76	-24%	4.58	5.42	-16%	3.71	5.14	-28%
	2012 - 2016	3.83	4.81	-20%	3.78	4.87	-23%	3.17	4.51	-30%
	2016	2.57	2.81	-9%	2.60	3.13	-17%	2.33	2.90	-20%
Acrolein	2007 - 2016	3.39	4.83	-30%	3.47	4.60	-25%	2.79	4.28	-35%
	2012 - 2016	3.05	4.26	-28%	2.99	4.17	-28%	2.45	3.87	-37%
	2016	2.34	2.64	-11%	2.23	2.95	-25%	2.16	2.70	-20%
Anthracene	2007 - 2016	0.62	0.67	-8%	0.63	0.59	6%	0.56	0.59	-6%
	2012 - 2016	0.56	0.66	-16%	0.59	0.56	6%	0.53	0.56	-6%
	2016	0.31	0.40	-23%	0.42	0.29	45%	0.48	0.29	63%
Benzene	2007 - 2016	11.46	14.08	-19%	11.43	13.30	-14%	9.08	12.80	-29%
	2012 - 2016	9.09	11.95	-24%	9.23	10.65	-13%	7.09	10.31	-31%
	2016	6.76	9.09	-26%	7.13	8.14	-12%	5.85	7.87	-26%
Benzo[a]pyrene	2007 - 2016	0.07	0.08	-14%	0.07	0.06	18%	0.09	0.07	39%
	2012 - 2016	0.06	0.02	242%	0.04	0.03	12%	0.09	0.02	307%
	2016	0.06	0.02	242%	0.04	0.03	12%	0.09	0.02	307%
1,3-Butadiene	2007 - 2016	2.59	3.02	-14%	2.70	2.76	-2%	2.34	2.78	-16%
	2012 - 2016	2.05	2.44	-16%	2.09	2.22	-6%	1.90	2.23	-15%
	2016	1.76	1.84	-5%	1.83	1.71	7%	1.78	1.75	2%
Carbon tetrachloride	2007 - 2016	0.61	1.52	-60%	0.99	0.96	3%	0.75	1.05	-28%
	2012 - 2016	0.42	1.07	-60%	0.62	0.69	-10%	0.51	0.71	-28%
	2016	0.35	0.95	-63%	0.54	0.60	-9%	0.47	0.61	-22%
Chlorine	2007 - 2016	1.24	1.60	-23%	1.55	1.32	17%	1.62	1.34	21%
	2012 - 2016	1.12	1.47	-24%	1.36	1.22	11%	1.48	1.18	25%
	2016	0.83	1.37	-39%	1.25	1.00	26%	1.16	0.99	17%

Emissions Scope: Share of Population Living in Tracts with Emissions (%) (2 of 3)										
Pollutant	**Year range**	**People of Color (POC)**	**Non POC**	**% Difference (POC - NonPOC) / NonPOC**	**People Living in Poverty (POV)**	**Non POV**	**% Difference (POV - NonPOV) / NonPOV**	**Limited English Household (LEH)**	**Non LEH**	**% Difference (LEH - NonLEH) / NonLEH**
Chromium and compounds	2007 - 2016	1.61	1.07	51%	1.50	1.35	11%	1.38	1.24	11%
	2012 - 2016	0.79	0.67	18%	0.72	0.77	-6%	0.54	0.73	-26%
	2016	0.57	0.54	5%	0.55	0.60	-8%	0.38	0.56	-32%
Diaminotoluene (mixed isomers)	2007 - 2016	0.22	0.72	-70%	0.34	0.44	-23%	0.29	0.44	-34%
	2012 - 2016	0.17	0.48	-65%	0.21	0.31	-33%	0.27	0.29	-5%
	2016	0.13	0.47	-73%	0.15	0.30	-48%	0.22	0.27	-18%
Fluoranthene	2007 - 2016	0.11	0.13	-12%	0.12	0.09	25%	0.07	0.12	-42%
	2012 - 2016	0.07	0.05	42%	0.06	0.05	36%	0.06	0.05	22%
	2016	0.07	0.05	42%	0.06	0.05	36%	0.06	0.05	22%
Formaldehyde	2007 - 2016	9.57	13.30	-28%	9.88	11.51	-14%	7.67	11.14	-31%
	2012 - 2016	8.52	12.12	-30%	8.65	10.51	-18%	6.62	10.13	-35%
	2016	5.75	8.66	-34%	5.99	7.49	-20%	4.79	7.22	-34%
Hydrogen chloride	2007 - 2016	2.89	3.32	-13%	3.07	2.98	3%	2.27	2.98	-24%
	2012 - 2016	2.26	2.53	-11%	2.59	2.22	17%	1.80	2.26	-21%
	2016	1.76	2.16	-18%	2.19	1.81	21%	1.37	1.86	-26%
Hydrogen cyanide gas	2007 - 2016	0.60	0.56	8%	0.69	0.51	36%	0.56	0.55	2%
	2012 - 2016	0.57	0.48	19%	0.69	0.46	50%	0.53	0.49	7%
	2016	0.33	0.41	-20%	0.43	0.30	46%	0.30	0.33	-8%
Hydrogen sulfide	2007 - 2016	3.46	4.48	-23%	3.96	3.69	7%	3.00	3.76	-20%
	2012 - 2016	3.22	4.15	-22%	3.52	3.46	2%	2.48	3.49	-29%
	2016	2.27	3.06	-26%	2.48	2.46	1%	1.85	2.48	-25%
Naphthalene	2007 - 2016	6.29	5.59	13%	6.67	5.70	17%	6.41	5.64	14%
	2012 - 2016	5.31	4.63	15%	5.50	4.76	16%	5.41	4.65	16%
	2016	3.92	3.52	11%	3.97	3.61	10%	4.05	3.51	16%
Phenanthrene	2007 - 2016	0.74	0.74	1%	0.81	0.67	21%	0.79	0.65	22%
	2012 - 2016	0.66	0.49	36%	0.69	0.54	28%	0.68	0.51	35%
	2016	0.60	0.48	26%	0.65	0.51	29%	0.65	0.48	37%

Emissions Scope: Share of Population Living in Tracts with Emissions (%) (3 of 3)										
Pollutant	**Year range**	**People of Color (POC)**	**Non POC**	**% Difference (POC - NonPOC) / NonPOC**	**People Living in Poverty (POV)**	**Non POV**	**% Difference (POV - NonPOV) / NonPOV**	**Limited English Household (LEH)**	**Non LEH**	**% Difference (LEH - NonLEH) / NonLEH**
Pyrene	2007 - 2016	0.29	0.19	51%	0.19	0.23	-19%	0.13	0.26	-48%
	2012 - 2016	0.07	0.05	42%	0.06	0.05	36%	0.06	0.05	22%
	2016	0.07	0.05	42%	0.06	0.05	36%	0.06	0.05	22%

Emissions Severity: Average Emissions Density for People Living in Tract with Emissions (1 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Acenaphthylene	2007 - 2016	1.4E-02	1.1E-02	26%	1.4E-02	1.2E-02	16%	3.0E-03	1.4E-02	-78%
	2012 - 2016	7.3E-04	5.1E-04	44%	4.3E-04	5.6E-04	-24%	7.3E-04	5.3E-04	37%
	2016	8.6E-04	4.6E-04	88%	3.1E-04	5.5E-04	-44%	8.6E-04	5.0E-04	72%
Acetaldehyde	2007 - 2016	9.3E-02	6.1E-02	54%	1.2E-01	6.3E-02	89%	1.5E-01	6.5E-02	129%
	2012 - 2016	1.1E-01	7.7E-02	45%	1.6E-01	7.6E-02	110%	2.1E-01	7.7E-02	175%
	2016	2.4E-01	1.9E-01	29%	3.5E-01	1.7E-01	110%	4.8E-01	1.6E-01	195%
Acrolein	2007 - 2016	1.2E-02	1.2E-02	-3%	7.6E-03	1.2E-02	-36%	1.3E-02	1.1E-02	11%
	2012 - 2016	1.2E-02	1.3E-02	-11%	9.4E-03	1.4E-02	-34%	1.5E-02	1.3E-02	13%
	2016	1.5E-02	2.0E-02	-24%	1.0E-02	2.2E-02	-53%	1.6E-02	2.0E-02	-18%
Anthracene	2007 - 2016	4.6E-03	4.1E-03	11%	6.9E-03	4.0E-03	75%	9.5E-03	3.8E-03	150%
	2012 - 2016	9.2E-04	7.6E-04	20%	1.1E-03	7.6E-04	48%	1.5E-03	7.5E-04	95%
	2016	1.3E-03	9.2E-04	36%	1.4E-03	1.1E-03	25%	1.6E-03	9.6E-04	69%
Benzene	2007 - 2016	2.6E-01	1.3E-01	93%	2.9E-01	1.6E-01	76%	4.0E-01	1.6E-01	150%
	2012 - 2016	2.7E-01	1.4E-01	95%	2.9E-01	1.7E-01	67%	4.0E-01	1.7E-01	140%
	2016	3.4E-01	1.7E-01	96%	3.3E-01	2.2E-01	48%	4.2E-01	2.1E-01	98%
Benzo[a]pyrene	2007 - 2016	5.4E-04	9.3E-05	487%	3.4E-04	3.2E-04	6%	6.6E-04	2.0E-04	232%
	2012 - 2016	2.0E-04	5.3E-04	-62%	1.4E-04	2.6E-04	-46%	1.8E-04	3.1E-04	-41%
	2016	1.8E-04	5.1E-04	-66%	1.1E-04	2.3E-04	-52%	1.5E-04	2.8E-04	-45%
1,3-Butadiene	2007 - 2016	1.2E+00	4.3E-01	167%	9.3E-01	7.5E-01	24%	2.1E+00	5.6E-01	270%
	2012 - 2016	1.3E+00	5.1E-01	156%	1.1E+00	8.6E-01	27%	2.3E+00	6.5E-01	260%
	2016	1.2E+00	5.9E-01	101%	1.0E+00	9.0E-01	13%	1.9E+00	6.8E-01	181%
Carbon tetrachloride	2007 - 2016	9.6E-03	4.6E-03	107%	1.2E-02	4.9E-03	150%	9.4E-03	5.5E-03	73%
	2012 - 2016	1.2E-02	5.1E-03	133%	1.7E-02	5.6E-03	197%	1.2E-02	6.4E-03	93%
	2016	5.0E-03	5.1E-03	-2%	6.9E-03	4.5E-03	52%	3.0E-03	5.6E-03	-47%
Chlorine	2007 - 2016	1.3E-01	5.7E-02	131%	1.6E-01	8.0E-02	99%	1.3E-01	8.1E-02	63%
	2012 - 2016	1.2E-01	4.9E-02	141%	1.5E-01	6.7E-02	125%	1.1E-01	7.4E-02	53%
	2016	1.5E-01	5.2E-02	193%	1.6E-01	8.0E-02	96%	1.3E-01	8.7E-02	52%

Emissions Severity: Average Emissions Density for People Living in Tract with Emissions (2 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Chromium and compounds	2007 - 2016	2.8E-03	4.5E-03	-38%	2.2E-03	3.3E-03	-32%	3.6E-03	3.4E-03	6%
	2012 - 2016	3.9E-03	4.7E-03	-18%	1.7E-03	3.4E-03	-50%	6.8E-03	3.3E-03	107%
	2016	7.3E-03	8.5E-03	-14%	2.8E-03	5.9E-03	-53%	1.3E-02	5.8E-03	125%
Diaminotoluene (mixed isomers)	2007 - 2016	1.1E-04	1.5E-04	-27%	1.8E-04	1.4E-04	27%	3.8E-05	1.5E-04	-75%
	2012 - 2016	2.8E-05	5.6E-06	398%	3.0E-05	1.1E-05	182%	2.3E-05	1.1E-05	106%
	2016	1.2E-06	1.2E-06	0%	1.2E-06	1.2E-06	0%	1.2E-06	1.2E-06	0%
Fluoranthene	2007 - 2016	6.7E-04	1.1E-03	-37%	7.8E-04	9.1E-04	-14%	2.8E-04	9.4E-04	-71%
	2012 - 2016	2.1E-04	3.5E-04	-42%	6.1E-05	2.7E-04	-78%	2.9E-04	2.2E-04	32%
	2016	2.1E-04	3.4E-04	-39%	8.1E-05	2.7E-04	-70%	2.9E-04	2.2E-04	28%
Formaldehyde	2007 - 2016	8.8E-02	8.2E-02	7%	7.5E-02	8.5E-02	-12%	8.6E-02	8.5E-02	0%
	2012 - 2016	8.7E-02	7.9E-02	11%	8.1E-02	8.2E-02	-2%	9.3E-02	8.2E-02	13%
	2016	1.1E-01	9.7E-02	13%	9.8E-02	1.1E-01	-14%	1.3E-01	1.1E-01	19%
Hydrogen chloride	2007 - 2016	3.9E-01	1.2E-01	224%	3.1E-01	2.3E-01	33%	3.0E-01	2.3E-01	28%
	2012 - 2016	4.7E-01	1.4E-01	235%	3.6E-01	2.8E-01	26%	3.7E-01	2.8E-01	30%
	2016	2.7E-01	1.4E-01	88%	2.2E-01	1.9E-01	16%	2.2E-01	2.0E-01	11%
Hydrogen cyanide gas	2007 - 2016	2.4E+00	6.3E-01	286%	1.6E+00	1.5E+00	5%	4.0E+00	1.1E+00	255%
	2012 - 2016	5.0E+00	1.3E+00	285%	3.2E+00	3.3E+00	-4%	8.3E+00	2.4E+00	253%
	2016	1.1E+01	2.0E+00	442%	6.3E+00	6.3E+00	0%	1.7E+01	4.4E+00	291%
Hydrogen sulfide	2007 - 2016	2.1E-01	9.3E-02	129%	1.6E-01	1.3E-01	26%	2.5E-01	1.2E-01	105%
	2012 - 2016	2.3E-01	9.4E-02	142%	1.8E-01	1.3E-01	33%	3.0E-01	1.3E-01	132%
	2016	3.4E-01	1.1E-01	200%	2.7E-01	1.9E-01	40%	4.4E-01	1.8E-01	145%
Naphthalene	2007 - 2016	6.7E-02	4.0E-02	66%	7.1E-02	4.9E-02	44%	8.7E-02	4.5E-02	91%
	2012 - 2016	7.5E-02	5.1E-02	46%	8.0E-02	5.7E-02	41%	9.9E-02	5.5E-02	81%
	2016	6.7E-02	5.4E-02	24%	8.1E-02	5.2E-02	55%	9.7E-02	5.2E-02	88%
Phenanthrene	2007 - 2016	2.1E-02	2.4E-02	-12%	7.7E-03	2.0E-02	-61%	2.5E-02	1.9E-02	37%
	2012 - 2016	4.2E-02	6.6E-02	-36%	1.4E-02	4.5E-02	-69%	5.4E-02	4.3E-02	25%
	2016	4.3E-02	6.3E-02	-31%	1.4E-02	4.4E-02	-68%	5.4E-02	4.3E-02	25%

Emissions Severity: Average Emissions Density for People Living in Tract with Emissions (3 of 3)

(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Pyrene	2007 - 2016	7.4E-04	2.0E-03	-64%	1.4E-03	1.1E-03	36%	3.0E-04	1.2E-03	-76%
	2012 - 2016	3.4E-04	5.9E-04	-43%	9.4E-05	4.5E-04	-79%	4.9E-04	3.6E-04	33%
	2016	3.1E-04	5.4E-04	-42%	9.2E-05	4.2E-04	-78%	4.5E-04	3.4E-04	33%

Average Emissions Density for People Living in Tract with Emissions (1 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Acenaphthylene	2007 - 2016	1.4E-02	1.1E-02	26%	1.4E-02	1.2E-02	16%	3.0E-03	1.4E-02	-78%
	2012 - 2016	7.3E-04	5.1E-04	44%	4.3E-04	5.6E-04	-24%	7.3E-04	5.3E-04	37%
	2016	8.6E-04	4.6E-04	88%	3.1E-04	5.5E-04	-44%	8.6E-04	5.0E-04	72%
Acetaldehyde	2007 - 2016	9.3E-02	6.1E-02	54%	1.2E-01	6.3E-02	89%	1.5E-01	6.5E-02	129%
	2012 - 2016	1.1E-01	7.7E-02	45%	1.6E-01	7.6E-02	110%	2.1E-01	7.7E-02	175%
	2016	2.4E-01	1.9E-01	29%	3.5E-01	1.7E-01	110%	4.8E-01	1.6E-01	195%
Acrolein	2007 - 2016	1.2E-02	1.2E-02	-3%	7.6E-03	1.2E-02	-36%	1.3E-02	1.1E-02	11%
	2012 - 2016	1.2E-02	1.3E-02	-11%	9.4E-03	1.4E-02	-34%	1.5E-02	1.3E-02	13%
	2016	1.5E-02	2.0E-02	-24%	1.0E-02	2.2E-02	-53%	1.6E-02	2.0E-02	-18%
Anthracene	2007 - 2016	4.6E-03	4.1E-03	11%	6.9E-03	4.0E-03	75%	9.5E-03	3.8E-03	150%
	2012 - 2016	9.2E-04	7.6E-04	20%	1.1E-03	7.6E-04	48%	1.5E-03	7.5E-04	95%
	2016	1.3E-03	9.2E-04	36%	1.4E-03	1.1E-03	25%	1.6E-03	9.6E-04	69%
Benzene	2007 - 2016	2.6E-01	1.3E-01	93%	2.9E-01	1.6E-01	76%	4.0E-01	1.6E-01	150%
	2012 - 2016	2.7E-01	1.4E-01	95%	2.9E-01	1.7E-01	67%	4.0E-01	1.7E-01	140%
	2016	3.4E-01	1.7E-01	96%	3.3E-01	2.2E-01	48%	4.2E-01	2.1E-01	98%
Benzo[a]pyrene	2007 - 2016	5.4E-04	9.3E-05	487%	3.4E-04	3.2E-04	6%	6.6E-04	2.0E-04	232%
	2012 - 2016	2.0E-04	5.3E-04	-62%	1.4E-04	2.6E-04	-46%	1.8E-04	3.1E-04	-41%
	2016	1.8E-04	5.1E-04	-66%	1.1E-04	2.3E-04	-52%	1.5E-04	2.8E-04	-45%
1,3-Butadiene	2007 - 2016	1.2E+00	4.3E-01	167%	9.3E-01	7.5E-01	24%	2.1E+00	5.6E-01	270%
	2012 - 2016	1.3E+00	5.1E-01	156%	1.1E+00	8.6E-01	27%	2.3E+00	6.5E-01	260%
	2016	1.2E+00	5.9E-01	101%	1.0E+00	9.0E-01	13%	1.9E+00	6.8E-01	181%
Carbon tetrachloride	2007 - 2016	9.6E-03	4.6E-03	107%	1.2E-02	4.9E-03	150%	9.4E-03	5.5E-03	73%
	2012 - 2016	1.2E-02	5.1E-03	133%	1.7E-02	5.6E-03	197%	1.2E-02	6.4E-03	93%
	2016	5.0E-03	5.1E-03	-2%	6.9E-03	4.5E-03	52%	3.0E-03	5.6E-03	-47%
Chlorine	2007 - 2016	1.3E-01	5.7E-02	131%	1.6E-01	8.0E-02	99%	1.3E-01	8.1E-02	63%
	2012 - 2016	1.2E-01	4.9E-02	141%	1.5E-01	6.7E-02	125%	1.1E-01	7.4E-02	53%
	2016	1.5E-01	5.2E-02	193%	1.6E-01	8.0E-02	96%	1.3E-01	8.7E-02	52%

Average Emissions Density for People Living in Tract with Emissions (2 of 3)
(tons / year / sq mile estimated at the census tract level)

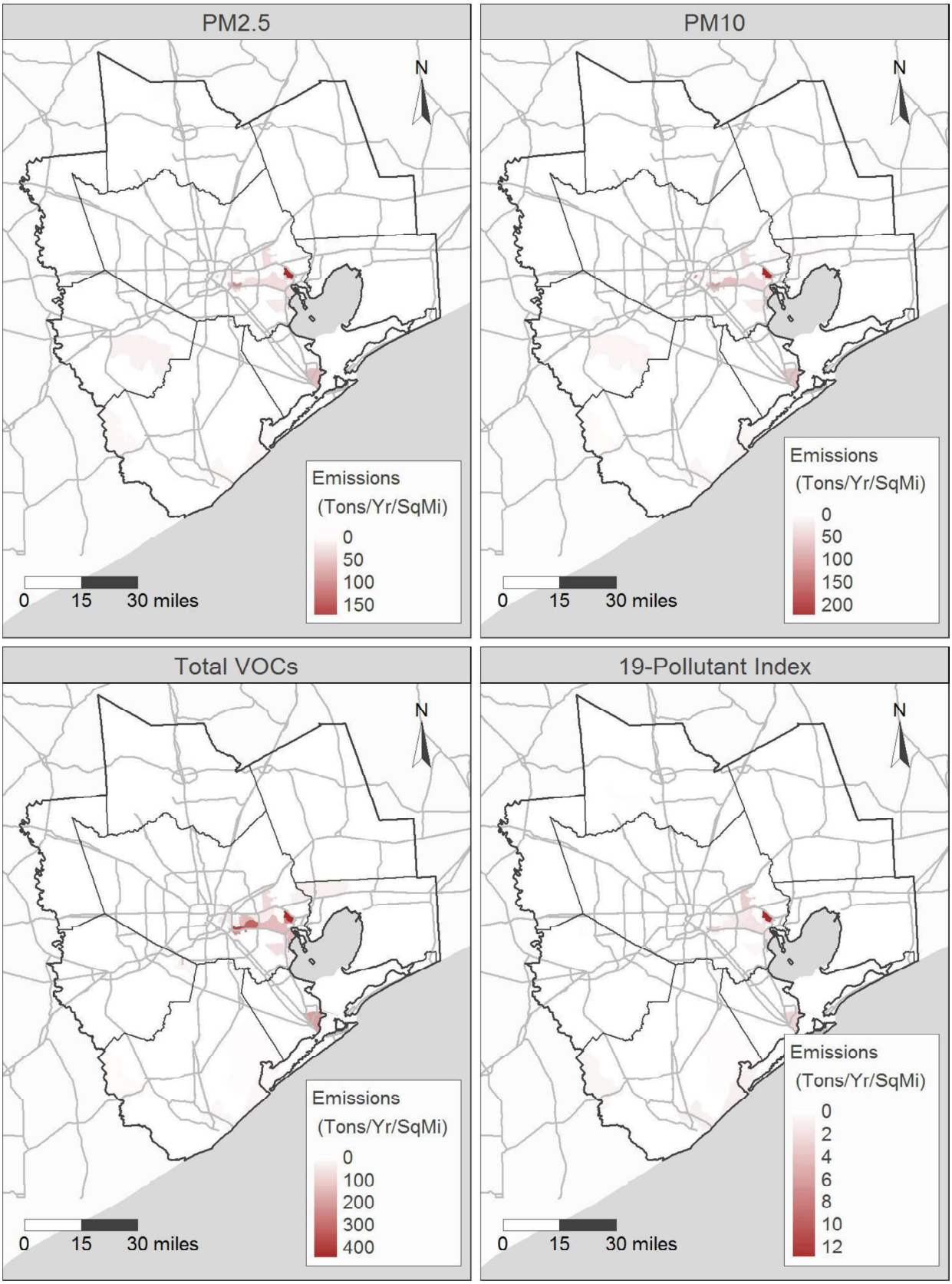
Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Chromium and compounds	2007 - 2016	2.8E-03	4.5E-03	-38%	2.2E-03	3.3E-03	-32%	3.6E-03	3.4E-03	6%
	2012 - 2016	3.9E-03	4.7E-03	-18%	1.7E-03	3.4E-03	-50%	6.8E-03	3.3E-03	107%
	2016	7.3E-03	8.5E-03	-14%	2.8E-03	5.9E-03	-53%	1.3E-02	5.8E-03	125%
Diaminotoluene (mixed isomers)	2007 - 2016	1.1E-04	1.5E-04	-27%	1.8E-04	1.4E-04	27%	3.8E-05	1.5E-04	-75%
	2012 - 2016	2.8E-05	5.6E-06	398%	3.0E-05	1.1E-05	182%	2.3E-05	1.1E-05	106%
	2016	1.2E-06	1.2E-06	0%	1.2E-06	1.2E-06	0%	1.2E-06	1.2E-06	0%
Fluoranthene	2007 - 2016	6.7E-04	1.1E-03	-37%	7.8E-04	9.1E-04	-14%	2.8E-04	9.4E-04	-71%
	2012 - 2016	2.1E-04	3.5E-04	-42%	6.1E-05	2.7E-04	-78%	2.9E-04	2.2E-04	32%
	2016	2.1E-04	3.4E-04	-39%	8.1E-05	2.7E-04	-70%	2.9E-04	2.2E-04	28%
Formaldehyde	2007 - 2016	8.8E-02	8.2E-02	7%	7.5E-02	8.5E-02	-12%	8.6E-02	8.5E-02	0%
	2012 - 2016	8.7E-02	7.9E-02	11%	8.1E-02	8.2E-02	-2%	9.3E-02	8.2E-02	13%
	2016	1.1E-01	9.7E-02	13%	9.8E-02	1.1E-01	-14%	1.3E-01	1.1E-01	19%
Hydrogen chloride	2007 - 2016	3.9E-01	1.2E-01	224%	3.1E-01	2.3E-01	33%	3.0E-01	2.3E-01	28%
	2012 - 2016	4.7E-01	1.4E-01	235%	3.6E-01	2.8E-01	26%	3.7E-01	2.8E-01	30%
	2016	2.7E-01	1.4E-01	88%	2.2E-01	1.9E-01	16%	2.2E-01	2.0E-01	11%
Hydrogen cyanide gas	2007 - 2016	2.4E+00	6.3E-01	286%	1.6E+00	1.5E+00	5%	4.0E+00	1.1E+00	255%
	2012 - 2016	5.0E+00	1.3E+00	285%	3.2E+00	3.3E+00	-4%	8.3E+00	2.4E+00	253%
	2016	1.1E+01	2.0E+00	442%	6.3E+00	6.3E+00	0%	1.7E+01	4.4E+00	291%
Hydrogen sulfide	2007 - 2016	2.1E-01	9.3E-02	129%	1.6E-01	1.3E-01	26%	2.5E-01	1.2E-01	105%
	2012 - 2016	2.3E-01	9.4E-02	142%	1.8E-01	1.3E-01	33%	3.0E-01	1.3E-01	132%
	2016	3.4E-01	1.1E-01	200%	2.7E-01	1.9E-01	40%	4.4E-01	1.8E-01	145%
Naphthalene	2007 - 2016	6.7E-02	4.0E-02	66%	7.1E-02	4.9E-02	44%	8.7E-02	4.5E-02	91%
	2012 - 2016	7.5E-02	5.1E-02	46%	8.0E-02	5.7E-02	41%	9.9E-02	5.5E-02	81%
	2016	6.7E-02	5.4E-02	24%	8.1E-02	5.2E-02	55%	9.7E-02	5.2E-02	88%
Phenanthrene	2007 - 2016	2.1E-02	2.4E-02	-12%	7.7E-03	2.0E-02	-61%	2.5E-02	1.9E-02	37%
	2012 - 2016	4.2E-02	6.6E-02	-36%	1.4E-02	4.5E-02	-69%	5.4E-02	4.3E-02	25%
	2016	4.3E-02	6.3E-02	-31%	1.4E-02	4.4E-02	-68%	5.4E-02	4.3E-02	25%

Average Emissions Density for People Living in Tract with Emissions (3 of 3)
(tons / year / sq mile estimated at the census tract level)

Pollutant	Year range	People of Color (POC)	Non POC	% Difference (POC - NonPOC) / NonPOC	People Living in Poverty (POV)	Non POV	% Difference (POV - NonPOV) / NonPOV	Limited English Household (LEH)	Non LEH	% Difference (LEH - NonLEH) / NonLEH
Pyrene	2007 - 2016	7.4E-04	2.0E-03	-64%	1.4E-03	1.1E-03	36%	3.0E-04	1.2E-03	-76%
	2012 - 2016	3.4E-04	5.9E-04	-43%	9.4E-05	4.5E-04	-79%	4.9E-04	3.6E-04	33%
	2016	3.1E-04	5.4E-04	-42%	9.2E-05	4.2E-04	-78%	4.5E-04	3.4E-04	33%

Appendix B: Additional Regionwide Maps of Four Pollution Categories

2012 to 2016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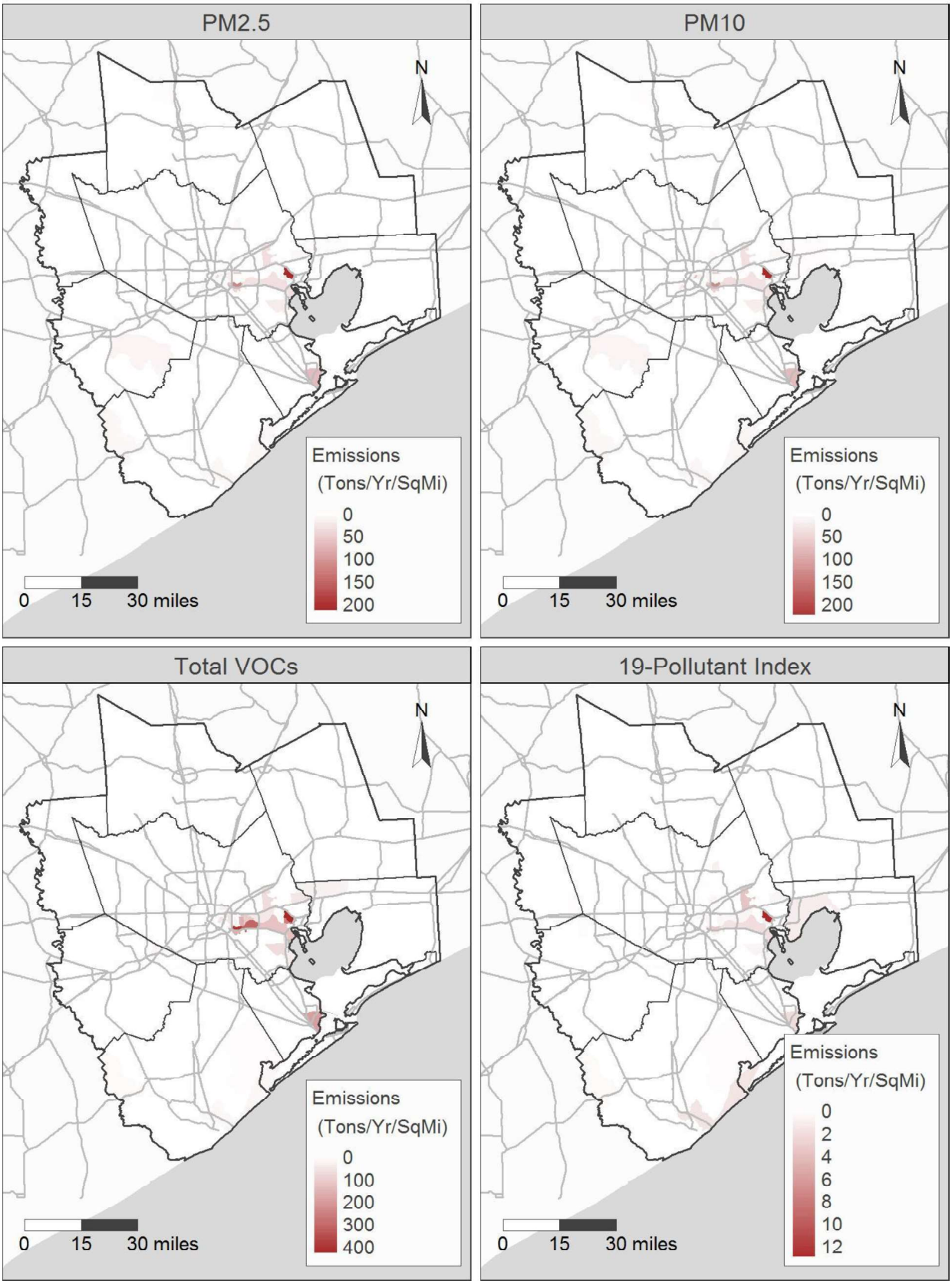
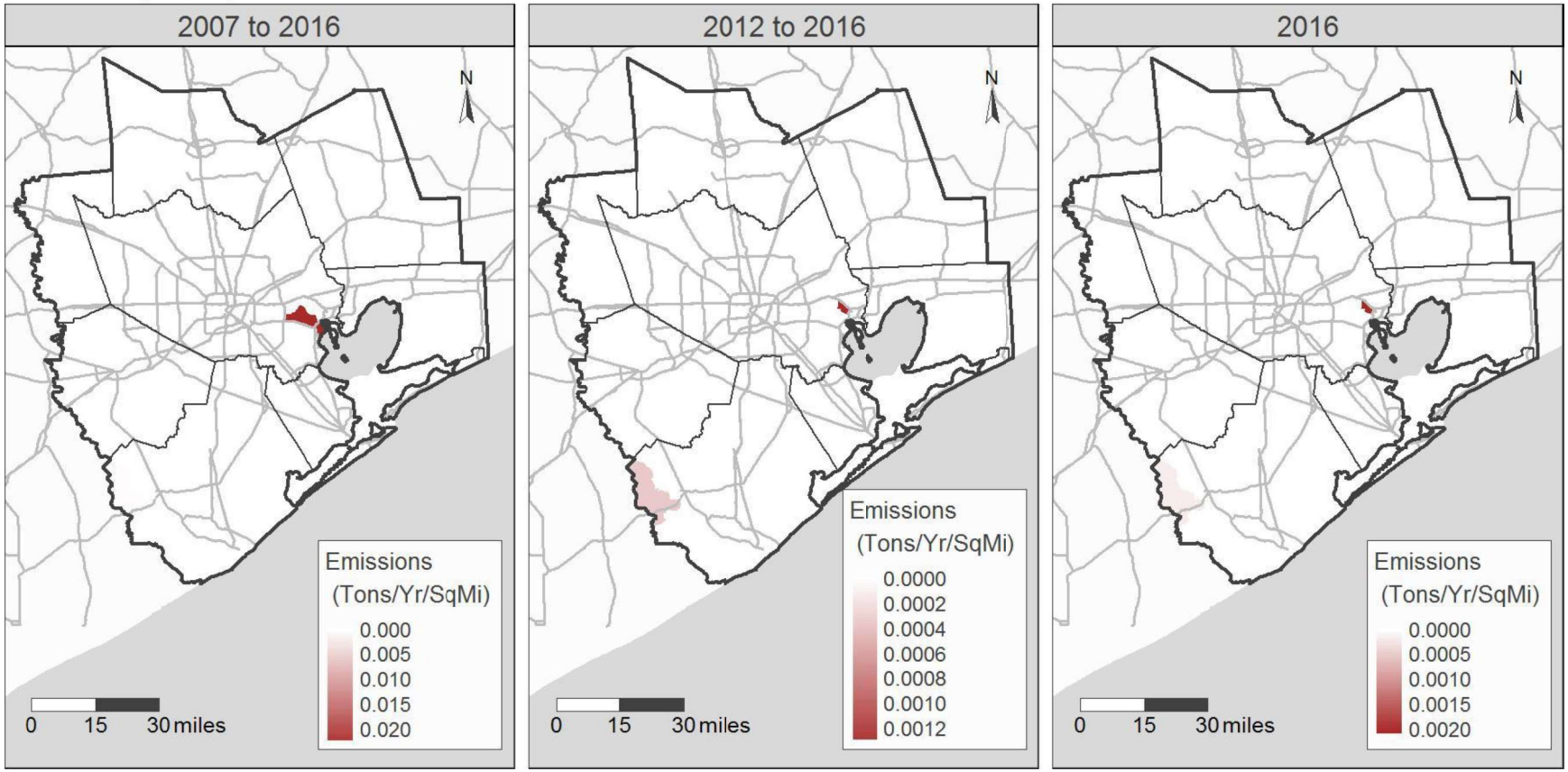
Emissions
(Tons/Yr/SqMi)
0
50
100
150
0 15 30 miles
PM10
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0 15 30 miles
Total VOCs
N
Emissions
(Tons/Yr/SqMi)
0
100
200
300
400
0 15 30 miles
19-Pollutant Index
N
Emissions
(Tons/Yr/SqMi)
0
2
4
6
8
10
12
0 15 30 miles

2016

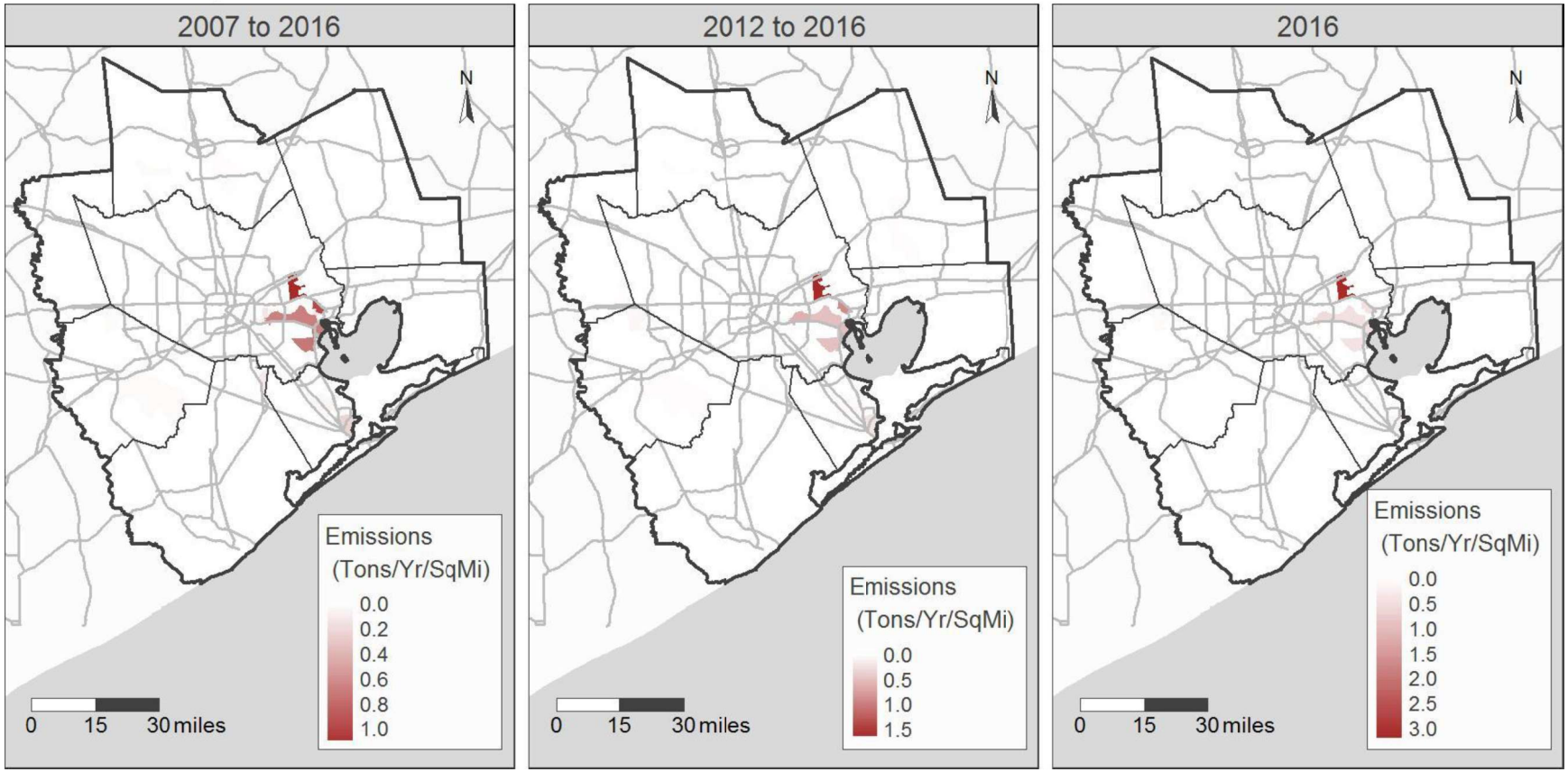

PM2.5
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0 15 30 miles
PM10
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0 15 30 miles
Total VOCs
N
Emissions
(Tons/Yr/SqMi)
0
100
200
300
400
0 15 30 miles
19-Pollutant Index
N
Emissions
(Tons/Yr/SqMi)
0
2
4
6
8
10
12
0 15 30 miles

Appendix C: Regionwide Maps of 19 Pollutants of Concern

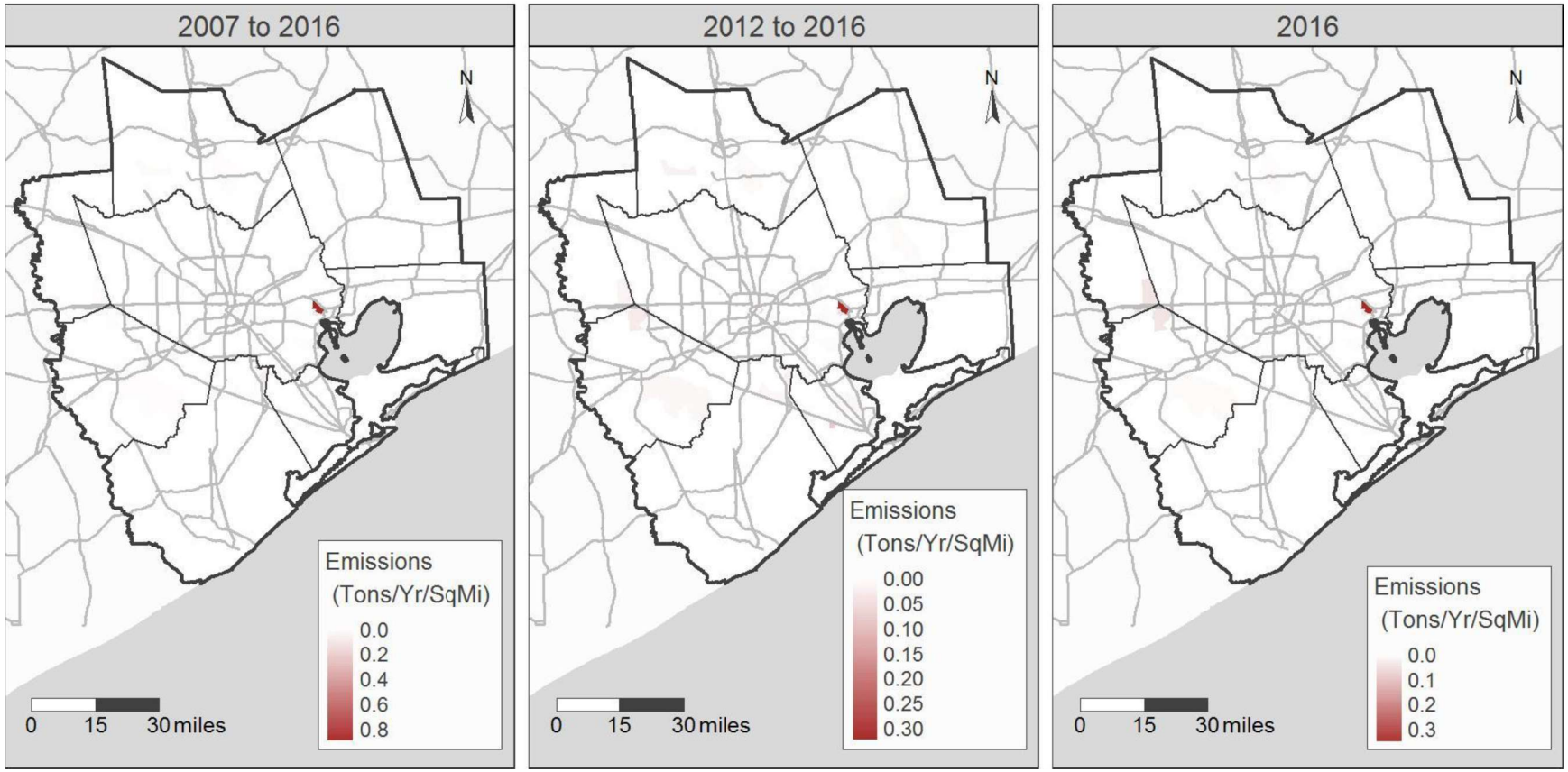
Acenaphthylene



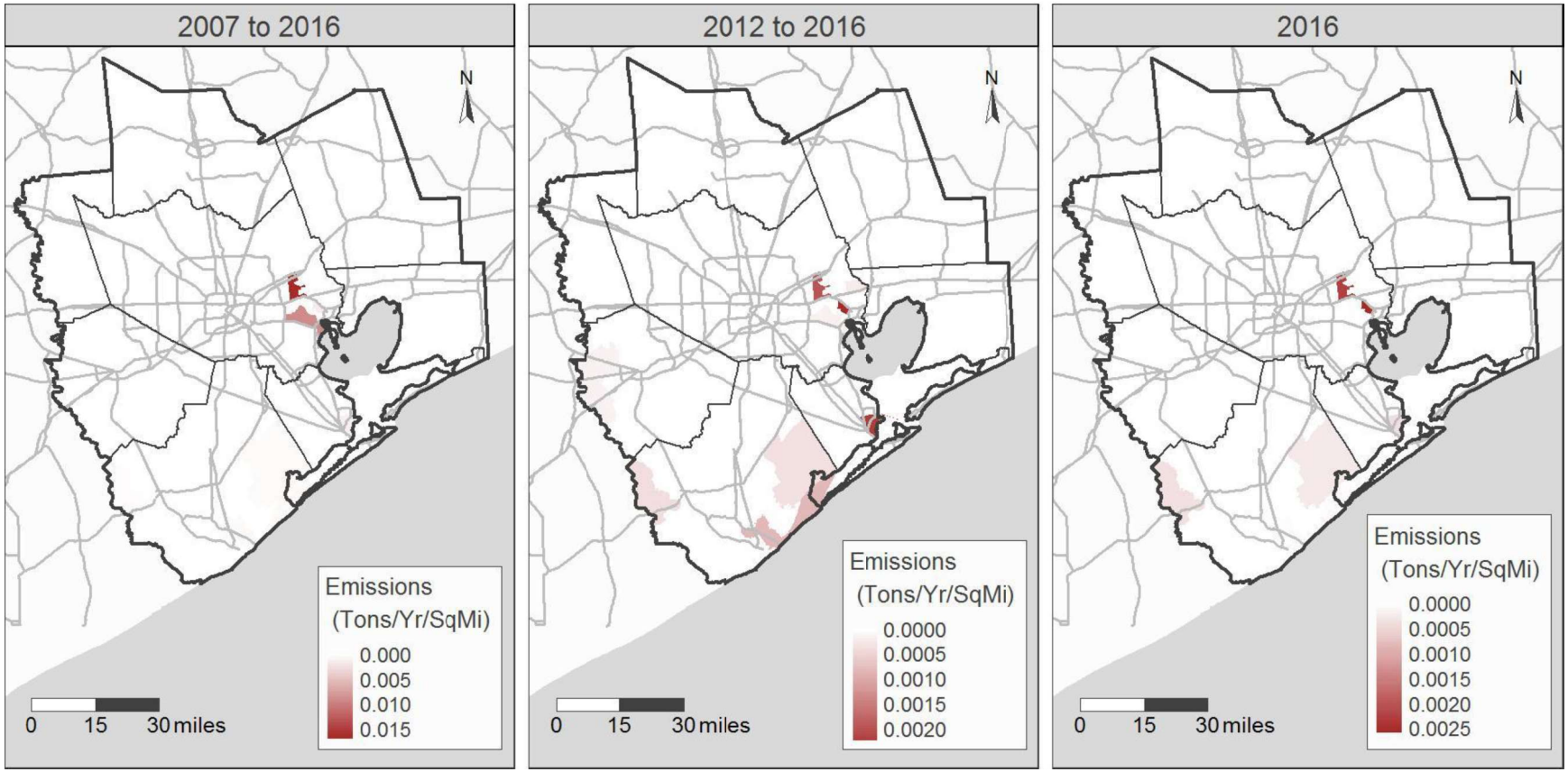
Acetaldehyde



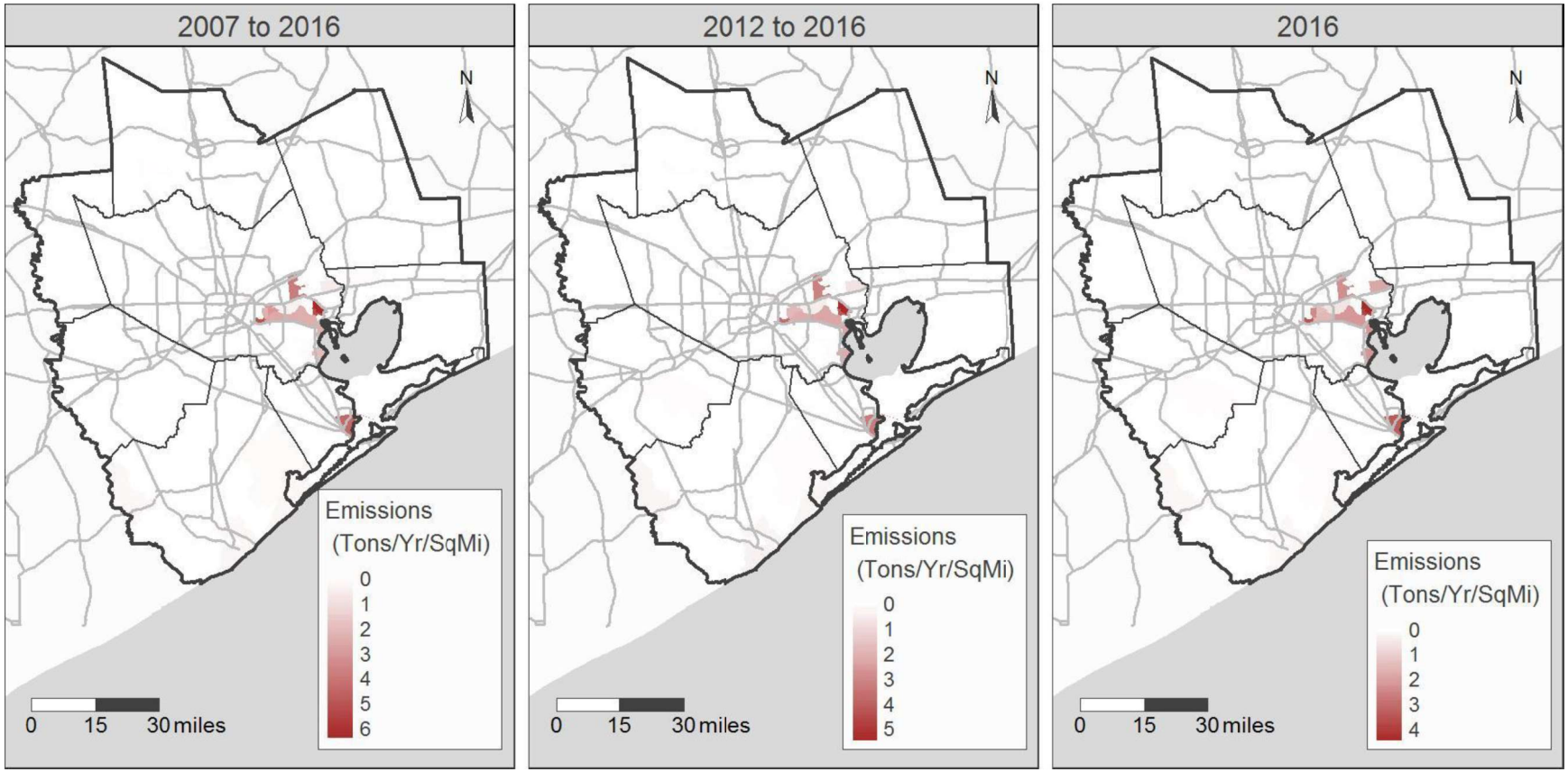
Acrolein


2007 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.0
0.2
0.4
0.6
0.8
0
15
30 miles
2012 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
15
30 miles
2016
N
Emissions
(Tons/Yr/SqMi)
0.0
0.1
0.2
0.3
0
15
30 miles

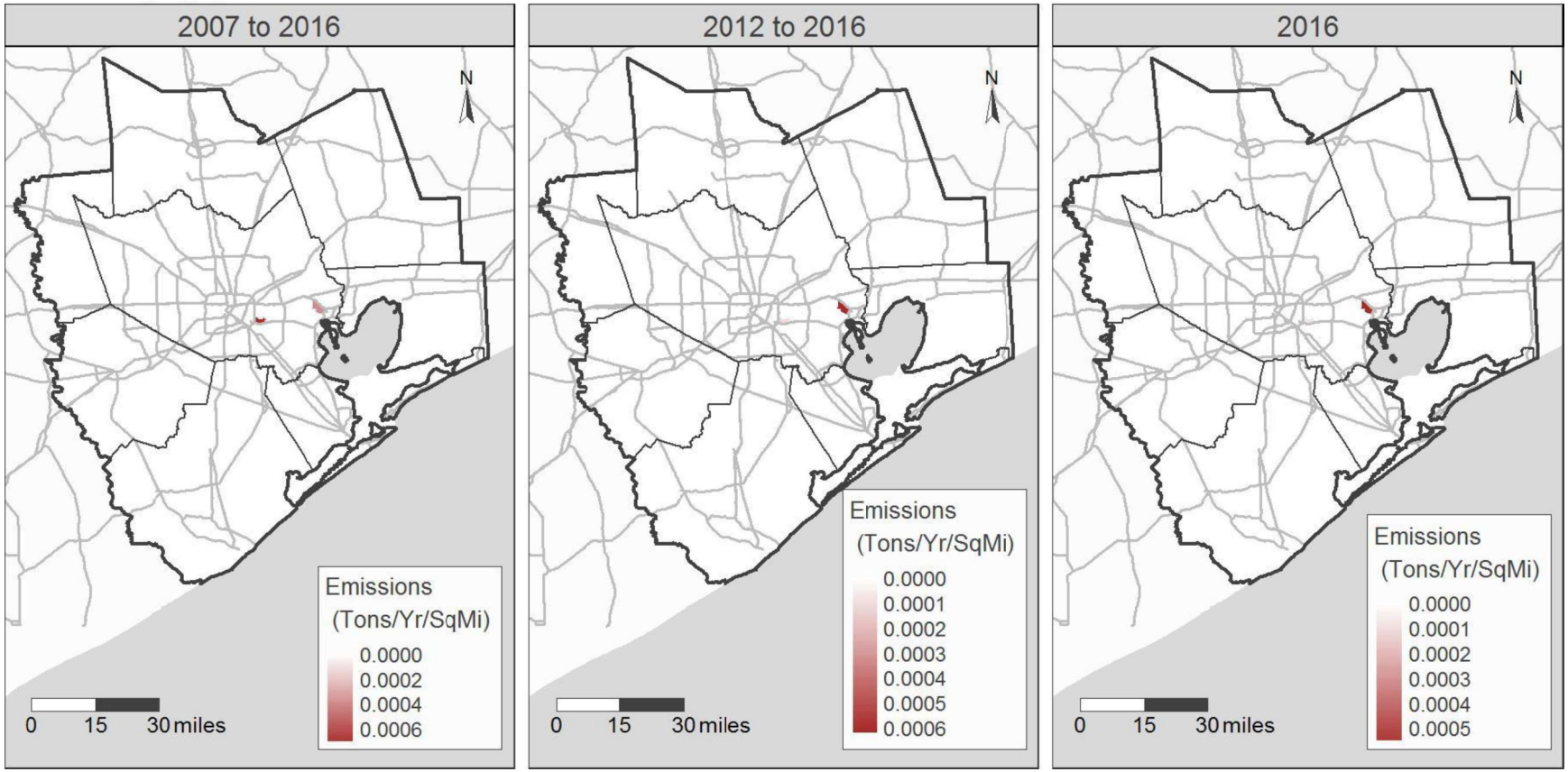
Anthracene


2007 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.000
0.005
0.010
0.015
0
15
30 miles
2012 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0
15
30 miles
2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0
15
30 miles

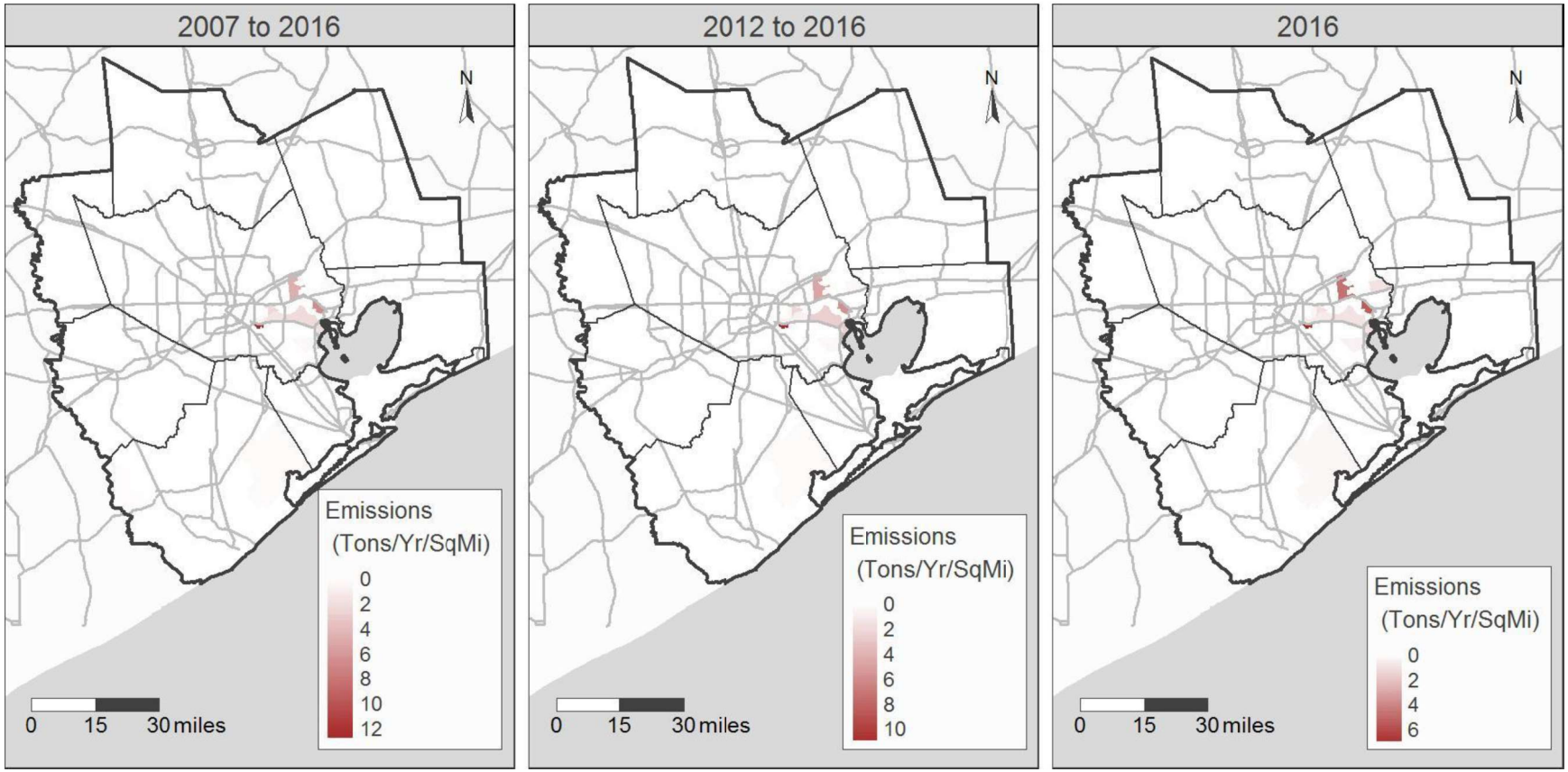
Benzene


2007 to 2016
N
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
6
0 15 30 miles
2012 to 2016
N
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
0 15 30 miles
2016
N
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
0 15 30 miles

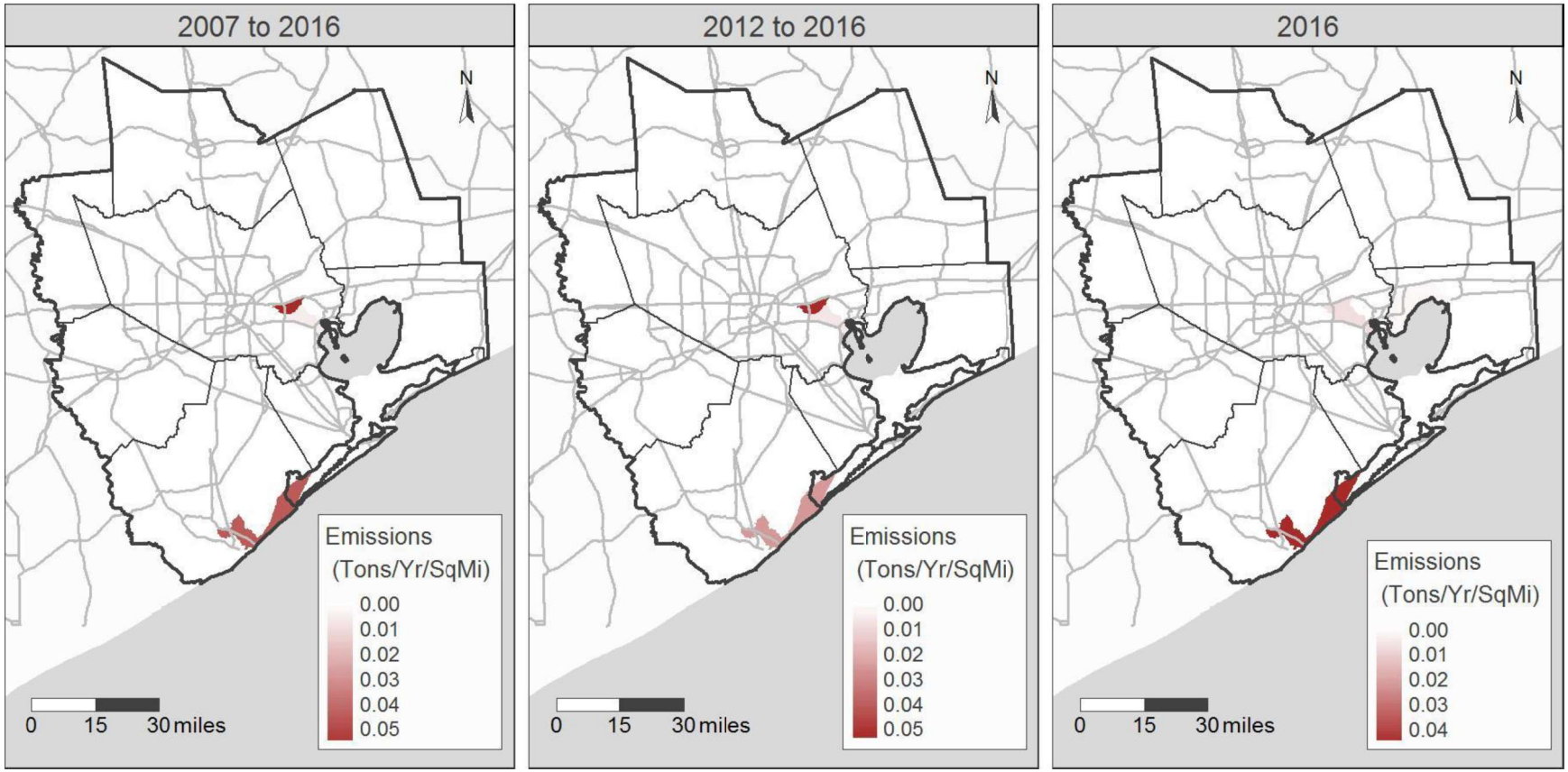
Benzo[a]pyrene



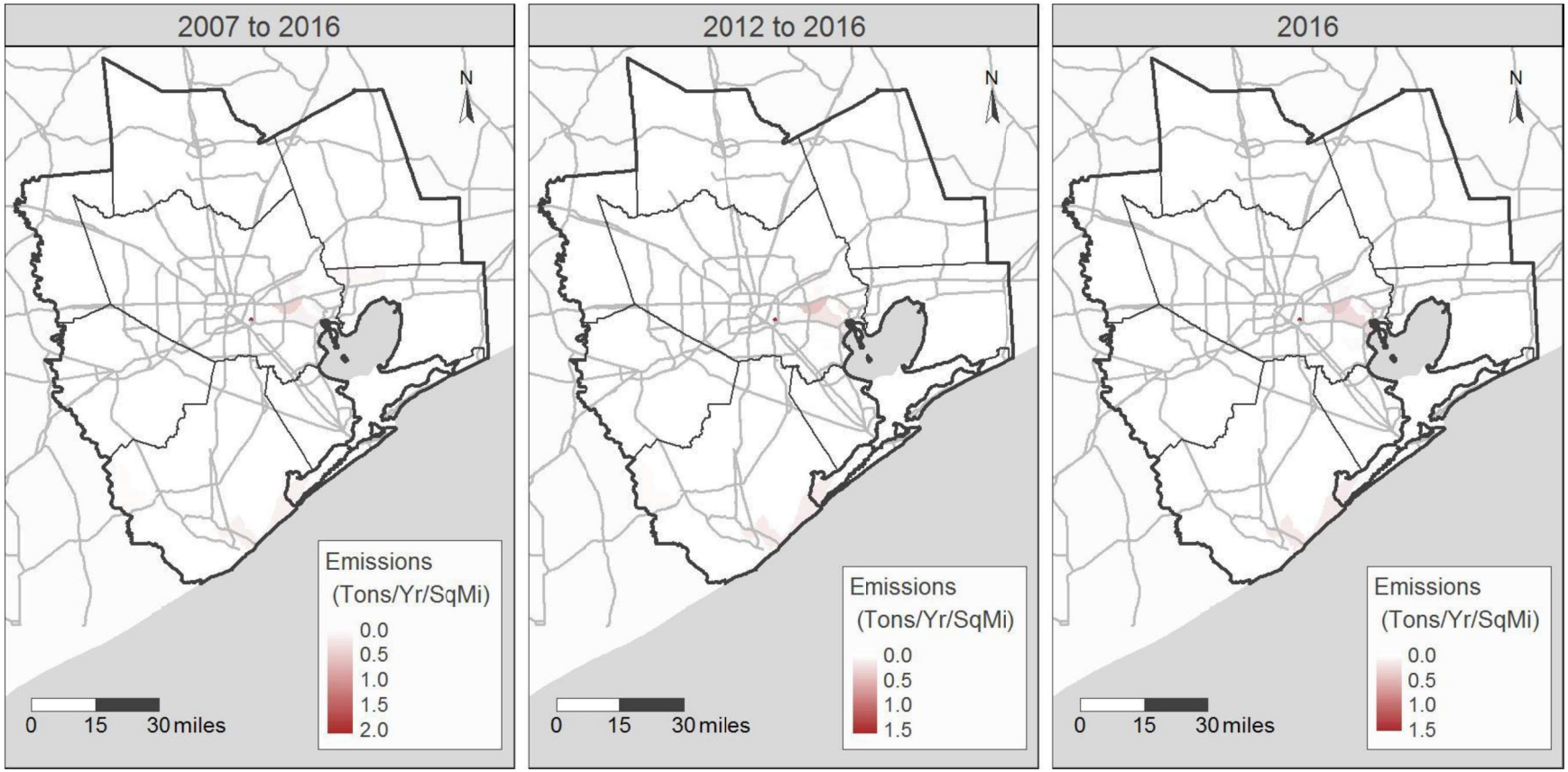
1,3-Butadiene



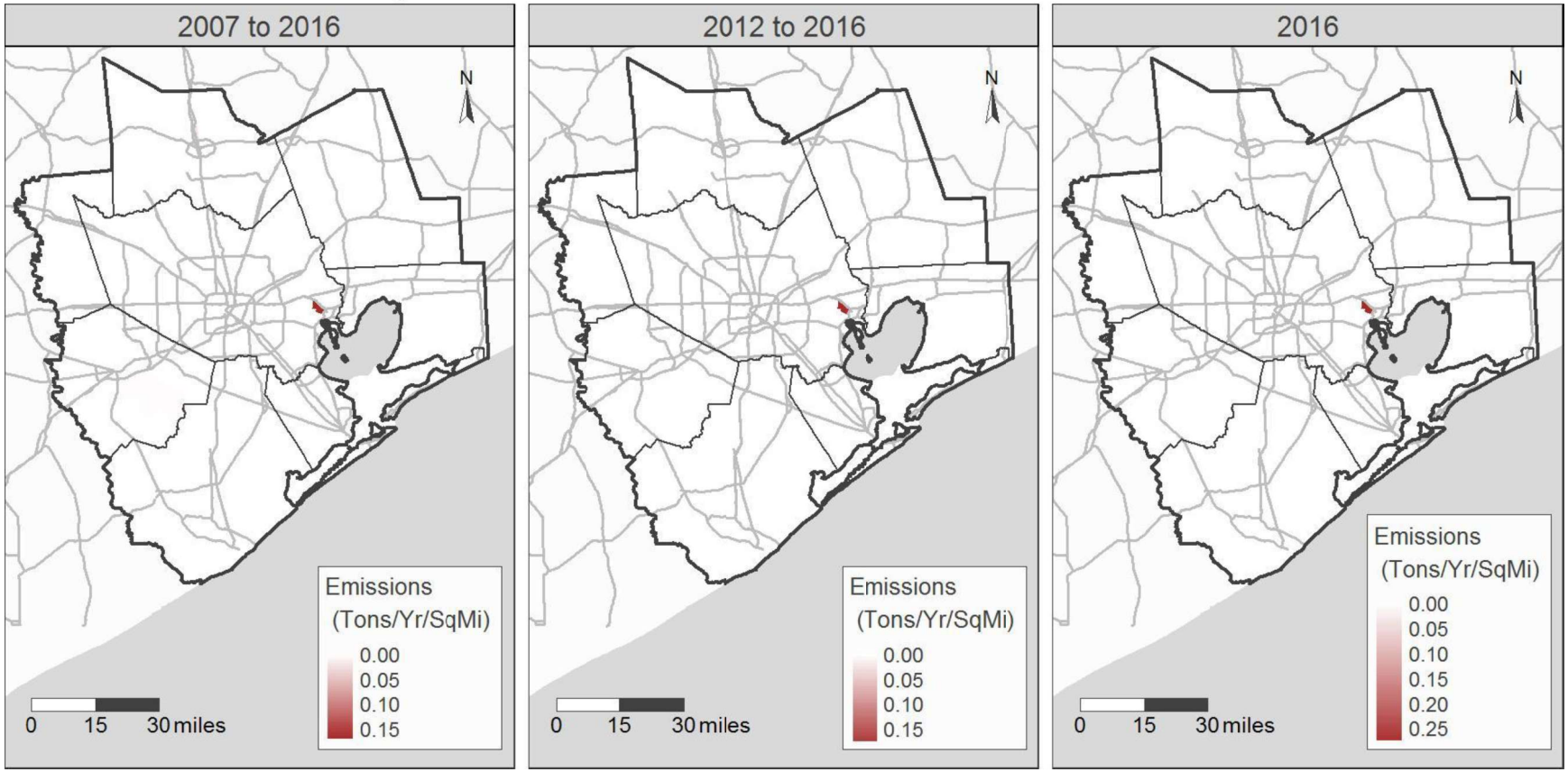
Carbon tetrachloride



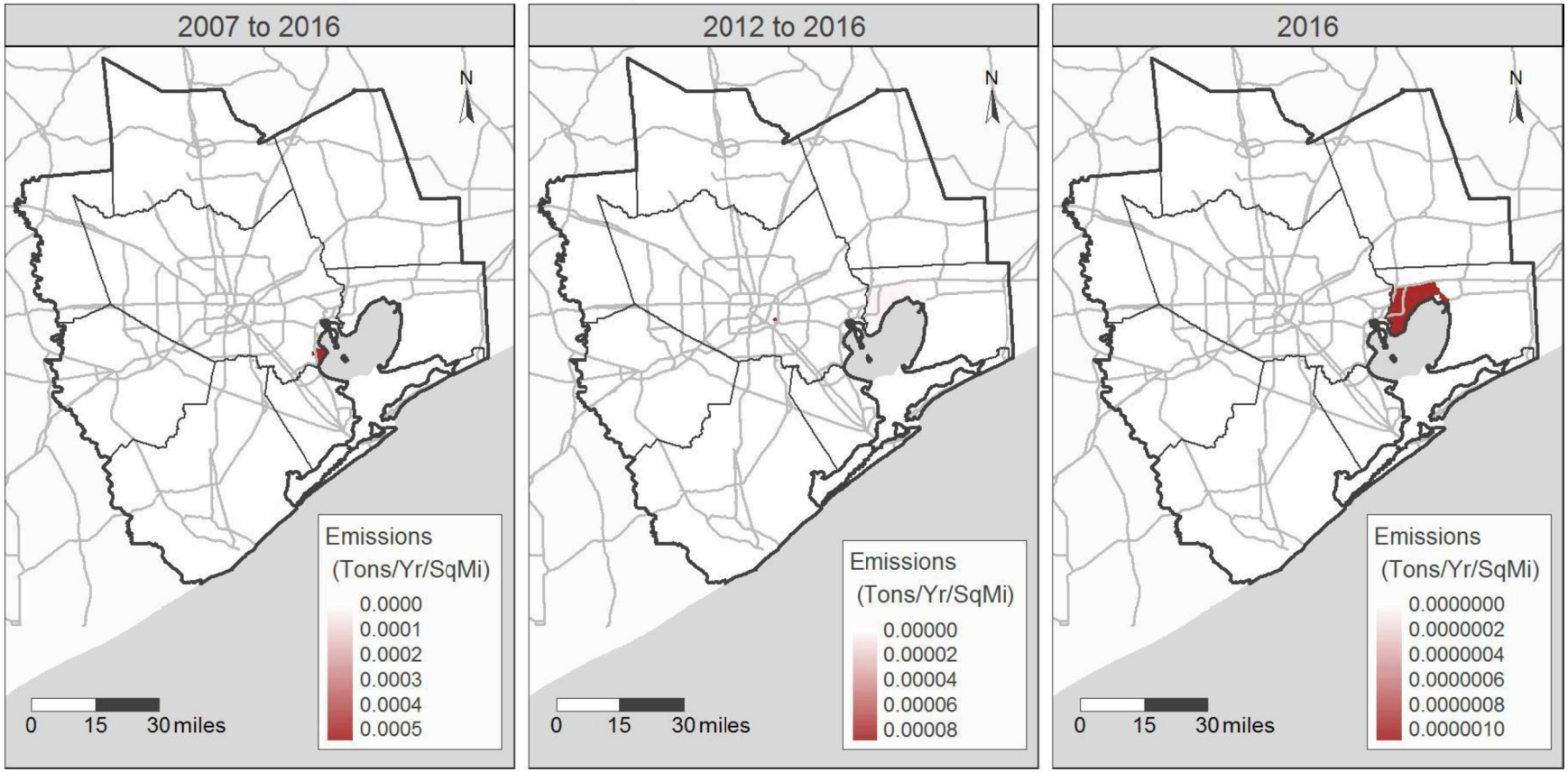
Chlorine


2007 to 2016
2012 to 2016
2016
N
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
2.0
0
15
30 miles

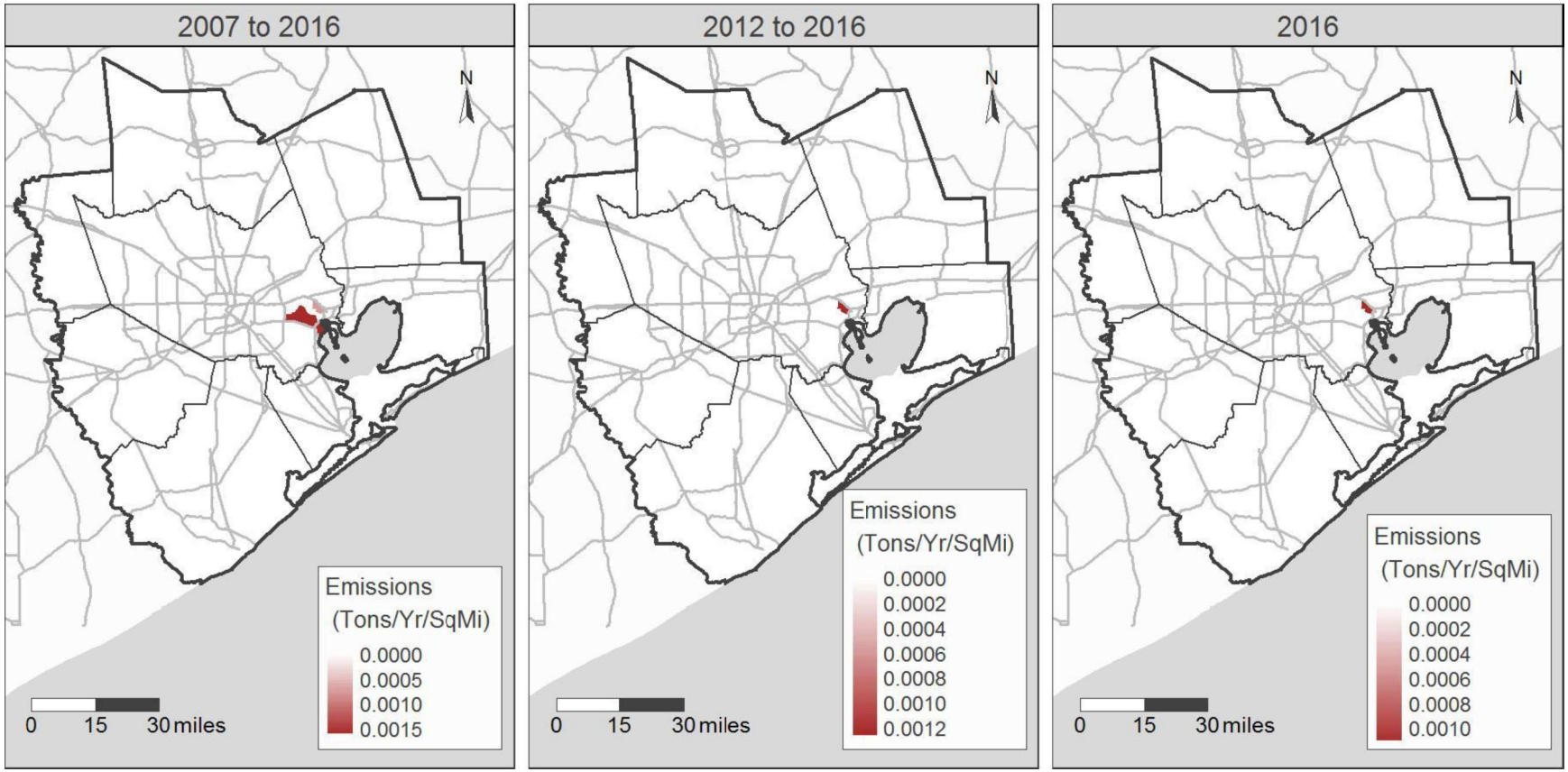
Chromium and compounds



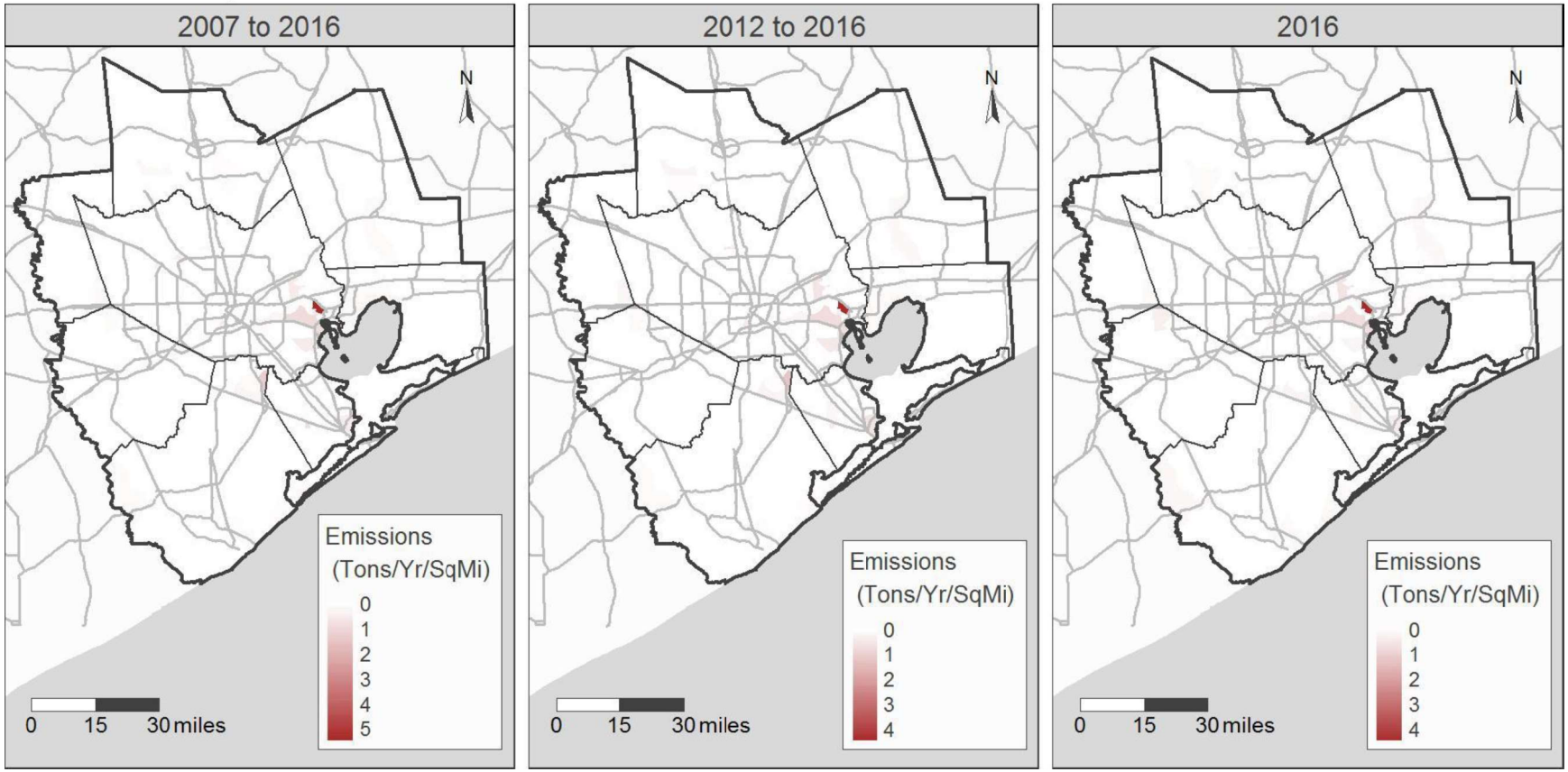
Diaminotoluene (mixed isomers)



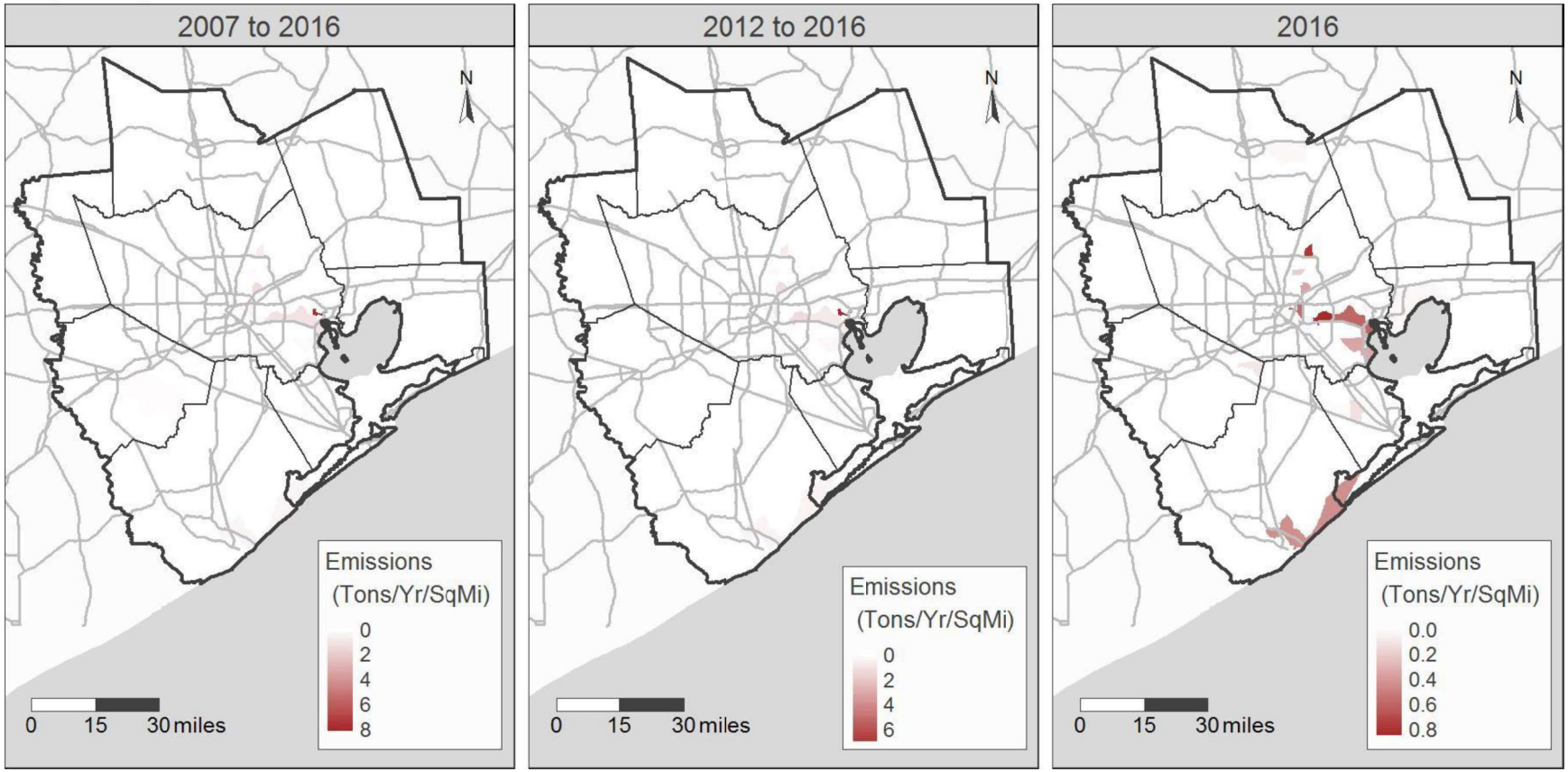
Fluoranthene



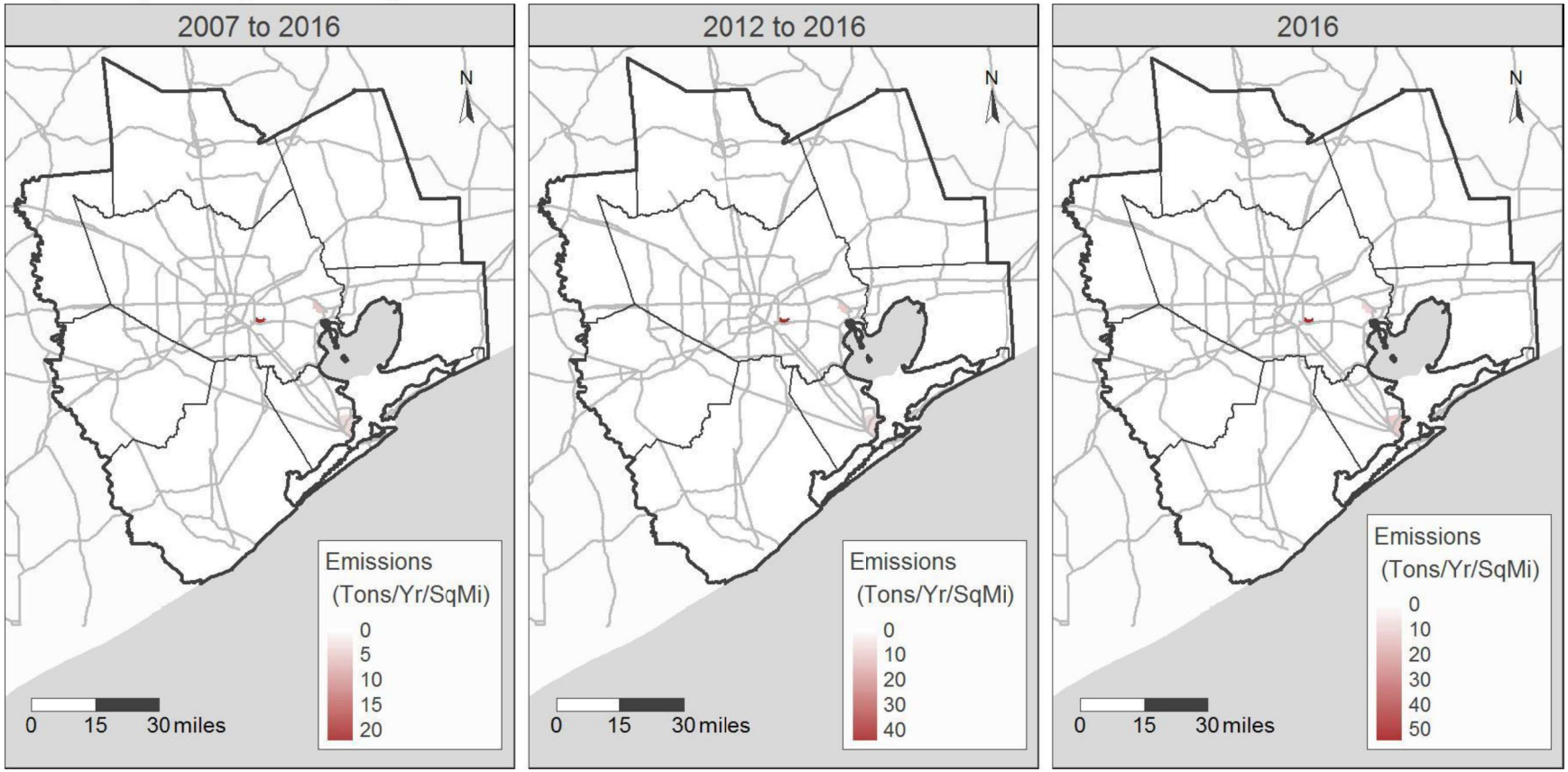
Formaldehyde



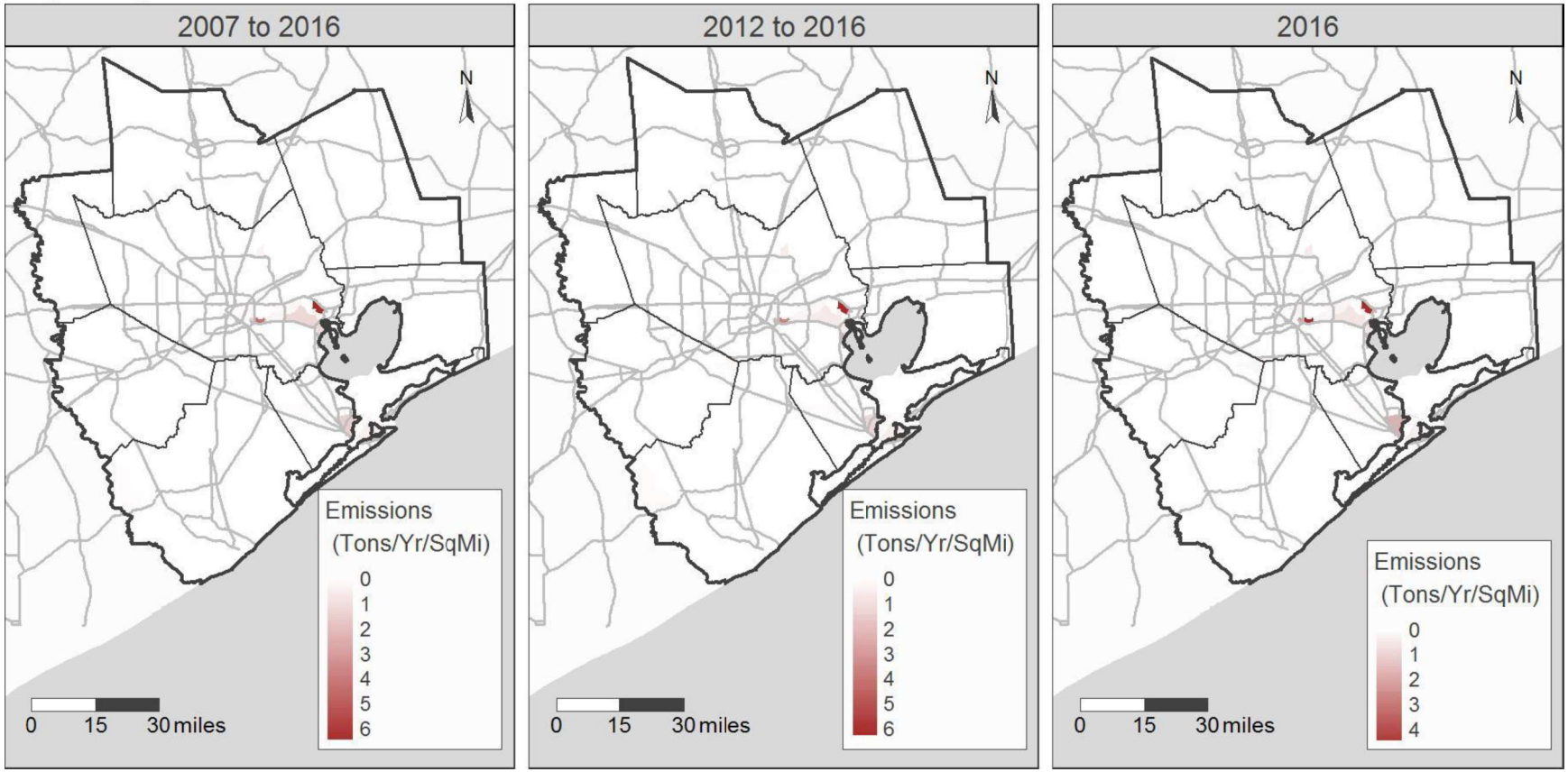
Hydrogen chloride



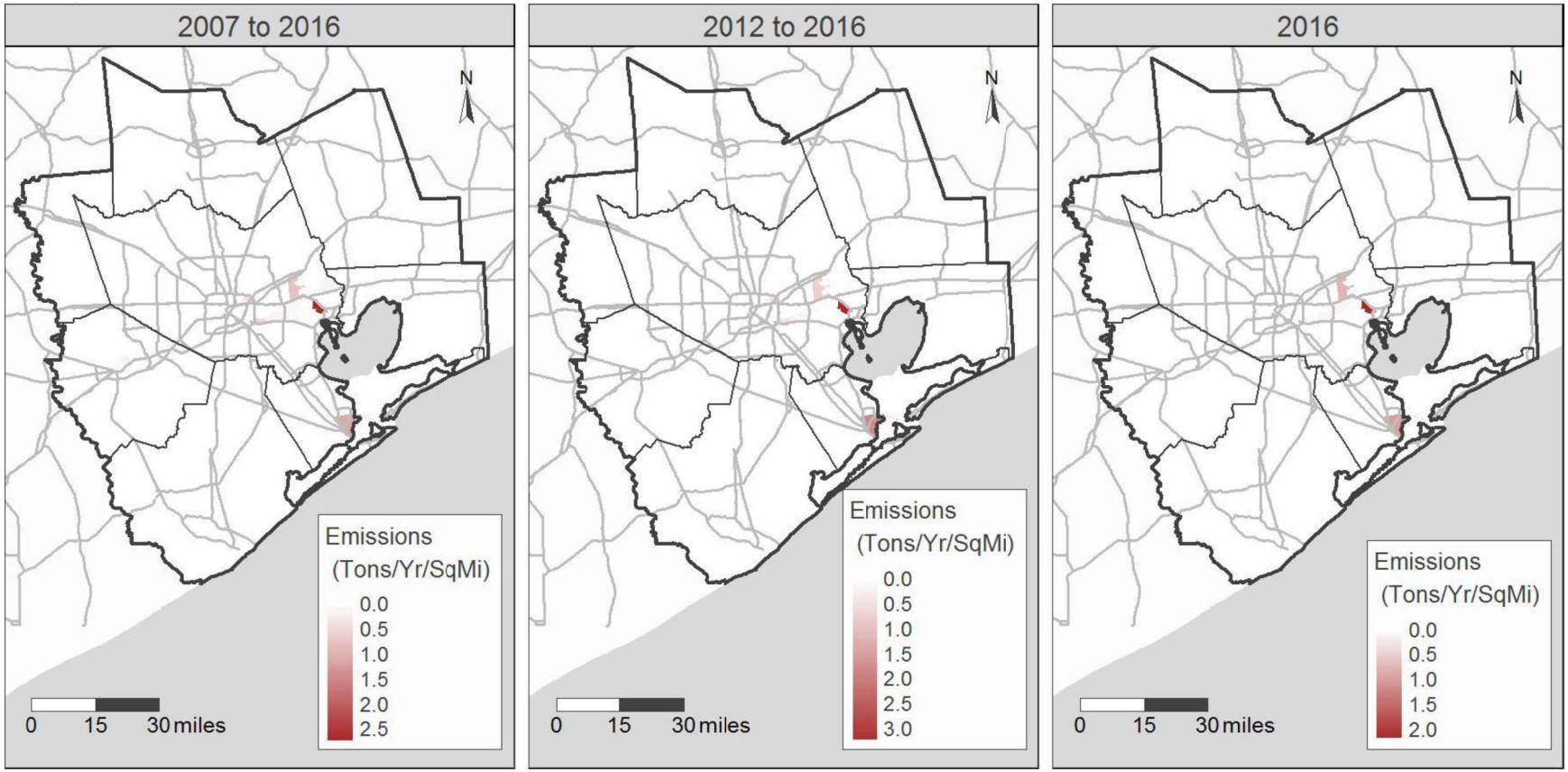
Hydrogen cyanide gas



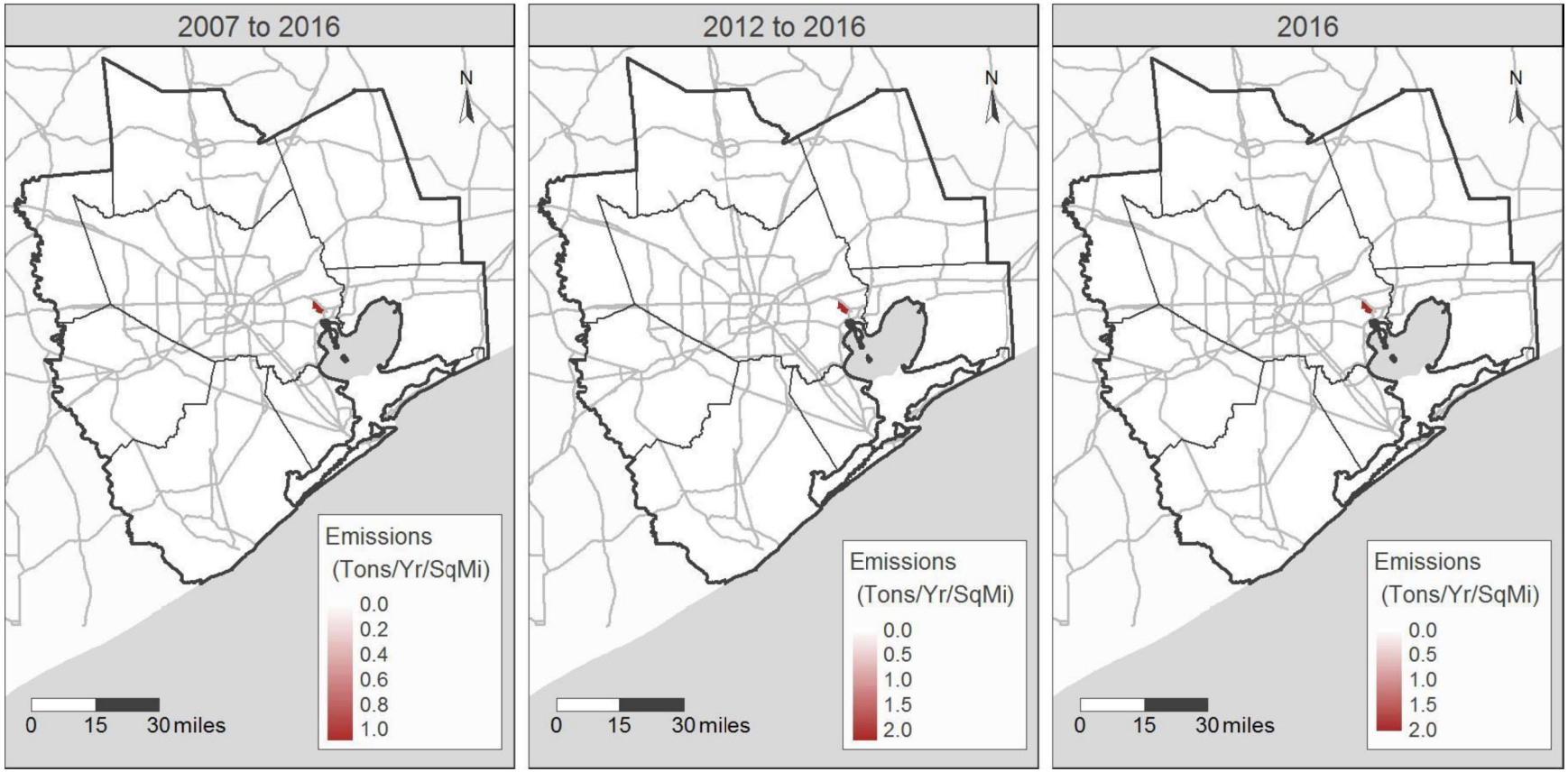
Hydrogen sulfide



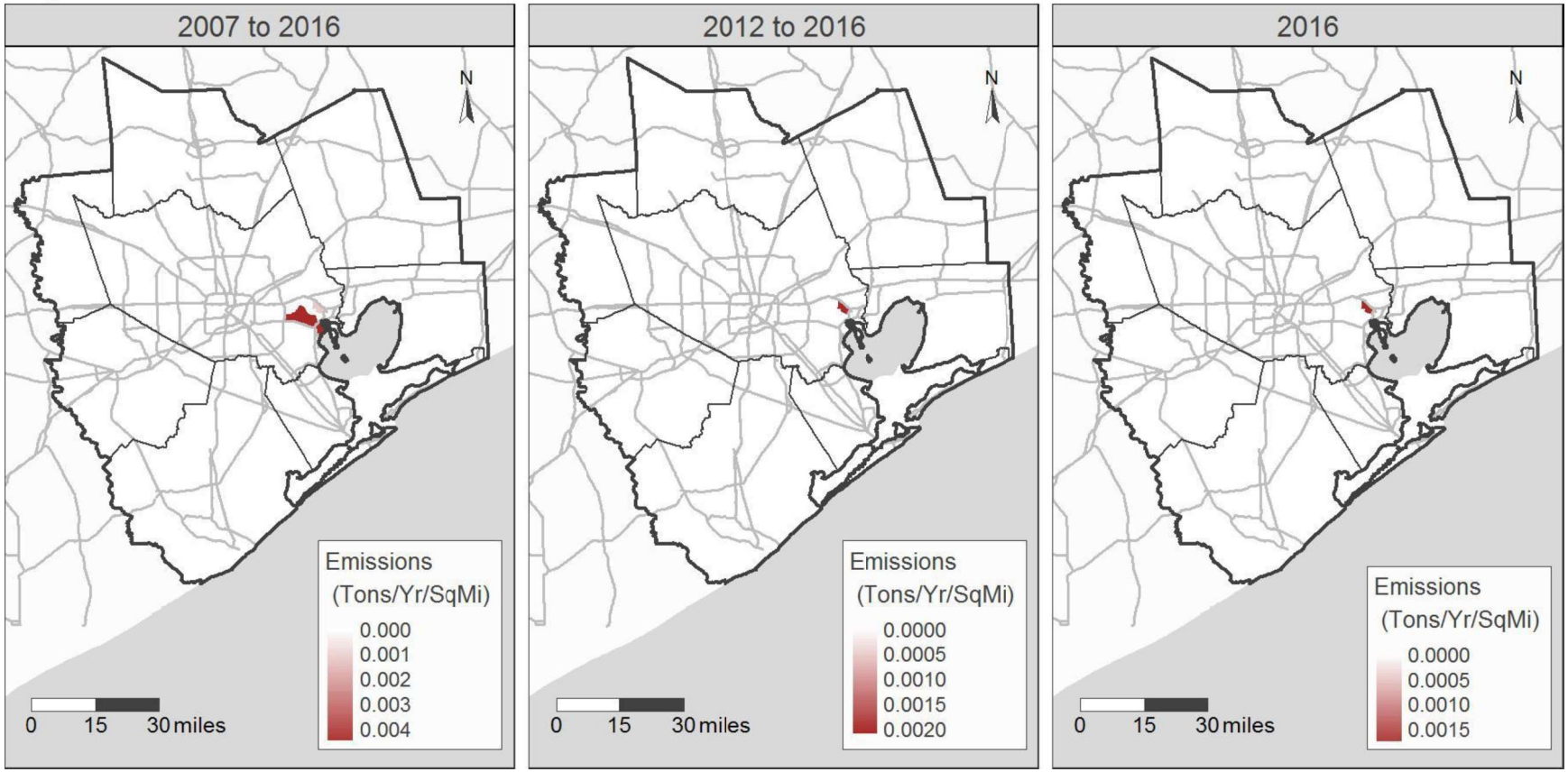
Naphthalene



Phenanthrene

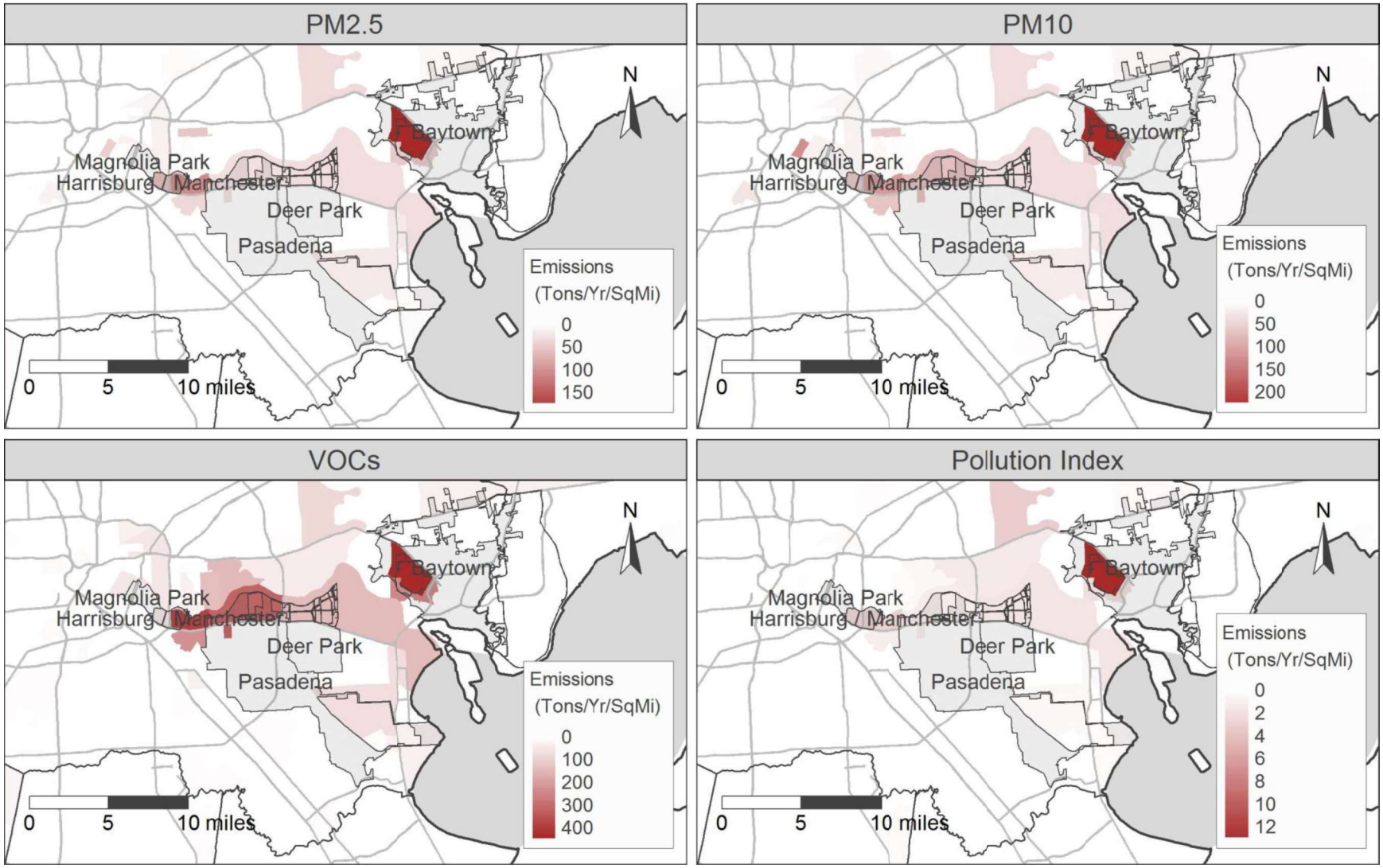


Pyrene

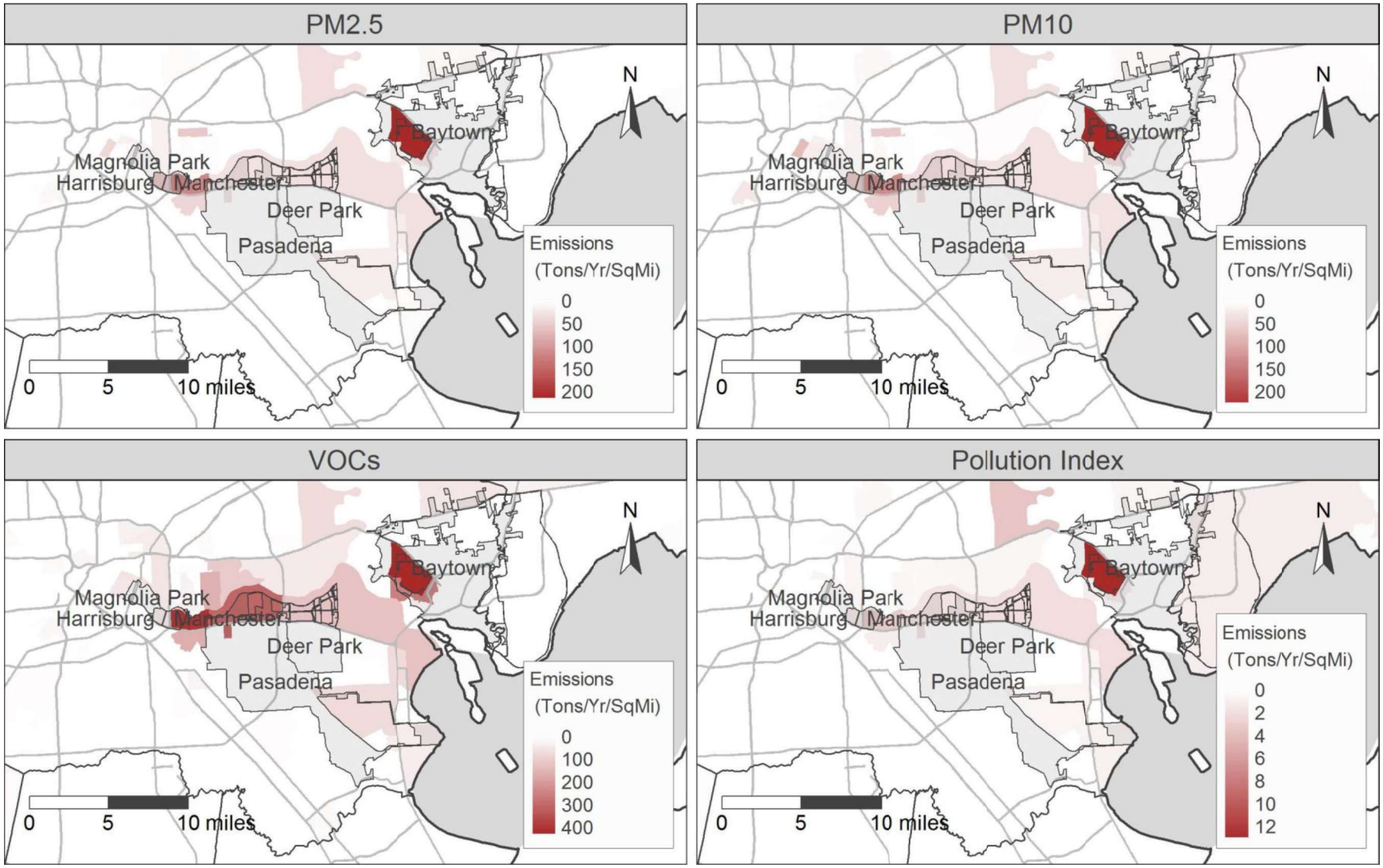

2007 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.000
0.001
0.002
0.003
0.004
0
15
30 miles
2012 to 2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0
15
30 miles
2016
N
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0
15
30 miles

Appendix D: Additional Ship Channel Maps of Four Pollution Categories

2012 to 2016

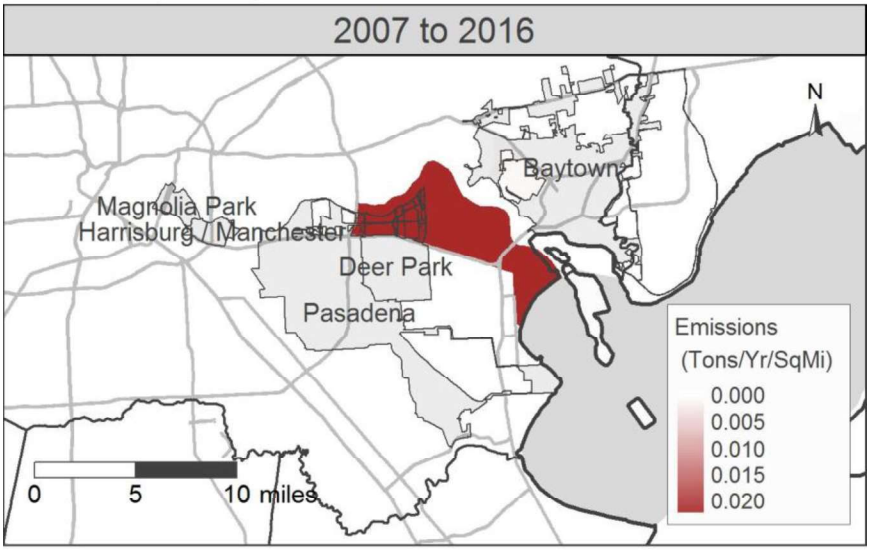

PM2.5
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
0
5
10 miles
PM10
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0
5
10 miles
VOCs
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0
100
200
300
400
0
5
10 miles
Pollution Index
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
N
Emissions
(Tons/Yr/SqMi)
0
2
4
6
8
10
12
0
5
10 miles

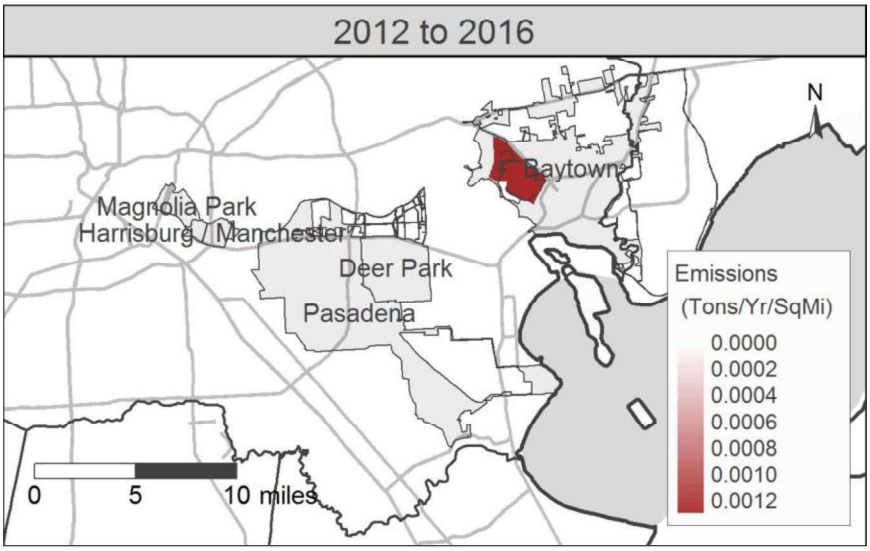
2016

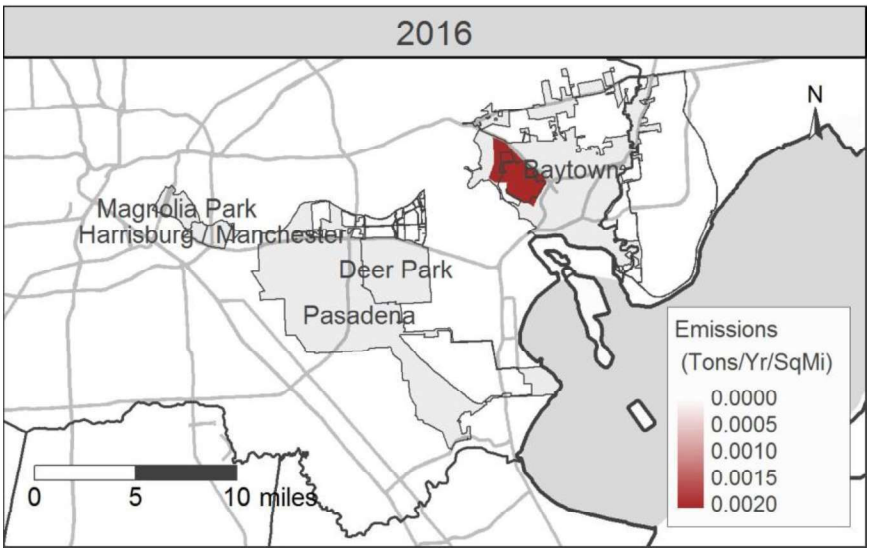

PM2.5
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Baytown
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0
5
10 miles
PM10
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Baytown
N
Emissions
(Tons/Yr/SqMi)
0
50
100
150
200
0
5
10 miles
VOCs
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Baytown
N
Emissions
(Tons/Yr/SqMi)
0
100
200
300
400
0
5
10 miles
Pollution Index
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Baytown
N
Emissions
(Tons/Yr/SqMi)
0
2
4
6
8
10
12
0
5
10 miles

Appendix E: Ship Channel Maps of 19 Pollutants of Concern

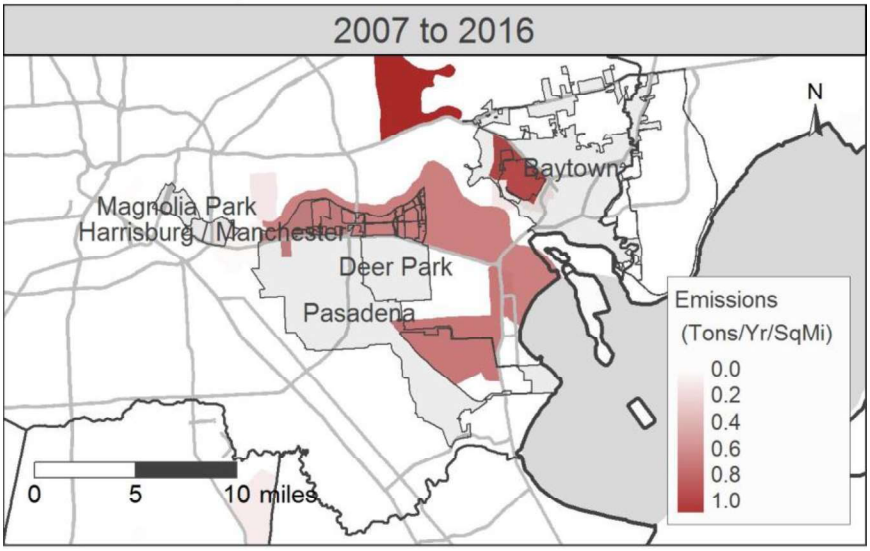
Acenaphthylene

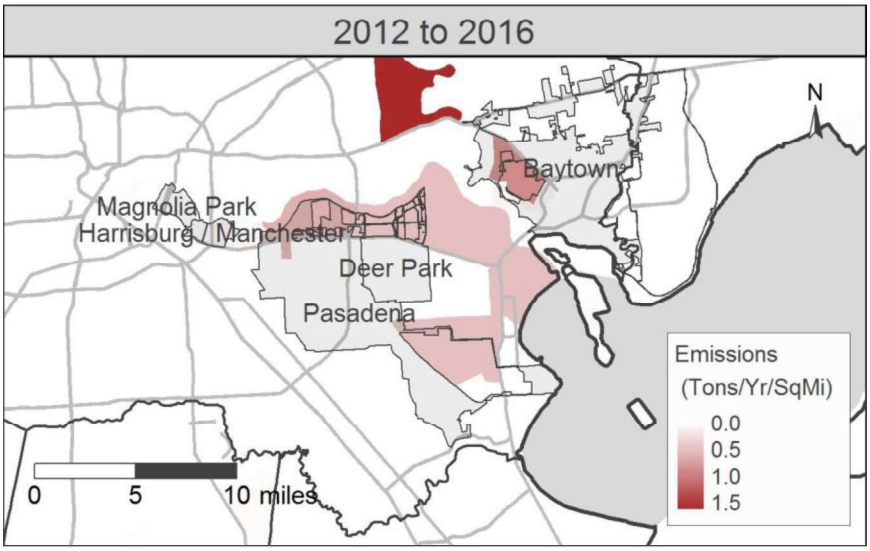


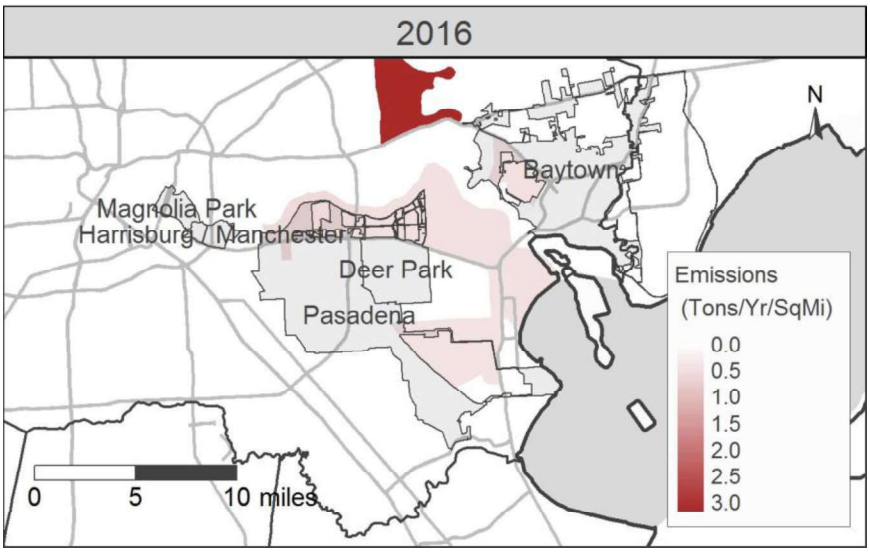




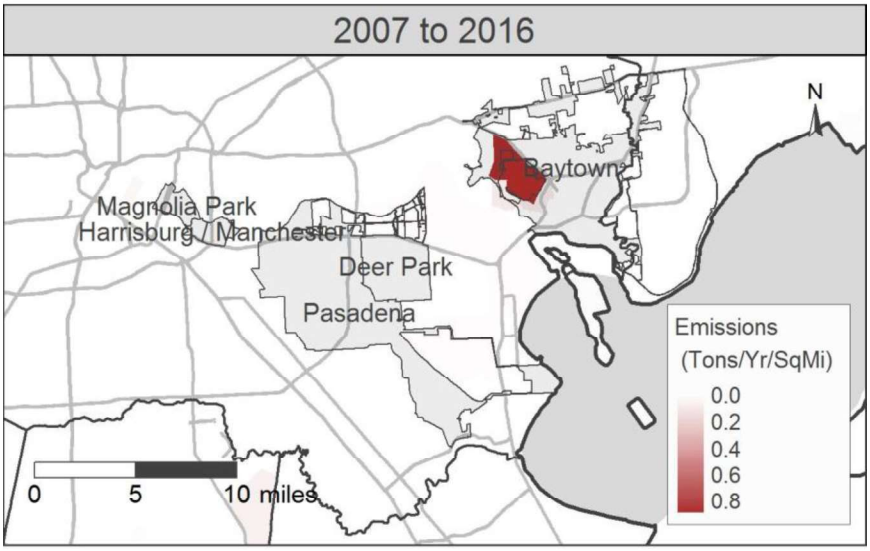
Acetaldehyde

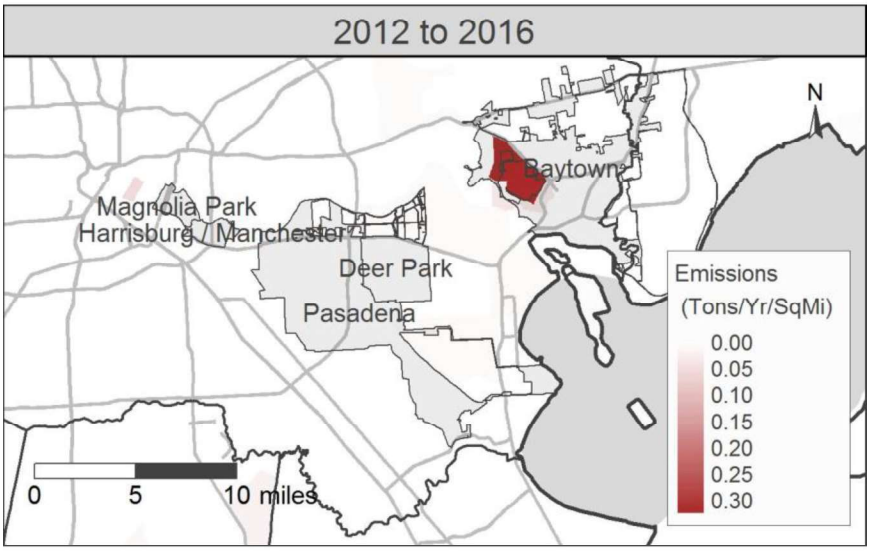


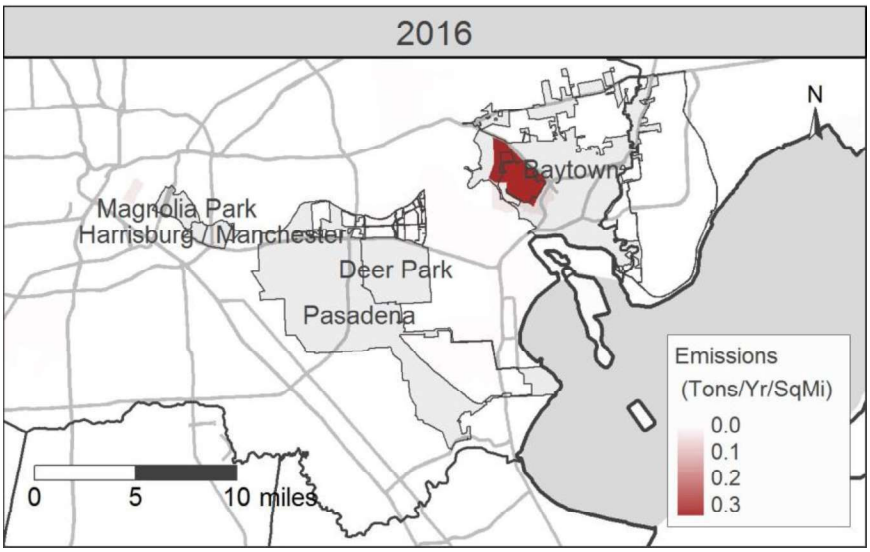




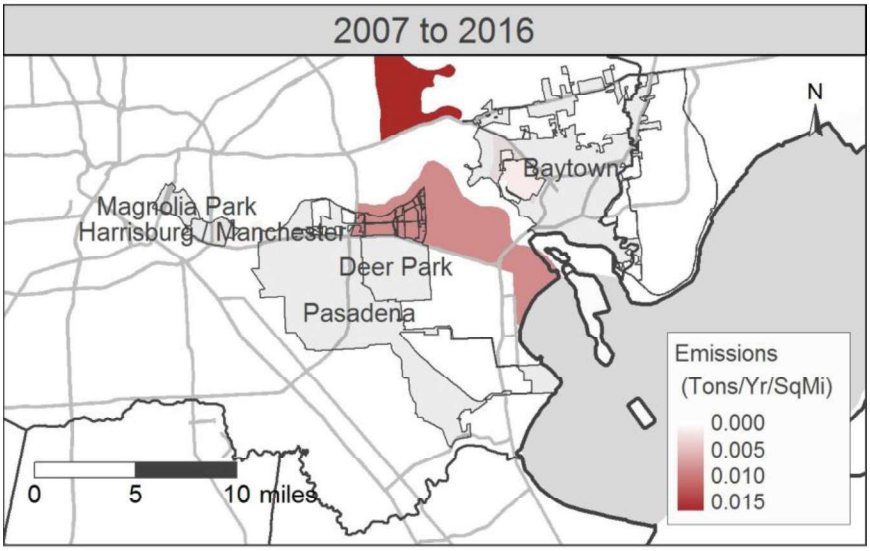
Acrolein

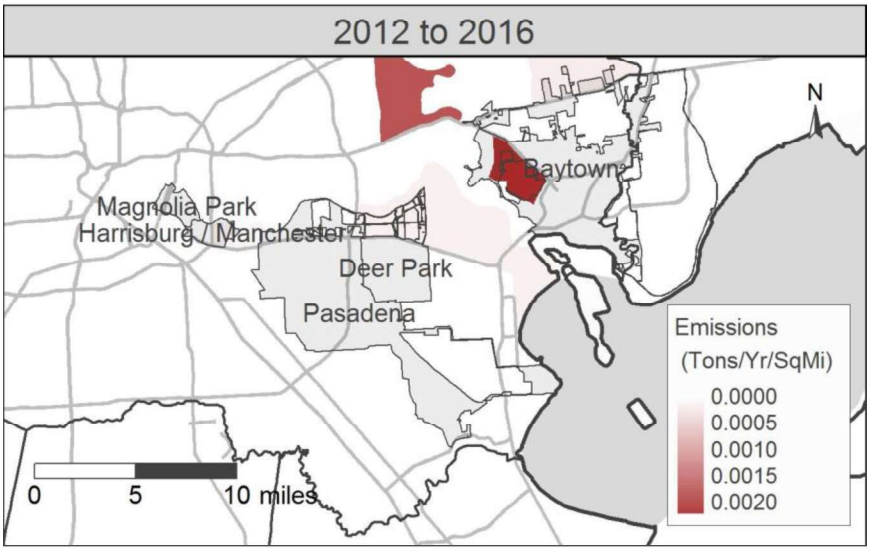

2007 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.2
0.4
0.6
0.8
0
5
10 miles

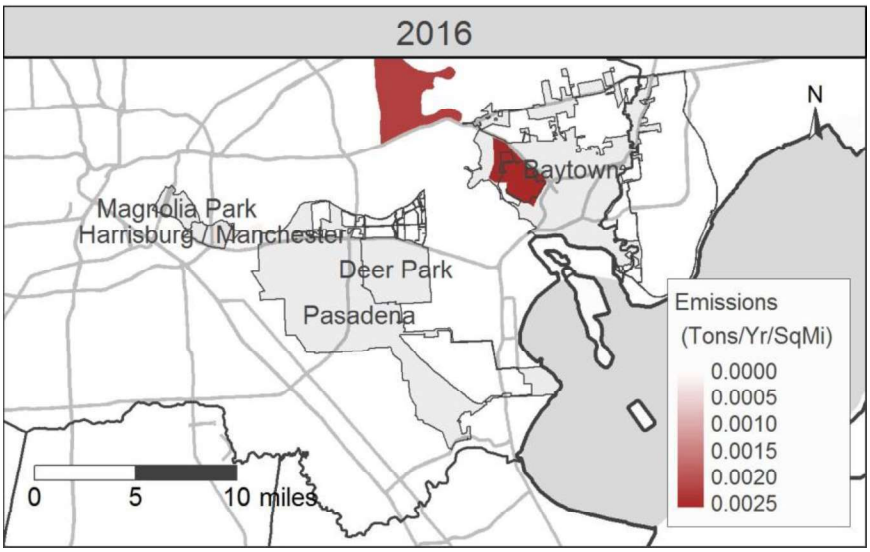

2012 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
5
10 miles


2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.1
0.2
0.3
0
5
10 miles

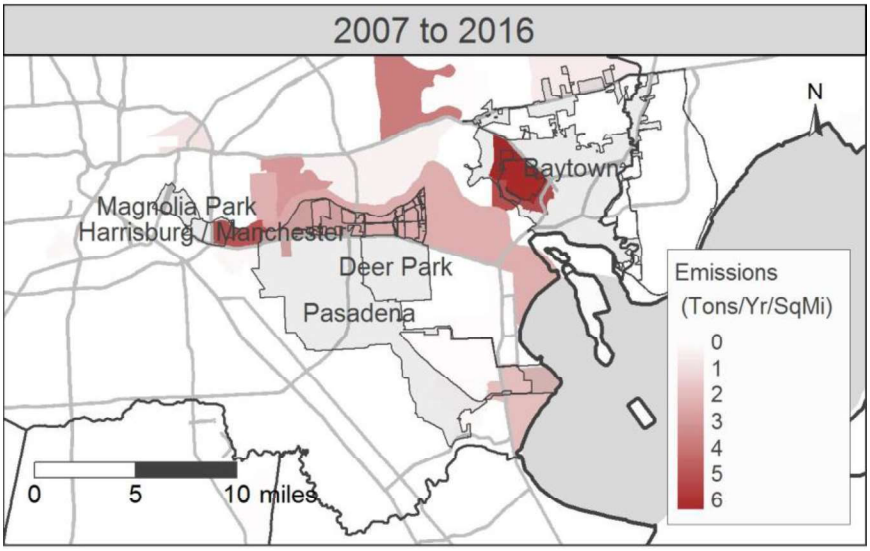
Anthracene

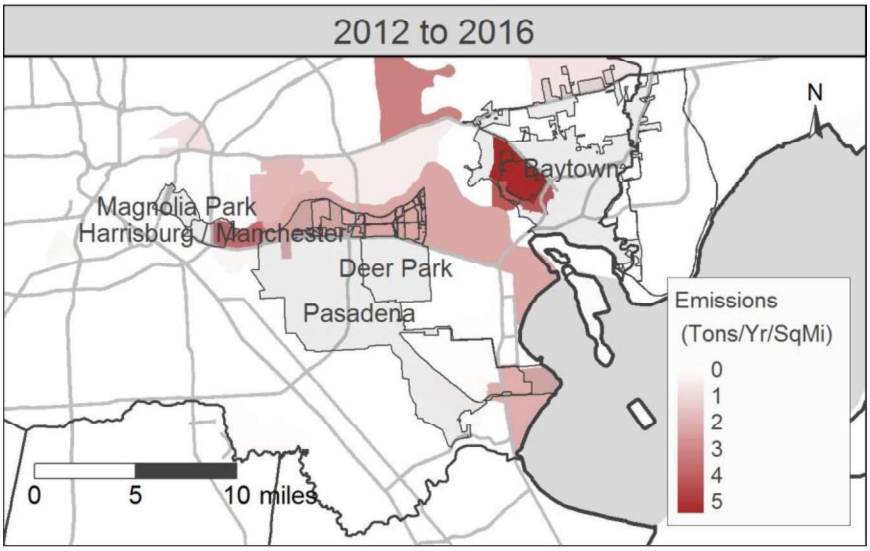

2007 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.000
0.005
0.010
0.015
0
5
10 miles

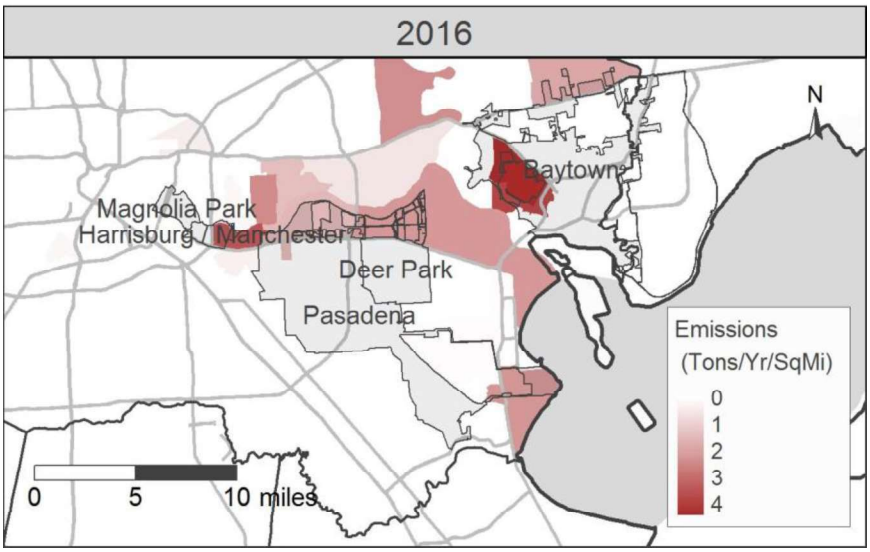

2012 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0
5
10 miles


2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0
5
10 miles

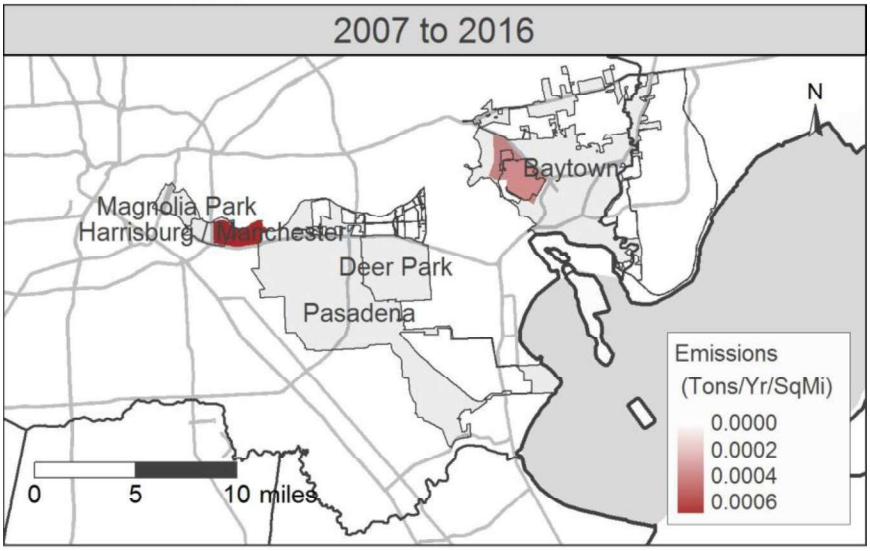
Benzene

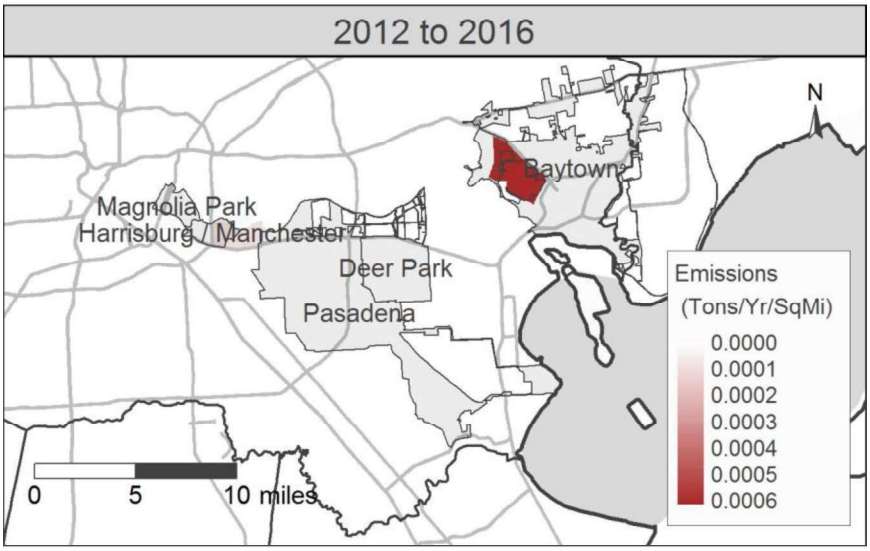

2007 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
6
0
5
10 miles

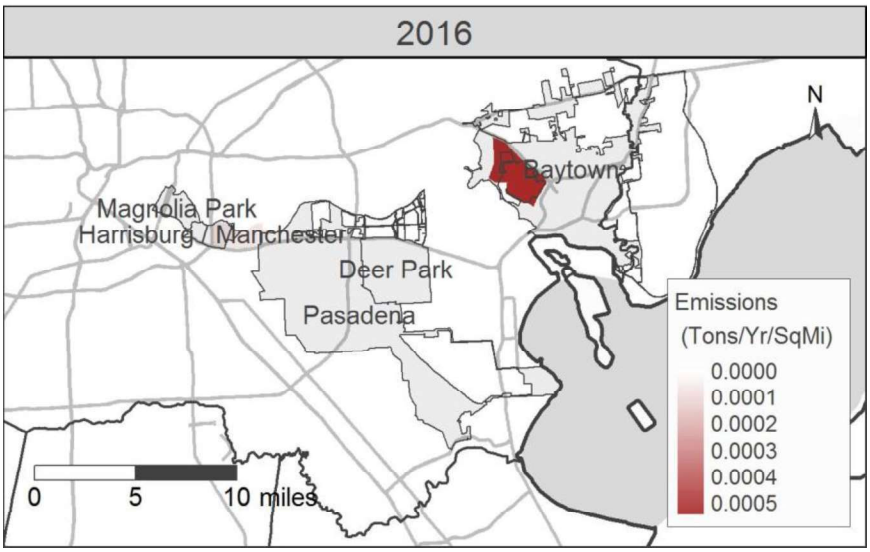

2012 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
5
0
5
10 miles


2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0
1
2
3
4
0
5
10 miles

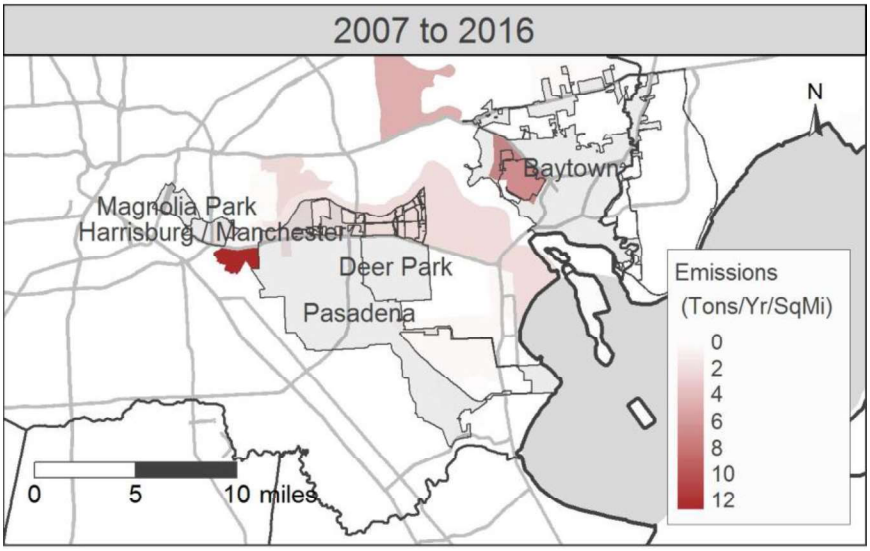
Benzo[a]pyrene

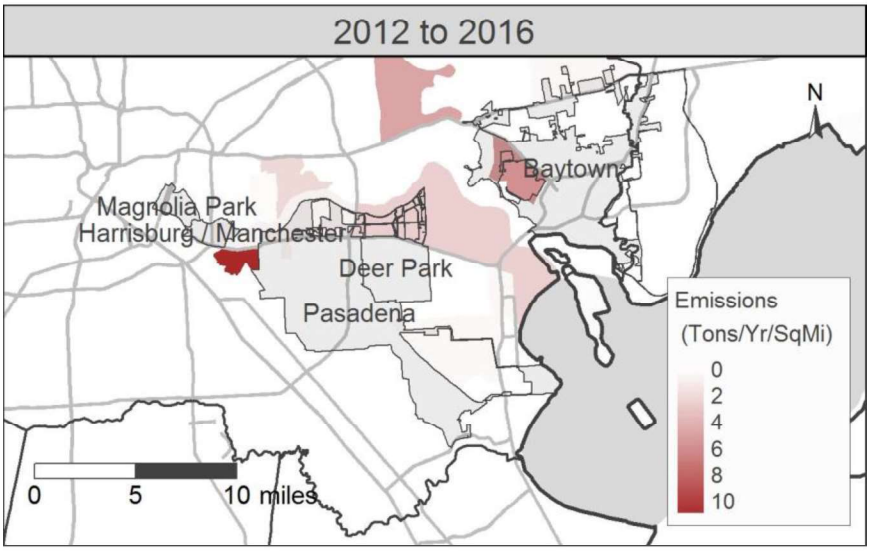


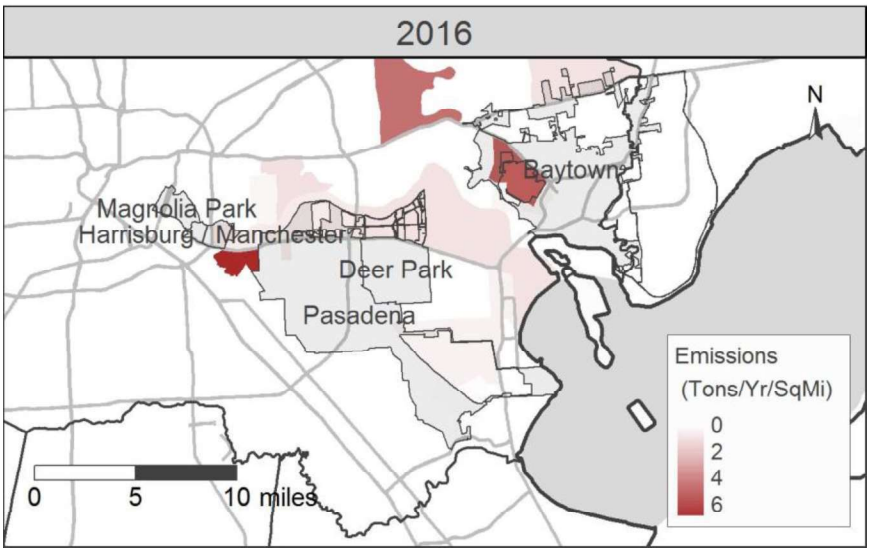




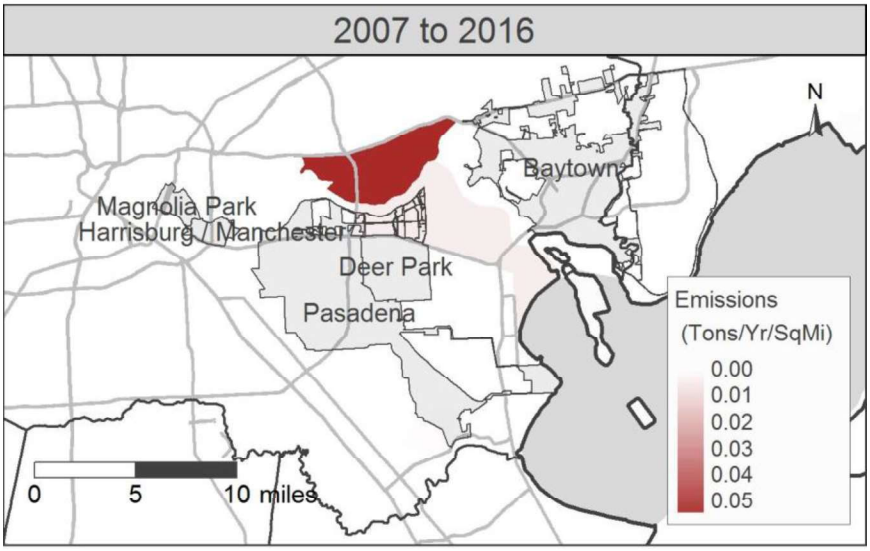
1,3-Butadiene

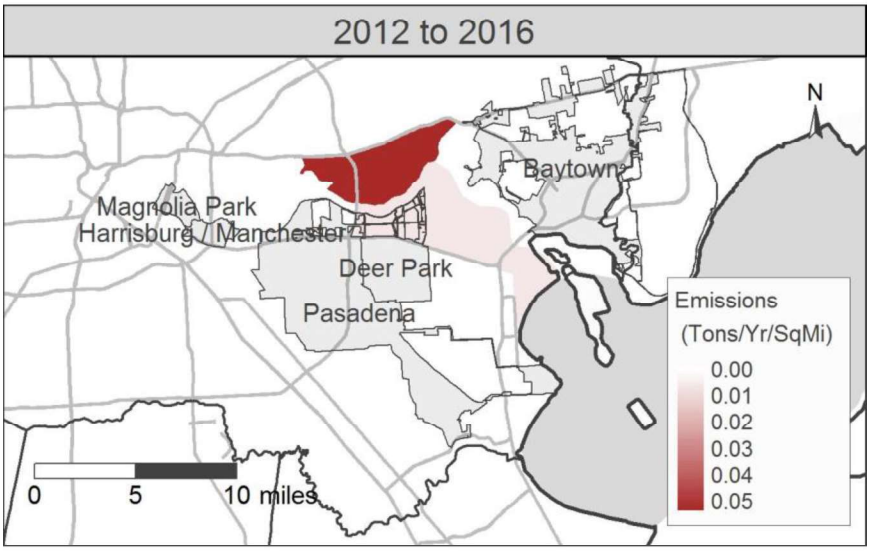


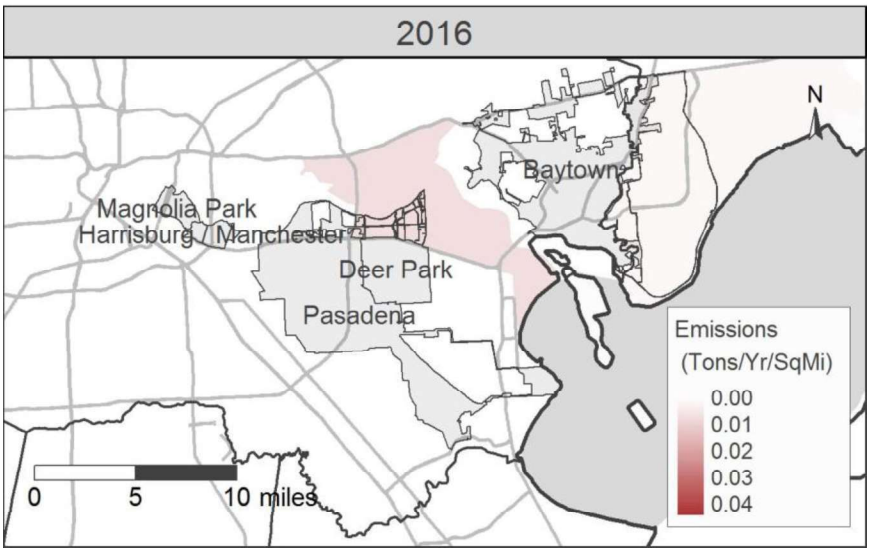




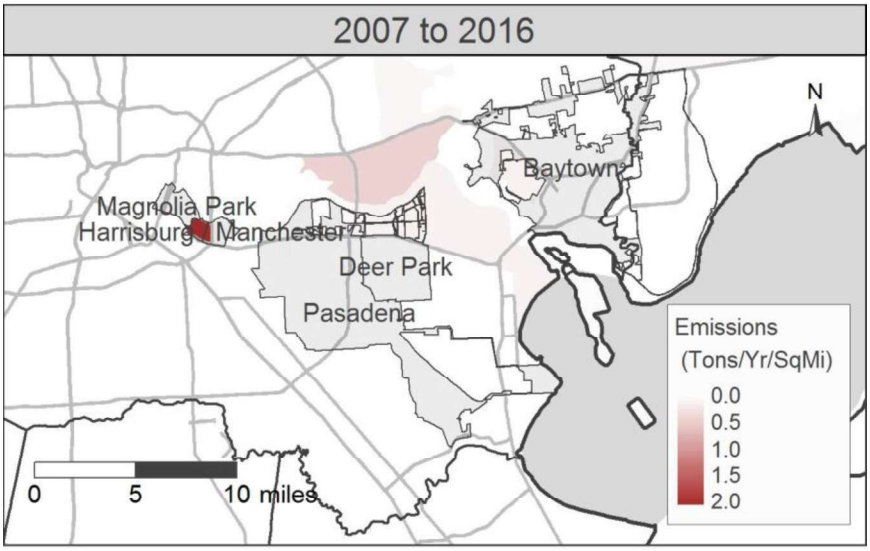
Carbon tetrachloride

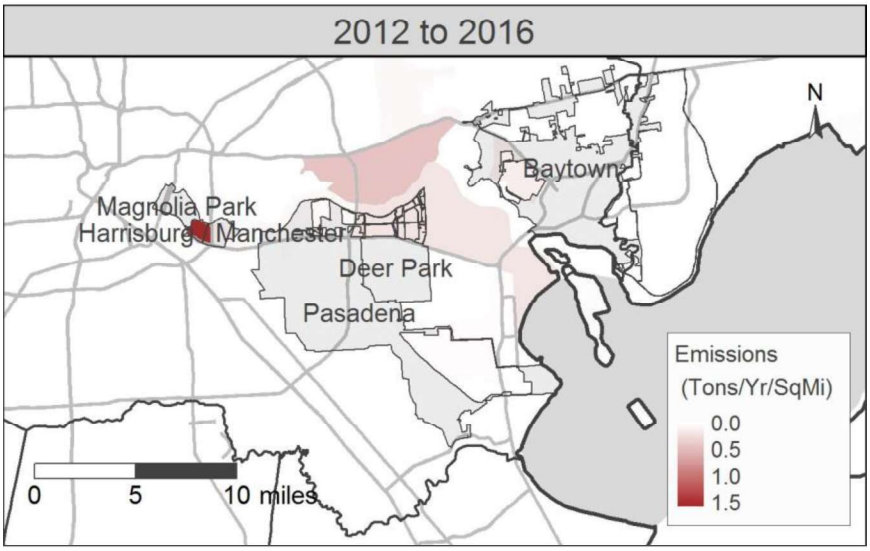


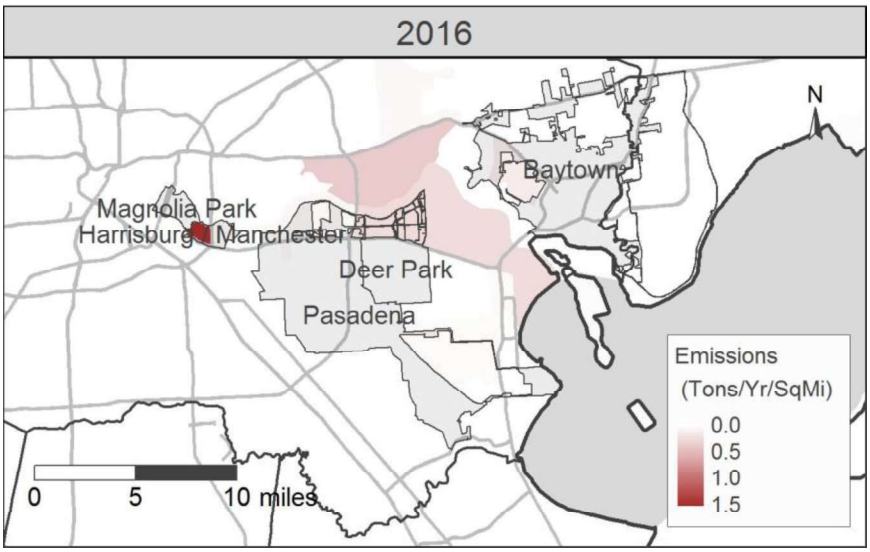




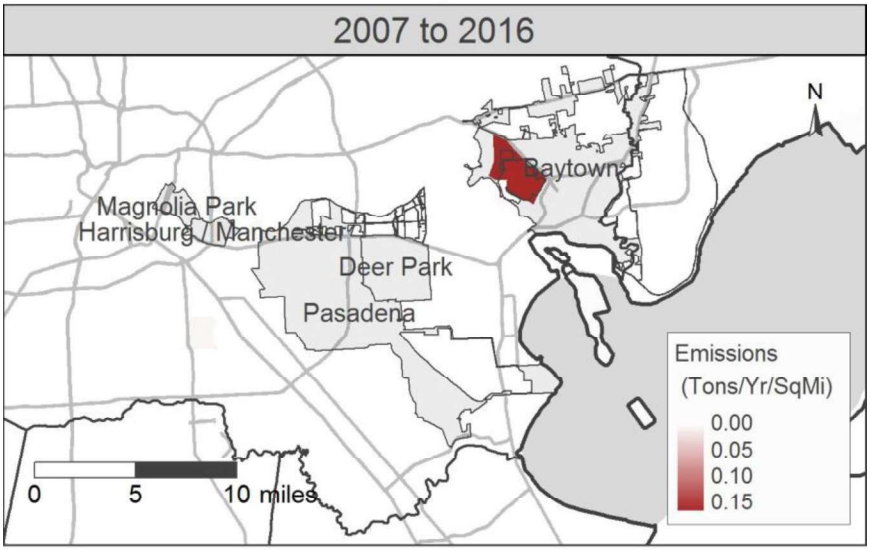
Chlorine

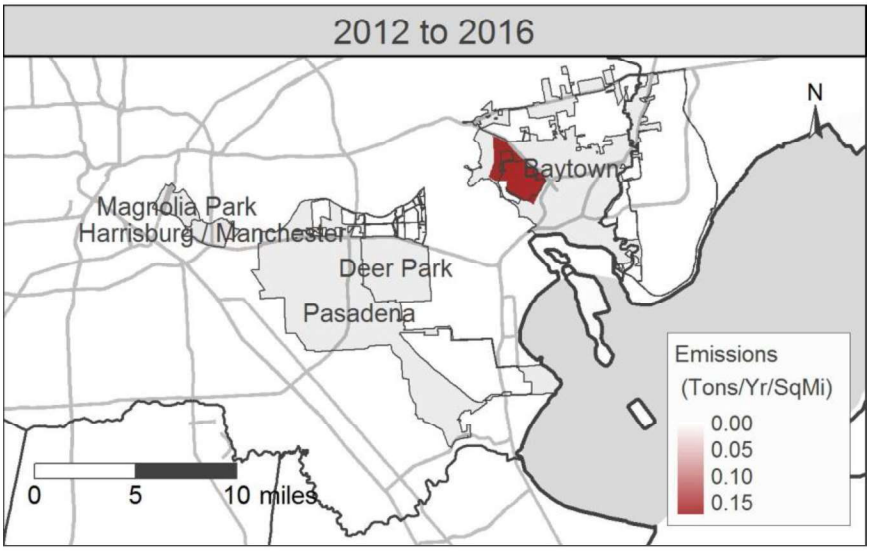

2007 to 2016
N
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
2.0
0
5
10 miles

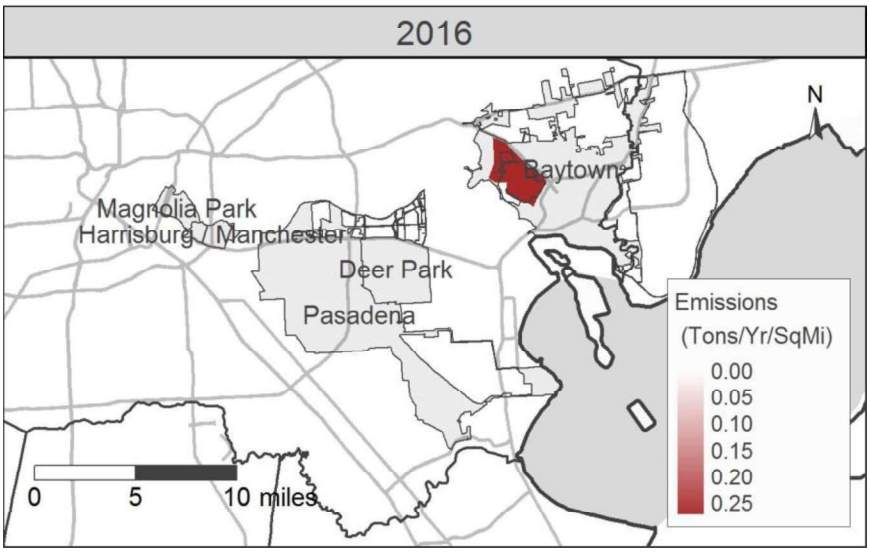

2012 to 2016
N
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
0
5
10 miles


2016
N
Baytown
Magnolia Park
Harrisburg
Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0
0.5
1.0
1.5
0
5
10 miles

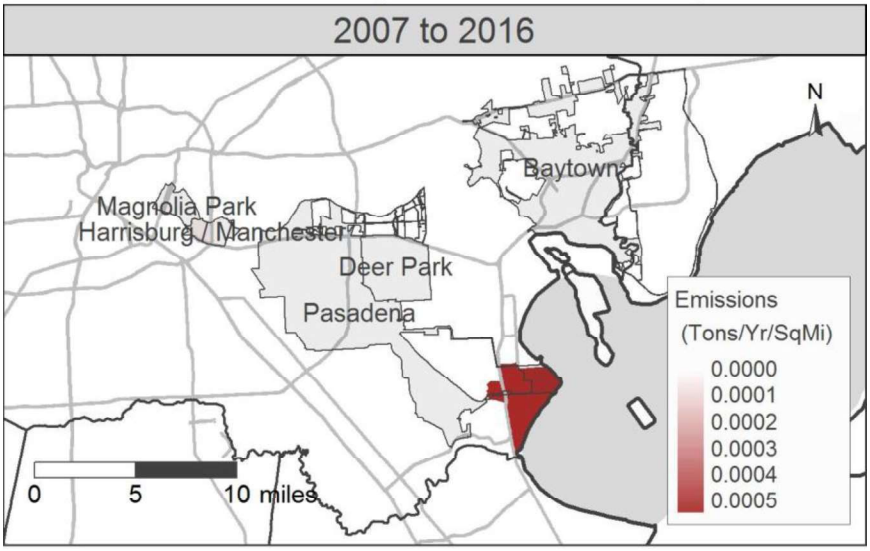
Chromium and compounds

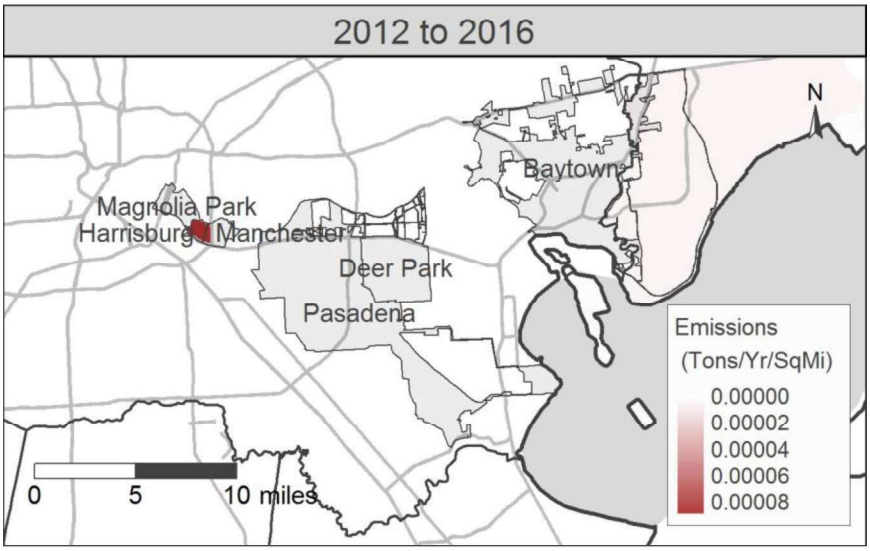


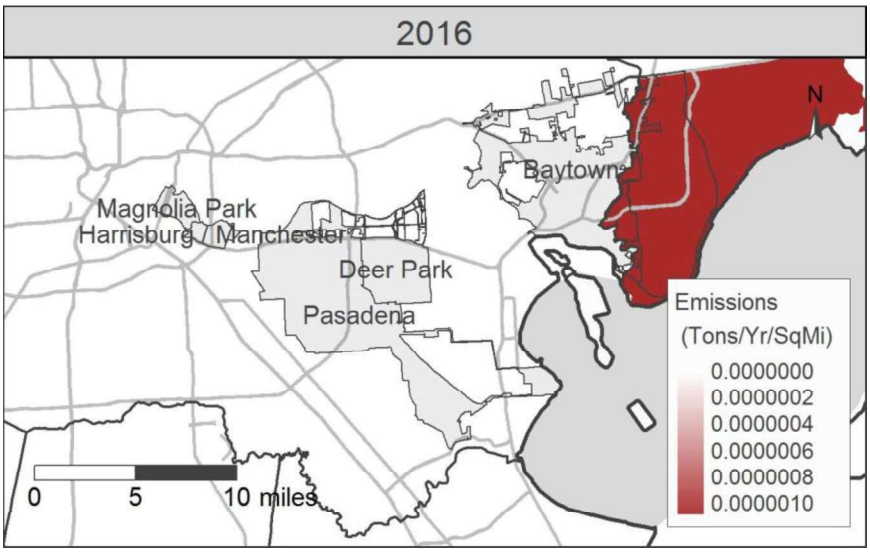




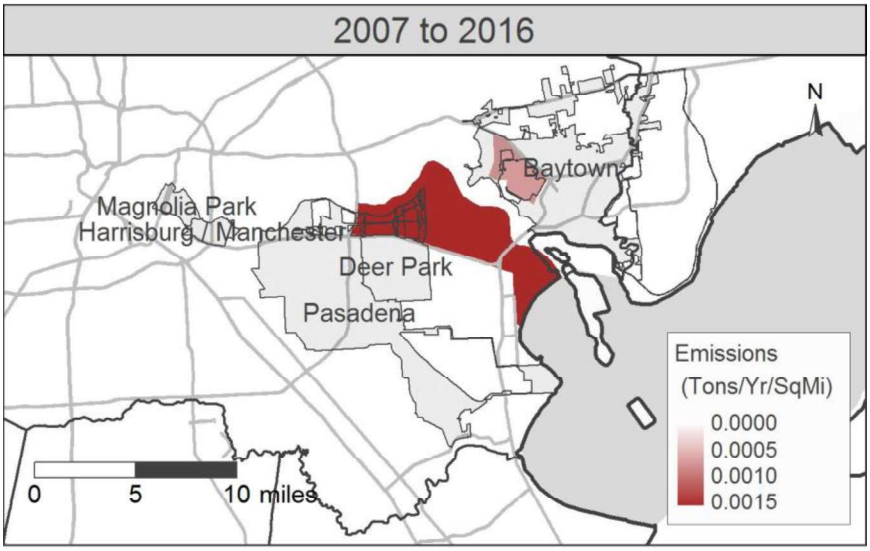
Diaminotoluene (mixed isomers)

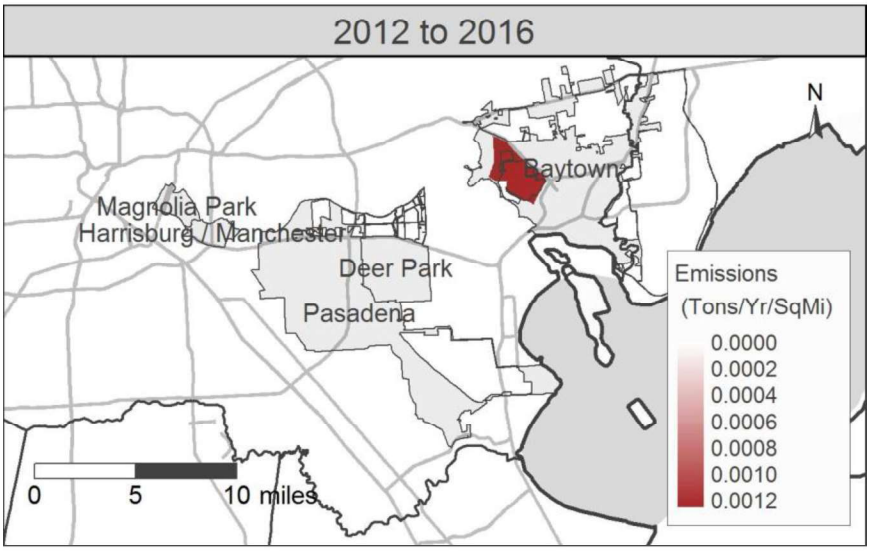


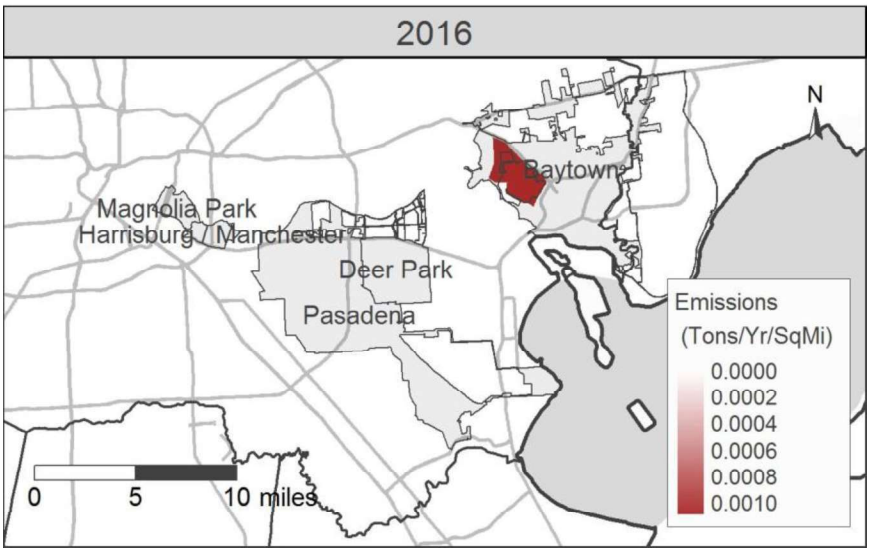




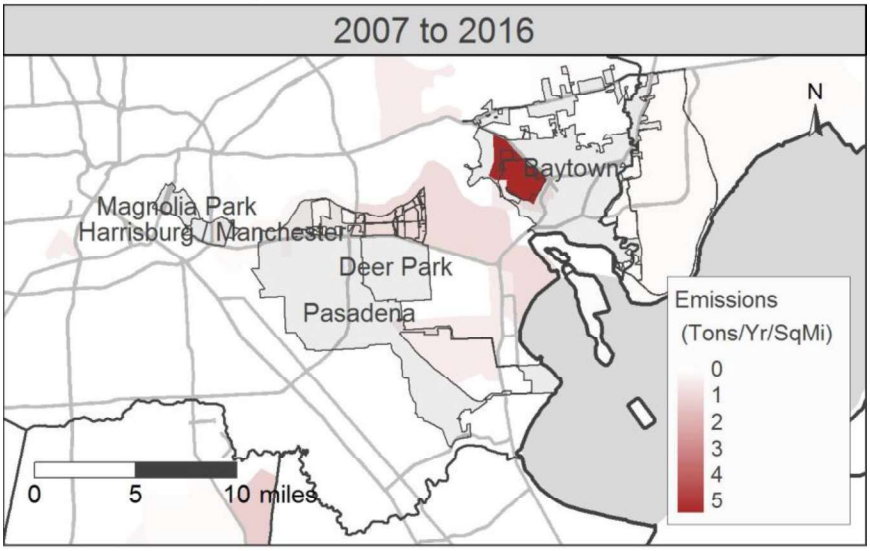
Fluoranthene

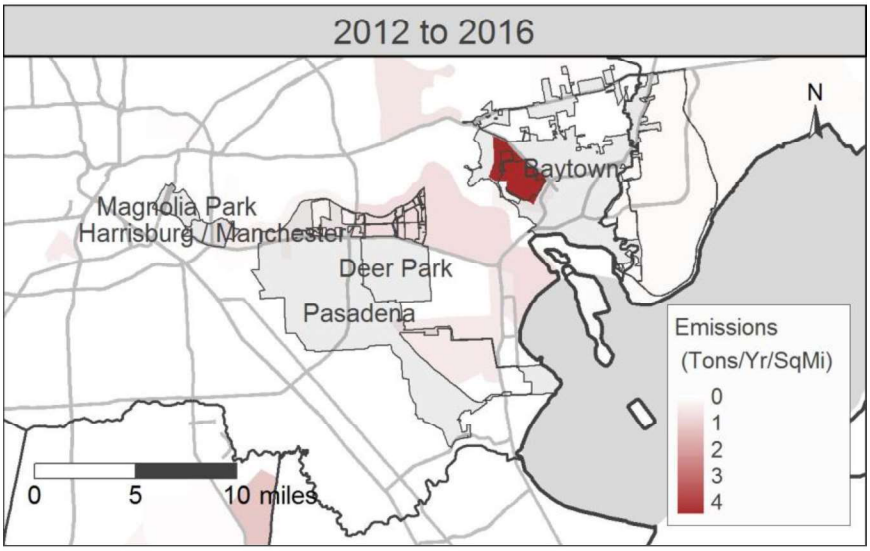


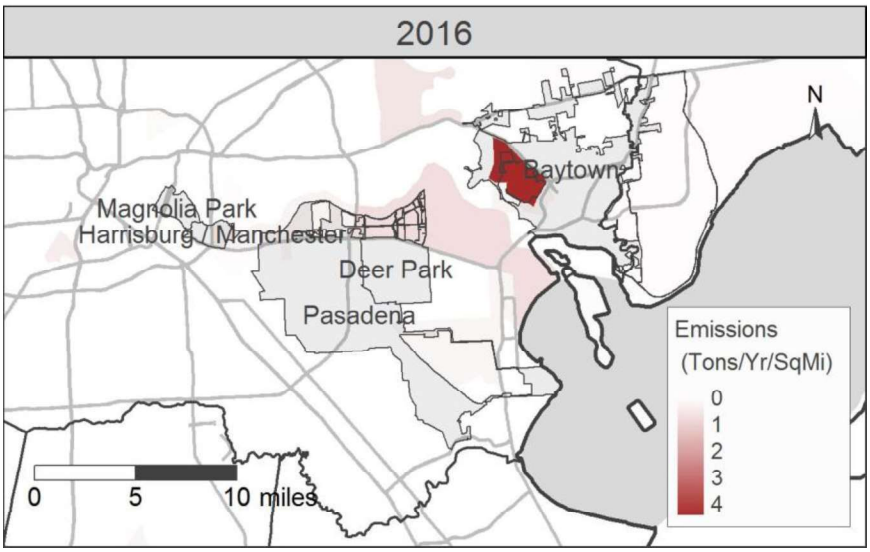




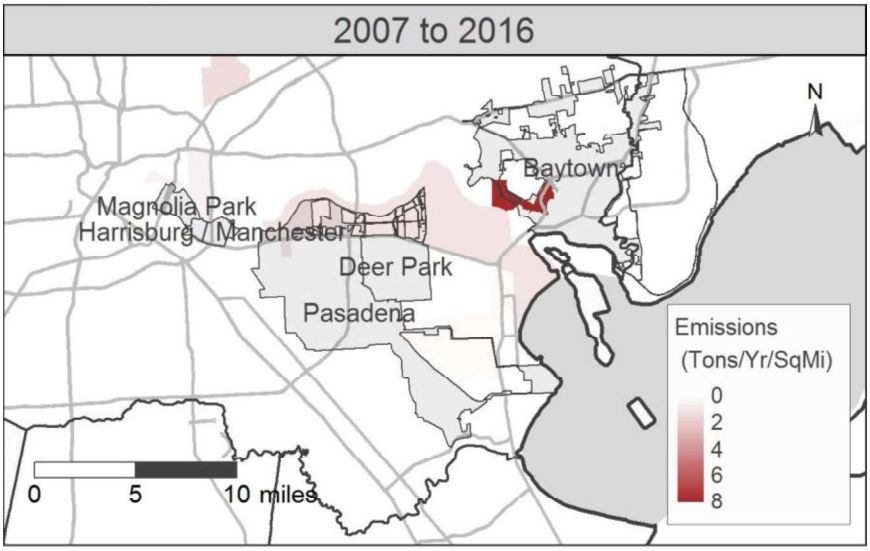
Formaldehyde

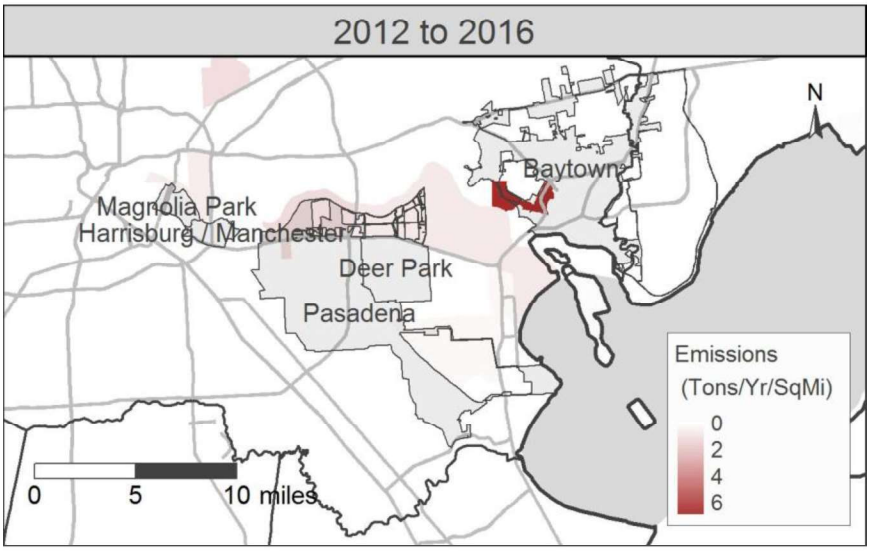


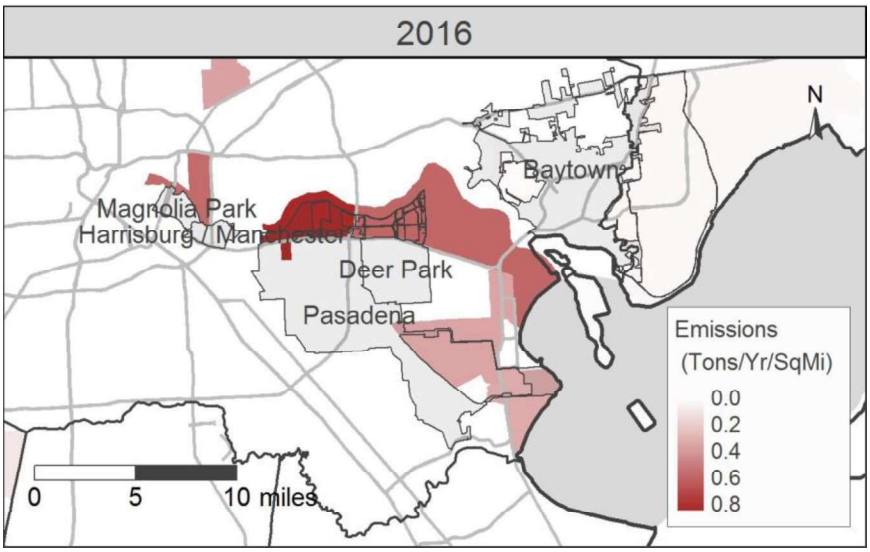




Hydrogen chloride







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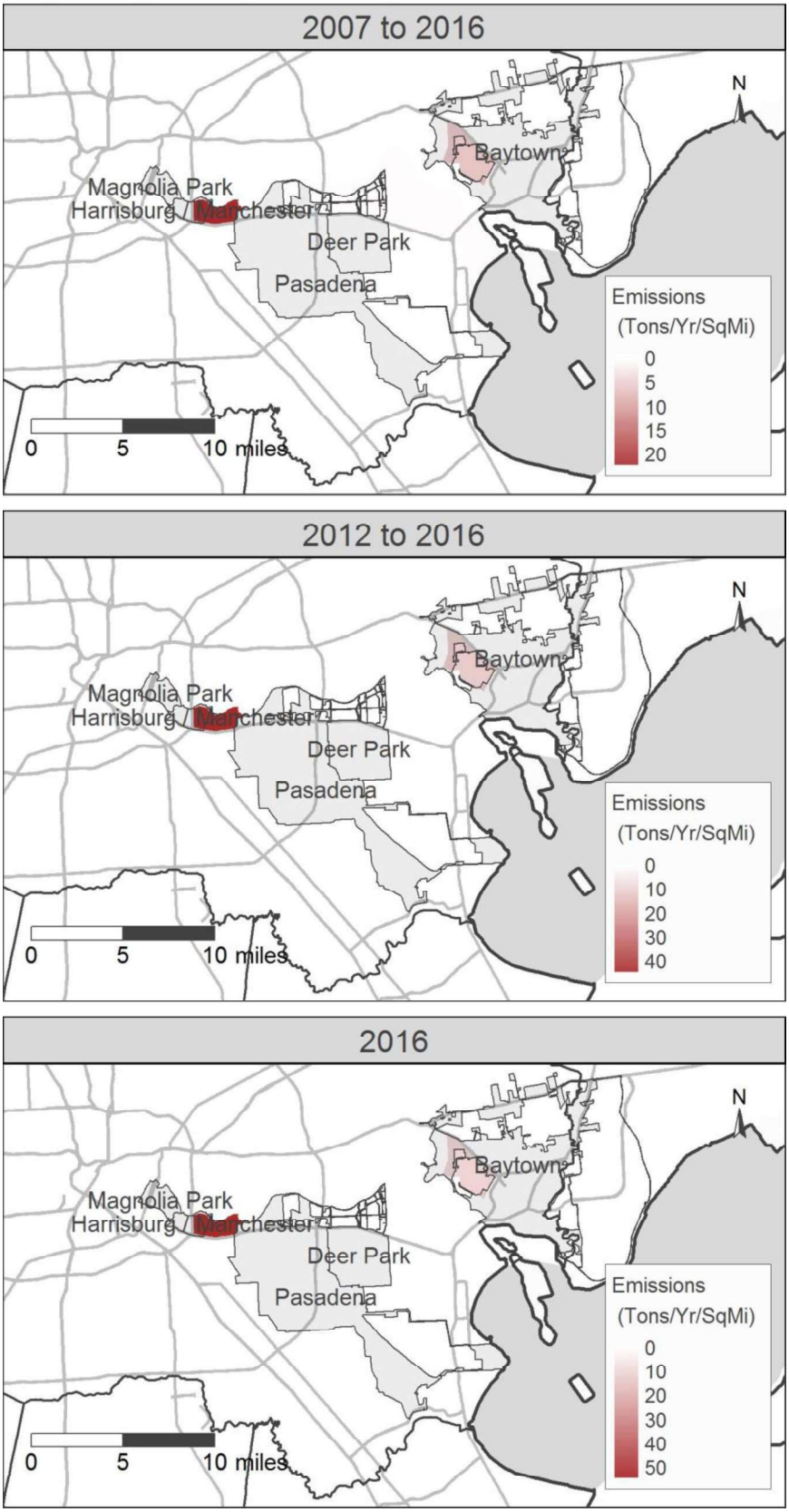

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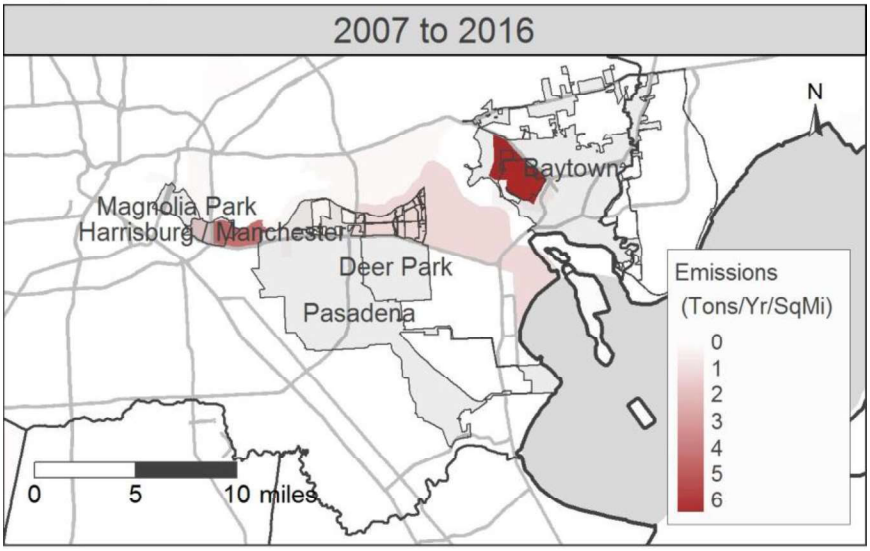
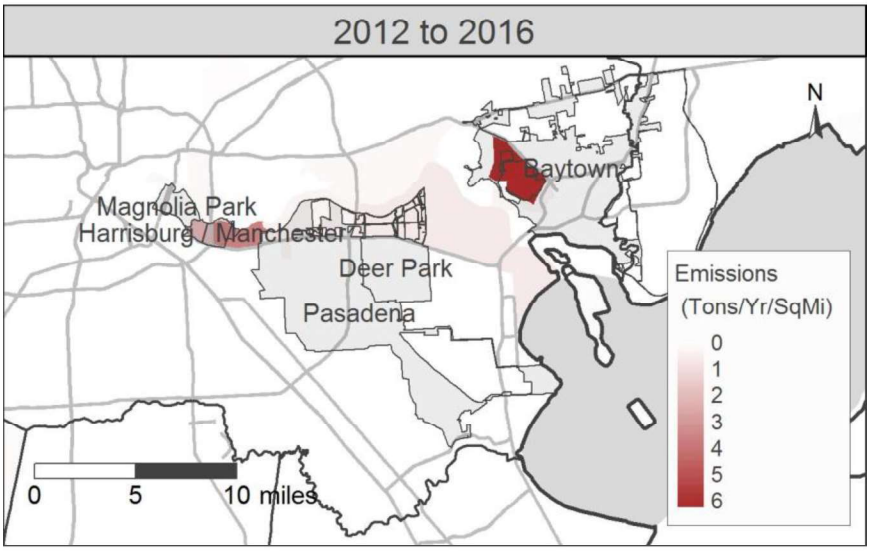
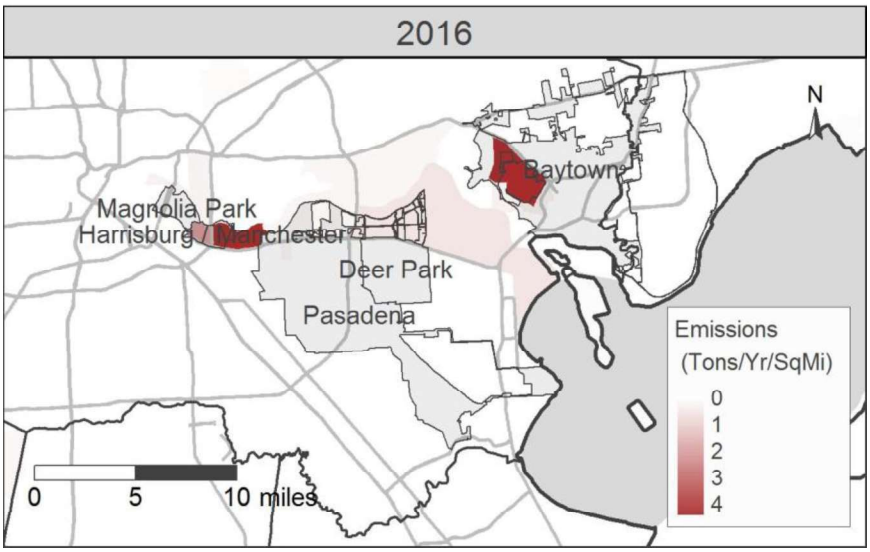
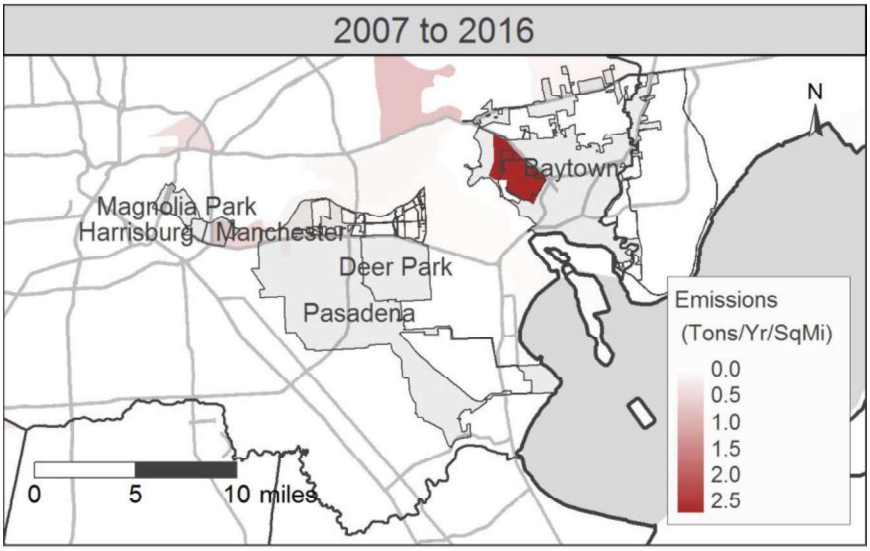
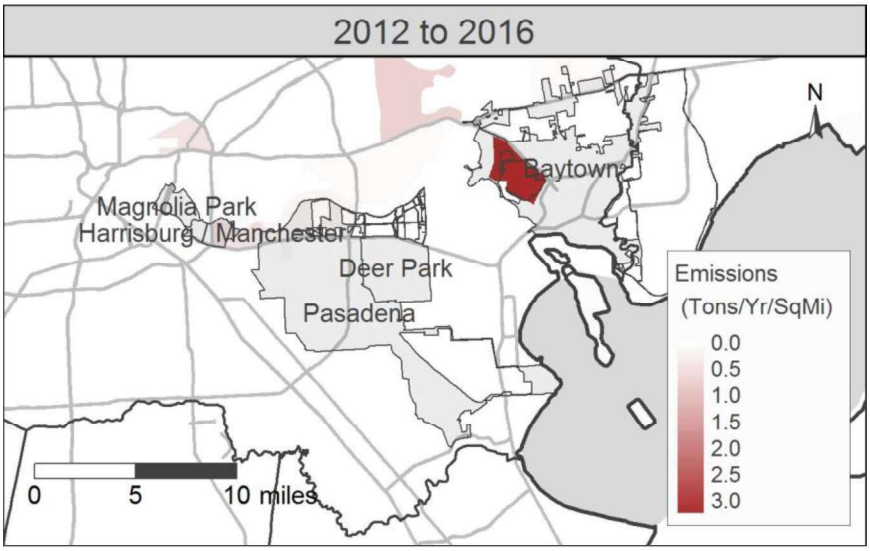


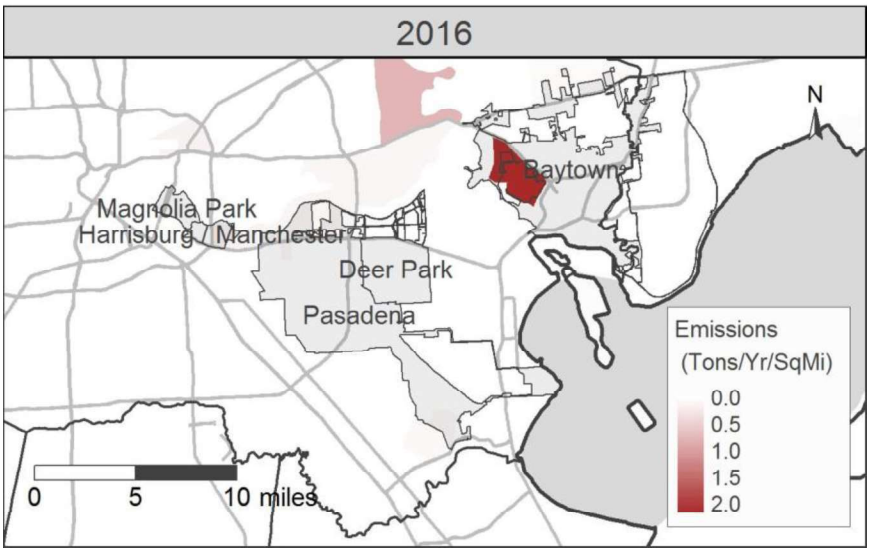




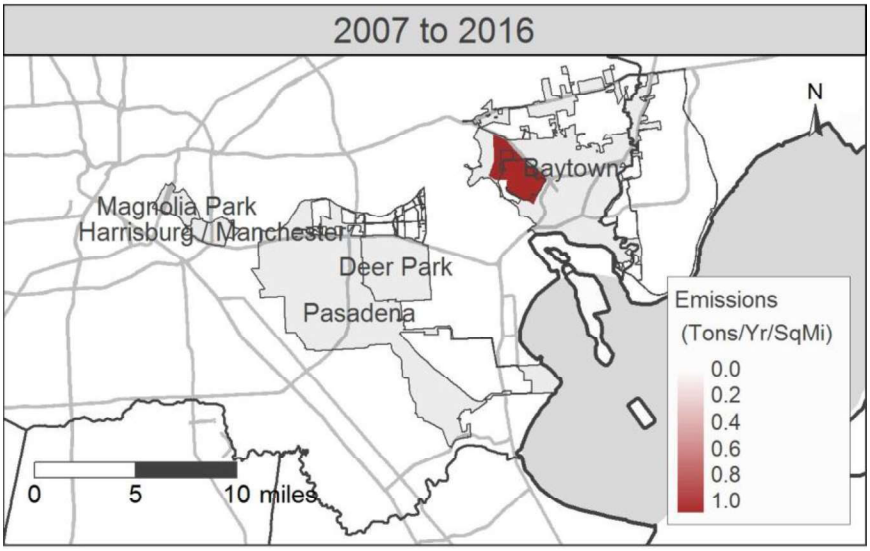
Naphthalene

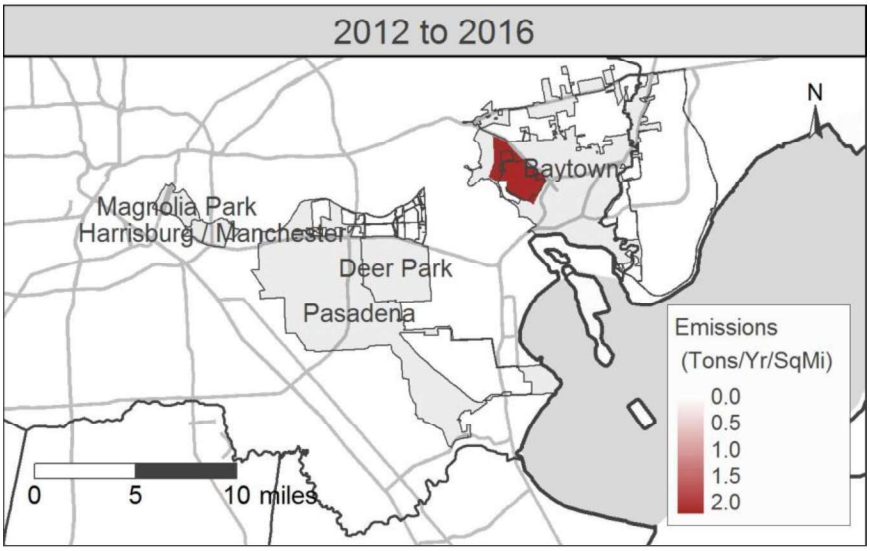


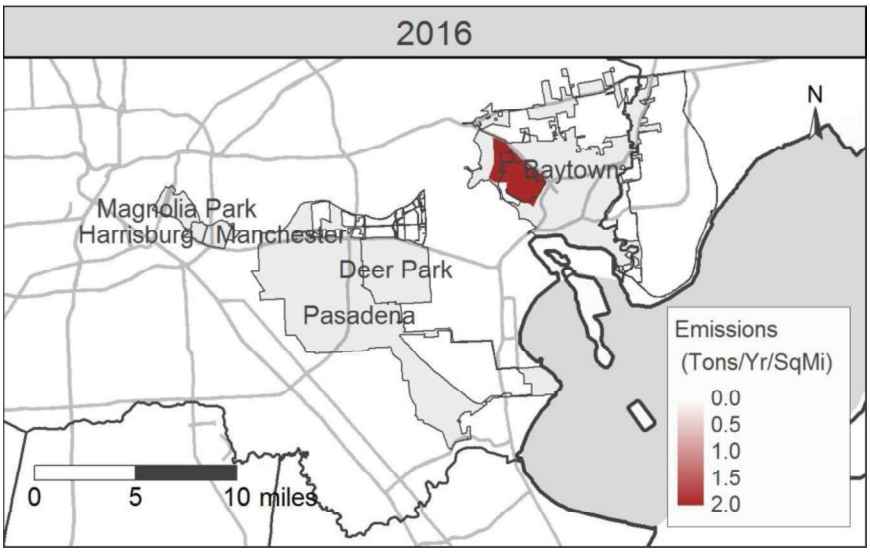




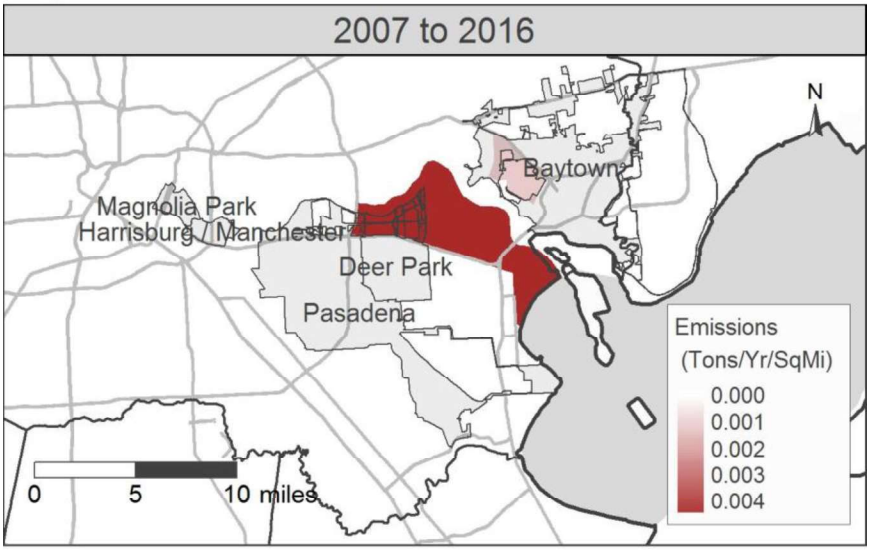
Phenanthrene

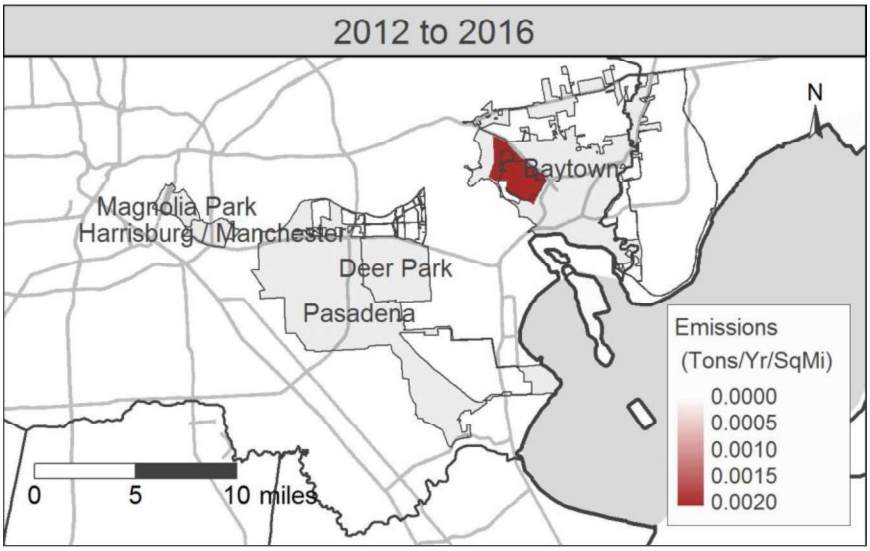


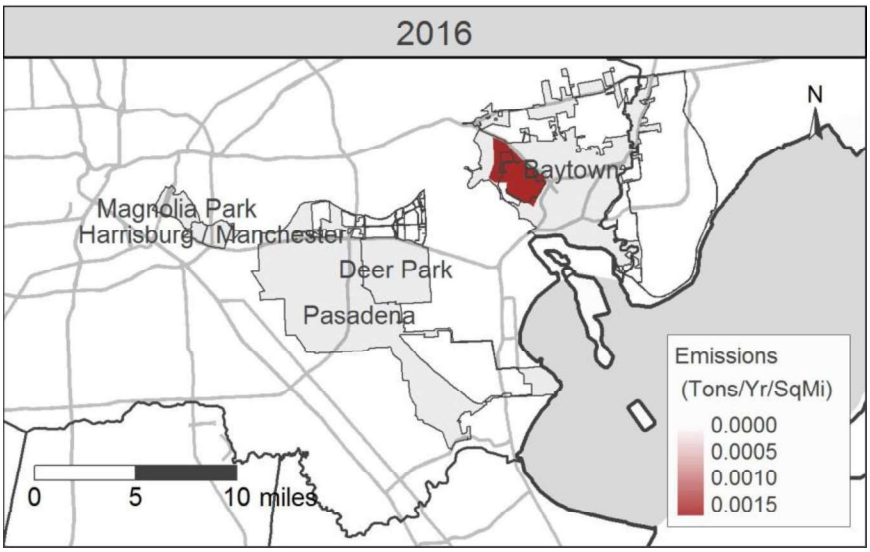




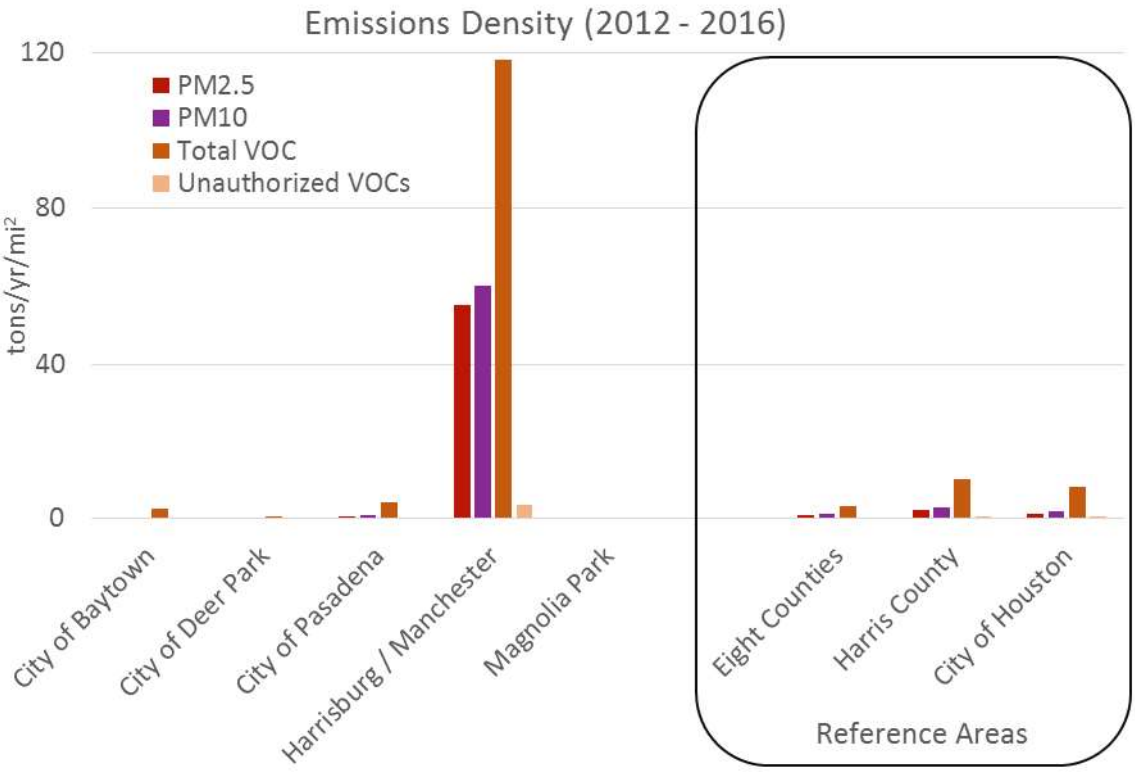
Pyrene

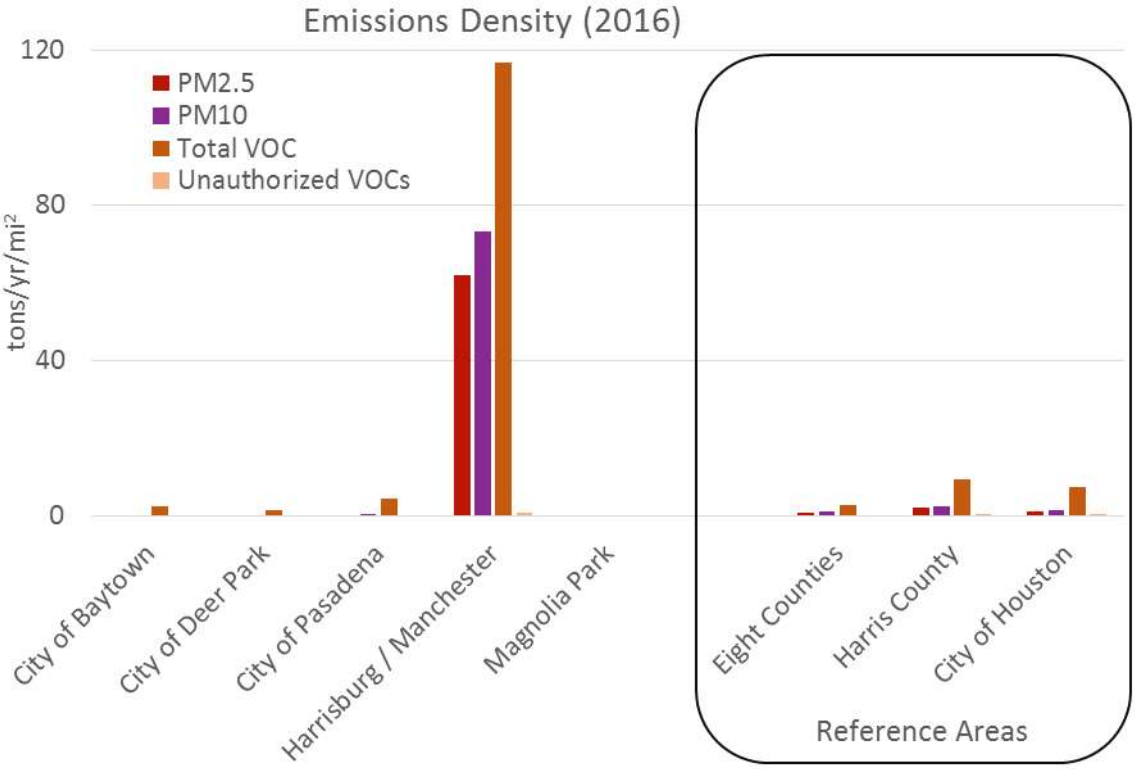

2007 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.000
0.001
0.002
0.003
0.004
0
5
10 miles


2012 to 2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0.0020
0
5
10 miles


2016
N
Baytown
Magnolia Park
Harrisburg / Manchester
Deer Park
Pasadena
Emissions
(Tons/Yr/SqMi)
0.0000
0.0005
0.0010
0.0015
0
5
10 miles

Appendix F: Emissions for 2012 to 2016 and 2016 in Communities of Interest


Emissions Density (2012 - 2016)
120
80
40
0
tons/yr/mi²
PM2.5
PM10
Total VOC
Unauthorized VOCs
City of Baytown
City of Deer Park
City of Pasadena
Harrisburg / Manchester
Magnolia Park
Eight Counties
Harris County
City of Houston
Reference Areas


Emissions Density (2016)
120
80
40
0
tons/yr/mi²
PM2.5
PM10
Total VOC
Unauthorized VOCs
City of Baytown
City of Deer Park
City of Pasadena
Harrisburg / Manchester
Magnolia Park
Eight Counties
Harris County
City of Houston
Reference Areas

Double Jeopardy in Houston

Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities

Center for Science and Democracy at the Union of Concerned Scientists

t.e.j.a.s
Texas Environmental Justice Advocacy Services

Introduction

There is compelling evidence that people of color and those living in poverty are exposed to higher levels of environmental pollution than whites or people not living in poverty (Cushing et al. 2015; Bullard, Johnson, and Torres 2011; Mohai, Pellow, and Roberts 2009; Bullard 2000). The health impacts on these populations from environmental degradation are amplified by other negative socioeconomic and health factors such as the lack of access to health care, healthy foods, and public transportation, along with stress from poverty, unemployment, and crime, among other factors (Prochaska et al. 2014; O'Neill et al. 2003). This disproportionate exposure to toxic pollution, and the associated health impacts, underscores the need to address environmental justice. Environmental justice is defined by the Environmental Protection Agency (EPA) as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2016a).

Recent reports by the Environmental Justice and Health Alliance for Chemical Policy Reform (EJHACPR 2014) and the Center for Effective Government (CEG 2016) found that, compared with national averages, a significantly greater percentage of African Americans, Latinos, and people in poverty live near industrial facilities that use large quantities of toxic chemicals and present a risk of major chemical disasters. A 2004 study found that larger, more chemical-intensive facilities tend to be located in counties with larger black populations and in counties with high levels of income inequality. It also found a greater risk of chemical accidents and spills at facilities in counties with larger African American populations (Elliott et al. 2004).

The release of toxic chemicals from industrial sources into surrounding communities is all too common. The EPA's Risk Management Plan (RMP) program encompasses the nation's most high-risk industrial facilities that produce, use, or store significant quantities of toxic and flammable chemicals. Among other requirements, these facilities must prepare plans for responding to a worst-case incident such as a major fire or explosion in which toxic chemical pollution is released into the surrounding community. The EPA estimates that approximately 150 catastrophic accidents occur each year in regulated industrial facilities. The EPA notes that these accidents "pose a risk to neighboring communities and workers

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Due to a lack of comprehensive zoning laws in Houston, many fenceline communities lie directly next to chemical facilities, and hence are exposed to high levels of air pollution and risk of catastrophic accidents. Compared with the Houston urban area, neighborhoods such as Harrisburg/Manchester and Galena Park comprise a larger percentage of African Americans, Latinos, and people living at or near poverty levels.

because they result in fatalities, injuries, significant property damage, evacuations, sheltering in place, or environmental damage" (EPA 2016b). Less severe accidents happen regularly—425 chemical accidents occurred in the little more than two years between the explosion in April 2013 at the West Texas fertilizer facility and August 2015 (CPCD 2015), and many others likely went unreported.

Communities closest to these hazardous facilities are likely to experience the greatest impacts from an explosion or chemical release—and would have the least amount of time to escape these dangers (USCSB 2016; Lezon 2016; Zaveri and Dempsey 2016). Therefore, while the "vulnerability zone" that would be impacted by a worst-case accident from some of these RMP facilities extends as far as 25 miles or more, this report focuses on the demographics and health risks for people living within one mile of these facilities—the fenceline zone.

THE HOUSTON CONTEXT

In addition to the acute risk of a catastrophic chemical accident, people in fenceline communities—those in close proximity to these facilities—face the "double jeopardy" of living with daily chronic exposure to high levels of toxic pollution in their air, water, and soil. Exposure to toxic air pollution in the Houston metropolitan area has long been a concern, especially for low-income communities and communities of color along the Houston Ship Channel, home to a large concentration of oil refineries and other heavy industry. An analysis of air pollution risks in the greater Houston area conducted in 2005 to 2006 for the Mayor's Task Force on Health Effects of Air Pollution, which also focused on several east Houston communities, found that air pollution in the Harrisburg/Manchester community exceeded safe levels for seven of the 12 air pollutants deemed "definite risks," the most of any of the communities. In assessing the results of air pollution on east Houston communities, the task force concluded that "east Houston neighborhoods that face a number of vulnerabilities based on their marginal social and economic standing also carry a heavier burden of health risks from breathing pollutants in their air. They tend to be located closer to major point sources than most other neighborhoods in the greater Houston area and to be nearer to major transportation corridors. The burden of these risks taken together poses special needs in these neighborhoods" (Mayor's Task Force 2006).

> ***The accidental release of toxic chemicals from industrial sources into surrounding communities is all too common.***

Other studies of the Houston area's air pollution have found similar disproportionate impacts on people of color and the poor. A 2008 study found a disproportionate cancer risk especially for Hispanics living in poverty and with other indicators of social disadvantage (Linder, Marko, and Sexton 2008). A recent study of the Houston area examined residents' acute risks from potential chemical facility accidents as well as chronic risks from exposure to air pollution, finding that "neighborhoods with a higher percentage of Hispanic residents, lower percentage of homeowners, and higher income inequality are facing significantly greater exposure to both chronic and acute pollution risks. . . . Households isolated by language—those highly likely to face evacuation problems during an actual chemical disaster—tend to reside in areas facing significantly greater exposure to high-impact acute events"(Chakraborty et al. 2014).

> ***425 chemical accidents occurred in the little more than two years between the explosion in April 2013 at the West Texas fertilizer facility and August 2015.***

This report builds on that past work, analyzing chronic exposure and health risks from toxic air pollution as well as potential acute exposures from unplanned chemical releases from neighboring chemical facilities included in the EPA's RMP program. We compare the risks and exposures facing residents of two predominantly Hispanic and low socioeconomic east Houston communities, Harrisburg/Manchester and Galena Park, with two primarily white and wealthier west Houston communities, West Oaks/Eldridge and Bellaire (see methodology section below).

Cities, towns, and neighborhoods composed predominantly of low-income people of color—such as those of Galena Park and Harrisburg/Manchester—with high densities of commercial and industrial spaces that pose serious health and societal impacts on their residents often go unnoticed, unappreciated, and even justified as acceptable by people

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The Houston neighborhoods of Harrisburg/Manchester and Galena Park, whose residents are predominantly African American, Hispanic, and low income, face far greater health risks than the members of more white and affluent communities like West Oaks/Eldridge and Bellaire, given their proximity to chemical facilities that pollute the surrounding air, water, and soil.

who have little experience with the circumstances of these communities. In his classic study of landfills and dumps in black neighborhoods in Houston, *Dumping in Dixie*, Dr. Robert Bullard asks, "Are environmental inequities a result of racism or class barriers or a combination of both? After more than two decades of modern environmentalism, the equity issues have not been resolved" (Bullard 2000). He also notes that, "poor whites and poor blacks [and brown communities] do not have the same opportunities to vote with their feet. Racial barriers to education, employment, and housing reduce mobility options available to the black [and brown] underclass and the black [and brown] middleclass."*

As a result of the multiple constraints on low-income residents, their relocation away from these polluting sources is not a realistic option without assistance. Cycles of poverty, institutionalized racism, hopelessness, fear, and complacency are the products of failed attempts to push for change. These factors call for a deeper understanding of and respect for the issues facing environmental justice communities—not only regarding the intersection of race and disproportionate impacts of pollution but including a broader look at the societal systems that allowed these situations to develop.

While Galena Park and Harrisburg/Manchester are no longer dotted by oil derricks, they now house facilities that store and produce large amounts of chemicals, oil, and other toxic products, posing disproportionate risks of catastrophic chemical spills and chronic air-pollution emissions on people of color. They are just two of many frontline environmental justice communities throughout the nation that pay the environmental and human price for rampant industrial growth.

Political Realities

Congressional and state legislative districts have a history of disenfranchising minority and low-income communities by drawing district lines to reinforce favorable voting patterns (Bush v. Vera 1994). While US House of Representatives District 29, which encompasses Galena Park, Manchester, Pasadena, and a handful of other environmental justice communities, is a majority Hispanic district established to diversify representation in Congress, it has yet to achieve this goal. Fortunately, a recent Texas voter-identification requirement was struck down in federal court, in part because it would disproportionately discourage Latino and black residents from voting (Veasey v. Perry 2014).

Further weakening the protection of east Houston communities is the lack of citywide zoning in Houston. The city officials maintain that its patchwork of ordinances and restrictions fills this gap. These include municipal management districts, ordinances, deed restrictions, historic designations, de facto locally controlled zoning, and developer-master-planned

* *Bullard added the inclusion of brown communities in personal communication with the report's authors (Bullard 2016).*

> ***Congressional and state legislative districts have a history of disenfranchising minority and low-income communities.***

communities. Such bodies have restricted motels, industrial facilities, and cell phone towers. Bodies such as the 22 municipal management districts that overlap with tax increment reinvestment zones in Houston can be effective at exerting influence over land use, and municipal management districts can use tax increment reinvestment zones to fund community improvement projects (Kiger 2015). Unfortunately, these land use efforts have not been as effective in marginalized communities as in other communities.

In recent years, Texas has frequently opposed national environmental protection efforts, having sued the EPA 23 times since the start of the Obama administration (Wray 2016a). To improve environmental conditions in their communities, local organizations such as Texas Environmental Justice Advocacy Service have communicated with the EPA, the Texas Commission on Environmental Quality, local and state officials, and industry players and have utilized the legal system to press their concerns about environmental conditions and health impacts (Selle 2013). Although working groups and strategy plans have been established to address these environmental issues, most of these bodies not only add a bureaucratic layer to communication between residents and agencies, but also create lengthy response times.

History and Community Characteristics

HARRISBURG/MANCHESTER

Harrisburg/Manchester sits beneath the 610 Ship Channel Bridge on a 5.81-square-mile plot of land and was once a booming shipping and oil town. Originally intended to be a wharf, since the 1860s Harrisburg/Manchester has been occupied by commercial industry—first, cotton and grains, followed by oil, petrochemical products, and plastics (Magnolia Park Land Company n.d.). Formerly predominately white, by the 1980s the population of Harrisburg/Manchester was predominantly Hispanic (CHPDD 2014; Kleiner 2010). While Houston, called the energy capital of the nation, experienced economic expansion fueled by the world's energy consumption and reliance on petrochemical products, Manchester and other east Houston communities bore the brunt of this growth.

Hartman Park, the only public green space in Harrisburg/Manchester, exemplifies what it means to be a fenceline community where industries such as Valero Refining and Westway Chemicals can be spotted from residents' doorsteps. These are large industrial plants. Valero Houston Refining has a throughput capacity of 160,000 barrels per day of a range of petroleum products including gasoline, kerosene, jet fuel, ultra-low sulfur, liquefied petroleum gases, propylene, no. 6 oil, and sulfur. Westway Chemical Terminals and Storage handles a wide variety of products from fertilizers to petroleum and houses 93 steel tanks ranging from 4,100 to 74,500 barrels with a total capacity of 2,059,512 barrels; additional railcar storage expansion is underway (Westway Terminal Group n.d.).

Located at the mouth of the 52-mile Houston Ship Channel, Harrisburg/Manchester is home to numerous polluting industrial facilities, including oil refineries and other heavy industry. Looming over the community to the east is the 610 Ship Channel Bridge, which casts a shadow on Harrisburg/Manchester as one of the busiest highways in the city, releasing an unbroken stream of diesel emissions. Beneath the bridge is Texas Port Recycling, a facility with the largest metals shredder in southeast Texas, specializing in ferrous and nonferrous scrap metal recycling, railcar dismantling, car crushing, torch processing, container dismantling, and other processes (Texas Port Recycling n.d.). There are more than 30 industrial emitters of wastewater, air contaminants, and hazardous waste in Harrisburg/Manchester that report to the EPA, in addition to many more facilities that handle hazardous materials but are not required to report to the agency. On the south end of this community are more than 26 lanes of Union Pacific rail tracks. Industries in neighboring communities also add to the cumulative exposures that affect this community.

Some older residents who at one point worked at nearby plants often share concerns over the workplace safety practices. If disaster struck one of these facilities, it would start a catastrophic domino effect leading to an evacuation. However, all possible exits, except for one, are crossed by rail tracks with the potential for trains blocking their use. The Bernie Guerra Bridge, named after a man who lost his life because an emergency vehicle could not reach him, provides the sole escape route and has just two lanes, one in and one out. An evacuation of Harrisburg/Manchester would require more than 3,000 people to use one road, consisting of a single lane, out of town.

Ninety-seven percent of the population in this economically depressed neighborhood is made up of people of color;

90 percent are low income and 37 percent live in poverty. Long-term daily exposures to air pollution can lead to health effects that go unaddressed due to residents' limited financial and health care resources. Residents of fenceline communities such as Harrisburg/Manchester are unable to relocate because of low home values, a product (paradoxically) of being so close to polluting industry. Residents lack access to public transportation: in March 2016 the public transportation authority stopped serving the area. They also lack sufficient access to healthy food, health care, and to political representation. This entanglement of issues, coupled with a lack resources and the disproportionate layering of intersecting social issues, epitomizes environmental justice communities like Harrisburg/Manchester.

Long-term daily exposures to air pollution can lead to health effects that go unaddressed due to residents' limited financial and health care resources.

GALENA PARK

East of Highway 610 and north of Harrisburg/Manchester is the city of Galena Park, originally named Clinton. Formed in 1835, Clinton was a ranching and farming community that benefited economically from being at the mouth of the Houston Ship Channel prior to the construction of the Turning Basin (Ramirez 2010). Due to development of the Houston Ship Channel and the oil industries it began to harbor in the early 1900s, Clinton's economy became less reliant on its agrarian trade and more on industrial development such as oil and synthetic rubber, as well as the movement of goods by water and then by rail (Sibley 2016). Clinton was renamed Galena Park in 1935 after the Galena Signal oil refinery (Siegel and Moretta 2005). Galena Park became an industry town where most of the population worked in oil production in some capacity (Leslie and Edwards 1993). At its inception, Galena Park's population was majority white, due to vast racial segregation in the city. Today, Galena Park is a low-income community of roughly 11,000 residents, of whom 81 percent are Hispanic (Census Bureau 2016).

Like Harrisburg/Manchester, Galena Park is surrounded by the oil, chemical, and supporting industries—the Valero refining stack and Eco Services' candy cane–striped sulfuric acid marker in Harrisburg/Manchester can be seen from homes in Galena Park. Today more than 50 industrial facilities are located in the community, including those owned or operated by Kinder Morgan, Shell, and United States Gypsum. Many sit within one-tenth of a mile from homes and workplaces (EPA 2015a) (see appendix).

Today, rail lines surround the city and intersect with its exits, creating a nightmare for emergency workers traveling to the site of a chemical release. Even though—unlike the city of Houston—Galena Park does have zoning restrictions, it has been on the Texas Commission on Environmental Quality's pollutant watch list for 16 years based on benzene levels that have exceeded screening levels of both the EPA and the Texas Commission on Environmental Quality (Wray 2016b). The toxic air-pollution problem is so extensive that the commission expanded the boundary of the Galena Park air pollutant watch list to include monitoring at additional benzene sources, and the Harris County Pollution Control Services Department added a monitor in 2011 (Capobianco et al. 2013).

BELLAIRE

We selected the west Houston community of West Oaks/Eldridge and the city of Bellaire as comparison communities based on their racial and economic demographics as well as their geographical locations. Both communities are substantially more affluent than the east Houston communities of Harrisburg/Manchester and Galena Park.

The city of Bellaire is a predominantly white (73 percent), upper-class community located within the inner Houston core and has an average income almost five times higher, home values eight times higher, and a poverty rate 7 and 12 times lower than those of Galena Park and Harrisburg/Manchester, respectively. Bellaire ("good air")—so named for its Gulf Coast winds—was founded in 1908 after Southwest Land Company purchased the 9,449-acre Rice Ranch and was incorporated in 1918. Bellaire has zoning for light industrial, commercial, and mixed-use residential and commercial areas. The zoning efforts do not permit open storage facilities such as wrecking, junk, or salvage yards (Bellaire, Texas, code of ordinances 2006). The city has only two allotments for light industrial activity, one of which houses the City of Bellaire Public Works.

WEST OAKS/ELDRIDGE

West Oaks/Eldridge is located in the outer Houston suburbs. Just 30 years ago, this area transitioned from rural sprawling ranches to more residential properties, with energy and business growth. Unlike Harrisburg/Manchester, West Oaks/

> ***Today, rail lines surround the city and intersect with its exits, creating a nightmare for emergency workers traveling to the site of a chemical release.***

Eldridge has a vast amount of green space, including the Terry Hershey Park trail system that provides walking and bike trails, the George Bush Park west, and the Ray Miller Park with a butterfly garden. Along with several public school districts, several private schools service the area. West Oaks/Eldridge is also the headquarters of many of the corporations that own facilities in east Houston, including BP America, Citgo, ConocoPhillips, Dow Chemical, and ExxonMobil Chemical. Although the majority of the population is people of color, whites are the predominant individual race, and the poverty rate is one-half to one-third that of the east Houston communities.

Methodology

HOUSTON COMMUNITIES INCLUDED IN THE REPORT

Our analysis of chemical exposures, cancer, and respiratory health risks focused on four communities within the Houston urban area (Census Bureau n.d.a.): Harrisburg/Manchester and Galena Park in east Houston, and Bellaire and West Oaks/Eldridge in west Houston (Figure 1). West Oaks/Eldridge and Harrisburg/Manchester are both Houston "super neighborhoods," while Bellaire and Galena Park are both classified by the US census as "cities" within the Houston metropolitan area.

FIGURE 1. The Four Houston-area Communities Analyzed for Toxic Chemical Pollution and Health Risks

Toxic air pollution levels and health risks in predominately Hispanic and low-income east Houston communities of Manchester/Harrisburg and Galena Park were compared the wealthier and predominantly white west Houston communities of Bellaire and West Oaks/Eldridge.

SOURCES: HOUSTON URBAN AREA, GALENA PARK, AND BELLAIRE BOUNDARIES, CENSUS BUREAU N.D.A.; MANCHESTER AND WEST OAKS/ELDRIDGE BOUNDAIRES, HOUSTON DATA PORTAL 2013.

The four communities were chosen to allow us to assess any differences in toxic-chemical exposures and potential health risks that may exist between the two types of communities based on demographics (Table 1). The east Houston communities of Harrisburg/Manchester and Galena Park were chosen as examples of Houston frontline communities that are directly impacted by numerous polluting industrial facilities. The west Houston community of West Oaks/Eldridge and the city of Bellaire were selected as comparison communities based on their economic demographics as well as their different geographical locations within the Houston Urban Area. Both communities are substantially more affluent than the east Houston communities of Harrisburg/Manchester and Galena Park. Bellaire is a predominantly white (73 percent), upper-class community located within the inner Houston core with an average income almost five times higher, home values eight times higher, and a poverty rate seven to 12 times lower than those of the east Houston communities. In contrast to the lack of citywide zoning in Houston, Bellaire has zoning for light industrial, commercial, and mixed-use residential and commercial uses. Though West Oaks/Eldridge has a majority of people of color, whites are the predominant individual race, and the poverty rate in that community is one-half to one-third that of the east Houston communities.

With respect to the percentage of people living in poverty in all Houston communities, the Harrisburg/Manchester and Galena Park communities rank in the top 94th and 60th percentiles, respectively, while the Bellaire and West Oaks/Eldridge communities rank in the bottom 4th and 30th percentiles. The two east Houston communities are in the top 92nd and 68th percentiles for percentage of people of color, respectively, and the two west Houston communities are in the bottom 17th and 46th percentiles, respectively (Figure 2, p. 9). Both West Oaks/Eldridge and Bellaire are home to fewer high-risk chemical facilities than the five and eight facilities located within one mile of Harrisburg/Manchester and Galena Park, respectively. Only four such facilities are located within one mile of West Oaks/Eldridge, and just one lies within a mile of Bellaire (see Table 8, p. 15).

DATA COLLECTION AND MAPPING

Publicly available data from the EPA's RMP as provided by the Right-to-Know Network (CEG 2014) were used to determine which RMP facilities were located in the Houston urban area (as defined by the US census) and, more specifically, in the four communities of interest. Facilities' locations were determined based on their self-reported latitude/longitude codes.

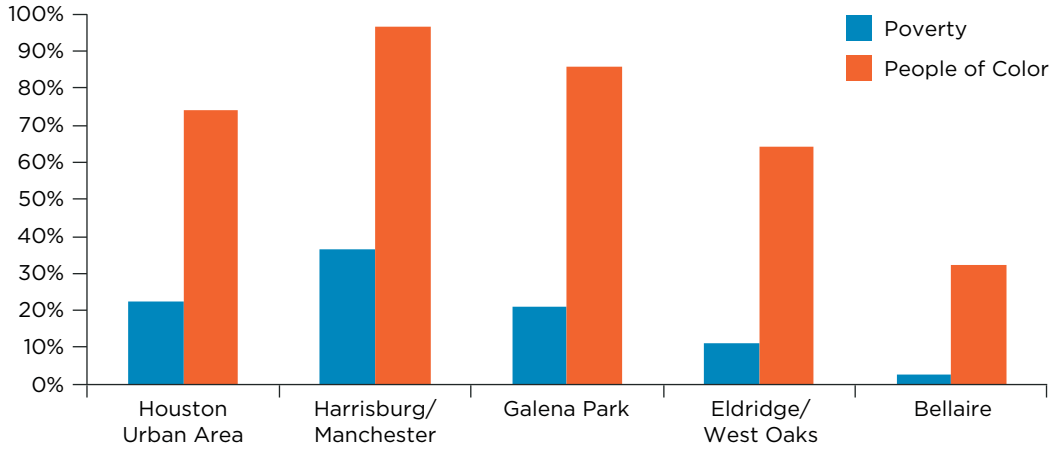
TABLE 1. Wide Demographic Differences Exist Among the Four Houston Communities, including those Populations Living within One Mile of an RMP Facility, and the Houston Urban Area

	Houston Urban Area	Galena Park	Galena Park RMP 1 Mile	Harrisburg/ Manchester	H/M RMP 1 Mile	Bellaire	Bellaire RMP 1 Mile	West Oaks/ Eldridge	West Oaks/ Eldridge RMP 1 Mile
% Population People of Color	67%	86%	86%	97%	97%	32%	34%	64%	76%
% Population in Poverty	17%	21%	21%	37%	38%	3%	4%	11%	11%
Average Home Value	$197,888	$68,118	$71,088	$80,028	$78,159	$647,544	$534,755	$243,912	$177,031
Average Household Income	$82,920	$49,732	$48,233	$45,431	$45,520	$226,333	$191,864	$91,055	$82,178

Demographic data from the US Census Bureau's American Community Survey, accessed via the Census Bureau's "data ferrett" interface (United States Census Bureau n.d.), were used to create census tract–level data tables. This database is updated annually and summarized into three- and five-year spans. The most recent five-year span, 2010 to 2014, was used for this analysis.

SOURCE: CENSUS BUREAU N.D.B.

FIGURE 2. Harrisburg/Manchester and Galena Park Have Substantially Higher Percentages of Poverty and People of Color Compared with West Oaks/Eldridge, Bellaire, and the Houston Urban Area



Using geographic boundaries and racial and poverty statistics from the Census Bureau and Houston government, the population in each of the four communities and the Houston Urban Area were compared to each other.

SOURCE: CENSUS BUREAU, N.D.B.

We obtained data from the EPA's 2011 National Air Toxics Assessment (NATA) cancer risk and respiratory hazard index, as well as specific pollutant risk data, from the NATA website (EPA 2015b), using the census-tract identification codes.

To identify the air pollution burden and chemicals with the greatest health impacts on the four Houston communities, we utilized data from the EPA's Risk Screening Environmental Indicators (RSEI) program (EPA 2016c). In addition, we used the RSEI database to identify industrial sources with the largest toxic air pollution in these communities. The RSEI data were obtained from the EPA and provided to us by Dr. Michael Ash. Dr. Ash is professor of economics and public policy and the chair of the Department of Economics at the University of Massachusetts Amherst. He is affiliated with the Political Economy Research Institute and has access to RSEI microdata. Although these data are publicly available, they are not readily available in the format we required for this analysis. Dr. Ash provided aggregated "toxic concentration" data for the census tracts in the Houston urban area.

The RSEI uses information from the EPA's Toxics Release Inventory (TRI), which tracks toxic chemical releases to the air and water as well as waste management activities for more than 400 chemicals at more than 50,000 industrial and federal facilities across the United States. The RSEI uses simplifying assumptions to fill data gaps and reduce the complexity of calculations. The RSEI toxic concentration scores are unitless numbers that integrate pollution emissions reported to the Toxics Release Inventory weighted by the toxicity of each pollutant and the amount impacting a location. It does not provide a formal risk assessment or describe a specific level of risk, but provides a numeric basis for comparing scores across communities.

Unlike the NATA data discussed previously, which are limited to information on toxic air pollution levels from 2011,

With respect to the percentage of people living in poverty in all Houston communities, the Harrisburg/ Manchester and Galena Park communities rank in the top 94th and 60th percentiles.

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In Harrisburg/Manchester and Galena Park, where numerous chemical facilities are located within residential neighborhoods, toxic air pollution levels are much higher than in Bellaire and West Oaks/Eldridge.

the RSEI toxic concentration values for the communities are based on more recent TRI data from 2014. However, it should be noted that while the NATA data are based on toxic air pollution emissions from a broad spectrum of sources (such as large and small industrial facilities, on-road and off-road mobile sources, secondarily formed air pollution), the RSEI data used for this analysis are limited to air pollution emissions from the industrial sources that report to the TRI program.

DEMOGRAPHIC AND TOXIC RISK CALCULATIONS

We used the areal apportionment method to determine the demographics of the neighborhoods and the one-mile zones around the RMP facilities (Mohai and Saha 2007; Mohai and Saha 2006). Thus, demographic characteristics were determined by weighting them based on the proportion of the tract that was captured in the area we studied, then aggregating those data.

NATA risk scores were calculated using the methodology explained in the NATA technical support document (EPA 2015c). We multiplied the "total cancer risk" by the tract population (calculated using the areal apportionment method described above) in the area studied, then aggregated those results and divided that total by the total population in the area. The "cancer risk" and "respiratory hazard index" were calculated for each of the pollutants, and the five chemicals with the highest cancer risk and the five chemicals with the highest respiratory hazard index in each area were identified.

The RSEI "toxic concentration" scores were calculated by multiplying the air pollution toxic concentration by the tract population (as determined using the areal apportionment method described previously) in the area studied, then aggregating those results and dividing that total by the total population in the area. The final values for toxic concentration were also analyzed by chemical and responsible facility in each of the areas studied. Those results were then sorted from highest to lowest values to determine the chemicals and facilities yielding the highest toxic concentration in each area. More information about RSEI can be found at *https://www.epa.gov/rsei/risk-screening-environmental-indicators-rsei-methodology-version-234*.

Results

TOXIC AIR POLLUTION IN HOUSTON

Using the EPA's RSEI data, we found large disparities between the east and west Houston communities in terms of overall toxicity levels from chemical exposures. Our analysis showed that toxicity levels from exposures in Harrisburg/Manchester are 12 and more than three times higher than in West Oaks/Eldridge and Bellaire, respectively, and exposures in Galena Park are 17 and almost five times higher (Table 2).

TABLE 2. Total Toxic Concentration Values in East Houston Communities Are Many Times Higher than West Houston Communities

Community	Total Toxic Concentration
Galena Park	157,653
Harrisburg/Manchester	110,712
Bellaire	32,291
West Oaks/Eldridge	9,233

RSEI data were utilized to derive total toxic concentration values from all of the reporting facility sources that release toxic chemicals into the air in the four Houston communities. By analyzing information from the Toxics Release Inventory together with risk factors, such as each chemical's toxicity, RSEI calculates a toxic concentration numeric score. These scores are then multiplied by the number of affected people in each location and divided by the location population to provide a population-adjusted toxic concentration value.

SOURCES: EPA 2016C; CENSUS BUREAU N.D.B.

POLLUTION SOURCES IMPACTING THE HOUSTON COMMUNITIES

We also analyzed which major industrial facilities contributed the greatest air pollution burden on the communities studied. The high levels of toxic air pollution from major industrial sources in the communities of Harrisburg/Manchester and Galena Park are shown in Table 3. The concentrations in the east Houston communities are 10 to 16 times greater than those in the west Houston communities.

TABLE 3. Top Five Industrial Facilities Impacting the Four Houston Communities

Community	Facility Name	Toxic Concentration	Type of Facility
Galena Park	Ameriforge Corp.	43,358	Iron and Steel Forging
	Targa Downstream LLC–Galena Park Marine Terminal	21,134	Petroleum Bulk Stations and Terminals
	Bayer Materialscience Baytown	16,414	All Other Basic Organic Chemical Manufacturing
	Valero Refining–Texas Lp Houston Refinery	15,180	Petroleum Refining
	Houston Refining LP	6,737	Petroleum Refining
	Total	**102,823**	
Harrisburg/ Manchester	The Goodyear Tire & Rubber Co.	17,191	Synthetic Rubber Manufacturing
	Valero Refining—Texas LP Houston Refinery	14,820	Petroleum Refining
	Ameriforge Corp	13,577	Iron and Steel Forging
	Bayer Materialscience Baytown	8,399	All Other Basic Organic Chemical Manufacturing
	Houston Refining LP	6,254	Petroleum Refining
	Total	**60,241**	
Bellaire	Ellwood Texas Forge	16,172	Iron and Steel Forging
	Ameriforge Corp.	2,167	Iron and Steel Forging
	Ameri-Forge Ltd. dba/Forged Vessel Connections	1,599	All Other Miscellaneous Fabricated Metal Product Manufacturing
	Dixie Chemical Co, Inc.	997	All Other Basic Organic Chemical Manufacturing
	Wyman-Gordon Forgings LP	908	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
	Total	**21,843**	
West Oaks/ Eldridge	Ellwood Texas Forge	2,413	Iron and Steel Forging
	Ameriforge Corp.	1,473	Iron and Steel Forging
	Wyman-Gordon Forgings LP	1,301	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
	Daniel Measurement & Control, Inc.	618	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
	Hoover Materials Handling Group, Inc.	565	All Other Plastics Product Manufacturing
	Total	**6,370**	

Toxic concentration scores are numbers without units calculated by aggregating the air-pollution toxic concentration for all tracts in each community studied. The toxic concentration numbers were further aggregated by responsible facility in each community. It is important to note that some of the facilities with major chemical-pollution impacts on these communities are not located within the community, but their pollution is transported over longer distances into these communities.

SOURCES: ASH 2016; EPA 2016C.

TOXIC AIR POLLUTION WITH THE GREATEST POTENTIAL FOR HEALTH IMPACTS

We further analyzed the individual chemicals contributing to the toxic concentration levels in the four Houston communities, highlighting the top five chemicals with the greatest concentrations (Table 4). While several of the chemicals with the largest toxic concentrations are consistent across the four communities, there are substantially greater exposures in the Harrisburg/Manchester and Galena Park communities for several of these toxic chemicals. For example, the toxic concentration of 1,3-butadiene, which causes cancer and a host of adverse neurological effects, was 174 times and 29 times greater in Harrisburg/Manchester than the levels in West Oaks/Eldridge and Bellaire, respectively, and levels in Galena Park were 228 times and 38 times greater. The toxic concentration of cancer-causing benzene was almost eight times greater in Harrisburg/Manchester compared with Bellaire. The toxic concentration of cobalt, which can cause respiratory health problems, was 11 and 33 times greater in Galena Park than in Bellaire and West Oaks/Eldridge, respectively.

HEALTH RISKS OF TOXIC AIR POLLUTION EXPOSURE

To compare the cancer risks and potential respiratory hazards from residents' exposure to toxic air pollution in the four Houston communities studied, we used data from the EPA's National Air Toxics Assessment. The NATA was developed primarily as a tool to inform both national and more localized efforts to collect air toxics information and characterize emissions (e.g., to prioritize pollutants or geographical areas of interest for more-refined data collection such as monitoring). The 2011 NATA data, the most recent available, include data for 140 toxic air pollutants from a broad spectrum of sources including large industrial facilities, such as refineries and power plants, and smaller sources, such as gas stations, oil and gas wells, and chrome-plating operations. Other pollution sources include cars, trucks, and off-road sources such as construction equipment and trains, as well as pollution formed by chemical reactions in the atmosphere.

The EPA calculates the amount of air pollution faced by people at the census-tract level and then uses health benchmarks to estimate cancer risks and respiratory health hazards from the combined effect of those exposures. Cancer risks are expressed as the projected number of cancers per million people based on a 70-year lifetime of exposure. The respiratory hazard index represents the ratio of pollutant levels compared with EPA benchmarks established as not likely to cause non-cancer respiratory illnesses based on a lifetime of exposure. An index value greater than 1 indicates the potential for adverse health impacts, with increasing concern as the value increases.

The cancer risk and respiratory hazard values are based on numerous modeled data and therefore should be viewed as estimates of average population risks and hazards rather than exact risk numbers for a particular person. Although NATA estimates cancer risks and non-cancer hazards for numerous toxic air pollutants, additional chemicals might exist that

TABLE 4. Chemicals with the Highest Toxic Concentration Values in Four Houston Communities

Community	Chemical	Toxic Concentration
Galena Park	Chromium and chromium compounds	47,783
	1,3-Butadiene	38,020
	Diaminotoluene (mixed isomers)	16,843
	Cobalt and cobalt compounds	11,975
	Hydrogen cyanide	11,684
Harrisburg/ Manchester	Chromium and chromium compounds	30,817
	1,3-Butadiene	29,083
	Hydrogen cyanide	9,512
	Diaminotoluene (mixed isomers)	8,541
	Benzene	6,795
West Oaks/ Eldridge	Chromium and chromium compounds	7,377
	Nickel and nickel compounds	470
	Cobalt and cobalt compounds	362
	Propyleneimine	187
	1,3-Butadiene	167
Bellaire	Chromium and chromium compounds	23,315
	Nickel and nickel compounds	1,323
	Cobalt and cobalt compounds	1,127
	1,3-Butadiene	992
	Benzene	884

Toxic concentration scores are numbers without units calculated by aggregating the air-pollution toxic concentration for all tracts in each area studied, and then multiplied by the population in each area.

SOURCES: ASH 2016; EPA 2016C.

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Major toxic air pollutants, including those found in high concentrations in Harrisburg/Manchester and Galena Park, are linked to cancers and other serious illnesses affecting the eyes, heart, and respiratory system.

are not identified or for which data on these health impacts are unavailable. Therefore, these risk and hazard estimates represent only a subset of the total potential cancer and non-cancer risks associated with air toxics exposures. It is also important to note that these risk estimates do not consider ingestion or the breathing of indoor sources of air toxics as an additional exposure pathway.

Residents of Harrisburg/Manchester and Galena Park face substantially higher cancer and respiratory health risks than people in West Oaks/Eldridge and Bellaire (Table 5). This finding is not surprising given the concentration of industrial pollution sources in east Houston communities and their proximity to major highways and the Houston Ship Channel.

Residents of the Harrisburg/Manchester community have a 24 and 30 percent higher cancer risk than those of Bellaire and West Oaks/Eldridge, respectively, with people in fenceline areas of Harrisburg/Manchester facing a 20 and 29 percent greater cancer risk than those in fenceline areas of Bellaire and West Oak/Eldridge. The cancer risk for

TABLE 5. The Harrisburg/Manchester Community Faces Cancer Risks 24 to 30 Percent Greater Than Those in Bellaire and West Oak/Eldridge

	Total Cancer Risk	Cancer Risk Within One Mile of RMP	Total Respiratory Hazard Index	Respiratory Hazard Within One Mile of RMP
Texas	41.07	42.80	1.77	1.90
Houston Urban Area	44.74	47.07	2.09	2.17
Galena Park	57.28	59.05	2.56	2.56
Harrisburg/Manchester	54.44	55.14	2.56	2.55
Bellaire	44.06	45.77	2.06	2.20
West Oaks/Eldridge	42.0	42.9	1.79	1.77

Values for cancer risk and respiratory health hazard for all four communities were calculated from the EPA's 2011 National Air Toxics Assessment, using the census-tract identification codes. Cancer risk is expressed as the incidences of cancer per million people. For the respiratory hazard index, an index value greater than 1 indicates the potential for adverse health impacts, with increasing concern as the value increases.

SOURCE: EPA 2015B.

Harrisburg/Manchester is 22 percent higher than for the overall Houston urban area and is 17 percent higher for people in fenceline areas of Harrisburg/Manchester than for people in fenceline areas of the overall Houston urban area.

Residents of Galena Park face cancer risks that are 30 and 36 percent higher than those in Bellaire and West Oak/Eldridge, respectively, with those in fenceline areas facing a 29 and 38 percent higher risk than fenceline areas of Bellaire and West Oak/Eldridge. Cancer risk for Galena Park is 28 percent greater than that for the entire Houston urban area and 25 percent higher than for people in the Houston urban area living within one mile of an RMP facility.

> ***The cancer risk for Harrisburg/Manchester is 22 percent higher than for the overall Houston urban area.***

The respiratory hazard index for both Harrisburg/Manchester and Galena Park is 24 and 43 percent higher than for Bellaire and West Oaks/Eldridge respectively, indicating that residents in these communities face a comparatively higher potential for developing or worsening lung diseases such as asthma and chronic bronchitis. The respiratory hazard index for Harrisburg/Manchester and Galena Park is 22 percent greater than for the overall Houston urban area. Results for people living within one mile of RMP facilities in each of the four communities are generally similar to those for the entire community, though the respiratory hazard index for people in Bellaire living within one mile of an RMP facility is somewhat higher (7 percent) than that of the entire Bellaire community.

TOXIC AIR POLLUTANTS WITH THE GREATEST POTENTIAL HEALTH IMPACTS

Using NATA data, we analyzed which air pollutants were the greatest contributors to health risks in the four Houston communities (Table 6). Though the chemicals that contribute the greatest to cancer risks and respiratory hazards are generally similar across all four communities analyzed, the substantially higher levels of 1,3-butadiene in Harrisburg/Manchester results in a cancer risk that is 63 percent and 51 percent higher than that of West Oaks/Eldridge and Bellaire, respectively, while risks in Galena Park are 52 percent and 41 percent higher. Benzene-related cancer risks for residents of Galena Park are 46 percent and 25 percent higher in com-parison with West Oaks/Eldridge and Bellaire, respectively, and are 27 percent and nine percent higher in Harrisburg/Manchester. The cancer and non-cancer health effects from these air pollutants are summarized in Table 7. The potential for adverse respiratory impacts from acrolein, which contributed the most to respiratory hazard values for all four communities, was 21 and 43 percent greater in Harrisburg/Manchester compared with Bellaire and West Oaks/Eldridge, respectively, and 19 and 41 percent greater in Galena Park.

DISTRIBUTION OF HIGH-RISK INDUSTRIAL FACILITIES

Industrial facilities included in the EPA's RMP program are those that pose a significant danger from explosions, fires, and other incidents that could result in a release of hazardous chemicals into surrounding communities and disastrously affecting their residents. The Harrisburg/Manchester and Galena Park communities house many more of these RMP industrial facilities than do Bellaire and West Oaks/Eldridge (Table 8). This finding is not surprising given the lack of zoning in Harrisburg/Manchester and the failure to buffer residential areas from industrial facility siting in Galena Park, which does have zoning.

Particularly striking is the difference in populations living within one mile of these facilities: 90 percent of the population of Harrisburg/Manchester and almost 40 percent of those in Galena Park live within one mile of these dangerous facilities in contrast with the 9 and 14 percent of those living in Bellaire and West Oaks/Eldridge, respectively. While the focus of this analysis is on those living within one mile of the chemical facility fence lines, many of the facilities have impact zones for a worst-case accident that extend out three miles or even much farther. The disparity in the number of RMP facilities within three miles in the two sets of communities is especially pronounced, with 28 and 16 facilities in Galena Park and Harrisburg/Manchester, respectively, compared with seven and one in West Oaks/Eldridge and Bellaire, respectively.

Communities in the east Houston area include many RMP facilities that have a history of numerous accidents reported to the EPA. Harrisburg/Manchester and Galena Park have each had two accidents from facilities within one mile of their communities during the five years prior to the facilities' report to the EPA, while facilities in West Oaks/Eldridge and Bellaire have not reported any accidents. For a detailed interactive map of these accidents, as well as demographic data, please visit *www.ucsusa.org/DoubleJeopardy*. It is important to note that these numbers reflect only serious accidents that are required to be reported to the EPA and thus may significantly underestimate the actual number of accidents and chemical releases at these facilities.

SECURING CLEAN AIR AND SAFE FACILITIES FOR ALL HOUSTON RESIDENTS

The communities of Harrisburg/Manchester and Galena Park face disproportionately high levels of toxic air and chemical pollution—and the attendant health effects—from a broad range of sources when compared with the Houston urban area overall as well as two west Houston communities. The east Houston communities contain more high-risk RMP

TABLE 6. Cancer Risks and Respiratory Health Hazards in East Houston Communities from the Top Five Toxic Air Pollutants and Cancer-Causing Chemicals by Total Risk (Cancer Incidence per Million People)

	Galena Park	Harrisburg/Manchester	Bellaire	West Oaks/Eldridge
Cancer-causing Chemicals by Total Risk (Cancers/Million People)				
Formaldehyde	25.76	25.02	23.78	24.44
1,3-Butadiene	7.53	8.03	5.33	4.94
Benzene	5.94	5.18	4.75	4.07
Acetaldehyde	5.49	5.13	3.28	3.28
Carbon Tetrachloride	3.29	3.28	2.47	1.88
Respiratory Hazard Index Chemicals by Hazard Impact				
Acrolein	1.72	1.74	1.44	1.22
Acetaldehyde	0.28	0.26	0.24	0.25
Formaldehyde	0.20	0.20	0.19	0.19
Diesel PM	0.19	0.18	0.13	0.10
Chlorine	0.08	0.06	0.01	0.01

Cancer risk and respiratory health hazard values by chemical for all four communities were calculated from the EPA's 2011 National Air Toxics Assessment, using the census-tract identification code.

SOURCE: EPA 2015B.

TABLE 7. Cancer and Non-Cancer Health Effects of Major Toxic Air Pollutants

Air Pollutant	Cancer	Non-Cancer
Formaldehyde	✔	Respiratory, eyes
1,3-Butadiene	✔	Female reproductive
Benzene	✔	Immune
Acetaldehyde	✔	Respiratory, eyes
Carbon Tetrachloride	✔	Liver, kidney damage
Acrolein	No	Respiratory, eyes
Diesel Particulate Matter (PM)*	✔	Respiratory, heart
Chlorine	No	Respiratory, eyes
Hydrochloric acid/ Hydrogen chloride	No	Respiratory, eyes

Six out of the nine major air pollutants found in the communities studied can cause cancer, and all nine can cause health problems.

* The EPA does not include cancer risks from diesel PM in the NATA.

SOURCES: EPA 2016E; ATSDR 2014; CALEPA 2016.

TABLE 8. High Percentages of People in Harrisburg/ Manchester and Galena Park Live Close to RMP Facilities

Community	# of Facilities (1 Mile)	# of Facilities (3 miles)	% of Total Population Within 1 Mile of at Least One RMP Facility
Harrisburg/ Manchester	5	16	90%
Galena Park	8	28	39%
Bellaire	1	1	9%
West Oaks/ Eldridge	4	7	14%

Publicly available data from the EPA's RMP program obtained from the Right-to-Know Network (CEG 2014) were used to determine which RMP facilities were located in the four Houston communities. Facility locations were based on their self-reported latitude/longitude code.

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Significant improvements in monitoring and regulating chemical exposure are needed to ensure the health and safety of east Houston residents.

> ***In recent years some east Houston monitoring stations have reported increased levels of hazardous pollutants.***

facilities in relatively close proximity to their communities and have a higher proportion of their population within vulnerable zones. In essence, they deal with the "double jeopardy" of stresses and health consequences of potential catastrophic accidents from nearby industrial facilities, as well as the daily, chronic exposure to high levels of toxic pollution. The disproportionate health and safety risks from this concentration of high-risk and heavily polluting facilities underscore the need for environmental justice for these communities.

These risks represent only one of the many factors that influence the health and well-being of the east Houston communities covered in this report. Indoor air pollution; mold and lead from inadequate housing; and lack of access to health care, healthy foods, and public transportation; along with other stresses related to poverty and crime, are just some of the compounding factors that contribute to the cumulative health impacts on residents of environmental justice communities such as those in east Houston (Prochaska et al. 2014; Hynes and Lopez 2007).

Efforts initiated by former Houston mayor Bill White in the mid-2000s to reduce the high levels of toxic air pollutants in east Houston did have some success. In recent years, however, some east Houston monitoring stations have reported increased levels of hazardous pollutants, and concentrations overall seem to be leveling off at these higher levels (Sexton and Linder 2015). A recent assessment of the efforts resulting from the earlier Mayor's Task Force on the Health Effects of Air Pollution concluded that "since White left office in 2010, air quality management in Houston has returned to the way it was before, and today there is scant evidence that his policies have had any lasting impact." This assessment also determined that toxic air-pollution levels are "still not good enough and are not improving fast enough, especially for sensitive and vulnerable populations living in close proximity to major emission sources" (Sexton and Linder 2015).

Recommendations

Significant and expedited improvements in regulatory and public policy are needed at the national, state, and municipal levels to address the health and well-being of at-risk commu-

nities in east Houston and elsewhere. The EPA is currently developing revisions to its RMP rule for chemical facilities (EPA 2016d). The program has the potential to improve the safety of chemical facilities and the ability of communities to prepare for—and respond to—accidents at these dangerous facilities (Kothari 2016).

The first four recommendations that follow aim to improve the safety of high-risk industrial facilities, expand communities' access to information about the acute hazards posed by nearby facilities, and improve communities' preparedness for responding to a toxic chemical release. They may have the additional benefit of reducing the daily load of toxic air pollution that affects these communities. The last two recommendations address both the acute risks from chemical facility accidents as well as the risks from daily chronic exposure to toxic air pollution.

Require chemical facilities to use safer chemicals and technologies. Switching to inherently safer chemicals and technologies wherever feasible is the most effective way to prevent deaths and injuries from chemical disasters. In revising its RMP rule, the EPA should require chemical facilities to assess the use of safer processes and adopt them wherever feasible.

Switching to inherently safer chemicals and technologies wherever feasible is the most effective way to prevent deaths and injuries from chemical disasters.

Ensure that facilities share information and their emergency response plans with fenceline communities. The EPA should ensure that communities have access through effective and purposeful outreach to information on hazards and emergency planning under its RMP program and that they have information on facility hazards submitted to states under the Emergency Planning and Community Right-to-Know Act. Local residents, trained health care professionals, emergency responders, and health-care providers need this information to prepare for and effectively respond to a chemical disaster, should one occur. Communities should be

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Communities like Galena Park in east Houston need stronger health and environmental policies at municipal, state, and federal levels to protect residents from toxic air pollution and potential chemical release from nearby chemical facilities.

included in emergency response planning and implementation. Emergency response facilities and the measures devised under these plans should be ready for operation should a chemical release occur.

Require large chemical facilities to continuously monitor and report their fenceline-area emissions and health hazards. Unplanned, smaller releases of toxic chemicals are often a precursor to more serious incidents at chemical facilities and may themselves directly impact the health of people living in fenceline communities. People living in fenceline areas should be able to easily access information (based on validated continuous monitoring) on the toxic emissions coming from industrial facilities, along with information about the chemicals' health hazards. The EPA should expand current requirements for benzene monitoring by oil refineries in fenceline areas to include other toxic air pollutants and other major industrial sources. This information can help communities advocate for vigorous enforcement of regulatory requirements by relevant authorities; push companies to use safer chemicals; alert and educate friends, family members, and community members; and encourage the media to report on polluting facilities in their areas.

Prevent the construction of new or expanded chemical facilities near homes and schools and, conversely, the siting of new homes and schools near dangerous chemical plants. The siting of new chemical facilities or expansion of existing ones in close proximity to homes, schools, or playgrounds significantly increases the possibility that an incident will result in a disaster. Similarly, new homes, schools, and playgrounds should not be sited near dangerous chemical plants. Municipal authorities should adopt and enforce local ordinances that require an assessment of the potential health and safety risks when siting homes, schools, and other public facilities. Requiring a buffer zone between these areas and polluting sources also reduces residents' daily exposure to toxic chemical pollution.

Require publicly accessible, formal health-impact assessments and mitigation plans to gauge the cumulative impact of hazardous chemical exposures on fenceline communities. Environmental and public health agencies in Houston, in Texas, and at the federal level should assess the potential impact of unplanned chemical releases and the cumulative impacts of daily air-pollution exposures on the health of fenceline communities. A focus on cumulative impacts is a cornerstone of environmental justice. Agencies and elected officials should provide the affected communities with the tools and resources they need to fully engage in the assessment process, and the EPA should review hazard assessments of these communities. Emissions permits should be strengthened where necessary to account for the cumulative impact of air-pollution emissions on fenceline communities and provide the reductions in air pollution necessary to protect public health.

Strengthen the enforcement of existing environmental and workplace health and safety regulations. Congress should increase funding to the EPA and the states for expanding inspections and improving the enforcement of environmental and workplace health and safety laws, so that problems in chemical facilities can be identified before they lead to disasters. Better oversight and enforcement will also help agencies and the public hold companies accountable if they fail to address identified hazards and emissions of toxic pollution. Communities facing some of the greatest threats from chemical facility incidents and toxic air pollution need strong governmental policies to protect them, including strict permitting requirements and reliable inspection and enforcement of these requirements. If state and municipal governments are not providing adequate protection, it is essential that the EPA engage to defend these communities' right to a safe environment.

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[APPENDIX A]

Industrial Facilities in Harrisburg/Manchester and Galena Park

TABLE A-1. Industrial Facilities in Harrisburg/Manchester

Name of Facility	Location	SIC/NAICS Code	Code Description
Houston, TX #1–Westway Terminals	9325 E. Avenue S Houston, TX 77012	NAICS 424910	Farm supplies merchant wholesalers
Valero Refining	9701 Manchester Houston, TX 77012	NAICS 324110	Petroleum refineries
Echo Distribution Systems	2000 Lawndale Street Houston, TX 77017	SIC 2911	Petroleum refining
SIMS Bayour North WWTP	9500 Lawndale Street Houston, TX 77017	NAICS 221310, 921190, 221320	Water supply and irrigation systems, other general government support, sewage treatment facilities
Quality Carriers	1710 Central St. Houston, TX 77017	NAICS 48412,4841	General freight trucking, long-distance, truckload; general freight trucking
Merichem Company John T Files Technical Center	1503 Central Houston, TX 77012	NAICS 54171, 541712	Research and development in the physical sciences, engineering, and life sciences; research and development in the physical sciences, engineering, and life sciences (except biotechnology)
Solid Waste Lawndale	1502 Central Dr. Houston, TX 77012	NAICS 92119	Other general government support
South Coast Terminals WWTP	Intersection of Loop 610 and HSC Houston, TX	SIC 5171	Petroleum bulk stations and terminals
JHA Environmental Services	8930 Lawndale Street Suite E Houston, TX 77012	NAICS 92411	Administration of air and water resource and solid waste management programs
Texas Port Recycling LP	8945 Manchester St. Houston, TX 77012	NAICS 42393	Recyclable material merchant wholesalers
Solvay - Houston Plant	8615 Manchester St. Houston, TX 77012	NAICS 325180	Other basic inorganic chemical manufacturing
Lone Star Industries	402 Concrete Houston, TX 77012	NAICS 32731	Cement manufacturing
Houston Dynamic Service Inc.	8150 Lawndale Houston, TX 77012	NAICS 333319	Other commercial and service industry machinery manufacturing

TABLE A-1. Industrial Facilities in Harrisburg/Manchester (CONTINUED)

Name of Facility	Location	SIC/NAICS Code	Code Description
Ameritech Inc. (SB)	8315 Manchester Houston, TX 77012	SIC 5051-06 NAICS 423510	Steel distributors and warehouses. Metal service centers and other metal merchant (wholesale)
SIMS Bayour North WWTP	9500 Lawndale Street Houston, TX 77017	NAICS 221310, 921190, 22132	Water supply and irrigation systems, other general government support, sewage treatment facilities
Chevron USA	8001 Lawndale Houston, TX 77012	NAICS 484121	General freight trucking, long-distance, truckload
Comsource Inc.	7412 Manchester St. Houston, TX 77012	NAICS 54138	Testing laboratories
Eddy Refining Company	7401 Manchester Houston, TX 77012	SIC 2911	Petroleum refining
SWS Holdings–Pasadena	8502 Cypress St. Houston, TX 77012	NAICS 336611	Ship building and repairing
Petro-Tech Environmental	8502 Cypress St. Suite B Houston, TX 77012	NAICS 562910	Remediation services
South Coast Terminals	9317 E Ave. S Houston, TX 77012	SIC 5171	Petroleum bulk stations and terminals
Jestex	8107 E. Magnolia Houston, TX 77012	SIC 3441	Fabricated structural metal
Buffalo Marine Service	8201 E Erath St. Houston, TX 77012	SIC 4213-02 NAICS 484230	Fuel, bulk delivery Specialized freight (except used goods) trucking, long distance
CJN Offshore Solutions	7601 Harrisburg Blvd Houston, TX 77012	NAICS 332311	Prefabricated metal building and component manufacturing
Gulf Stream Marine	10000 Manchester Houston, TX 77012	NAICS 488320	Marine cargo handling
Houston Mooring Co.	10000 Manchester Suite C Houston, TX 77012	NAICS 488330	Navigational services to shippings

TABLE A-2. Industrial Facilities in Galena Park

Name of Facility	Location	SIC/NAICS Code	Code Description
Chemical Exchange Industries, Inc. (CXI)	900 Clinton Dr. Galena Park, TX 77547	SIC 2869 NAICS 424690	Industrial organic chemicals, not elsewhere classified Other chemical and allied products merchant wholesalers
Texmark Chemicals, Inc.	900 Clinton Dr. Galena Park, TX 77547	SIC 2899-05 NAICS 325110	Chemicals—manufacturers Petrochemical manufacturing,
GATX Terminals Corp	906 Clinton Dr. Galena Park, TX 77547	SIC 4226	Special warehousing and storage, not elsewhere classified
Kinder Morgan Kansas, Inc.	906 Clinton Dr. Galena Park, TX 77547	NAICS 486210	Pipeline transportation of natural gas
Equilon Enterprises LLC	780 Clinton Dr. Galena Park, TX 77547	SIC 1311 NAICS 211111	Crude petroleum and natural gas Crude petroleum and natural gas extraction
Shell Oil Company	780 Clinton Dr. Galena Park, TX 77547	SIC 2992	Lubricating oils and greases
Shell Lubricants	708 Clinton Dr. Galena Park, TX 77547	NAICS 211111	Crude petroleum and natural gas extraction
National Oilwell Varco, Inc.	210 Magnolia Dr. Galena Park, TX 77547	NAICS 213112	Support activities for oil and gas operations
Mercantile Oil & Gas Producing Corporation	2203 7th St. Galena Park, TX 77547	NAICS 211111	Crude petroleum and natural gas extraction
Enterprise Crude Oil LLC	901 Clinton Dr. Galena Park, TX 77547	SIC 5172	Petroleum and petroleum products wholesalers, except bulk stations and terminals
Texas Mill Supply & Manufacturing Company Inc.	2413 Avenue K Galena Park, TX 77547	NAICS 339999	All other miscellaneous manufacturing
Tri Resources, Inc.–Targa Resources Inc.	12801 American Petroleum Rd. Galena Park, TX 77547	NAICS 211111	Crude petroleum and natural gas extraction
Targa Downstream LLC–Galena Park Marine Terminal	12510 American Petroleum Rd. Galena Park, TX 77547	NAICS 424710	Petroleum bulk stations and terminals
Louis Dreyfus Biofuels Holdings LLC	1500 S Main St. Galena Park, TX 77547	NAICS 523130, 488210	Commodity contracts dealing, Support activities for rail transportation
Galena Park Chevron U.S.A. Inc.	12523 American Petroleun Rd. Galena Park, TX 77547	NAICS 424710	Petroleum bulk stations and terminal
Chevron Marketing Terminal	12523 American Petroleum Rd. Galena Park, TX 77547	SIC 5088-05 NAICS 423860	Ship chandlers Transportation equipment andsupplies (exceptmotor vehicle) merchant

TABLE A-2. Industrial Facilities in Galena Park (CONTINUED)

Name of Facility	Location	SIC/NAICS Code	Code Description
Kinder Morgan Liquids Terminals L.P.	405 Clinton Dr. Galena Park, TX 77547	NAICS 493110	General warehousing and storage
KM Liquids Terminals, L.P	906 Clinton Dr. Galena Park, TX 77547	NAICS 48411, 493110	General freight trucking, local; general warehousing and storage
Green Earth Fuels of Houston LLC	550 Clinton Dr. Galena Park, TX 77547	NAICS 325199	All other basic organic chemical manufacturing
Kinder Morgan Crude and Condensate LLC	407 Clinton Dr. Galena Park, TX	NAICS 32411	Petroleum refineries
Kinder Morgan Inc.	405 Clinton Dr. Galena Park, TX 77547	SIC 4925-01 NAICS 221210	Gas companies Natural gas distribution
Kinder Morgan Inc.	701 Philpot Dr. Galena Park, TX 77547	SIC 4612-01 NAICS 486110	Crude petroleum pipelines Pipeline transportation of crude oil
Kinder Morgan Inc.	906 Clinton Dr. Galena Park, TX 77547	SIC 5171-98 NAICS 424710	Petroleum bulk stations and terminals (wholesale) Petroleum bulk stations and terminals
Oil States Intl Inc.	550 Clinton Dr. Galena Park, TX 77547	NAICS 211111	Crude petroleum and natural gas extraction
Sopus Products	780 Clinton Dr. Galena Park, TX 77547	NAICS 324191	Petro lubricating oil and grease manufacturing
USG Corp. Galena Park	1201 Mayo Shell Rd. |Galena Park, TX 77547	NAICS 322121	Paper (except newsprint) mills
American Plant Food Corp Galena Park	903 Mayo Shell Rd. Galena Park, TX 77547	NAICS 325314	Fertilizer (mixing only) manufacturing
Campbell Concrete & Materials Galena Park	914 Mayo Shell Rd. Galena Park, TX 77547	NAICS 327320	Ready-mix concrete manufacturing
Century Asphalt Ltd. Galena	922 Mayo Shell Rd. Galena Park, TX 77547	NAICS 324121	Asphalt paving mixture and block manufacturing
Vopak Terminal Galena Park Inc.	1500 Clinton Dr. Galena Park, TX 77547	NAICS 42471, 493110, 493190	Petroleum bulk stations and terminals, general warehousing and storage, other warehousing and storage
Magellan Galena Park Laydown Yard	901 Clinton Dr. Galena Park, TX 77547	N/A	N/A
ESI Environmental	902 ½ Holland Ave. Galena Park, TX 77547	NAICS 48411	General freight trucking, local
Burbank Barrel & Drum	1402 Clinton Dr. Galena Park, TX 77547	NAICS 81131 SIC 5093	Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance Scrap and waste materials
Tank Wash of America Inc.	1506 Clinton Dr. Galena Park, TX 77547	NAICS 488999	All other support activities for transportation

TABLE A-1. Industrial Facilities in Galena Park (CONTINUED)

Name of Facility	Location	SIC/NAICS Code	Code Description
Chem-coast Inc.	1609 First St. Galena Park, TX 77547	NAICS 54138	Testing laboratories
Dixie Services	1706 First St. Galena Park, TX 77547	NAICS 54138	Testing laboratories
Pick Instrument Products Co.	102 Eastway Galena Park, TX 77547	SIC 3599	Industrial and commercial machinery and equipment, not elsewhere classified
Pacific Eastern Carriers	2000 Avenue K Galena Park, TX 77547	NAICS 48411	General freight trucking, local
Rescar	2011 Clinton Dr. Galena Park, TX 77547	NAICS 488999	All other support activities for transportation
Container Care International	500 Mayo Shell Galena Park, TX 77547	N/A	N/A
Nov Rig Systems Galena Park	210 Magnolia Dr. Galena Park, TX 77547	NAICS 333132	Oil and gas field machinery and equipment manufacturing
Houston Lube Oil Blending Plant	780 Clinton Dr. Galena Park, TX 77547	NAICS 324191	Petroleum lubricating oil and grease manufacturing
Seaway Galena Park Station	901 Clinton Dr. Galena Park, TX 77547	NAICS 48611	Pipeline transportation of crude oil
Rayco Oilfield Service Inc.	2229 10th St. Galena Park, TX 77547	NAICS 213112	Support activities for oil and gas operations
Cassco Grinding & Machining	2410 Clinton Dr. Galena Park, TX 77547	NAICS 332812	Metal coating, engraving (except jewelry and silverware), and allied services to manufacturers
Cassco Grinding & Machining	300 Mayo Shell Rd. Galena Park, TX 77547	NAICS 332710	Machine shops
Speedy Transportation	202 Eastway St. Galena Park, TX 77547	NAICS 488210	Support activities for rail transportation
Texas Transloaders Inc.	701 Philpot Dr. Galena Park, TX 77547	NAICS 488510	Freight transportation arrangement
Transco Shipping Inc.	1606 Clinton Dr. #2 Galena Park, TX 77547	NAICS 488510	Freight transportation arrangement
Twin Carrier Transportation	806 Sage Dr. Galena Park, TX 77547	NAICS 488210	Support activities for rail transportation
Velasco Logistics Transportation	1902 3rd St. Galena Park, TX 77547	NAICS 488210	Support activities for rail transportation
Watco Transloading LLC	920 Mayo Shell Rd. Galena Park, TX 77547	NAICS 488210	Support activities for rail transportation

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Double Jeopardy in Houston

Acute and Chronic Chemical Exposures Pose Disproportionate Risks for Marginalized Communities

Harrisburg/Manchester and Galena Park in east Houston face disproportionately high levels of toxic air pollution and risk of chemical spills compared with the two west Houston communities.

This report examines the health risks of exposure to toxic air pollution to people living in different Houston neighborhoods that abut high-risk chemical facilities—as well as their potential exposure to unplanned chemical releases. Our analysis compares risks and exposure within two predominantly Hispanic and low income east Houston communities to those within two primarily white and wealthier west Houston communities.

We found that Harrisburg/Manchester and Galena Park in east Houston face disproportionately high levels of toxic air pollution—and risks from their attendant health effects—compared with the two west Houston communities, West Oaks/Eldridge and Bellaire, as well as to the Houston urban area. The east Houston communities also contain more high-risk facilities, and have a higher proportion of their population in close proximity to these dangerous facilities.

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Texas Commission on Environmental Quality
Investigation Report

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Customer: Valero Energy Partners LP
Customer Number: CN604780486

Regulated Entity Name: VALERO PARTNERS HOUSTON
Regulated Entity Number: RN109290692

Investigation # 1408309

Incident Numbers
266275 270570

Investigator: GREGORY CROOK

Site Classification MAJOR SOURCE

Conducted: 10/05/2017 -- 11/15/2017

NAIC Code: 324110
SIC Code: 2911
NAIC Code: 32411

Program(s): AIR NEW SOURCE PERMITS

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Investigation Type: Compliance Investigation

Location:

Additional ID(s): HGA164H
106017

Address: 9701 MANCHESTER ST TANK FARM,
HOUSTON, TX , 77012

Local Unit: REGION 12 - HOUSTON

Activity Type(s): UML3ON - AIR UML3ON - ON-SITE UPSETMAINTENANCE LEVEL 3 AIRCOMPL - AIR CMPL - AIR COMPLAINT INV

Principal(s):

Role	Name
RESPONDENT	VALERO ENERGY PARTNERS LP

Contact(s):

Role	Title	Name	Phone	
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Other Staff Member(s):

Role	Name
Supervisor	WARDA OMAR
Investigator	JASON HOLLOMAN
QA Reviewer	WARDA OMAR
Investigator	WARDA OMAR

Associated Check List

Checklist Name	Unit Name
AIR EMISSIONS EVENT REVIEW (ON OR AFTER 01/05/2006)	Tank T-003

Investigation Comments:

INTRODUCTION

An onsite investigation was conducted in response to an incident notification submitted on August 27, 2017 by Valero Partners Houston (Valero) to determine compliance with the emissions event rules. The incident occurred on August 27, 2017 at Tank T-003. The final report was submitted on September 21, 2017. Incident notifications are provided in Attachment 1.

Daily Narrative

On October 5, 2017, TCEQ investigator Mr. Chris Crook and Team Leader Ms. Warda Omar conducted an onsite investigation at Valero. Facility representatives present during the investigation were Mr. Matt Lindquist, Environmental Engineer; and Mr. Jeff Hude, Director of Environmental/Safety Affairs.

During the onsite investigation, Mr. Lindquist and Mr. Hude discussed the emissions event and the efforts to mitigate the release. Mr. Hude stated that the roof drain for Tank T-003 could not handle the amount of rain caused by Hurricane Harvey, which led to the failure of the external floating roof (EFR). The failure of the EFR resulted in crude oil leaking to the top of the floating roof tank. Subsequently, an oil/water mixture drained through the roof drains and into the secondary containment area.

At approximately 2:40 p.m., TCEQ staff was escorted to the crude tank farm area. Mr. Lindquist and Mr. Hude gave TCEQ staff a tour of Tank T-003 and the surrounding area. TCEQ personnel were shown the demolished portions of the roof drain system. At the time of the onsite investigation, Tank T-003 had been degassed and was being cleaned. A light hydrocarbon odor was present around the tank area. Valero representatives stated that on September 4, 2017 the skimming of oil in the secondary containment berm was completed. Subsequently, water was removed from the berm area allowing for the remaining contents of Tank T-003 to be transferred to Tank T-004. TCEQ staff continued to survey the secondary containment area that extended from Tanks 1 through 5. During the site walk through Valero representatives stated that Tank T-003 was scheduled to be taken out of service; however, they did not indicate the exact time frame. The investigators departed the site at 3:10 p.m.

An air dispersion modeling (ADM) request was sent on September 27, 2017. The deadline for receipt of the ADM report was October 18, 2017. Valero requested a two week extension on October 17, 2017. The extension was subsequently granted on October 18, 2017 which changed the report due date to November 1, 2017. Valero requested a second extension on October 31, 2017 for 30 additional days. The TCEQ denied the request. The ADM report was submitted on November 15, 2017.

The following information was requested October 3, 2017: Streamlining questions, Root Cause Analysis, inspection records, maintenance records.

The deadline for receipt of the requested information was October 17, 2017. A request for three day extension was granted to Valero October 17, 2017. The requested information was received on October 20, 2017. See Attachment 2.

EXCESSIVE EMISSIONS EVENT REVIEW

Based upon a review of information provided, it was determined that this incident is an excessive emissions event. A detailed review of the criteria for excessive emissions event determinations is included in this section.

1) The frequency of the facility's emissions events:

This was the only reportable emissions event that has occurred at Tank T-003 during the past year.

2) The cause of the emissions event:

Information provided by Valero indicates the event was caused by a failure of the EFR. Valero stated that excessive rain from Hurricane Harvey caused the tank roof to fail as the roof drain capacity was not able to handle the rainfall.

According to Valero, the facility began to experience heavy rainfall throughout the night of August 26th and into the morning hours of August 27th. Valero added that as the facility was experiencing heavy rainfall, Tank T-002 and Tank T-003 were feeding Tank T-907 and Valero operations were awaiting a pipeline transfer of crude oil into Tank T-003. Valero's Root Cause Analysis (RCA) report indicated that a pipeline transfer into Tank T-003 began at approximately 5:50 a.m. on August 26th. Valero stated that "although unknown to operations at the time, at approximately 12:15 a.m. on August 27th, the weight of the rain accumulating on the EFR of Tank T-003 exceeded the buoyancy of the western side of the roof deck which resulted in a deformation and breach of the roof seal, allowing water to flow off the roof into the tank and crude oil to flow over the submerged roof section and onto the surface of the roof deck." The outcome was a mixture of crude oil and water draining through the Tank T-003 roof drain system to the secondary containment area of the Crude Tank Farm, where it was observed by the facility's operators in the early morning hours of August 27th. The RCA report further indicated that operations personnel discovered the oil/water mixture in the secondary containment area and believed it to be localized to a small area at the southwestern corner of the Crude Tank Farm where a transfer pump basin had flooded. Despite operations personnel's knowledge of the oil/water mixture in the containment area, the loading activity of Tank T-003 continued. The RCA report stated that as daylight approached operations personnel saw that the oil/water mixture covered a greater area than they had initially thought. Subsequently, Valero operators noticed that Tank T-003 roof access ladder was at an abnormal angle and soon determined that the floating roof had become partially submerged, at which point operations stopped the pipeline transfer of crude oil into Tank T-003. The record indicates that the drain valve was closed by 9:24 a.m., which stopped the release of oil/water mixture from Tank T-003 into the secondary containment area.

Valero stated that the oil/water mixture in the secondary containment area was captured and collected by refinery response and contractor spill response personnel. Valero stated that firefighting foam was applied to the tank to reduce emissions and odors as conditions allowed. According to the incident timeline provided by Valero, the emissions from Incident No. 266275 ceased September 14, 2017. Valero's records indicated that approximately 315 barrels of crude oil were released into the secondary containment area during this incident.

A satellite image from Google Earth taken on August 30, 2017 shows a leak outside the containment area of T-003. See Attachment 3, Photo No.5. The drainage pump is located inside the containment area.

Conditions of the EFR main drainage sump and inspection records indicated that the tank was not in a good operating condition before this incident. This will be further discussed under excessive emissions event criteria #6.

3) The quantity and impact on human health or the environment of the emissions event:

It was reported that the following compounds were released during the incident:

COMPOUNDS	QUANTITY (POUNDS)
2- methylhexane	6,401.46
2- methylpentane	11,363.76
3- methylhexane	6,395.00
3- methylpentane	6,590.64
benzene	1,883.68
butane, n	9,016.74
cyclohexane	5,491.26
ethane	55.32
heptane, -n	13,333.23
hexane	16,783.72
isobutane	2,828.00
isopentane	18,027.00
methylcyclohexane	12,413.90
methylcyclopentane	5,270.57

pentane	20,040.70
propane	1,509.37
toluene	6,307.34
i-butane	2829.09
2,2-dimethylpropane	561.08
i-pentane	18,033.47
2,2- dimethylbutane	932.49
cyclopentane	31.61
2,3-dimethylbutane	1,944.01
2,2-dimethylpentane	457.72
2,4-dimethylpentane	1,308.95
2,2,3-trimethylbutane	102.54
3,3-dimethylpentane	393.03
2,3-dimethylpentane	2,380.10
1,1-dimethylcyclopentane	642.71
1c,3-dimethylcyclopentane	1,255.86
1t,3-dimethylcyclopentane	1,640.47
1t,2-dimethylcyclopentane	2,264.19
1,1,3-trimethylcyclopentane	1,218.91
ethylcyclopentane	1,216.37
1c,2t,4-trimethylcyclopentane	889.00
3,3-dimethylhexane	527.35
1t,2c,3-trimethylcyclopentane	553.80
2,3,4-trimethylcyclopentane	91.69
2,3-dimethylhexane	496.05
1, 1,2-trimethylcyclopentane	358.41
2-methylheptane	3,925.35
4-methylheptane	1,627.16
3-methyl-3-ethylpentane	568.78
3-methylheptane	2,920.17
1c,2t,3-trimethylcyclopentane	789.04
1t,4-dimethylcyclohexane	2,471.59
1,1-dimethylcyclohexane	1,401.45
2,2,5-trimethylhexane	402.99
3c-ethylmethylcyclopentane	115.89
3t-ethylmethylcyclopentane	275.98
2t-ethylmethylcyclopentane	331.77
1,1-methylethylcyclopentane	29.67
1t,2-dimethylcyclohexane	900.62
octane	5,584.33
1c,4-dimethylcyclohexane	29.02
2,4,4-trimethylhexane	40.74
2,3,5-trimethylhexane	204.57
2,3,4-trimethylhexane	287.10
n2	91.86
1,1,4-trimethylcyclohexane	866.05
ethylcyclohexane	1,633.08
2,4-dimethylheptane	32.27
4,4-dimethylheptane	1,632.37
3,3-&3,5-dimethylheptane	52.90
1c,2t,4t-trimethylcyclohexane	27.29
1c,2t,4t-trimethylcyclohexane	285.92
1,3-dimethylbenzene	2,103.18
2,3-dimethylheptane	1,902.34
4-methyloctane	640.96
2-methyloctane	1,480.72
1,1,2-trimethylcyclohexane	87.47
3-methyloctane	1,246.33
3-ethylheptane	132.17

1c,2t,4c-trimethylcyclohexane	93.79
1,2-dimethylbenzene	601.28
i-propylcyclohexane	471.65
2,4-dimethyloctane	12.17
butylcyclopentane	472.37
2,5-dimethyloctane	125.19
3,6-dimethyloctane	113.12
3-methyl-5-ethylheptane	259.97
1,3-methylethylbenzene	267.57
1,4-methylethylbenzene	141.82
1,3,5-trimethylbenzene	225.40
5-methylnonane	256.91
4-methylnonane	414.41
1,2-methylethylbenzene	550.81
2-methylnonane	95.98
3-methylnonane	387.79
1,2,4-trimethylbenzene	593.97
decane	1.166.67
jet fuel	3,023.85
diesel	7,654.81
resid	46.85
nonane	3,147.73
1,1-methylethylcyclohexane	225.11
unknown {unknown c6} (properties as assumed same as hexane)	620.87
unknown {unknown c7}(properties assumed same as heptane)	71.50
unknown {unknown c7}(properties assumed same as heptane)	71.50
11 unknown c8 (properties assumed same as octane)	91.86
unknown {unknown c8}(properties assumed same as octane)	40.83
unknown {unknown c8} (properties assumed same as octane)	567.48
12 {unknown c9} (properties assumed same as nonane)	176.61
n1 {unknown c8}(properties assumed same as octane)	34.70
n12 {unknown c9}(properties assumed same as nonane)	168.25
unknown {unknown c9}(properties assumed same as nonane)	35.80
unknown {unknown c9}(properties assumed same as nonane)	35.80
i6 {unknown c9}(properties assumed same as nonane)	78.76
n19 {unknown c9}(properties assumed same as nonane)	7.16
18 {unknown c9}(properties assumed same as nonane)	175.41
19 {unknown c9}(properties assumed same as nonane)	72.79
n21 {unknown c9}(properties assumed same as nonane)	7.16
n24 {unknown c9}(properties assumed same as nonane)	110.98
n25 {unknown c9}(properties assumed same as nonane)	27.45
n27 {unknown c9}(properties assumed same as nonane)	45.34
n29 {unknown c9}(properties assumed same as nonane)	151.55
n30 {unknown c10}(properties assumed same as decane)	29.98
114 {unknown c10}(properties assumed same as decane)	142.55
n34 {unknown c10}(properties assumed same as decane)	73.28
118 {unknown c10}(properties assumed same as decane)	9.99
i19 {unknown c10}(properties assumed same as decane)	19.98
unknown {unknown c10}(properties assumed same as decane)	19.98
i21 {unknown c10}(properties assumed same as decane)	64.62
unknown {unknown c10}(properties assumed same as decane)	12.66
n32 {unknown c10}(properties assumed same as decane)	13.32
Total VOC	240,050.93

The final incident notification lists 92,266 lbs of unspeciated volatile organic compounds (VOC). For more information see VTN 669543.

According to the Hurricane Harvey Unified Command Emergency Response Report, the Damage Assessment

Team had oversight of the incident. On August 28, 2017, the lead assessor, United States Coast Guard Marine Safety Technician Butcher explained that pumping from the bottom of the containment area was being conducted. Additionally, containment water was being discharged into the Sims/Buffalo Bayou. Marine Safety Technician Butcher also stated that the pumping and skimmer operations discharged enough product to cause a sheen. See Attachment 6.

Ambient area air monitoring was conducted September 5th through September 8th in response to the release from Tank T-003 picked up readings of VOCs with the MultiRAE and Toxic Vapor Analyzers of 0.2 parts per million (ppm) and readings ranging from 1.3 ppm to 33 ppm, respectively. During the survey, some of the investigators experienced various health effects ranging from dizziness, soreness of throat, upper respiratory irritations, and headaches (mild to uncomfortable). These symptoms did not last for an extended period of time.

Reported VOC concentrations were compared to TCEQ's short-term health and/or welfare-based air monitoring comparison values (ACMVs). Toxicological evaluation of air monitoring (two grab samples using summa canisters) conducted near the Intersection of Manchester St. & 97th St. (Latitude 29.71835, Longitude – 95.25377) on September 6, 2017 for ambient air samples reported concentrations of target VOCs were either not detected or were detected below levels of short-term health and/or welfare concern.

The modeled concentrations were compared to the corresponding short-term health-based effects screening level (ESL) or the short-term health-based air monitoring comparison value (AMCV) to determine whether there were any exceedances. Based on the modeling data for this incident, with the exception of benzene and methylcyclopentane, the maximum predicted ground level concentrations (GLCsmax) and the maximum off-property, non-industrial ground level concentrations (GLCsni) for all chemicals were below their respective comparison value.

Benzene

Based on the modeling data, the predicted 1-hour GLCsmax (1,080 µg/m3(microgram per cubic meter)) is 1.86 times the 1-hour AMCV of 580 µg/m3, the predicted GLCsni (624 µg/m3) is 1.08 times the AMCV, and the predicted 24-hour GLCsmax (372 µg/m3) is 1.16 times the 24-hour AMCV of 320 µg/m3. Benzene is an aromatic liquid with a paint-thinner-like or sweet odor with a detection threshold value of 8,700 µg/m3 (2,700 part per billion (ppb)). Acute exposure to high concentrations of benzene may result in central nervous system depression and hematological effects. Mild mucous membrane irritation, dizziness, nausea, headache, as well as damage to blood cells and anemia were noted in workers at occupational exposures of > 60 ppm for up to 3 weeks (mean of 5 days).

Methylcyclopentane

Based on the modeling data, the predicted 1-hour GLCsmax (4,0492 µg/m3) is 1.57 times the ESL of 2,600 µg/m3. There is little toxicity information on methylcyclopentane. This can mostly be attributed to methylcyclopentane normally being found as a component of a mixture, commercial grade hexane solvent, rather than as a pure unique chemical. Commercial hexane consists of approximately 50% n-hexane and smaller amounts of many other C5 and C6 materials including methylcyclopentane. Inhalation of n-hexane usually causes eye, nose, throat and respiratory irritation which are rapidly reversible when exposure is discontinued. Acute effects are considered similar to that of other saturated aliphatic hydrocarbons of similar length (C3-C8 alkanes). In a human inhalation study, no symptoms were experienced by three to six volunteers exposed to 2,000 ppm hexane for 10 min, but dizziness and a sense of giddiness were experienced at 5,000 ppm.

4) The duration of the emissions event:

The reported duration of the incident was: 440 hours 30 minutes
Tank T-003's annual operating hours were 8,760. This incident accounted for 5.02% of its total annual operating hours.

This incident lasted over seven days (approximately 19 days); therefore, this incident is considered a high priority violation (HPV).

5) The percentage of the facility's total annual operating hours during which emissions events occur:

The duration of reportable emissions events in Tank T-003 for the past 12 months was 440 hours and 30 minutes. Based on 8,760 annual operating hours, reportable emissions events have accounted for 5.02% of its total annual operating hours.

6) The need for startup, shutdown, and maintenance activities:

Based on the information provided by Valero, the performance of startup, shutdown, or maintenance activities could have prevented this incident.

Issues identified during the various inspections are discussed below. While some of the issues identified below are not specifically related to the failure of the EFR roof or roof drainage system, they are part of the pattern of poor maintenance activities concerning the Tank T-003.

A report from an American Petroleum Institute (API) 653 internal inspection conducted by HMT on August 2, 1996 indicated that the tank was in poor condition. The tank bottom coating failed the inspection. The report recommended that the entire bottom coating should be abrasive blasted and recoated. Nozzles A, B, C, D, E, G, H, K, L, P, and Q were found to have a weld spacing between the reinforcing plate and shell-to-bottom joint less than that required by API 650 requirements. The report stated that such a practice results in areas of increased stress concentration and possible accelerated corrosion. The EFR inspection found the secondary seal wiper tip and the primary seal vapor barrier to be deteriorating. The report recommended that these items should be replaced. All of the EFR legs were found to be corroded to the extent that they should not be relied upon under load. The report recommended that the EFR legs should be replaced. In addition to two missing EFR roof legs, the inspection also found 12 pontoon manway covers to be severely corroded. The report recommended that these covers should be replaced. The inspection found the adequacy of the floating roof drainage to be questionable and recommended that a satellite sump drainage system be added in order to provide added capacity for areas that currently do not drain adequately. The inspection found coating failure throughout the EFR. The report recommended that the entire EFR be abrasive blasted and completely recoated.

According to the 2008 external inspection report a new tank bottom and concrete ringwall were installed in 1997 following the August 1996 internal inspection.

According to the August 2, 1996 inspection report the next internal inspection should have been conducted on August 2, 2016 in accordance with API 653 standards, which indicates that in no case should the internal inspection interval exceed 20 years. In a response received from Valero, it was stated that Tank T-003 was scheduled to be taken out-of-service for internal inspection once Tank T-001 was placed back into service. According to Valero, the inspection was anticipated to occur in the first quarter of 2018. However, Valero did not have any records of a maintenance plan to demonstrate such an inspection was scheduled. According to this information, T-003 was overdue for API 653 internal inspection.

A review of the API 653 external inspection records (Required every 5 years as per API 653 standard) for the Tank T-003 conducted on January 26, 2004, March 27, 2008, December 8-9, 2008, April 27-30, 2012, March 15, 2013, and April 29, 2014 indicated that the tank was in poor condition. A detailed discussion of the inspection records are below.

The report from a March 2008 external inspection conducted by Sentinel indicated that the foundation moisture barrier had failed in many areas between the tank floor and the concrete ringwall. The report also stated that fresh air is required to access the roof, but numerous attempts to access the roof were not allowed by Tank Farm Operations. Therefore, the EFR condition was not inspected.

The report from a December 8-9, 2008 external inspection conducted by HMT indicated that the moisture barrier had pieces missing. The report recommended that consideration should be given to installing an appropriate moisture barrier to seal against water intrusion under the tank bottom. For the tank shell, the report recommended that consideration should be given to removing the insulation that is blistering, repairing and re-insulating as needed. The report also indicated that nozzles B, E, F, I, N, P, R, U, and W had weld spacing between their reinforcing plates and the shell-to-bottom joint, which was less than that required by API 650. The inspection report noted that such practice results in areas of increased stress concentration and possible accelerated corrosion. Nozzles N and R were found to have evidence of leakage around the valves and ball swivel on the mixers. The report recommended that the mixers and valves should be repaired at the next available opportunity. Valero did not provide any records to demonstrate if any maintenance was performed on the tank to

address any of the issues listed on this inspection report. The floating roof was not inspected during the inspection.

The report from a April 27-30, 2012 external inspection conducted by HMT indicated that the concrete ringwall had areas of mild to moderate hairline cracks and spalling intermittently around the perimeter. The report recommended that these areas should be sealed to minimize further degradation of the foundation from moisture penetration corroding the reinforcement or from freeze/thaw cycling further opening these cracks. The moisture barrier was found to have moderate to severe deterioration present. The report recommended that consideration should be given to repairing the moisture barrier to seal against water intrusion under the tank bottom. The bottom edge projection was found to have mild to severe leafing-type corrosion present intermittently around the perimeter. The shell inspection found areas of moderate to severe deterioration and areas of holes in the shell foam insulation. The report recommended that consideration should be given to repairing the affected areas. The report also indicated that the neck thickness of nozzles C, M, Q, and U did not meet the minimum requirements of API 650. The report recommended that these nozzles should be replaced with API standard nozzle details the next time the tank has welded repairs to the shell. It was also noted that nozzles M, Q, and U had reinforcing plates that do not meet the minimum thickness requirements of API 650. The report recommended that these reinforcing plates should be replaced with API standard nozzle specifications the next time that the tank has welded repairs to the shell. Inspection of the roof drainage noted only one drain line was present. The report recommended that consideration should be given to evaluate the adequacy of the floating roof drainage. The inspection report stated that no inspection was performed on the floating roof at the time of the inspection since the elevation of the roof was lower than within six (6) feet from the platform.

The report from a March 15, 2013 external inspection conducted by HMT indicated that the concrete ringwall was found to have hairline cracks and was spalling intermittently around the tank perimeter. The report recommended that these areas should be repaired and sealed to minimize further degradation. The moisture barrier was found to be severely deteriorated and separated from the concrete ringwall and the bottom edge projection. The report recommended that consideration should be given to installing an appropriate moisture barrier to seal against water intrusion under the tank bottom. The visual inspection revealed moderate to severe leafing-type corrosion sporadically on the bottom edge projection. The report noted that the coating had faded and peeled. The report recommended that consideration should be given to properly cleaning and re-coating these areas at the next available opportunity. The inspection report further noted that the shell ultrasonic thickness readings up the spiral stairway were not possible due to safety restrictions on personnel access imposed by client operations resulting from high concentrations of hydrogen sulfide gas. The visual inspection of the wind girder and spiral stairway revealed moderate coating failure with surface rust present. The inspection report found that the neck thickness of nozzle M and reinforcing plates for nozzles M, Q, and U thickness did not meet the minimum requirements of API 650. The report recommended that these nozzles be replaced with API standard nozzles the next time the tank has major repairs to the shell. The visual inspection of the nozzles and appurtenances revealed product leaking between the flange and valves of Manways O and S and Nozzle J. The report recommended that consideration should be given to making the appropriate repairs at the next available opportunity. Access to the EFR was not allowed during the inspection.

The report from a April 2014 external inspection conducted by Stronghold detailed numerous faults with the external integrity of the tank. The inspection found that the moisture barrier was deteriorated and recommended that consideration should be given to installing an appropriate moisture barrier to seal against water intrusion under the tank bottom. The moisture barrier has been a reoccurring problem with regards to API 653 external inspections. Besides the 2014 report, four different occasions of moisture barrier deterioration were noted in the API 653 external inspection reports. See above for more information. The 2014 inspection report also noted that the concrete ringwall that the tank rests on had hairline cracks intermittently around the perimeter. The inspection report recommended that the cracks be sealed to minimize further degradation of the foundation from moisture penetration corroding the reinforcement or from freeze and thaw cycling further opening the cracks. Besides the 2014 inspection report, the concrete ringwall was also noted as an issue in the 2012 and 2013 API 653 external inspections. The maintenance records provided by Valero did not indicate that any maintenance activity was completed after the April 29, 2014 inspection to fix the concrete ring wall hairline cracks or the moisture barrier issues.

The 2014 inspection report also noted the shell insulation had several areas of insulation bulging, flaking, and missing. The report recommended that consideration should be given to repairing and sealing the insulation to prevent moisture from entering between the shell and insulation. The shell insulation has been a reoccurring problem with regards to API 653 external inspections. In addition to the 2014 inspection report, the external

inspection reports for 2004, December 2008, 2012, and 2013 all noted similar shell insulation issues. According to maintenance records provided by Valero, no maintenance was completed after the April 29, 2014 inspection to address the shell insulation issues.

The 2014 inspection of the nozzles and appurtenances indicated that nozzles N, R, and V had low thickness readings at the 180° bottom, which were more than 12.5% of the nominal thickness. The report recommended that consideration should be given to monitoring the nozzle thickness until the tank is taken out of service and the three nozzles are replaced. Nozzle integrity has been a concern in past inspection reports as well. The 2004 inspection noted that minor leaking occurred at nozzles D, J, O, and S. The two 2008 inspections noted nozzle corrosion and leakage at nozzles N and R. In the 2013 inspection product was found leaking between the flange and valves of nozzles J, O, and S.

Additionally, the 2014 inspection report indicated that a visual inspection of the EFR showed that there were areas of coating and fading failure. As such, the report recommended that consideration should be given to properly clean and coat the EFR. Additionally, the visual inspection of the EFR noted that debris had built up throughout the roof deck. The report recommended that consideration should be given to removing the debris from the floating roof. Maintenance records dated June 30th and August 28th of 2015 indicated oil was cleaned off of the EFR, grass was removed from the EFR, and plants were removed from the EFR drains. The 2014, 2013, 2012, and December 2008 inspection records do not indicate that ultrasonic (UT) thickness measurement testing was completed for the EFR. The maintenance records did not indicate that maintenance was completed to address the EFR coating and fading failure.

Photographs taken during the onsite investigation of the drain sumps showed extensive corrosion on the main sump of the drainage system. According to information provided by Valero, the tank was equipped with three drain sumps, which drained into one main sump. Photographs are provided in Attachment 3.

This investigation determined that better maintenance practices and inspections (including inspection of the EFR) of Tank T-003 could have prevented the failure of the EFR and subsequent seal breakage and crude oil spill.

See Attachment 2 for maintenance and inspection records.

Exit Interview

An Exit Interview was not conducted at the end of the onsite investigation. The company representatives were informed that no final conclusions could be made on the compliance status until all pertinent findings, data, and information were evaluated and the investigation report is completed and approved. Representatives were provided an opportunity to ask questions and address any issues or concerns regarding the investigation.

A Notice of Preliminary Findings (NOPF) letter with the alleged violations was sent on January 25, 2018.

A meeting was requested and held on February 2, 2018 to discuss the event. Valero representatives present during the meeting were Mr. Matthew Lindquist, Environmental Manager; Mr. Jeff Hude, EHS Director; Mr. Parker Wilson, Legal Representative; Mr. John Corella, Chief Inspector; and Mr. Ed Heard, Staff Inspector. The TCEQ staff present during the meeting were Mr. Chris Crook and Ms. Nicolina Fraietta, TCEQ investigators; as well as Ms. Warda Omar and Ms. Karen Lewis-Holmes, Team Leaders. Additional information was not provided during the meeting; however, Valero continued to assert an affirmative defense. TCEQ staff asked why the API 653 internal inspection was delayed. Valero stated that a Risk Based Investigation (RBI) was performed in 2011 and again in 2015 to push back the inspection date. Valero added that the RBI used the rate of corrosion from all of the prior inspections to determine progression of the corrosion rate. Valero did not provide the RBI investigation records. TCEQ staff also asked about the high H2S reading noted in the 2013 inspection records, and why contractors performing the external inspections were not allowed onto the tank roof to inspect the EFR and drain system. Valero did not have any information related to the high H2s reading; however, Valero indicated that they were not aware of any high H2S reading. As for why contractors were not allowed onto the tank roof, Valero stated that the tank height prevented operations personnel from allowing contractors onto the roof. Rain accumulation documents were presented to show the amount of rain compared to previous hurricanes and heavy rain events. Valero responded by email on February 07, 2018 with a recap of the meeting discussions.

An updated exit interview form was emailed to Valero on March 14, 2018.

The alleged violation as described in the enclosed Summary of Investigation Findings will be referred for enforcement review.

GENERAL FACILITY AND PROCESS INFORMATION

Process Description

Tank T-003 is an atmospheric storage tank in the Crude Tank Farm at Valero. Tank T-003 stores crude oil delivered to the refinery by either pipeline or barge. The crude oil is then pumped to the refinery to be processed in Valero's crude units.

BACKGROUND

Agreed Orders, Court Orders, and Other Compliance Agreements

There were four Agreed Orders, Court Orders, and other Agreements issued against Valero for the past 5 years.

1. AdminOrder 2012-1006-AIR-E issued on 03/09/2013
2. AdminOrder 2012-2692-AIR-E issued on 07/28/2013
3 .AdminOrder 2012-2667-AIR-E issued on 01/25/2014
4. AdminOrder 2013-1837-AIR-E issued on 03/16/2014

Prior Enforcement Issues

There were no same or similar violations issued in the past 5 years.

Complaints

A database search confirmed that there was one complaint related to this incident. The complaint incident #270570 is associated to this investigation. The complaint was received on August 27, 2017 at 7:06 a.m.

The complainant stated that, "a gas-like odor is coming from outside, but is unsure where."

On November 10, 2017 TCEQ investigators Mr. Chris Crook and Mr. Jason Holloman conducted an odor complaint survey in reference to incident#270570. The investigators arrived in the Manchester subdivision outside of Valero at 10:10 a.m. From 10:10 a.m. to 10:20 a.m. the investigators surveyed the neighborhood surrounding the alleged complaint. At 10:20 a.m., the first 15 minute odor log was conducted at 97th St and E Avenue J. The first odor log was completed at 10:35 a.m. No odors were detected. At 10:40 a.m., the second odor log was conducted. Very light garbage odors were detected at the intersection of Avenue H and 96th st. for five minutes during a 30 minute odor survey. See Attachment 4. No gaseous odors were detected that could be associated to the Valero Partners Houston tank farm. The investigators completed the second odor log at 11:10 a.m. The investigators drove with the windows down throughout the neighborhood, no odors were detected. The investigators departed the area at 11:20 a.m See Attachment 5 for Odor survey path and odor log locations.

ADDITIONAL INFORMATION

Conclusions, Recommendations, and Current Enforcement Actions

It was determined this event did not meet the demonstration criteria necessary to present an affirmative defense for the unauthorized emissions that resulted from this incident. Additionally, a Notice of Enforcement (NOE) will be issued for the unauthorized emissions that resulted from this incident.

Additional Issues

No additional issues.

Report Attachments

1. Initial Notification and Final Report

2. Additional Information
3. Photographs
4. Odor Logs
5. Odor survey path and odor log locations
6. Hurricane Harvey Unified Command Emergency Response Report
7. NOPF Documents
8. Exit Interview

NOE Date: 3/16/2018

OUTSTANDING ALLEGED VIOLATION(S)

ASSOCIATED TO A NOTICE OF ENFORCEMENT

Track Number: 660469 **Compliance Due Date: To Be Determined**

Violation Start Date: 8/27/2017

30 TAC Chapter 106.261(a)(2)
30 TAC Chapter 106.6(b)
5C THSC Chapter 382.085(b)

Alleged Violation:

Investigation: 1408309 Comment Date: 03/07/2018

Failure to prevent the release of unauthorized emissions during an emissions event.

Incident no. 266275 occurred on August 27, 2017 due to a failed External Floating Roof (EFR). The EFR on tank 3 (T-003) became partially submerged which caused product to seep onto the roof and subsequently into the secondary containment area through the roof drain. The incident resulted in the release of the following unauthorized emissions from Tank T-003 (EPN: 90FB003): 241,217.6 lbs of volatile organic compounds (VOCs) including 1,883.68 lbs of benzene. The duration of this event was 440 hours and 30 minutes. This constitutes a violation of Texas Administrative Code (TAC) 30 TAC 106.6(b), which states, "All representations with regard to construction plans, operating procedures, and maximum emission rates in any certified registration under this section become conditions upon which the facility permitted by rule shall be constructed and operated." Operation of Tank T-003 and the emissions from the tank are certified under PBR registration Nos. 47166 and 106017. All of the emissions during this incident were unauthorized.

This further constitutes a violation of 30 TAC 106.261(a)(2), and 5C Texas Health and Safety Code 382.085(b).

Recommended Corrective Action: Submit a written description of corrective action taken and the required documentation demonstrating that compliance has been achieved for this outstanding alleged violation.

Track Number: 669543 **Compliance Due Date: To Be Determined**

Violation Start Date: 8/27/2017

30 TAC Chapter 101.201(b)(1)(G)
5C THSC Chapter 382.085(b)

Alleged Violation:

Investigation: 1408309 Comment Date: 03/07/2018

Failure to speciate unauthorized emissions in the final notification report.

Incident # 266275 occurred on August 27, 2017 at the crude tank farm area due to a failed External Floating

Roof (EFR). On the final incident notification, Valero Houston reported 92,266 lbs of unspeciated VOC emissions. This constitutes a violation of 30 TAC 101.201(b)(1)(G), which states, "...The final record of a reportable emissions event must identify the compounds descriptive type of all individually listed compounds or mixtures of air contaminants in the definition of RQ in §101.1 of this title, from all emission points involved in the emissions event that are known through common process knowledge or past engineering analysis or testing to have been released during the emissions event..." Additionally, 30 TAC 101 Preamble states that the speciation of all emissions is required with the final report for evaluation of the event in order to evaluate impacts from emissions.

This further constitutes a violation of 5C Texas Health and Safety Code 382.085(b).

Recommended Corrective Action: Submit a written description of corrective action taken and the required documentation demonstrating that compliance has been achieved for this outstanding alleged violation.

Signed Chris Crosby **Date** 3/16/2018

Environmental Investigator

Signed [illegible] **Date** 3/16/2018

Supervisor

Attachments: (in order of final report submittal)

✓ Enforcement Action Request (EAR)

✓ Letter to Facility (specify type) : NOE

Investigation Report

___ Sample Analysis Results

___ Manifests

___ Notice of Registration

___ Maps, Plans, Sketches

___ Photographs

___ Correspondence from the facility

✓ Other (specify) :

See Report Attachments

Sour Wind in West Texas

Air Pollution From Surging Oil and Gas Industry Exceeds Health Standards

ENVIRONMENTAL INTEGRITY PROJECT

EMBARGOED FOR RELEASE:
THURSDAY, MAY 9, 2019

ACKNOWLEDGEMENTS

Written by Ilan Levin, Courtney Bernhardt, and Ari Phillips of the Environmental Integrity Project.

THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

CONTACTS:

For questions about this report, please contact:

Tom Pelton, Environmental Integrity Project, (202) 888-2703 or tpelton@environmentalintegrity.org

PHOTO CREDITS: Cover image: Gas flaring; Shutterstock. Pumpjack located south of Midland, Texas; Wikimedia Commons. Big Spring monitoring station; Texas Commission on Environmental Quality.

Sour Wind in West Texas

Air Pollution from Surging Oil and Gas Industry Exceeds Health Standards

The Permian Basin oil producing region encompasses about 63,834 square miles in western Texas and southeastern New Mexico, extending to 29,000 feet underground, making it one of the thickest hydrocarbon producing regions in the world.[1] Oil companies have been drilling in the Permian since the 1920s, but horizontal drilling and hydraulic fracturing brought a new boom to the region in the past decade. In 2015, Congress lifted the U.S. ban on the export of crude oil, further boosting domestic production. Industry insiders predict that by 2021, Permian Basin oil will account for about 40 percent of all U.S. production.[2] By 2023, the industry expects oil production to double from 2017 levels.[3] According to the International Energy Agency, U.S. crude oil will account for 80 percent of the growth in global oil supply over the next seven years, and most of that oil will come from the Permian.[4]

With that oil comes record-breaking production of natural gas and natural gas liquids, along with the processing, storage, and transportation that these products require. This requires a massive buildout of plants, tanks, pipes, and other infrastructure – most of which release air pollution.

Despite excessive levels of unauthorized pollution in the Permian Basin, the region lacks enough air quality monitors to protect public health.

According to industry reports filed with the Texas Commission on Environmental Quality (TCEQ), Permian Basin oil and gas facilities release more illegal air pollution during equipment failures, shutdowns, and other non-routine "emission events" than in any other part of the state.[5]

A 2018 study, published in the American Chemistry Society's *Environmental Science and Technology*, found that health costs in Odessa (Ector County) attributable to unpermitted air pollution are greater than many of Texas' heavily industrialized Gulf Coast counties.[6] This research strongly suggests that residents of sparsely populated West Texas bear a disproportionate share of health burdens from air pollution. A 2019 study of TCEQ data by the non-profit Environment Texas also concluded that the Permian Basin region leads the state of Texas in illegal (unpermitted) air pollution emissions.[7] These studies are remarkable

given that the Texas Gulf Coast, including the Houston Ship Channel, is home to the largest concentration of oil refineries and petrochemical plants in the nation.

Despite the excessive levels of unauthorized emissions in the Permian Basin, the region lacks enough air quality monitors to determine if the air is safe to breathe. The TCEQ's Houston region has approximately 60 active air quality monitoring stations, while the Midland-Odessa region has three.[8] Of these three monitors, only one measures sulfur dioxide, which is the most prevalent air pollutant in the Permian Basin. The lone sulfur dioxide air monitor in this region, which is located in Big Spring (about 60 miles east of Odessa) was activated in 2016.[9] It shows there is cause for concern. On at least 30 occasions between December 2016 and April 2019, hourly sulfur dioxide pollution levels measured at Big Spring exceeded the national health-based standard.[10] In March 2018, the Big Spring air monitor recorded 460 parts per billion of sulfur dioxide – more than six times higher than the 75 parts per billion air quality standard for one hour.

The TCEQ Air monitoring station in Big Spring began operating Dec. 3, 2016. Sulfur dioxide air pollution levels there are frequently above federal health standards.

Because there is only one functioning air monitoring station measuring sulfur dioxide in the Permian Basin, the Environmental Integrity Project studied the regional air quality, based on industry self-reported unauthorized releases of air pollution, which occurred mainly from flaring.

Using the Environmental Protection Agency (EPA)-approved air quality model known as AERMOD (the American Meteorological Society/Environmental Protection Agency Regulatory Model), we demonstrated the air quality impacts in Ector County resulting from the oil and gas industry's self-reported emissions of sulfur dioxide, matching them with actual weather conditions at the time and place of the emissions incidents. We chose Ector County due to the relatively large (for West Texas) population of about 156,000 residents, including 117,000 in the county seat, Odessa.

According to the modeling results, excessive flaring from the oil and gas industry is causing dangerous levels of sulfur dioxide air pollution in and around Odessa. Pollution levels in much of Ector County exceed the hourly health-based standard set by EPA. More broadly, our study suggests that across the Permian Basin, residents, workers, and visitors are exposed to excessive air pollution as a result of excessive flaring.

Summary of Findings:

- Oil and gas operators in and around Ector County self-reported 2,564 unauthorized releases of air pollution in a four-year period from 2014-2017.
- The worst sulfur dioxide pollution for all four years studied was 3,644 micrograms per cubic meter, in 2014, near Goldsmith, northwest of Odessa. That pollution level was 18 times higher than the EPA's health-based National Ambient Air Quality Standard of 75 parts per billion.[11]
- The one functioning sulfur dioxide monitoring station in the Permian Basin, in Big Spring, frequently measures sulfur dioxide concentrations at levels above 75 parts per billion.
- Residents of the Permian Basin are breathing air with excessive levels of sulfur dioxide pollution, resulting from the widespread flaring of "sour gas" (gas that contains significant amounts of hydrogen sulfide).
- According to computer modeling, excessive flaring at oil and gas operations in and around Ector County result in pollution levels exceeding the national health based standard for sulfur dioxide.

Recommendations:

There is a serious and ongoing air pollution problem in the Permian Basin. Residents of the Permian Basin are bearing a heavy burden when it comes to health impacts from air pollution. Federal and state leaders should do more to protect health and safety in West Texas, where illegal pollution from oil and gas production is reaching levels of serious concern based on the federal health-based standard for sulfur dioxide.

Federal and state regulators have an important obligation to control this pollution. The EPA should investigate whether air quality in the Permian Basin meets the federal health-based National Ambient Air Quality Standards. If the most reliable available data (including air dispersion model results where monitoring does not yet exist) indicates air pollution in violation of federal standards, then EPA should designate the area as being in nonattainment for sulfur dioxide. This would trigger stricter environmental and health protections in the Permian, which would improve both air quality and human health.

Texas has laws in place that, if enforced, would help reduce this air pollution.

- The Texas Commission on Environmental Quality and the Railroad Commission of Texas (which regulates oil and gas operations) should more strictly enforce their permitting rules. These state agencies should only approve permits for facilities that can demonstrate their emissions will comply with state and federal standards.
- TCEQ should more closely scrutinize permit applications to ensure they are not authorizing dangerous levels of sulfur dioxide. The agency should not issue permits that allow flaring in violation of any federal ambient air standards.
- Texas should ramp up its enforcement in the Permian Basin by penalizing oil and gas companies for flaring emissions over permitted levels. Both the TCEQ and the Railroad Commission should assess fines at levels sufficient to create an incentive for

companies to comply with anti-waste, flare-minimazation, and clean air laws. In addition to penalties, the TCEQ should order the largest emitters to establish monitoring networks upwind and downwind of their facilities.

- Texas should make a modest investment in the health of Permian Basin residents by establishing a regional air quality monitoring network to measure air quality in Midland-Odessa. Monitoring stations should measure multiple pollutants and meteorological conditions, and should be located to measure baseline and worst-case conditions.

West Texas communities that are paying the steepest price – in terms of air quality and health – should not be left at the mercy of polluters. State and federal regulators have an obligation to step in and protect the public from harmful emissions.

Air Pollution in the Texas Permian Basin

The Permian Basin is the largest oil and natural gas-producing basin in the U.S., and is home to about 1.4 million people, according to 2017 U.S. Census estimates. As stated in the introduction, oil companies have been drilling and extracting oil from the Permian since the 1920s, but horizontal drilling and hydraulic fracturing brought a new boom to the region starting around 2010. This trend was accelerated in 2015 by Congress' approval of crude oil exports. Oil and gas producers in the Permian are now extracting more than ever.[12]

Oil and gas production relies on a system of interconnected infrastructure. Most of the components of this system (wells, tank batteries, pipelines, compressor stations, gas processing plants, oil refineries, petrochemical plants, and power plants) are also sources of air pollution. For that reason, oil and gas production facilities are required to have air pollution permits that comply with the federal Clean Air Act.

But, according to industry reports filed with TCEQ, Permian Basin oil and gas facilities also release a large amount of *unpermitted* pollution during equipment breakdowns, maintenance, and other non-routine so-called "emission events." Because many oil and gas production facilities are interconnected to other similar facilities and to pipelines, a breakdown at one site often sparks a chain reaction, causing simultaneous releases of pollution up and down the supply chain.

In recent years, a new and disturbing trend has become evident: oil and gas production facilities, which have historically been considered to be relatively small sources of air pollution, are emitting more air pollution during unpermitted "emission events" than during routine operations, and more than their Clean Air Act permits allow.[13]

However, controlling air pollution in West Texas has not been a priority for the state, as evidenced by the scarcity of air pollution monitoring stations in the Permian Basin. And yet, the type of air pollution in the Permian Basin – dominated by excessive emissions of sulfur dioxide and hydrogen sulfide – is known to have serious environmental and public health consequences.

Health Impacts of Sulfur Dioxide and Hydrogen Sulfide

Sulfur dioxide (SO_2) forms when substances containing sulfur, including coal, oil, and gas, are burned. According to EPA, short-term exposures to sulfur dioxide can harm the human respiratory system and make breathing difficult. Children, the elderly, and those who suffer from asthma are particularly sensitive to sulfur dioxide. The pollutant also reacts with other compounds in the atmosphere to form dangerous soot-like fine particles (also known as particulate matter), which can penetrate deeply into sensitive parts of the lungs and cause additional health problems.[14] Studies show correlations between short-term exposure to sulfur dioxide and increased visits to hospital emergency rooms. Children, the elderly, asthmatics, and those who exercise regularly are most at risk.[15]

Historically, extremely high concentrations of sulfur dioxide caused – for example -- London's Great Smog of 1952, which killed at least 10,000 people and hospitalized 200,000. Since that era, better emission controls and decreased use of coal have done much to reduce atmospheric concentrations of SO_2.

Hydrogen sulfide is best known for a rotten egg smell that is often associated with oil and gas production. At low levels this acid can cause causes headaches, breathing problems, and irritation of the eye, nose, and throat. Long-term exposure can lead to miscarriages, poor memory, and dizziness. Very high concentrations cause coma and even death.[16]

Natural gas fields in New Mexico, Arkansas, West Texas, and north-central Wyoming are well known for having "sour gas," which is gas with high concentrations of hydrogen sulfide. Because this gas is heavier than air, it can pool in low-lying areas when the wind is not blowing. In February 1975, a hydrogen sulfide release killed eight people in a home near an oil and gas site in the West Texas town of Denver City.[17]

Environmental Impacts of Pollutants

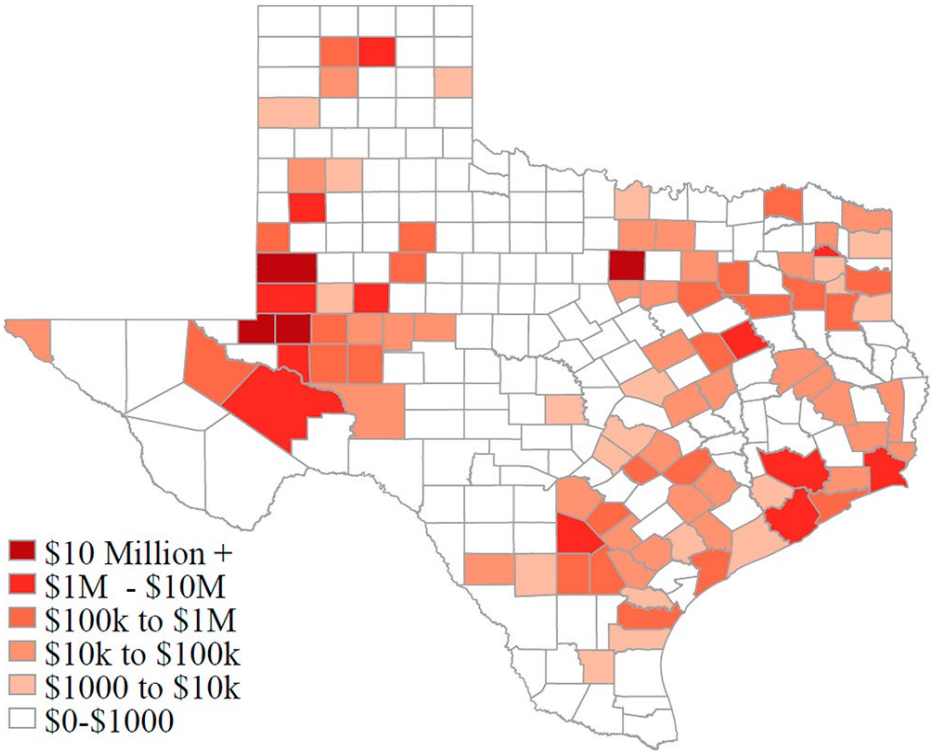
Sulfur dioxide and hydrogen sulfide are not only dangerous for people, but can also acidify soils and water. The pollutants harm trees and plants by decreasing growth and damaging foliage. Sulfur dioxide and hydrogen sulfide also react with other compounds in the air to form haze that reduces visibility in national parks and wilderness areas.[18] Sulfur dioxide is also one of the key pollutants that forms acid rain, which can leach aluminum particles from soil and clay, killing fish, insects, and plants.

Other wildlife is harmed by sulfur dioxide and hydrogen sulfide in much the same ways as people are, primarily through respiration. Hydrogen sulfide acts such the same way on all vertebrate species that breathe, such as in migratory birds, mammals, and certain reptiles and amphibians.[19]

West Texas Residents Bear a Heavy Health Burden

An article published in the *Journal of Environmental Science and Technology* on January 27, 2018, estimates that air pollution "emission events" in Texas cause $150 million per year in health costs.[20] The authors acknowledge that this cost is likely an underestimation, because it is based only on premature deaths from fine particle pollution. Figure 1 shows the distribution of the health costs, with some of the highest in the Permian Basin.

Figure 1: Distribution of Health Costs From Unpermitted Emissions Across Texas



This map shows the distribution of estimated health costs due to unpermitted emissions from industrial facilities based on a 2018 study in the Journal of Environmental Science and Technology. The highest concentration of dark red zones – showing highest costs – are in the Permian Basin in West Texas.

Sulfur dioxide is the most prevalent air pollutant released by facilities in the Permian Basin, according to Texas' database of unauthorized emission events.

The Clean Air Act requires EPA to protect human health from this pollutant by setting maximum limits on the amount of sulfur dioxide that can be present in outdoor air. These limits, called primary National Ambient Air Quality Standards, are based on short- and long-term exposure. The current health-based standard is 75 parts per billion (which is equivalent to 196 micrograms per cubic meter) based on the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum concentrations.[21]

A total of 258 facilities in Texas' Permian basin reported releasing 27 million pounds of unauthorized sulfur dioxide (SO_2) in 2017. See table below.

Table 1: Unauthorized SO_2 Emissions Reported in Permian Basin Counties, 2017

County	2017 Population Estimate	# Facilities that Reported Unpermitted SO2 Releases	# of Events Reported	Total Unauthorized SO2 Releases (lbs)
Ward	11,472	7	64	8,281,725
Ector	157,087	109	782	5,335,754
Andrews	17,722	26	299	4,234,912
Gaines	20,638	18	212	3,161,380
Crane	4,740	36	320	3,041,220
Yoakum	8,568	10	77	862,064
Howard	36,040	10	99	706,390
Hockley	23,088	3	29	532,136
Pecos	15,634	4	86	331,249
Reagan	3,710	3	38	271,003
Winkler	7,574	5	47	154,422
Reeves	15,281	2	41	146,052
Scurry	17,050	4	6	73,700
Dawson	12,813	3	31	51,950
Kent	763	2	13	36,504
Glasscock	1,348	2	9	21,915
Mitchell	8,468	4	12	10,137
Cochran	2,851	1	7	6,716
Martin	5,626	3	4	4,013
Crockett	3,564	1	4	3,852
Garza	6,528	1	3	2,444
Coke	3,306	1	1	798
Upton	3,663	3	10	126
Total:	**387,534**	**258**	**2194**	**27,270,462**

As the data indicate, the largest emissions occurred in Ward, Ector, Andrews, Gaines, and Crane counties. Facilities in each county reported releasing between 3 million and 8.2 million pounds of unauthorized SO_2 in 2017. Ector County, which has the highest population of these counties, had the second highest number of unauthorized releases.

A large number of facilities that reported unauthorized emissions are owned or operated by a small handful of companies, as shown in Table 2 below. For example, Occidental Permian owns 74 facilities that released 10.6 million pounds of sulfur dioxide during 500 incidents in 2017. XTO Energy (an Exxon subsidiary) owns 42 facilities that reported releasing nearly 2.4 million pounds of unauthorized sulfur dioxide during 359 incidents.

Table 2: Ten Companies Responsible for the Most Unauthorized SO_2 Releases in the Permian Basin, 2017

Company	# Facilities	# Events Reported	Unauthorized SO2 (lbs)
Occidental Permian Ltd. (CN600755086)	74	500	10,618,267
Chevron U.S.A. Inc. (CN600132484)	6	76	5,015,784
XTO Energy Inc. (CN600601348)	42	359	2,387,124
ConocoPhillips Co. (CN601674351)	37	315	1,863,664
Hess Corp. (CN600132245)	3	20	1,760,370
James Lake Midstream, LLC (CN604509893)	1	106	1,214,775
DCP Operating Co. LP (CN601229917)	11	76	923,794
OXY USA Inc. (CN604677401)	9	52	559,618
Burlington Resources Oil & Gas Co. LP (CN602989436)	18	170	531,261
Kinder Morgan Production Co. LLC (CN603227380)	4	21	412,371

Some of the companies responsible for the most unauthorized SO_2 emissions own or operate large gas processing plants and acid gas disposal wells. For example, Canyon Midstream (James Lake Midstream), operator of the James Lake Gas Plant in Ector County, reported 106 events that resulted in the release of 1.2 million pounds of sulfur dioxide. According to state reports, nearly all of these emissions were associated with flaring due to problems with the facility's acid gas injection well.

The 10 facilities that reported the most unauthorized sulfur dioxide pollution in 2017 are listed below.

Table 3: Facilities that Reported the Most Unauthorized SO_2 in the Permian Basin, 2017

Company	Site	County	# Events	Total Unauthorized SO_2 (lbs)
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 7	Ward	10	6,759,756
Chevron U.S.A. Inc.	Mabee Ranch CO_2 Plant	Andrews	29	2,925,848
Hess Corp.	Seminole Gas Processing Plant	Gaines	18	1,680,384
Chevron U.S.A. Inc.	J.T. McElroy 202 TB	Crane	17	1,483,836
James Lake Midstream LLC	James Lake Gas Plant	Ector	106	1,214,775
DCP Operating Co. LP	Goldsmith Gas Plant	Ector	36	792,238
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 3	Ward	13	538,448
Chevron U.S.A. Inc.	McElroy Section 199 Emergency Flare	Crane	14	505,427
Occidental Permian Ltd.	Sealy Smith Clearfork Satellite 8	Ward	12	478,356
XTO Energy Inc.	Goldsmith CO_2 Pilot Phase II Facility	Ector	8	468,752

Seven of these 10 facilities listed in the above chart have state air pollution control permits (called "Permits-by-Rule") that are intended for small sources that emit no more than 25

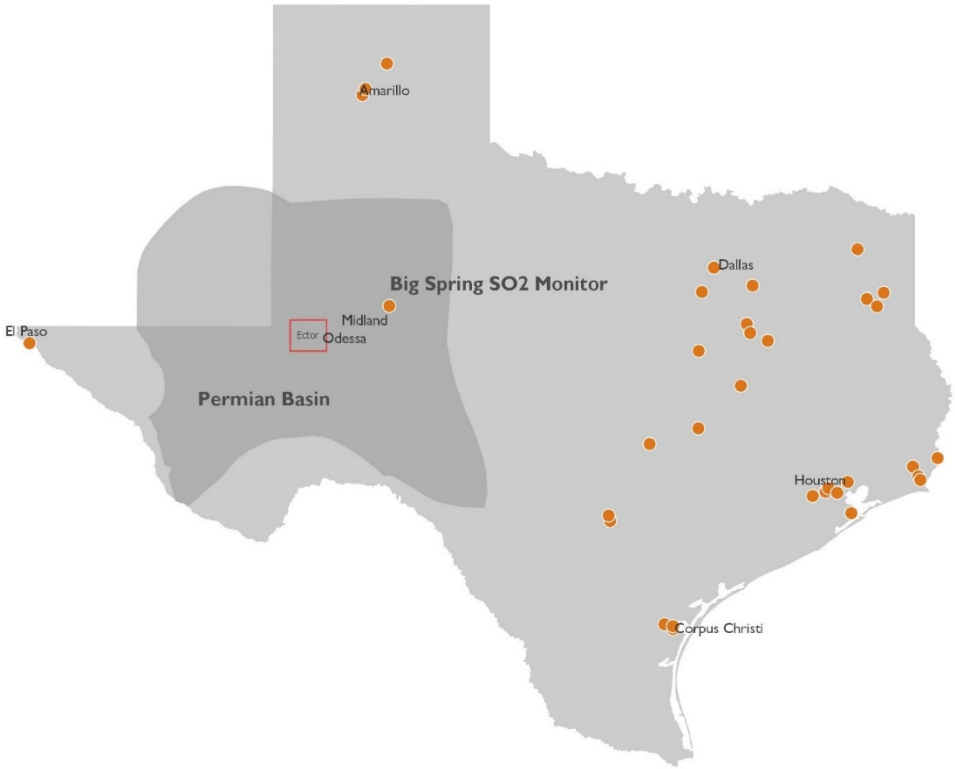
tons per year of sulfur dioxide. However, as shown in Figure 4 on page 12, these seven plants released far in excess of the 25-ton limit in 2017. This means that the emissions were illegal and that Texas should require these plants to obtain and follow stricter air pollution control permits.

Texas Lacks Adequate Air Monitors in the Permian Basin

The federal Clean Air Act requires states to monitor ambient air quality to protect public health. EPA regulations require states to monitor sulfur dioxide levels in areas that satisfy certain population and emission level requirements. Monitors are also required near large emitters (>2,000 tons per year of SO_2). Due to the small population in the Permian Basin (approximately a quarter of a million people live in Midland-Odessa), neither Texas nor EPA has seen fit to monitor sulfur dioxide levels associated with Permian Basin oil and gas production.[22]

The closest sulfur dioxide air monitor to Odessa is located in Big Spring, over 60 miles to the northeast of Odessa, and that monitor was established to measure air quality adjacent to a particular oil refinery. Even so, between December 2016 and April 2018, that monitor recorded 30 hours in which sulfur dioxide concentrations reached levels above the federal 1-hour standard of 75 ppb. Recorded concentrations during these times ranged from just over 75 ppb to as high as 460 ppb.

Figure 3: Locations of Active Sulfur Dioxide Monitoring Stations in Texas



The red dots indicate the locations of sulfur dioxide monitoring stations across Texas in December 2018. Although the oil and gas industry is booming in the Permian Basin (marked in darker gray), air quality monitoring there is sparce – with only one SO_2 monitor.

Modeling Shows Ector County is Flunking Air Quality Standard for Sulfur Dioxide

Because there are no sulfur dioxide air pollution monitors in Ector County,[23] the Environmental Integrity Project used an EPA-approved air dispersion model to determine the effects of oil and gas emissions on local air quality. We modeled industry reported emission events in Ector County between 2014 and 2017. EIP conducted the modeling in this location with the understanding that similar air quality impacts are likely in other parts of the Permian where there are large releases of SO_2.

Table 4 shows the largest sources of unauthorized sulfur dioxide emissions in Ector County in 2017. The two top facilities are large gas plants located in Goldsmith, Texas, that together reported 142 events and released over 2 million pounds of unauthorized sulfur dioxide pollution.

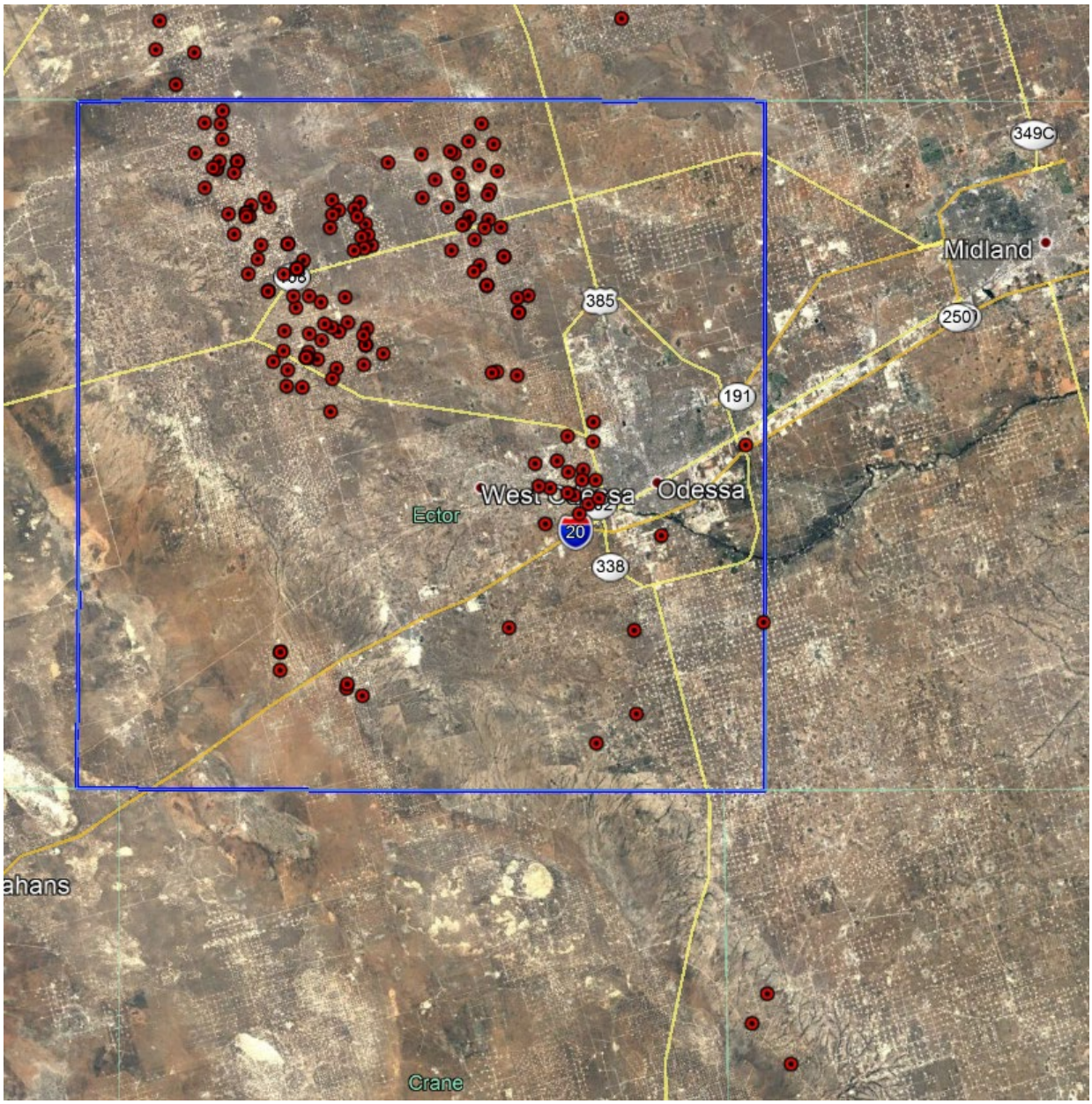
Table 4: Largest Sources of Unauthorized SO_2 Emissions in Ector County, 2017

Company	Site	County	# Events	Unauthorized SO_2 (lbs)
Canyon Midstream/James Lake Midstream LLC	James Lake Gas Plant	Ector	106	1,214,775
DCP Operating Co., LP	Goldsmith Gas Plant	Ector	36	792,238
XTO Energy Inc.	Goldsmith CO_2 Pilot Phase II Facility	Ector	8	468,752
ConocoPhillips Co.	Embar 2 - WCAB	Ector	11	222,249
XTO Energy Inc.	CAG Central Battery No 448	Ector	5	197,143
XTO Energy Inc.	GSAU 2 2 Battery	Ector	9	188,773
Occidental Permian Ltd.	North Cowden Unit South Central Tank Battery	Ector	12	149,916
Occidental Permian Ltd.	OB Holt R Lease TB 1	Ector	2	92,977
ConocoPhillips Co.	Gandu Battery 34	Ector	21	92,117
Occidental Permian Ltd.	Rhodes Cowden Unit Central Battery	Ector	4	84,895

Using the above data, we conducted air dispersion modeling using the regulatory model that EPA and the State of Texas require, called AERMOD, to estimate the air quality impacts of unauthorized SO_2 emissions in Ector County. We ran the air dispersion model, using the industry self-reported emission events for calendar years 2014 – 2017, and National Weather Service meteorological data for the days and times that the emissions events occurred. We obtained source parameters (i.e., the location, height, and other specifications) for the flares and other emission points from publicly available databases.[24] (For more on methodology, see Appendix A).

In Ector County, over the four-year study period, a total of 155 sources reported 2,564 separate emission incidents (mainly flaring events), including 495 in 2014; 669 in 2015; 568 in 2016; and 832 in 2017.

Figure 3: Locations of the Pollution Sources Included in the Modeling Study



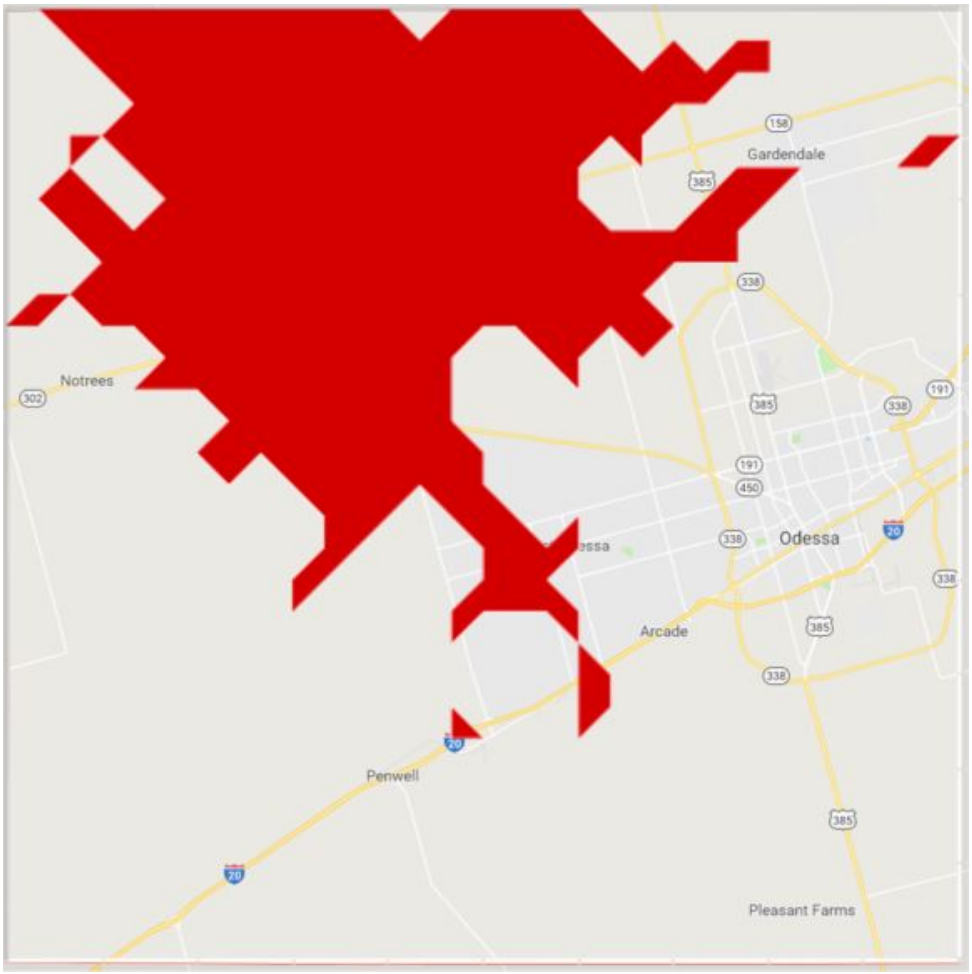
The red dots indicate the locations of the 155 sources of oil and gas industry emissions included in the EIP analysis, with the blue square depicting Ector County. The sources cluster north and west of the city of Odessa, exposing residents to potentially harmful air pollution.

The total amount of sulfur dioxide emitted from all 155 sources for all four years was 15,270 tons, or an average of 3,818 tons of unauthorized sulfur dioxide pollution per year. Overall, the average incident lasted 70.3 hours and released 11,911 lbs of sulfur dioxide. The overall average emission rate for all incidents was 169.5 lb/hr (with a wide variation). [25]

Results

Over a four-year period, from 2014 through 2017, roughly 35 percent of Ector County experienced sulfur dioxide air pollution levels in excess of the federal health-based standard, as shown in the map below. The model results indicate that in each year, oil and gas flaring resulted in hundreds of exceedences of the U.S. health-based air quality standard for sulfur dioxide.[26] In 2015, pollution levels over the national standard covered an an approximate area of 579 km^2, about 25 percent of Ector County.

Figure 4: 4-Year Maximum Modeled 1-Hour Average Sulfur Dioxide Levels Exceeding Health Standards



Over a four year period, roughly 35 percent of Ector County experienced sulfur dioxide air pollution levels in excess of the federal health standards (196 micrograms per cubic meter). Occuring mostly Northwest of Odessa, this elevated pollution corresponded with an area of intense oil and gas industry emissions.

Recommendations

EPA and the Texas Commission on Environmental Quality share the responsibility to protect air quality and to stop illegal pollution. While the state agency is on the frontline in terms of issuing air pollution permits and enforcing emissions limits, EPA has oversight and enforcement authority. At the state level, the Railroad Commission of Texas also bears responsibility for issuing most drilling permits. When these regulators fail to protect public health and the environment, the law allows members of the affected public to hold violators accountable and to enforce pollution limits.

The state and federal regulators should take the following steps to reduce air pollution in the Permian Basin:

- Both EPA and TCEQ should expand their air quality monitoring programs for the Permian Basin, including establishing stationary air monitors in and around Odessa.
- Because EPA's air quality determinations using information gathered from the new air quality monitors will take years to complete (according to the usual EPA regulatory process), EPA should immediately conduct its own modeling to determine whether areas in the Permian Basin meet the national ambient air quality standards. EPA should also initiate the formal, public, information-gathering request and rulemaking process to gather information from the industry and the public, and to ensure all stakeholders participate in this determination.
- EPA and TCEQ should strengthen air pollution control permits in the Permian Basin, including by reviewing Texas' reliance on the less-stringent standard permits and "permits-by-rule" in oil and gas production, processing, storage, and transportation. Texas should also ensure that all major sources of air pollution obtain appropriate major source permits. The goal is to ensure that all sources of potentially dangerous air pollution have enforceable permits that protect public health.
- TCEQ should revise its rules and policies on unpermitted air pollution incidents, such that all unauthorized emissions over a threshold level determined by the state should be subject to automatic penalties.
- EPA and the State of Texas (both the TCEQ and Railroad Commission) should exercise their enforcement authority by investigating and prosecuting those operators in the Permian Basin who routinely violate anti-pollution rules and their permit limits.
- TCEQ should review its policy allowing industrial emitters to avoid compliance simply by filing timely reports about unpermitted emissions. TCEQ should adopt a rule specifying the factors that the agency will use in exercising enforcement discretion for emission events. The rule should specify that penalties will apply for any emission event over a certain threshold and for which the root cause has occurred more than once before. For all other emission events, the TCEQ should exercise its enforcement discretion as long as the operator provides proof that the

source employs the best available control technology to control emissions, and that the incident did not contribute to an exceedance of any national ambient air standard.

With common-sense steps like these, there is no reason that oil and gas producers in the Permian Basin cannot comply with air pollution rules that ensure and safeguard the health of the people of West Texas.

ENDNOTES:

[1]NGI's Shale Daily, "Information on the Permian Basin". https://www.naturalgasintel.com/permianinfo
[2] RBN Energy LLC, PowerPoint Presentation (The Big Picture, Module 1), Permicon Conference, Houston, Texas, October 18, 2018.
https://rbnenergy.com/sites/default/files/static_pages/permicon_brochure_20180830.pdf
[3] New IHS Markit Outlook – "Stunning" Permian Basin Oil Production to More than Double from 2017-2023, Exceeding Expectations. BusinessWire, June 13, 2018.
https://www.businesswire.com/news/home/20180613005357/en/New-IHS-Markit-Outlook-–-"Stunning"-Permian.
[4] "As oil and gas exports surge, West Texas becomes the world's 'extraction colony,'" by Kiah Collier, The Texas Tribune and Jamie Smith Hopkins and Rachel Leven, Center for Public Integrity, published Oct. 11, 2018, available at: https://www.texastribune.org/2018/10/11/west-texas-becomes-worlds-extraction-colony-oil-gas-exports-surge/
[5] *See*, "Report: Unauthorized air pollution in Texas up 27 percent in 2017," Texas Tribune, by Kiah Collier, published Jan. 31, 2019, available at: https://www.texastribune.org/2019/01/31/environment-texas-report-unauthorized-air-pollution/ (the report found that the TCEQ's Midland region, located in the heart of the Permian Basin, accounted for more than half of the statewide total of unauthorized air pollution in 2017, more than even the Houston region which suffered from pollution releases during Hurricane Harvey.
[6] "Understanding Excess Emissions from Industrial Facilities: Evidence from Texas," Nikolaos Zirogiannis, Alex J. Hollingsworth, and David M. Konisky, *Environmental Science and Technology* 52 (5): 2482-2490 (2018)
[7] Environment Texas study, using TCEQ data obtained by the Environmental Integrity Project, "Major Malfunction:
Air Pollution from Industrial Malfunctions and Maintenance in Texas in 2017," January 2019. Link:
https://environmenttexas.org/sites/environment/files/reports/TX_MajorMal_scrn.pdf
[8] GeoTAM, TCEQ
https://tceq.maps.arcgis.com/apps/webappviewer/index.html?id=ab6f85198bda483a997a6956a8486539
[9] *See*, https://www.tceq.texas.gov/airquality/monops/sites/monitors_map.html (Map of all Texas air quality monitoring stations); *See,* https://www.tceq.texas.gov/cgi-bin/compliance/monops/monitors.pl?region=07 (listing three "active" air monitoring stations in the Odessa-Midland TCEQ region)
[10] *See*, TCEQ Site Information for CAM 1072 (Big Spring Midway), March 2018, available at:
https://www.tceq.texas.gov/cgi-bin/compliance/monops/monthly_summary.pl
[11] *See*, https://www3.epa.gov/ttn/naaqs/standards/so2/s_so2_history.html. 75 parts per billion sulfur dioxide is equivalent to 196 micrograms per cubic meter.
[12] *See*, NGI's Shale Daily "Severe 'Takeaway Capacity Disorder' Striking Permian, Says RBN Chief," November 8, 2018. https://www.naturalgasintel.com/articles/116414-severe-takeaway-capacity-disorder-striking-permian-says-rbn-chief; "Cryogenic gas processing plants cropping up throughout basin," Midland Reporter-Telegram, February 3, 2018. https://www.mrt.com/business/oil/article/Cryogenic-gas-processing-plants-cropping-up-12547366.php
[13] *See*, Environmental Integrity Project. Breakdowns in Air Quality: Air Pollution from Industrial Malfunctions and Maintenance in Texas; Environmental Integrity Project: Washington, DC, 2016.
[14] https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects
[15] United State Environmental Protection Agency. (2013). *Sulfur Dioxide: Health.* Available:
http://www3.epa.gov/airquality/sulfurdioxide/health.html
[16] U.S Department of Labor. (2005). Osha Fact Sheet. Available:
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[18] EPA, "Sulfur Dioxide Basics." https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects
[19] "Hydrogen Sulfide Monitoring Near Oil and Gas Production Facilities in SE New Mexico and Potential Effects of Hydrogen Sulfide to Migratory Birds and Other Wildlife," by Joel D. Lusk and Erik A. Kraft, U.S. Dept. of the Interior, Fish and Wildlife Service, Project Identification Number: FFS 2F41- 200220006.1, December 2010, at p. 4 (citing Dombkowski, R.A., M.J. Russell, A.A. Schulman, M.M. Doellman, and K.R.

Olson. 2005. Vertebrate phylogeny of hydrogen sulfide vasoactivity. American Journal of Physiology: Regulatory, Integrative and Comparative Physiology 288:R243-R252.)

[20] "Understanding Excess Emissions from Industrial Facilities: Evidence from Texas," Nikolaos Zirogiannis, Alex J. Hollingsworth, and David M. Konisky, *Environmental Science and Technology* 52 (5): 2482-2490 (2018)

[21] The threshold of 75 parts per billion of sulfur dioxide in air can also be expressed as 196 micrograms of sulfur dioxide per cubic meter of air.

[22] TCEQ, "Annual Monitoring Networking Plan, 2018" pp. 10-11 https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2018-AMNP.pdf.

[23] Continuous Air Monitoring Stations (CAMS), available at: https://www.tceq.texas.gov/airquality/monops/sites/monitors_map.html (Map of all Texas air quality monitoring stations)

[24] The sources were either the TCEQ's Air Permits Allowables Database, or individual permit application files.

[25] The maximum incident duration was 2,659 hrs (or 110 days). Eight incidents had a duration that exceeded 1,000 hours each. The largest incident resulted in the release of more than a million pounds of SO2 and lasted 15.5 days starting in late November 2016. Forty-six incidents had total SO2 emissions exceeding 50 tons.The highest emission rate was 39,561 pounds of sulfur dioxide per hour, which occurred during a two-hour period in December 2016. Twenty six (26) incidents resulted in emission rates that exceeded 10,000 pounds per hour; and 329 incidents resulted in emission rates that exceeded 1,000 pounds per hour.

[26] The standard was set by U.S. EPA at 196 micrograms per cubic meter, the 1-hour sulfur dioxide national ambient air quality standard

APPENDIX A: METHODOLOGY

The Environmental Integrity Project ran an EPA approved air dispersion model called AERMOD, which is also used by the state of Texas when it issues air quality permits. We ran the air dispersion model using the industry self-reported emission events for calendar years 2014 – 2017 and National Weather Service meteorological data for the days and times that the emissions events occurred as inputs. We obtained source parameters (i.e., the location, height, and other specifications) for the flares and other emission points from TCEQ via publicly available databases and a Public Information Act request.

In some cases, mainly for smaller sources, the specific source parameters were unavailable in TCEQ records. In these instances, we used conservative inputs as estimates, based on TCEQ guidance, i.e. tall stack/flare height.

The model results indicate that in each year from 2014 through 2017, oil and gas flaring resulted in hundreds of exceedences of the U.S. health-based air quality standard for sulfur dioxide (set by U.S. EPA at 196 micrograms per cubic meter or the equivalent of 75 ppb, the 1-hour sulfur dioxide national ambient air quality standard). In 2015, pollution levels over the national standard covered an an approximate area of 579 km^2, about 25 percent of the entire Ector County. In 2016, the 1-hour SO_2 design value (the modeling result that defines air quality relative to the national standards) exceeded 400 $\mu g/m^3$ at 74 receptors in 2016. The peak design value during all 4 model years was 3,644 $\mu g/m^3$ (in 2014, located about 1 km NW of the Goldsmith Gas Plant).

Martin Lake Generating Station

Tatum, Texas

Evaluation of Compliance with the 1-hour NAAQS for SO_2

March 31, 2016

Conducted by:

Steven Klafka, P.E., BCEE

Wingra Engineering, S.C.

Madison, Wisconsin

1. Introduction

Wingra Engineering, S.C. was hired by the Sierra Club to conduct an air modeling impact analysis to help USEPA, state and local air agencies identify facilities that are likely causing exceedences of the 1-hour sulfur dioxide (SO_2) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation of the Martin Lake Generating Station located in Tatum, Texas.

This analysis supplements the evaluation described in the September 11, 2015 report prepared on behalf of the Sierra Club. To improve the accuracy, this analysis used actual hourly emissions and stack exhaust flow rates for the 2013-15 period. This analysis also incorporates a more current and lower background concentration than the previous September 2015 modeling.

The dispersion modeling analysis predicted ambient air concentrations for comparison with the 1-hour SO_2 NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to the Sierra Club by regulatory air agencies and through other publicly-available sources as documented below. The analysis was conducted in adherence to all available USEPA guidance for evaluating source impacts on attainment of the 1-hour SO_2 NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; USEPA's March 2011 Modeling Guidance for SO_2 NAAQS Designations; [1] and, USEPA's December 2013 SO_2 NAAQS Designations Technical Assistance Document.[2]

It was determined that based on measured actual emissions, the Martin Lake Generating Station is estimated to create SO_2 concentrations which exceed the 1-hour NAAQS.

2. Compliance with the 1-hour SO_2 NAAQS

2.1 1-hour SO_2 NAAQS

The 1-hour SO_2 NAAQS takes the form of a three-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 parts per billion (ppb).[3] Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of $\mu g/m^3$. The 1-hour SO_2 NAAQS of 75 ppb equals 196.2 $\mu g/m^3$, and this is the value used for determining whether modeled impacts exceed the

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[1] http://www.epa.gov/scram001/so2_modeling_guidance.htm
[2] http://www.epa.gov/oaqps001/sulfurdioxide/pdfs/SO2ModelingTAD.pdf
[3] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010.

NAAQS.[4] The 99th percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Modeling results for Martin Lake Generating Station are summarized in Table 1. It was determined that based on measured actual emissions, the Martin Lake Generating Station is estimated to create downwind SO_2 concentrations which exceed the 1-hour NAAQS. "Actual" represents the emissions which occurred during each hour of the 2013-15 period. Actual emission measurements were taken from two databases, USEPA *Clean Air Markets Program Data (CAMD)* [5] and the Emissions Modeling Clearinghouse State-Level Hourly Sulfur Dioxide (SO_2) Data. [6]

To more accurately predict the dispersion of emissions, hourly exit velocities were used. Continuous emissions monitor measurements were not publicly available for this analysis so exit velocities were derived from the hourly flow rates and heat input in the USEPA Clearinghouse and CAMD databases. The Clearinghouse emissions and exit velocities for 2013-14 were supplemented with CAMD emissions for 2015. The velocities for 2015 were derived from the hourly heat input reported in CAMD.

Air quality impacts in Texas are based on a background concentration of 5.2 $\mu g/m^3$. This is the 2012-14 design value for El Paso, Texas - the lowest measured background concentration in the state. This is the most recently available design value. See Section 5 for further discussion of the background concentrations used for this analysis.

Table 1 - SO_2 Modeling Results for Martin Lake Generating Station

Emission Rates	Averaging Period	99th Percentile 1-hour Daily Maximum ($\mu g/m^3$)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Actual 2013-15	1-hour	244.1	5.2	249.3	196.2	No

[4] The ppb to $\mu g/m^3$ conversion is found in the source code to AERMOD v. 15181, subroutine Modules. The conversion calculation is 75/0.3823 = 196.2 $\mu g/m^3$.
[5] http://ampd.epa.gov/ampd/
[6] https://www3.epa.gov/ttn/chief/emch/so2naaqs/index.html

Figure 1 shows the extent of NAAQS violations based on actual hourly emissions for the 2013-15 period.

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- No consideration of building or structure downwash. These downwash effects typically increase predicted concentrations near the facility.
- No consideration of off-site sources. These other sources of SO_2 will increase the predicted impacts.
- Air quality impacts are based on a background SO_2 concentration of 5.2 µg/m3, which is the lowest measured background concentration in the state. Given the proximity to other major sources of SO_2, the actual background concentration is likely much higher.
- No evaluation has been conducted to determine if the stack height exceeds Good Engineering Practice or GEP height. If the stack height exceeds GEP, the predicted concentrations will increase.

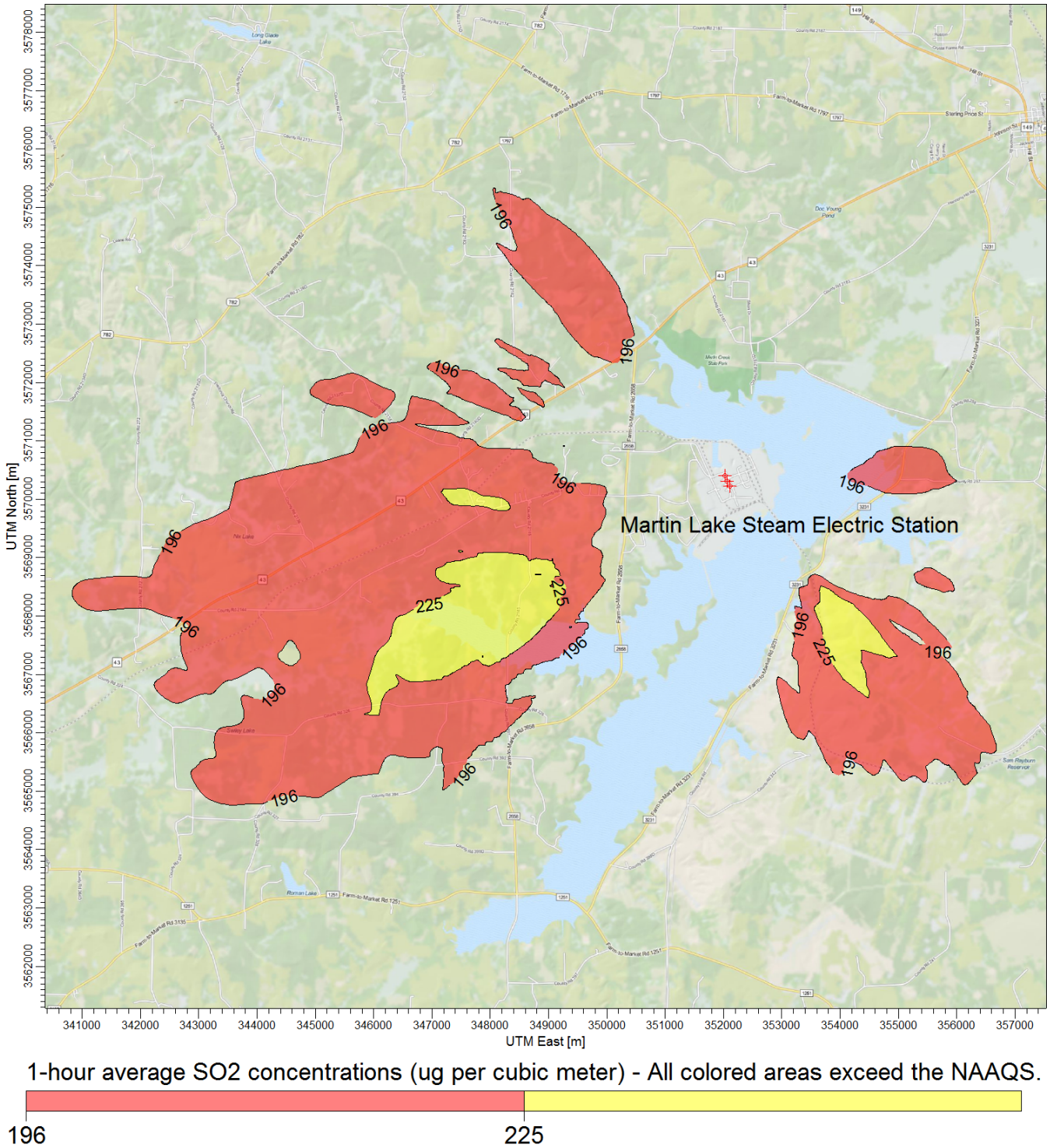

Figure 1 - Impacts Based on Actual Emissions & Exit Velocities from Martin Lake Generating Station

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, v. 15181. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.[7] For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on three years of recent meteorological data. The modeling analyses used one run with three years of sequential meteorological data from 2013-2015. Consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO_2 impacts concentrations consistent with the form of the 1-hour SO_2 NAAQS.[8]

Please refer to Table 1 for the modeling results.

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[7] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.
[8] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A GIS was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.[9]

USEPA's AERSURFACE v. 13016 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 6.4% of surrounding land use around the modeled facility was of urban land use types including Type 21 – Low Intensity Residential, Type 22 – High Intensity Residential and Type 23 – Commercial / Industrial / Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

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[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analyses only considered SO_2 emissions from the facility. Off-site sources were not considered. Stack parameters used for the modeling analysis are summarized in Table 2. The exit temperature was held constant but the hourly exit velocity varied based on flow rate and heat input information provided by USEPA Clearinghouse and CAMD databases.

Table 2 – Facility Stack Parameters[10]

Facility	Martin Lake		
Stack	S01	S02	S03
Description	Unit 1	Unit 2	Unit 3
X Coord. [m]	352028	352066.8	352107.1
Y Coord. [m]	3570404.46	3570314.64	3570224.87
Base Elevation [m]	95.18	94.95	94.79
Release Height [m]	137.77	137.77	137.8
Gas Exit Temperature [°K]	449.261	449.261	449.261
Inside Diameter [m]	7.01	7.01	7.01
Gas Exit Velocity [m/s]	-	-	-
Actual Emission Rate [g/s]	-	-	-

The above stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.2. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

4.3 Building Dimensions and GEP

No building dimensions or prior downwash evaluations were available. Therefore this modeling analysis did not address the effects of downwash and this may under-predict impacts.

4.4 Receptors

For Martin Lake Generating Station, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Martin Lake Generating Station and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Martin Lake Generating Station and

[10] Height and exit area were obtained from the USEPA Emissions Modeling Clearinghouse State-Level Hourly Sulfur Dioxide (SO_2) Data. Exit temperatures were obtained from Environ, 2018 Base CaseCAMx Simulation, Texas Haze Evaluation, Appendix A: Stack Parameters of Major Units at the Selected 38 Facilities, September 7, 2013.

extending out 10 kilometers.

3. A 1,000-meter Cartesian receptor grid centered on Martin Lake Generating Station and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.[11]

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2013-2015 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD. Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.[12] The USEPA software program AERMINUTE v. 15272 is used for these tasks.

This section discusses how the meteorological data was prepared for use in the 1-hour SO_2 NAAQS modeling analyses. The USEPA software program AERMET v. 15181 is used for these tasks.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Longview Texas Regional Airport located near the Martin Lake Generating Station. Integrated Surface Hourly (ISH) data for the 2013-2015 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a "weather balloon" that is released twice per day at selected

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[11] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

[12] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Martin Lake Generating Station, the concurrent 2013-2015 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the Shreveport, Louisiana measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA's FSL website.[13] All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey's 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

AERSURFACE v. 13016 was used to develop surface roughness, albedo, and daytime Bowen ratio values in a region surrounding the meteorological data collection site. AERSURFACE was used to develop surface roughness in a one kilometer radius surrounding the data collection site. Bowen ratio and albedo was developed for a 10 kilometer by 10 kilometer area centered on the meteorological data collection site. These micrometeorological data were processed for seasonal periods using 30-degree sectors. Seasonal moisture conditions were considered average with winter months having no continuous snow cover.

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.[14] The AERMOD output file shows there were 0.93% missing data.

To confirm the representativeness of the airport meteorological data, the surface characteristics of the airport data collection site and the modeled source location were compared. Since the Longview Texas Regional Airport is located close to Martin Lake Generating Station, this meteorological data

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[13] Available at: http://esrl.noaa.gov/raobs/
[14] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.

set was considered appropriate for this modeling analysis.[15] Additionally, this weather station provided high quality surface measurements for the most recent 3-year time, and had similar land use, surface characteristics, terrain features and climate.

Finally, TCEQ provides pre-processed meteorological data suitable for modeling for each county.[16] For Rusk County, TCEQ recommends using data from the same surface and upper air stations used for this modeling analysis. The TCEQ data were not used for this project because they were not from the most recent years needed for this analysis and had not been processed using the latest versions of USEPA modeling software.

5. Background SO_2 Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO_2 NAAQS Designations.[17, 18] To preserve the form of the 1-hour SO_2 standard, based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the background fourth-highest daily maximum 1-hour SO_2 concentration was added to the modeled fourth-highest daily maximum 1-hour SO_2 concentration.[19] Background concentrations were based on the 2012-14 design value measured by the ambient monitors located in Texas.[20]

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

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[15] USEPA, AERMOD Implementation Guide, March 19, 2009, pp. 3-4.
[16] Texas Commission on Environmental Quality, Meteorological Data for Refined Screening with AERMOD, http://www.tceq.texas.gov/permitting/air/modeling/aermod-datasets.html, Last updated November 22, 2013.
[17] USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.
[18] USEPA, SO_2 NAAQS Designations Modeling Technical Assistance Document, Dec. 2013, section 8.1, pp 27-28.
[19] USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard, August 23, 2010, p. 3.
[20] http://www.epa.gov/airtrends/values.html

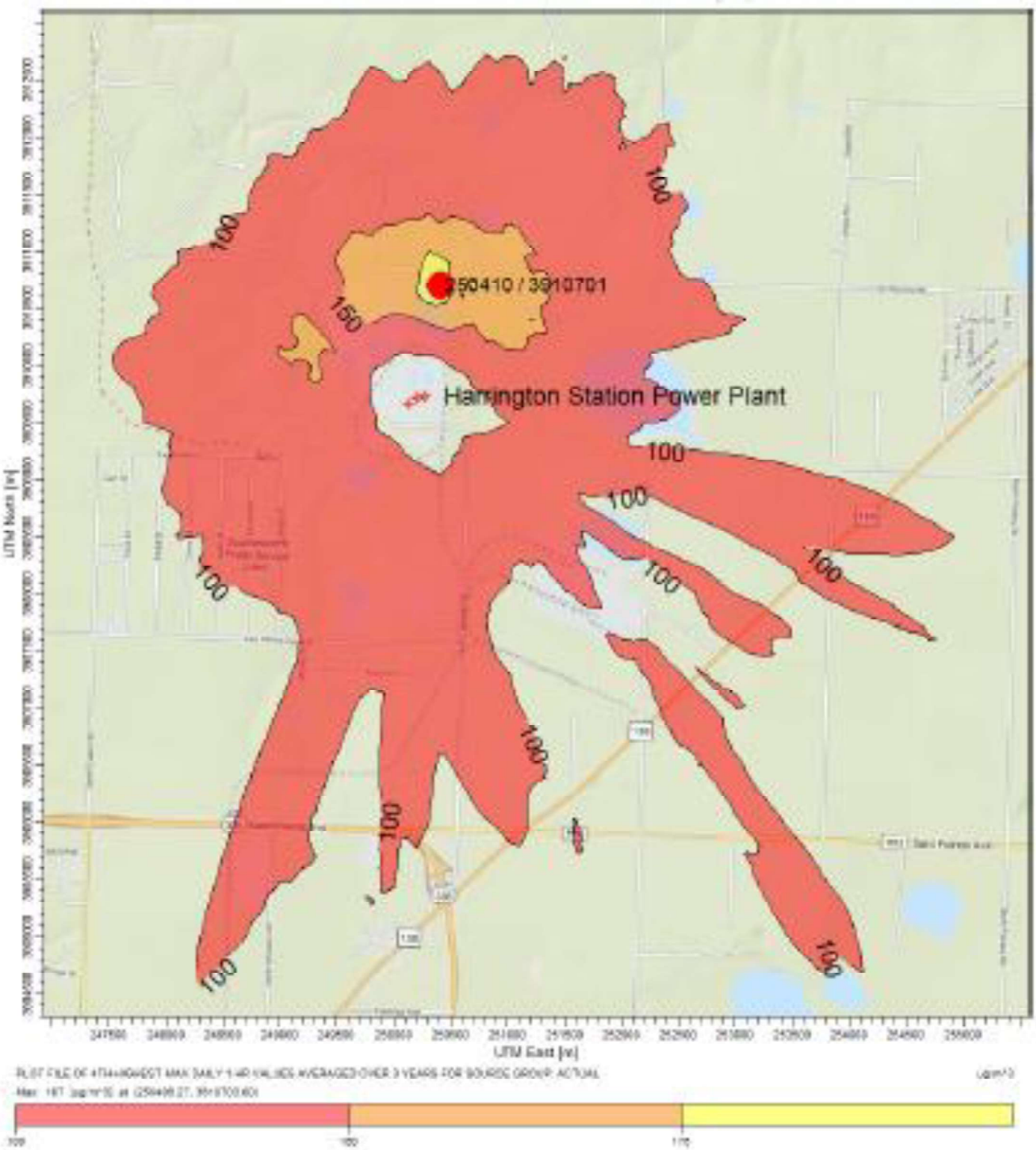

Figure 1 – Impacts Based on Actual Emissions from Harrington Station Power Plant. All colored areas exceed the 2010 SO_2 NAAQS. The red dot indicates the coordinates for the location with the highest modeled impacts.

Figure 2 – TCEQ Proposed Monitor Location for Harrington Relative to Modeled Peak Impacts

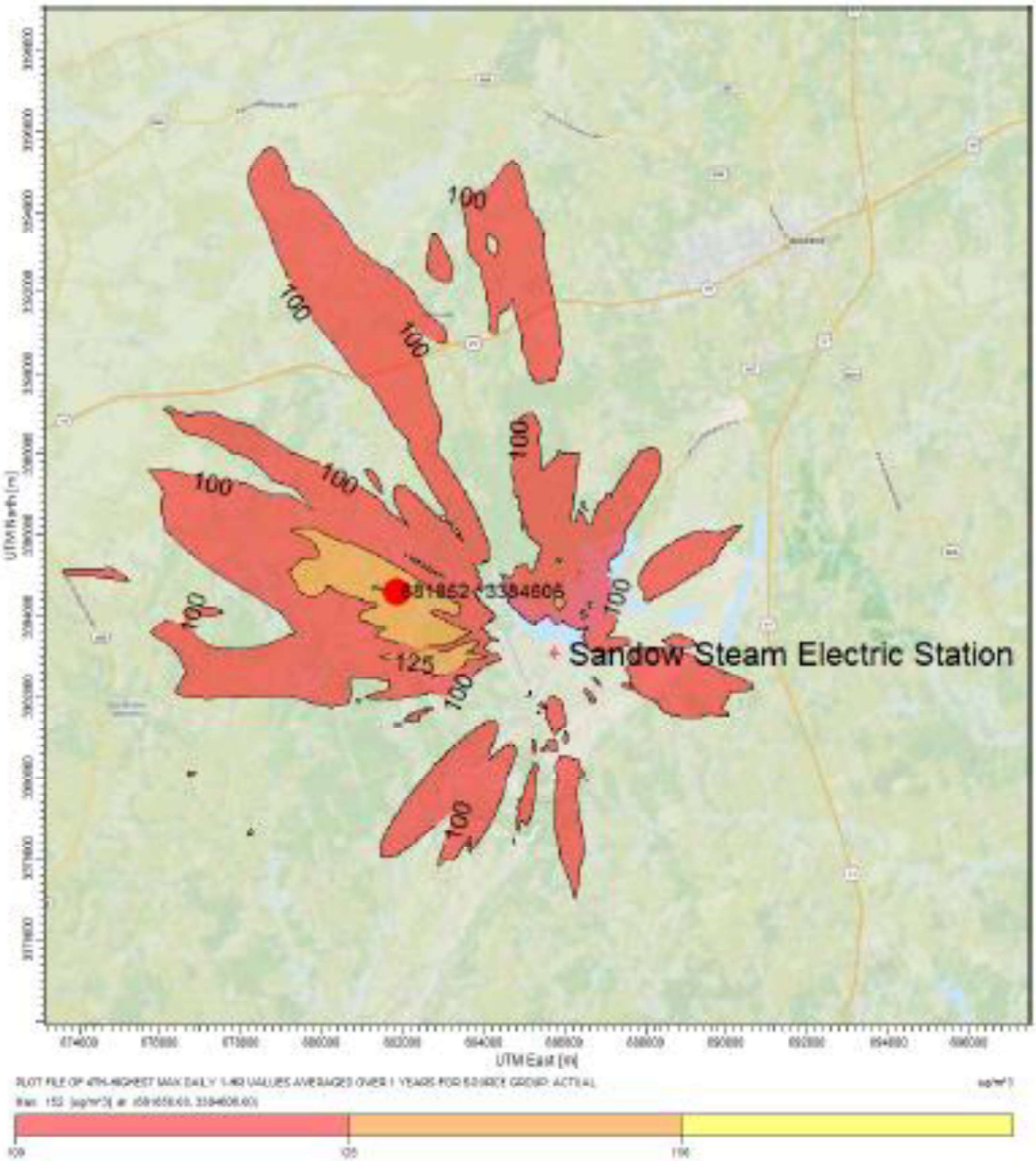

Figure 3 – Impacts Based on Actual Emissions from Sandow Steam Electric Station. All colored areas exceed the 2010 SO_2 NAAQS. The red dot indicates the coordinates for the location with the highest modeled impacts.

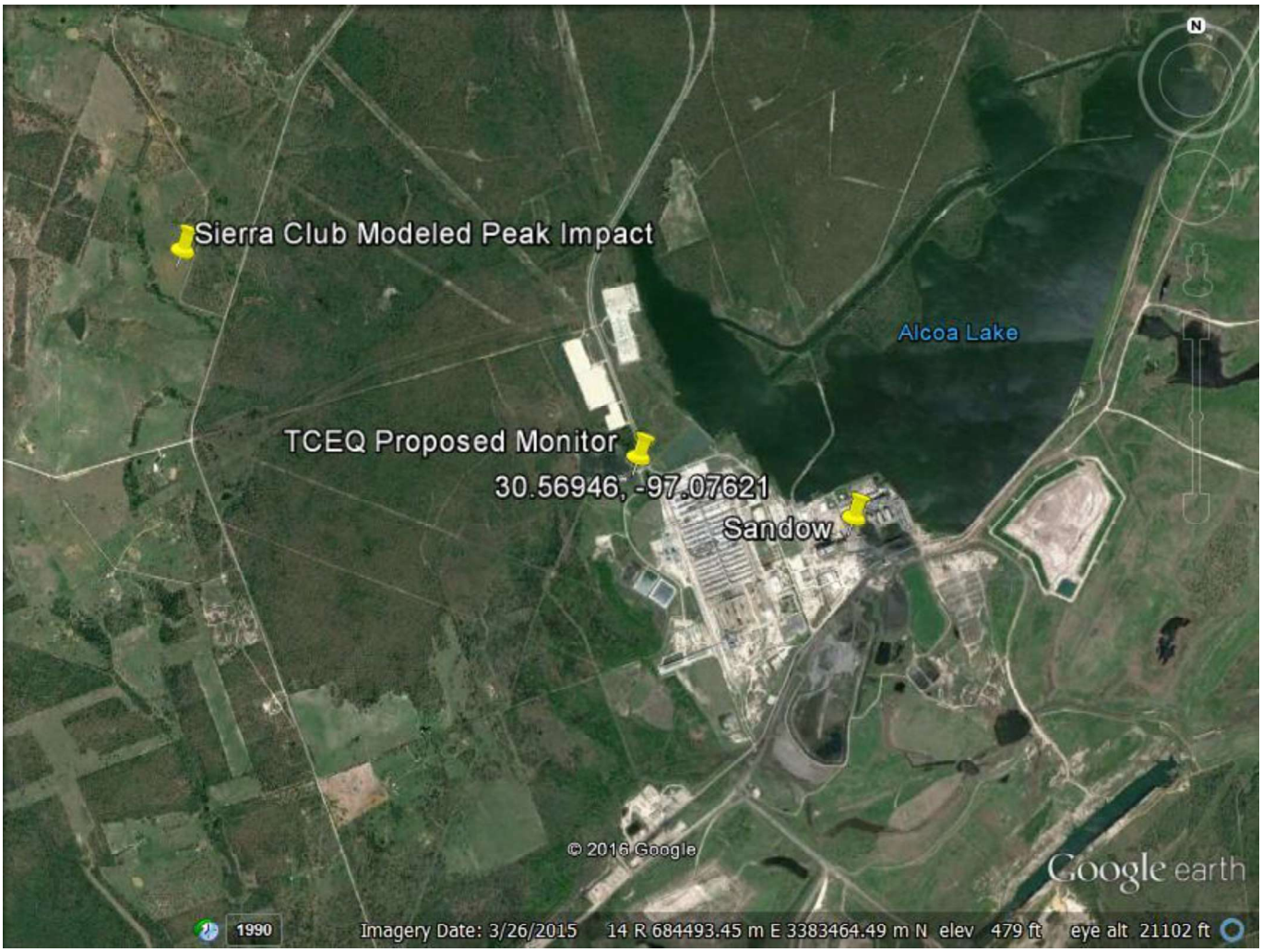

Figure 4 – TCEQ Proposed Monitor Location for Sandow Relative to Modeled Peak Impacts